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MYSIDACEA

By

OLIVE S. TATTERSALL, D.Sc.

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MYSIDACEA

By Olive S. Tattersall, D.Sc.

(Text-figs. 1–46)

INTRODUCTION

Before his death in 1943 my husband, the late Professor W. M. Tattersall, had done a considerable amount of preliminary identification of the very large number of mysids sorted from the collections of the 'Discovery' Investigations, now incorporated in the National Institute of Oceanography. Unfortunately not a single note concerning this work has been found among his papers so that all the counting, measuring and ascertaining the sex and age of the specimens has had to be done again. However, his provisional sorting into genera and, in some cases, into species has been of the utmost help in working on the material.

This very rich collection, amassed over a number of years, does not comprise all the mysids in the 'Discovery' collections, for much of the plankton has yet to be sorted, but there are over 5000 specimens, generally in very good condition, from 391 stations which are nearly all situated in the South Atlantic and Southern Ocean. In addition I have included a record of specimens of *Boreomysis rostrata* Illig, collected in surface tow-nets off the shores of Heard Island, which were sent to me for identification by the courtesy of Dr P. G. Law, Director of the Antarctic Division of the Department of External Affairs, Australian National Antarctic Expedition. This is particularly interesting because I can find no other record of this species from surface waters.

Identification of the Mysidacea is made difficult by the fact that, in many of the species, the animals continue to grow long after sexual maturity has been attained. This growth is accompanied by considerable changes in the proportions and armature of the body and appendages, so that smaller individuals differ profoundly from larger ones. This disconcerting phenomenon has led to much confusion in the past, because workers with only a few specimens at their command have frequently founded new species, which have subsequently proved to be different growth stages of species already described. The actual size of the animals is, unfortunately, not a reliable guide because specimens living in warmer waters mature more rapidly and reach the various growth stages at a much smaller size than those inhabiting colder regions.

Only when large numbers of specimens of all sizes are available can the gradual growth changes be traced and the true identity of younger individuals of a species be established. Such growth changes are particularly conspicuous in species of the genera *Gnathophausia* and *Eucopia*. The Discovery collection contains over sixty specimens (of all sizes) of *Gnathophausia ingens* and more than thirty of *G. gigas*. I have made detailed measurements of these species and the results, which I give in tabular form, fully endorse the valuable work in this field done by Ortmann and others. I have also drawn up a list of the species represented in the Discovery collection together with their synonymies, so that when isolated specimens are found they can the more readily be referred to their true species even though they may represent quite young growth stages (see p. 24–27).

Another difficulty in working out large collections lies in deciding how much individual variation should be tolerated among members of any one species. In many genera such a mass of slightly differing characters occurs that it seems impossible to find any consistent features whereby the animals can be separated into definite groups. As a result two alternatives arise, (i) making a very large number of new species, or (ii) 'lumping' them all into one species with a very flexible definition. This problem occurs very markedly in the genera *Boreomysis*, *Pseudomma* and *Euchaetomera*. I have perhaps erred on the side of too much 'lumping' in these genera and I think that possibly future workers may find satisfactory characters which are sufficiently constant to justify the formation of several new species.

I have found little evidence of any correlation between differences in form and geographical distribution for specimens captured in the same areas and even in the same hauls display the same individual variation as those from completely different localities. There does appear, however, to be evidence of a geographical race in a species of *Boreomysis* captured in the waters around South Georgia. In general form, in the shape of the rostrum and in the characteristic form of the telson, the specimens agree with the descriptions of *B. rostrata* Illig, but they are distinctly larger and the eyes are nearly twice the usual size found in this species. These characters are so noticeable that the animals can be picked out with the naked eye. I would have founded a new species for them, but for the fact that specimens were present in near-by localities, in which the size of the eyes and the length of adult animals were intermediate between those of the normal *B. rostrata* and the large-eyed variety. I have therefore recorded them simply as '*Boreomysis rostrata* with very large eyes' and suggested that they may represent a geographical race.

A total of thirty-six genera and ninety-five species is represented in the collection. Of these I regard two genera and twenty-eight species as new. A review of past records and, in some cases, an examination of material from other collections has made it necessary to change the names of one or two species, but this has only been done where absolutely necessary and full explanations are given in the text. In this connexion I should like to express my gratitude to Dr Waldo L. Schmitt of the Smithsonian Institution, Washington, for most generously lending me some specimens of a very rare and interesting mysid for comparison with some of the Discovery material and to Dr Isobel Gordon of the British Museum for allowing me to examine so many of the valuable collections in her care.

While this work was in progress I received a small supplementary collection of Mysidacea taken by R.R.S. 'William Scoresby' during a survey of the Benguela Current in March 1950. Mysids occurred at twelve stations and, although the actual numbers were few, ten genera were represented and sixteen species, one of which is new to science. The records are included in the list of stations of the 'William Scoresby' and a short account of the collection is added as an appendix to this report.

I should like to express my grateful thanks to Dr N. A. Mackintosh, Deputy Director of the National Institute of Oceanography for allowing me to examine this valuable and interesting collection and to tender my warm appreciation and thanks to Dr Helene Bargmann for her unfailing help and encouragement throughout the course of this work.

GEAR

Abbreviations used in the list of stations to indicate kind of gear used

B, oblique; H, horizontal; V, vertical; BNR, Russell's bottom tow-net; BTS, small beam trawl; DC, conical dredge; DL and DLH, large dredge; DS, small dredge; LH, hand lines; N4-T, N7-T, nets attached to back of trawl; N50, 50 cm. tow-net; N70, 70 cm. tow-net; N100, 1 m. tow-net; N200, 2 m. tow-net; N450, $4\frac{1}{2}$ m. tow-net; NC50, coarse 50 cm. tow-net; NCS-D, NCS-T, NCS-N, tow-net attached to dredge, trawl or other net; NRL, large rectangular net; NRM, medium rectangular net; OTL, large otter trawl; TYF and TYF70 B, young-fish trawl.

Where the depth of termination of an oblique haul is written '(–0)' it must be understood that the net failed to close at some intended intermediate depth and fished all the way to the surface. The last part of the haul from the intended depth of closing to the surface would usually occupy a small fraction of the total time of fishing.

LIST OF STATIONS AT WHICH MYSIDACEA WERE COLLECTED WITH THE SPECIES OBTAINED AT EACH STATION

R.R.S. 'DISCOVERY I' AND R.R.S. 'DISCOVERY II'

6. x. 25. 29° 27′ N., 15° 07′ W. From stomach of *Naucrates ductor*, 900–0 m.: *Euchaetomera typica* G. O. Sars.

10. x. 25. 41° 37′ 15″ N., 12° 36′ 20″ W. Net 2 m. 900–0 m.: *Gnathophausia ingens* (Dohrn); *Eucopia sculpticauda* Faxon.

14. x. 25. 34° 23′ N., 14° 32′ W. Surface: *Siriella thompsonii* (M.-Ed.).

28. x. 25. 13° 25′ N., 18° 22′ W. 900–0 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon.

2. xi. 25. 6° 55′ N., 15° 54′ W. N 200. 800–0 m.: *Caesaromysis hispida* Ortmann; *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon.

St. 9. 11. ii. 26 (day). Midway between Gough Island and South Georgia. N 200. 1250(–0) m.: *Gnathophausia gigas* W.-Suhm.

St. 31. 17. iii. 26 (night). 13·5 miles N. 89° E. of Jason Light, South Georgia. N 100 H. 90(–0) m.: *Antarctomysis maxima* (Hansen).

St. 32. 17. iii. 26 (night). 22·8 miles N. 70° E. of Jason Light, South Georgia. N 100 H. 90(–0) m.: *Antarctomysis maxima* (Hansen).

St. 39. 25. iii. 26 (day). East Cumberland Bay, South Georgia. N 7-T. 235–179 m.: *Mysidetes posthon* Holt and Tattersall; *Mysidetes kerguelensis* Illig; *Mysidetes microps* sp.n.; *Antarctomysis maxima* (Hansen); *Antarctomysis ohlini* Hansen.

St. 41 D, St. 41 E. 28. iii. 26 (night). 16½ miles N. 39° E. of Barff Point, South Georgia. N 200 V. 100–50 m.: *Antarctomysis maxima* (Hansen); *Antarctomysis ohlini* Hansen.

St. 42. 1. iv. 26 (day). Off mouth of Cumberland Bay, South Georgia. OTL and N 4-T. 120–204 m.: *Boreomysis rostrata* var. (with very large eyes) Illig; *Pseudomma armatum* Hansen; *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* (Hansen); *Antarctomysis ohlini* Hansen.

St. 45. 6. iv. 26 (day). 2·7 miles S. 85° E. of Jason Light, South Georgia. OTL, N 4-T and N 7-T. 238–270 m.: *Pseudomma sarsi* W.-Suhm in MS. Hansen; *Pseudomma armatum* Hansen; *Mysidetes posthon* Holt and Tattersall; *Mysidetes microps* sp.n.; *Mysidetes dimorpha* sp.n.; *Antarctomysis maxima* (Hansen); *Antarctomysis ohlini* Hansen.

St. 49. 3. v. 26 (night). Off Cape Bougainville, East Falkland Is. N 100 H. 0–5 m.: *Mysidopsis acuta* Hansen.

St. 51. 4. v. 26 (day). Off Eddystone Rock, East Falkland Is. NCS-T. 105–115 m.: *Pseudomma minutum* sp.n. ♂ TYPES; *Pseudomma calmani* sp.n.; *Mysidetes crassa* Hansen; *Mysidetes intermedia* sp.n.; *Mysidopsis acuta* Hansen.

St. 56. 16. v. 26 (day). Port William, East Falkland Is. NCS-T. 10½–16 m.: *Mysidopsis acuta* Hansen.

St. 71. 30. v. 26 (day). North-east of Falkland Is. TYF. 2000(–0) m.: *Gnathophausia gigas* W.-Suhm; *Eucopia grimaldii* Nouvel; *Boreomysis rostrata* Illig.

St. 72. 1. vi. 26 (night). North-east of Falkland Is. N 450. 2000(–0) m.: *Gnathophausia gigas* W.-Suhm.

St. 76. 5. vi. 26 (day). Midway between Gough Is. and Bahia, Argentine. N 450. 1500(–0) m.: *Gnathophausia ingens* (Dohrn); *Gnathophausia gigas* W.-Suhm.

St. 78. 12. vi. 26 (day). Mid-Atlantic, West of Cape Town. TYF. 1000(–0) m.: *Eucopia australis* Dana; *Boreomysis rostrata* Illig; *Caesaromysis hispida* Ortmann; *Longithorax capensis* Zimmer.

St. 81. 18. vi. 26 (day). Mid-Atlantic, West of Cape Town. N 450. 650(–0) m.: *Gnathophausia ingens* (Dohrn); ? *Boreomysis rostrata* Illig; *Caesaromysis hispida* Ortmann.

St. 83. 21. vi. 26 (night). North-east of Tristan da Cunha. N 200 V. 650(–0) m.: *Boreomysis rostrata* Illig.

St. 85. 23. vi. 26 (night). West of Cape Town. N 450. 2000(–0) m.: *Eucopia australis* Dana; *Boreomysis bispinosa* sp.n.; *Boreomysis sibogae* Hansen.

St. 86. 24. vi. 26 (day). West of Cape Town. N 450. 1000(–0) m.: *Gnathophausia ingens* (Dohrn); *Gnathophausia gigas* W.-Suhm; *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis rostrata* Illig; *Boreomysis bispinosa* sp.n.

St. 87. 25. vi. 26 (day). West of Cape Town. TYF. 1000(–0) m.: *Boreomysis rostrata* Illig; *Boreomysis illigi* sp.n.; *Siriella thompsonii* (M.-Ed.); *Katerythrops oceanae* Holt and Tattersall; *Meterythrops picta* Holt and Tattersall; *Euchaetomera typica* G. O. Sars.

St. 89. 28. vi. 26 (day). Off Cape Town. TYF. 1000(–0) m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia grimaldii* Nouvel; *Boreomysis rostrata* Illig; *Boreomysis bispinosa* sp.n.; *Siriella thompsonii* (M.-Ed.); *Meterythrops picta* Holt and Tattersall; *Katerythrops oceanae* Holt and Tattersall; *Longithorax capensis* Zimmer; *Euchaetomera typica* G. O. Sars; *Euchaetomera tenuis* G. O. Sars; *Caesaromysis hispida* Ortmann; *Siriella thompsoni* (M.-Ed.).

St. 90. 10. vii. 26 (day). False Bay, South Africa. NRM. 10–12 m.: *Gastrosaccus sanctus* (van Beneden); *Anchialina truncata* (G. O. Sars); *Mysidopsis major* (Zimmer); *Mysidopsis schultzei* (Zimmer); *Mysidopsis similis* (Zimmer); *Mysidopsis camelina* sp.n.

St. 91. 8. ix. 26 (day). False Bay, South Africa. NCS-N. 35 m.: *Anchialina truncata* (G. O. Sars). TYF. 0–5 m.: *Mysidopsis schultzei* (Zimmer); 35 m., *Mysidopsis similis* (Zimmer).

12. ix. 26. Walvis Bay (from stomach of *Trigla capensis*). 4·57 m.: *Afromysis hansoni* Zimmer.

St. 100. 2. x. 26 (day). West of Cape Town. TYF. 450–550 m.: *Longithorax capensis* Zimmer. 475(–0) m., ? *Boreomysis rostrata* Illig; *Meterythrops picta* Holt and Tattersall; *Longithorax capensis* Zimmer. 675–625 m., *Katerythrops oceanae* Holt and Tattersall; *Boreomysis rostrata* Illig.

3. x. 26 (day). TYF. 310–260 m.: *Euchaetomera tenuis* G. O. Sars; *Caesaromysis hispida* Ortmann.

3/4. x. 26 (night). TYF. 1000–900 m.: *Gnathophausia ingens* (Dohrn); *Boreomysis microps* G. O. Sars; *Boreomysis rostrata* Illig; *Meterythrops picta* Holt and Tattersall.

4. x. 26 (day). TYF. 2500(–0) m.: *Gnathophausia ingens* (Dohrn); *Eucopia sculpticauda* Faxon; *Gibberythrops megalops* sp.n. ♂ TYPE; *Euchaetomera tenuis* G. O. Sars; *Caesaromysis hispida* Ortmann.

4. x. 26 (day). TYF. 2500–2000 m.: *Gnathophausia gigas* W.-Suhm; *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Boreomysis rostrata* Illig; *Boreomysis atlantica* Nouvel; *Euchaetomera zurstrasseni* (Illig); *Caesaromysis hispida* Ortmann.

St. 101. 14. x. 26 (night). West of Cape Town. N 450. 2580–2480 m.: *Gnathophausia ingens* (Dohrn); *Chalaraspidum alatum* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel.

14. x. 26 (day). N 450. 1410–1310 m.: *Gnathophausia gigas* W.-Suhm; *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Boreomysis rostrata* Illig.

15. x. 26 (day). N 450. 950–850 m.: *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel.

15. x. 26 (night). N 450. 350–400(–0) m.: *Gnathophausia ingens* (Dohrn).

St. 107. 4. xi. 26 (day). South-south-west of Cape Town. N 450. 950–850 m.: *Gnathophausia ingens* (Dohrn).

St. 114. 12. xi. 26 (day). North-east of Bouvet I. N 450. 700–650 m.: *Gnathophausia gigas* W.-Suhm.

St. 120. 22. xi. 26 (day). North-west of Bouvet I. N 100 H. 360–340(–0) m.: *Euchaetomera zurstrasseni* (Illig).

St. 123. 15. xii. 26 (day). Off Cumberland Bay, South Georgia. N 7-T, N 4-T. 230–250 m.: *Pseudomma armatum* Hansen; *Mysidetes posthon* Holt and Tattersall; *Mysidetes microps* sp.n.; *Mysidopsis acuta* Hansen; *Antarctomysis maxima* Holt and Tattersall; *Antarctomysis ohlini* Hansen.

St. 129. 19. xii. 26 (dusk to dark). Off South Georgia. N 70 V. 950–750 m.: *Boreomysis rostrata* var. (with very large eyes) Illig.

St. 134. 21. xii. 26 (day). South-east of Cumberland Bay, South Georgia. N 100 H. 123 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 138. 22. xii. 26 (day). Off South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 140. 23. xii. 26 (day). Off South Georgia. OTL. 122–136 m.: *Pseudomma sarsi* (W.-Suhm); *Mysidetes microps* sp.n.; *Mysidetes dimorpha* sp.n.; *Antarctomysis maxima* H. and T.

St. 142. 30. xii. 26 (day). East Cumberland Bay, South Georgia. N 7-T, N 4-T. 88–273 m.: *Pseudomma armatum* Hansen; *Pseudomma sarsi* (W.-Suhm); *Mysidetes posthon* Holt and Tattersall; *Mysidetes kerguelensis* Illig; *Mysidetes microps* sp.n.; *Mysidetes macrops* sp.n.; *Antarctomysis ohlini* Hansen.

St. 143. 30. xii. 26 (day). Off Cumberland Bay, South Georgia. NCS-T. 273 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 144. 5. i. 27 (day). Off Stromness Harbour, South Georgia. NCS-T. 155-178 m.: *Mysidetes posthon* Holt and Tattersall; *Mysidetes microps* sp.n.; *Antarctomysis maxima* Holt and Tattersall.

St. 146. 8. i. 27 (day). Off South Georgia. DLH. 728 m.: *Boreomysis rostrata* var. (with very large eyes) Illig; *Boreomysis inermis* (W.-Suhm).

St. 148. 9. i. 27 (day). Off Cape Saunders, South Georgia. N 4-T. 132–148 m.: *Pseudomma armatum* Hansen; *Mysidetes posthon* Holt and Tattersall; *Mysidetes brachylepis* W. M. Tattersall; *Mysidetes microps* sp.n.; *Antarctomysis maxima* Holt and Tattersall.

St. 149. 10. i. 27 (day). East Cumberland Bay, South Georgia. NCS-T. 200–234 m.: *Rhopalophthalmus egregius* Hansen; *Gastrosaccus sanctus* (van Beneden); *Pseudomma sarsi* (W.-Suhm); *Antarctomysis maxima* Holt and Tattersall.

St. 151. 16. i. 27 (day). North of South Georgia. N 450. 1275–1025 m.: *Eucopia grimaldii* Nouvel; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 152. 17. i. 27 (day). Off South Georgia. DLH. 245 m.: *Mysidetes posthon* Holt and Tattersall.

St. 154. 18. i. 27 (day). Off South Georgia. N 4-T. 60–160 m.: *Pseudomma armatum* Hansen; *Antarctomysis maxima* Holt and Tattersall; *Antarctomysis ohlinii* Hansen; NCS-T. 60–160 m.: *Pseudomma sarsi* W.-Suhm; *Mysidetes posthon* Holt and Tattersall; *Mysidetes microps*. TYPES, sp.n.; *Antarctomysis ohlini* Hansen.

St. 156. 20. i. 27 (day). Off South Georgia. DLH. 200–236 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 162. 17. ii. 27 (day). Off Signy I., South Orkneys. DLH. 320 m.: *Pseudomma armatum* Hansen; *Pseudomma sarsi* W.-Suhm; *Antarctomysis maxima* Holt and Tattersall.

St. 164. 18. ii. 27 (day). Near Cape Hansen, South Orkneys. NCS-T. 24–36 m.: *Antarctomysis maxima* Hansen in MS. Holt and Tattersall.

St. 167. 20. ii. 27 (day). Off Signy I., South Orkneys. N 4-T. 244–344 m.: *Pseudomma armatum* Hansen; *Pseudomma sarsi* W.-Suhm; *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 169. 22. ii. 27 (day). West of South Orkneys. TYF. 1100–1000 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 170. 23. ii. 27 (day). Off Cape Bowles, South Shetlands. DLH. 342 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 172. 26. ii. 27 (day). Off Deception I., South Shetlands. DLH. 525 m.: *Mysidetes brachylepis* W. M. Tattersall.

St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago. N 4-T, N 7-T, NCS-T. 160–335 m.: *Hansenomysis antarctica* Holt and Tattersall; *Pseudomma belgicae* Hansen; *Pseudomma schollaertensis* TYPES, sp.n.; *Pseudomma longicaudum* TYPES, sp.n.; *Paramblyops brevirostris* ♀ TYPES, sp.n.; *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 182. 14. iii. 27 (day). Schollaert Channel, Palmer Archipelago. N 4-T. 278–500 m.: *Pseudomma antarcticum* Zimmer; *Pseudomma belgicae* Hansen; *Paramblyops brevirostris* sp.n., ♂ TYPES; *Mysidetes posthon* Holt and Tattersall.

St. 187. 18. iii. 27 (day). Neumayr Channel, Palmer Archipelago. DLH. 259 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 190. 24. iii. 27 (day). Bismarck Strait, Palmer Archipelago. DLH. 43 m., 93–126 m. and 315 m.: *Antarctomysis maxima* Holt and Tattersall; *Mysidetes posthon* Holt and Tattersall. 93–126 m.: *Mysidetes dimorpha* sp.n.

St. 204. 6. iv. 27 (day). Bransfield Strait, South Shetlands, N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 205. 6. iv. 27 (day). Bransfield Strait, South Shetlands: *Antarctomysis ohlini* Hansen. (No depth given.)

St. 208. 7. iv. 27 (day). Off Livingstone I., South Shetlands. TYF. 800(–0) m.: *Boreomysis brucei* W. M. Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall; *Antarctomysis ohlini* Hansen.

St. 239. 2. vi. 27 (day). North-east of South Georgia. N 450. 1350–1050(–0) m.: *Gnathophausia gigas* W.-Suhm; *Eucopia grimaldii* Nouvel; *Boreomysis bispinosa* sp.n.

St. 245. 10. vi. 27 (day). West of Tristan da Cunha. N 450. 2000–1800 m.: *Gnathophausia zoea* W.-Suhm; *Eucopia australis* Dana; *Boreomysis atlantica* Nouvel.

St. 250. 17. vi. 27 (night). North-east of Tristan da Cunha. TYF. 300(–0) m.: *Euchaetomeropsis merolepis* (Illig).

St. 252. 20. vi. 27 (night). East-north-east of Tristan da Cunha. N 100 H. 135 m.: *Euchaetomera typica* G. O. Sars; *Arachnomysis megalops* Zimmer.

St. 253. 21. vi. 27 (day). North-east of Tristan da Cunha. TYF. 1050–1000 m.: *Chalaraspidum alatum* (W.-Suhm); *Gnathophausia gigas* W.-Suhm; *Eucopia unguiculata* (W.-Suhm); *Eucopia grimaldii* Nouvel.

St. 254. 21. vi. 27 (night). North-east of Tristan da Cunha. TYF. 200(–0) m.: *Euchaetomera zurstrasseni* (Illig); *Euchaetomera intermedia* Nouvel; *Longithorax capensis* Zimmer.

St. 256. 23. vi. 27 (day). West of Cape Town. TYF. 1100–850(–0) m.: *Gnathophausia ingens* (Dohrn); *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis rostra* Illig; *Siriella thompsonii* (M.-Ed.); *Katerythrops oceanae* Holt and Tattersall; *Katerythrops resimora* sp.n. Types; *Meterythrops picta* Holt and Tattersall; *Euchaetomera typica* G. O. Sars; *Euchaetomera tenuis* G. O. Sars; *Euchaetomera intermedia* Nouvel; *Caesaromysis hispida* Ortmann.

St. 257. 24. vi. 27 (night). West of Cape Town. TYF. 250(–0) m.: *Gnathophausia ingens* (Dohrn); *Siriella thompsonii* (M.-Ed); *Euchaetomera typica* G. O. Sars; *Euchaetomera intermedia* Nouvel; *Euchaetomeropsis merolepis* (Illig).

St. 258. 25. vi. 27 (night). West of Cape Town. TYF. 450–320 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera tenuis* G. O. Sars; *Longithorax capensis* Zimmer.

St. 259. 26. vi. 27 (night). West of Cape Town. TYF. 450–370(–0) m.: *Longithorax capensis* Zimmer; *Euchaetomera zurstrasseni* Illig; *Euchaetomera intermedia* Nouvel.

St. 266. 21. vii. 27 (night). West of Orange River estuary. TYF. 200(–0) m.: *Longithorax capensis* Zimmer; *Euchaetomera typica* G. O. Sars; *Euchaetomera glyphidophthalmica* Illig; *Euchaetomeropis merolepis* (Illig).

St. 267. 23. vii. 27 (night). Off Angra Pequena. TYF. 550–450(–0) m.: *Boreomysis rostrata* Illig; *Meterythrops picta* Holt and Tattersall; *Katerythrops oceanae* Holt and Tattersall; *Euchaetomera tenuis* G. O. Sars; *Euchaetomera zurstrasseni* (Illig); *Euchaetomera intermedia* Nouvel; *Euchaetomeropsis merolepis* (Illig); *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer.

St. 268. 25. vii. 27 (night). West of Cape Frio, South Africa. TYF. 150–100(–0) m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera intermedia* Nouvel; *Arachnomysis megalops* Zimmer.

St. 270. 27. vii. 27 (night). TYF. 200(–0) m. West of Benguela: *Arachnomysis leuckartii* Chun.

St. 274. 4. viii. 27 (day). Off St Paul de Loanda, Angola. N4-T. 65–64 m.: *Rhopalophthalmus egregius* Hansen; NCS-T. 65–64 m.: *Leptomysis apiops* G. O. Sars; *Leptomysis megalops* Zimmer; *Antarctomysis maxima* Holt and Tattersall.

St. 276. 5. viii. 27 (night). Off Congo River estuary. TYF. 150(–0) m.: *Euchaetomera glyphidophthalmica* Illig.

St. 277. 7. viii. 27 (night). South of Cape Lopez. TYF. 63(–0) m.: *Lophogaster challengeri* Fage; *Anchialina truncata* (G. O. Sars); *Erythrops africana* sp.n. Types; *Leptomysis apiops* G. O. Sars; *Leptomysis megalops* Zimmer.

St. 279. 10. viii. 27 (day). Off Cape Lopez. NCS-T. 58–67 m.: *Lophogaster challengeri* Fage; *Rhopalophthalmus egregius* Hansen; *Leptomysis apiops* G. O. Sars; *Leptomysis capensis* Illig.

St. 280. 10. viii. 27 (night). Off Cape Lopez. N 100 B. 84–0 m.: *Afromysis hansoni* Zimmer.

St. 281. 12. viii. 27 (day). West of Cape Lopez. TYF. 950–850(–0) m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia grimaldii* Nouvel; *Eucopia sculpticauda* Faxon.

St. 282. 12. viii. 27 (night). West of Cape Lopez. TYF. 300(–0) m.: *Euchaetomera typica* G. O. Sars; *Euchaetomera tenuis* G. O. Sars; *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer; *Arachnomysis leuckartii* Chun.

St. 285. 16. viii. 27 (night). Gulf of Guinea. N 450. 175–125(–0) m.: *Gnathophausia ingens* (Dohrn).

St. 286. 17. viii. 27 (night). Midway between Cape Lopez and Ascension I. TYF. 125(–0) m.: *Euchaetomera typica* G. O. Sars.

St. 287. 19. viii. 27 (night). Gulf of Guinea. TYF. 1000–800(–0) m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis microps* G. O. Sars.

St. 288. 21. viii. 27 (night). Gulf of Guinea. TYF. 250(–0) m.: *Gnathophausia ingens* (Dohrn).

St. 289. 23/24. viii. 27 (night). Gulf of Guinea. TYF. 225–125(–0) m.: *Gnathophausia ingens* (Dohrn).

St. 290. 24. viii. 27 (dawn). West of Sierra Leone. TYF. 100(–0) m.: *Arachnomysis leuckartii* Chun.

St. 295. 25. viii. 27 (day). West of Sierra Leone. TYF. 2700–2500(–0) m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia* sp.; *Euchaetomera typica* G. O. Sars; *Euchaetomera tenuis* G. O. Sars.

St. 296. 26. viii. 27 (night). South-west of Monrovia. TYF. 550–450(–0) m.: *Gnathophausia ingens* (Dohrn).

St. 298. 29. viii. 27 (day). West of Cape Verde. TYF. 1200–900(–0) m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis illigi* sp.n. Types.

St. 300. 20. i. 30 (day). North of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 302. 21. i. 30 (day). North of South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 303. 21. i. 30 (day). North of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 305. 21/22. i. 30 (night). North of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 322. 31. i. 30 (day). North-west of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 323. 31. i. 30 (day). North-west of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 326. 2. ii. 30 (night). West of South Georgia. N 70 V. 50–0 m.: *Mysis australe* sp.n. ♀ Types. 100–50 m. and 200–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 327. 2. ii. 30 (day). West of South Georgia. N 70 V. 50–0 m.: *Mysis australe* sp.n. 200–100 m. *Antarctomysis maxima* Holt and Tattersall.

St. 331. 2. ii. 30 (day). West of South Georgia. N 70 V. 100–50 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 334. 4. ii. 30 (day). South of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 337. 5. ii. 30 (day). South of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 338. 5. ii. 30 (day). South of South Georgia. N 70 V. 225–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 339. 5. ii. 30 (day). South of South Georgia. N 70 V. 100–50 m. and 250–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 340. 5. i. 30 (night). South of South Georgia. N 70 V. 100–50 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 341. 5/6. ii. 30 (night). South-west of South Georgia. N 70 V. 50–0 m., 100–50 m., and 230–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 344. 7/8. ii. 30 (night). South-east of South Georgia. N 70 V. 1000–750 m. and 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 348. 8. ii. 30 (day). Off south-east of South Georgia. N 70 V. 90–50 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 349. 8. ii. 30 (night). South-east of South Georgia. N 70 V. 100–50 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 353. 9. ii. 30 (day). East of South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 357. 10. ii. 30 (dusk to dark). North-east of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 358. 11. ii. 30 (night). North-east of South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 363. 26. ii. 30 (day). South Sandwich Is. DLH. 329–278 m.: *Mysidetes posthon* Holt and Tattersall.

St. 366. 6. iii. 30 (day). 4 cables South of Cook Is., South Sandwich Is. DLH. 322–155 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 368. 8. iii. 30 (day). Douglas Strait, South Sandwich Is., 1 mile North of Twitcher Rock. DLH. 653 m.: *Mysidetes posthon* Holt and Tattersall.

St. 371. 14. iii. 30 (day). 1 mile East of Montagu I., South Sandwich Is. N 4-T. 99–161 m.: *Mysidetes crassa* Hansen; *Antarctomysis maxima* Holt and Tattersall.

St. 376. 11. iv. 30 (day). South of South Shetlands. N 70 V. 750–500 m.: *Antarctomysis ohlini* Hansen.

St. 391. 18. iv. 30 (day). Midway between South Georgia and Cape Horn. N 450 B. 1300–1200(–0) m. (carapace only): *Gnathophausia gigas* W.-Suhm; *Eucopia australis* Dana.

St. 395. 13. v. 30 (day). North-east of South Georgia, N 450 B. 1600–1500 m.: *Eucopia australis* Dana; *Eucopia grimaldii* Nouvel; *Boreomysis atlantica* Nouvel.

St. 405. 4. vi. 30 (day). West of Cape Town. TYFB. 1200–0 m.: *Eucopia unguiculata* (W.-Suhm); *Boreomysis rostrata* Illig.

St. 406. 5. vi. 30 (day). 6 cables north-east of Roman Rocks, Simon's Bay, Cape Peninsula. BRN. 29 m.: *Anchialina truncata* (G. O. Sars); *Mysidopsis camelina* sp.n., ♀ Type; *Leptomysis capensis* Illig.

St. 407. 12. vi. 30 (day). South-west of Cape Town. N 450 B. 950–800 m.: *Gnathophausia ingens* (Dohrn); *Eucopia unguiculata* (W.-Suhm); *Boreomysis rostrata* Illig; *Meterythrops picta* Holt and Tattersall.

St. 413. 21. viii. 30 (day). West of Saldanha Bay, Natal. TYFB. 2200–1600(–0) m.: *Gnathophausia gigas* W.-Suhm. 1600–1000 m.: *Gnathophausia gigas* W.-Suhm; *Eucopia australis* Dana; *Eucopia linguicauda* sp.n. Type; *Boreomysis rostrata* Illig.

St. 414. 28. viii. 30 (night). South of Cape Town. N 100 B. 1700–1000 m.: *Eucopia sculpticauda* Faxon.

St. 421. 31. viii. 30 (day). South of Cape Town. N 100 B. 77–0 m.: *Leptomysis capensis* Illig.

St. 423. 3. ix. 30 (night). South of Port Elizabeth, South Africa. N 100 B. 56–0 m.: *Anchialina truncata* (G. O. Sars).

St. 424. 4. xi. 30 (night). Off Port Elizabeth, South Africa. N 100 B. 59–0 m.: *Lophogaster challengeri* Fage; *Anchialina truncata* (G. O. Sars); *Leptomysis capensis* Illig.

St. 436. 20. ix. 30 (day). Off Durban. BNR. 416(–0) m.: *Amblyops durbani* sp.n. Types.

St. 437. 20. ix. 30 (night). East of Durban. N 100 B. 123–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 440. 21. ix. 30 (day). East of Durban. TYFB. 1050–950(–0) m.: *Lophogaster rotundatus* Illig; *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; (dusk to dark) TYFB. 1000–0 m.: *Gnathophausia ingens* (Dohrn).

St. 441. 22. ix. 30 (night). South-east of Durban. N 100 B. 180–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 443. 23. ix. 30 (night). South-west of Port Elizabeth. N 100 B. 49–0 m.: *Gastrosaccus sanctus* (v. Beneden); *Anchialina truncata* (G. O. Sars); *Lophogaster challengeri* Fage; *Leoptomysis capensis* Illig.

St. 444. 24. ix. 39 (night). Off Cape Peninsula. N 100 B. 80–0 m.: *Lophogaster challengeri* Fage; *Anchialina truncata* (G. O. Sars); *Leptomysis capensis* Illig; *Leptomysis megalops* Zimmer.

St. 448. 10. x. 30 (night). South-west of Cape Town. N 70 B. 161–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 461 D. 22. x. 30 (night). West-south-west of Bouvet Is. N 100 B. 490–385 m.: *Euchaetomera zurstrasseni* (Illig).

St. 517. 26. xi. 30 (night). East of South Georgia. N 100 B. 102–0 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 518. 27. xi. 30 (night). South Georgia. N 100 B. 90–0 m., *Antarctomysis maxima* Holt and Tattersall. 14 juv. 9–11 mm.

St. 563. 1. i. 31 (day). Bellingshausen Sea. N 100 B. 450–180 m.: *Euchaetomera zurstrasseni* (Illig).

St. 590. 14. i. 31 (day). West of Graham Land. TYFH. 1400–1150 m.: *Eucopia australis* Dana; *Boreomysis brucei* Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall; *Euchaetomera zurstrasseni* (Illig).

St. 591. 14. i. 31 (day). West of Graham Land. N 100 B. 360–122 m.: *Euchaetomera zurstrasseni* (Illig).

St. 592. 15. i. 31 (day). Bellingshausen Sea. N 100 B. 350–124 m.: *Euchaetomera zurstrasseni* (Illig).

St. 594. 15. i. 31 (day). North-west of Graham Land. N 100 B. 435–165 m.: *Euchaetomera zurstrasseni* (Illig).

St. 661. 2. iv. 31 (day). South-east of South Georgia. TYFV. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall. 1500–1000 m. *Boreomysis brucei* Tattersall. 2000–1500 m. (night): *Boreomysis brucei* Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall. 3000–2000 m. (night): *Eucopia australis* Dana; *Boreomysis brucei* Tattersall; *Dactylamblyopsis hodgsoni* Tattersall.

St. 663. 5. iv. 31 (day). East-north-east of South Georgia. TYFV. 500–250 m.: *Boreomysis rostrata* Illig; *Euchaetomera zurstrasseni* (Illig). 1500–1000 m.: *Dactylamblyops hodgsoni* Tattersall. 2000–1500 m.: *Dactylamblyops hodgsoni* Tattersall.

St. 666. 17/18. iv. 31 (day). North-east of South Georgia. TYFV. 750–500 m.: *Euchaetomera zurstrasseni* (Illig). 1000–750 m.: *Dactylamblyops hodgsoni* Tattersall.

St. 668. 19. iv. 31 (day). North-west of South Georgia. TYFV. 750–500 m. and 1500–0 m.: *Euchaetomera zurstrasseni* (Illig).

St. 671. 22/23. iv. 31 (night). South-west of Tristan da Cunha. TYFV. 1000–0 m.: *Boreomysis rostrata* Illig. 1500–1000 m. (night): *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 673. 25. iv. 31 (night). West of Tristan da Cunha. TYFB. 340–0 m.: *Siriella thompsonii* (M.-Ed.); *Echinomysis chuni* Illig; *Euchaetomera typica* G. O. Sars; *Euchaetomera tenuis* G. O. Sars; *Euchaetomera intermedia* Nouvel. 500–250 m.: *Euchaetomera zurstrasseni* (Illig). 1000–750 m.: *Caesaromysis hispida* Ortmann. 1500–1000 m.: *Boreomysis rostrata* Illig.

St. 674. 25. iv. 31 (night). West of Tristan da Cunha. TYFB. 280–0 m.: *Euchaetomera typica* G. O. Sars; *Euchaetomera intermedia* Nouvel; *Arachnomysis megalops* Zimmer.

St. 675. 26. iv. 31 (day). West-north-west of Tristan da Cunha. TYFV. 1500–1000 m.: *Eucopia australis* Dana.

St. 676. 26. iv. 31 (night). West-north-west of Tristan da Cunha. TYFB. 290–0 m.: *Euchaetomera typica* G. O. Sars.

St. 677. 28. iv. 31 (night). Mid-Atlantic, North-west of Tristan da Cunha. TYFB. 420–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 679. 29. iv. 31 (night). South of Ilha da Trinidade. TYFB. 300–0 m.: *Lophogaster spinosus* Ortmann; *Siriella thompsonii* (M.-Ed.). 500–250 m.: *Siriella thompsoni* (M.-Ed.). 2000–1500 m. (day): *Eucopia grimaldii* Nouvel.

St. 680. 30. iv. 31 (night). South of Ilha da Trinidade. TYFB. 260–0 m.: *Lophogaster spinosus* Ortmann.

St. 685. 3. v. 31 (night). East of San Salvador, Brazil. TYFB. 350–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 687. 5. v. 31 (day). South-east of Pernambuco. TYFV. 1500–1000 m. *Eucopia australis* Dana.

St. 689. 6. v. 31 (night). East of Pernambuco. TYFB. 410–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 691. 8. v. 31 (night). Equator, south-west of Cape Verde Is. TYFB. 400–0 m.: *Gnathophausia ingens* (Dohrn).

St. 692. 9. v. 31 (night). Mid-Atlantic, just north of equator. TYFB. 350–0 m.: *Euchaetomera typica* G. O. Sars; *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer.

St. 693. 10. v. 31 (day). Mid-Atlantic near equator. TYFV. 250–0 m.: *Boreomysis sibogae* Hansen; *Euchaetomera typica* G. O. Sars. 750–500 m.: *Eucopia unguiculata* (W.-Suhm). 2000–1500 m.: *Eucopia australis* Dana.

St. 694. 10. v. 31 (night). Mid-Atlantic, south-south-west of Cape Verde Is. TYFB. 210–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera typica* G. O. Sars; *Arachnomysis leuckartii* Chun; *Arachnomysis megalops* Zimmer.

St. 695. 11. v. 31 (night). Mid-Atlantic, south-south-west of Cape Verde Is. TYFB. 370–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera tenuis* G. O. Sars; *Euchaetomera glyphidophthalmica* Illig; *Caesaromysis hispida* Ortmann.

St. 696. 12. v. 31 (day). South-west of Cape Verde Is. TYFV. 1000–750 m.: *Boreomysis illigi* sp.n.; *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon.

St. 697. 12. v. 31 (night). Mid-Atlantic, south-west of Cape Verde Is. TYFB. 460–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera tenuis* G. O. Sars; *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer.

St. 698. 13. v. 31 (night). South-west of Cape Verde Is. TYFB. 470–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera typica* G. O. Sars; *Euchaetomera intermedia* Nouvel.

St. 699. 14. v. 31 (night). West of Cape Verde Is. TYFB. 370–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera typica* G. O. Sars; *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer; TYFV. 250–0 m. (day): *Arachnomysis leuckartii* Chun; *Caesaromysis hispida* Ortmann. TYFV. 1000–750 m. (day): *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon.

St. 700. 18. 5. 31 (day). North-east of Cape Verde Is. TYFB. 2025–0 m.: *Gnathophausia gracilis* W.-Suhm; *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Siriella thompsonii* (M.-Ed.); *Meterythrops picta* Holt and Tattersall; *Katerythrops oceanae* Holt and Tattersall; *Euchaetomera intermedia* Nouvel.

St. 701. 16. x. 31 (night). Off Cape Verde Is. TYFB. 242–0 m. *Euchaetomera typica* G. O. Sars; *Euchaetomera glyphidophthalmica* Illig.

St. 702. 17. x. 31 (night). West of Sierra Leone. TYFB. 236–0 m.: *Euchaetomera tenuis* G. O. Sars.

St. 703. 18. x. 31 (night). South-south-west of Cape Verde Is. TYFB. 358–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 704. 19. x. 31 (night). South of Cape Verde Is. TYFB. 231–0 m.: *Siriella thompsonii* (M.-Ed.); *Anchialina typica* (Kroyer); *Euchaetomera intermedia* Nouvel; *Arachnomysis megalops* Zimmer.

St. 705. 20. x. 31 (night). North-east of Pernambuco. TYFB. 150–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 706. 21. x. 31 (night). North-east of Pernambuco. TYFB. 354–0 m.: *Siriella thompsonii* (M.-Ed.); *Caesaromysis hispida* Ortmann; *Arachnomysis megalops* Zimmer.

St. 709. 24. x. 31 (night). Off Abrolhos Is. TYFB. 216–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 713. 29. x. 31 (night). East of Porto Alegre, Brazil. TYFB. 200–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 714. 30. x. 31 (night). East of Monte Video. TYFB. 246–0 m.: *Katerythrops oceanae* Holt and Tattersall; *Euchaetomera intermedia* Nouvel.

St. 717. 2. xi. 31 (night). North-north-east of Falkland Is. TYFB. 212–0 m.: *Euchaetomera intermedia* Nouvel.

St. 844. 8. iv. 32 (night). South of Cape Town. N 100 B. 155–0 m.: *Lophogaster challengeri* Fage; *Anchialina truncata* (G. O. Sars); *Longithorax capensis* Illig; *Leptomysis megalops* Zimmer.

St. 942. 31. viii. 32 (night). East of Cook Strait, New Zealand. N 100 B. 350–110 m.: *Boreomysis rostrata* Illig (doubtfully).

St. 946. 3. ix. 32 (night). South of Chatham I. N 100 B. 270–120 m.: *Euchaetomera zurstrasseni* (Illig).

St. 971. 25. ix. 32 (night). North of Bellingshausen Sea. N 100 B. 340–120 m.: *Euchaetomera zurstrasseni* (Illig).

St. 980. 15. x. 32 (night). East of Magellan Strait. N 100 B. 104–0 m.: *Mysidopsis acuta* Hansen.

St. 1298. 2. iii. 34 (day). Ice Edge, Bellingshausen Sea. N 450 H. 1000(–0) m.: *Gnathophausia gigas* W.-Suhm; *Eucopia australis* Dana.

St. 1371. 19. v. 34 (night). South-east of Port Elizabeth. N 70 B. 146–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 1372. 20. v. 34 (night). East of East London. N 70 B. 102–0 m.: *Siriella thompsonii* (M.-Ed.).

St. 1374. 24. v. 34 (night). East of St Johns, Natal. TYFB. 230–0 m.: *Longithorax capensis* Zimmer.

St. 1377. 4. viii. 34 (night). South-west of Cape Town. N 100 B. 100–0 m.: *Euchaetomera typica* G. O. Sars.

St. 1517. 14. ii. 35 (night). Ice-edge east of Weddell Sea. N 100 B. 420–230 m.: *Euchaetomera zurstrasseni* Illig.

St. 1539. 25. ii. 35 (night). Ice-edge off Enderby Land. N 100 B. 350–230 m.: *Euchaetomera zurstrasseni* Illig.

St. 1555. 29. iii. 35 (night). South of South Africa. TYFB. 1000–0 m.: *Katerythrops oceanae* Holt and Tattersall.

St. 1558. 1. iv. 35 (night). West of Prince Edward Is. TYFB. 1300–0 m.: *Euchaetomera zurstrasseni* Illig.

St. 1561. 4. iv. 35 (night). West of Prince Edward Is. TYFB. 1250–0 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1566. 9. iv. 35 (night). North of Prince Edward Is. TYFB. 1350–0 m.: *Boreomysis rostrata* Illig.

St. 1567. 10. iv. 35 (night). North of Prince Edward Is. TYFB. 1350–0 m.: *Gnathophausia ingens* (Dohrn); *Siriella thompsonii* (M.-Ed.).

St. 1568. 11. iv. 35 (night). South-east of Durban. TYFB. 1400–0 m.: *Boreomysis rostrata* Illig; *Euchaetomera tenuis* G. O. Sars; *Euchaetomera oculata* Hansen; *Gibberythrops acanthura* (Illig).

St. 1569. 12. iv. 35 (night). South-east of Durban. TYFB. 1200–500 m.: *Meterythrops picta* Holt and Tattersall.

St. 1571. 21. iv. 35 (night). South-west of Madagascar. TYFB. 500–0 m.: *Siriella thompsonii* (M.-Ed.). 1400–1000 m.: *Gnathophausia ingens* (Dohrn); *Euchaetomera intermedia* Nouvel.

St. 1573. 22. iv. 35 (night). Mozambique Channel. TYFB. 800–0 m.: *Gnathophausia ingens* (Dohrn).

St. 1574. 23. iv. 35 (night). Mozambique Channel. TYFB. 1100–450 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon.

St. 1575. 24. iv. 35 (night). Mozambique Channel. TYFB. 400–0 m. and 800–550 m.: *Gnathophausia ingens* (Dohrn). N 70 B. 800–0 m. (night); *Katerythrops oceanae* Holt and Tattersall.

St. 1576. 25. iv. 35 (night). Mozambique Channel. TYFB. 400–0 m.: *Gnathophausia ingens* (Dohrn). 1100–400 m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon.

St. 1578. 26. iv. 35 (night). North of Mozambique Channel. TYFB. 500–0 m.: *Gnathophausia ingens* (Dohrn); *Siriella aequiremis* Hansen; *Euchaetomera typica* G. O. Sars.

St. 1580. 27. iv. 35 (night). South-east of Zanzibar. TYFB. 450–0 m.: *Gnathophausia ingens* (Dohrn). N 70 B. 1300–0 m.: *Eucopia sculpticauda* Faxon. TYFB. 1300–750 m.: *Eucopia unguiculata* (W.-Suhm).

St. 1581. 28. iv. 35 (night). East of Zanzibar. TYFB. 600–0 m.: *Euchaetomera tenuis* G. O. Sars.

St. 1582. 29. iv. 35 (night). East of Zanzibar. N 450 H. 1900–1850(–0) m.: *Gnathophausia ingens* (Dohrn); *Gnathophausia zoea* W.-Suhm; *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel.

St. 1585. 1. v. 35 (night). East of Juba, Somaliland. TYFB. 500–0 m.: *Lophogaster schmidti* Fage; *Siriella gracilis* Dana; *Siriella aequiremis* Hansen; *Caesaromysis hispida* Ortmann. 1400–700 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis tattersalli* sp.n.

St. 1586. 2. v. 35 (night). East of Somaliland. TYFB. 550–0 m.: *Gnathophausia ingens* (Dohrn); *Siriella aequiremis* Hansen; *Petalophthalmus oculatus* Illig; *Gibberythrops acanthura* Illig; *Longithorax capensis* Zimmer; *Euchaetomera tenuis* G. O. Sars. 1650–950 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel.

St. 1587. 3. v. 35 (night). South of Cape Guardafui. TYFB. 450–0 m.: *Lophogaster schmidti* Fage; *Echinomysis chuni* Illig. 1250–800 m.: *Lophogaster schmidti* Fage; *Eucopia unguiculata* (W.-Suhm); *Eucopia sculpticauda* Faxon; *Boreomysis tattersalli* sp.n. Types; *Gibberythrops acanthura* (Illig).

St. 1590. 13. x. 35 (night). South of Canary Isles. TYFB. 400–320 m.: *Gnathophausia ingens* (Dohrn).

St. 1596. 21. x. 35 (night). Gulf of Guinea. TYFB. 450–310 m.: *Euchaetomera typica* G. O. Sars.

St. 1602. 27. x. 35 (night). East of St Helena. TYFB. 470–300 m.: *Boreomysis rostrata* Illig; *Boreomysis illigi* sp.n. 175–0 m.: *Siriella thompsonii* (M.-Ed.); *Euchaetomera typica* G. O. Sars.

St. 1604. 29. x. 35 (night). South-east of St Helena. TYFB. 620–500 m.: *Boreomysis plebeja* Hansen; *Boreomysis rostrata* Illig; *Meterythrops picta* Holt and Tattersall.

St. 1606. 31. x. 35 (night). West of Angra Pequena, South-west Africa. TYFB. 600–500 m.: *Heteroerythrops purpura* gen. et sp.nov. ♀ Type; *Boreomysis rostrata* Illig; *Boreomysis plebeja* Hansen; *Meterythrops picta* Holt and Tattersall.

St. 1633. 29. xi. 35 (day). South-east of Heard Is. N 70 B. 1100–875 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1644. 16. i. 36 (day). Bay of Whales. BNR. 626 m.: *Pseudomma belgicae* (Hansen in MS.), Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 1652. 23. i. 36 (day). Bay of Whales, Ross Sea. DLH. 567 m.: *Amblyops antarctica* sp.n.; *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 1660. 27. i. 36 (day). Bay of Whales. N 7-T. 351 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 1702. 17. iii. 36 (day). Ice Edge off Wilkes Land. TYFB. 2000–1250 m.: *Boreomysis brucei* W. M. Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1715. 23. iii. 36 (night). Ice Edge off Budd's High Land. TYFB. 1400–1100 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1739. 17. iv. 36 (day). West of Perth, Western Australia. TYFB. 3000–2000(–0) m.: *Katerythrops oceanae* Holt and Tattersall.

St. 1741. 18. iv. 36 (day). West of Perth, Western Australia. N 450 B. 900–0 m.: *Gnathophausia ingens* (Dohrn).

St. 1747. 23. iv. 36 (day). Indian Ocean, North of Amsterdam Is. TYFB. 400–0 m.: *Euchaetomera typica* G. O. Sars.

St. 1753. 27. iv. 36 (day). North-west of New Amsterdam, South Indian Ocean. TYFB. 2900–1400 m.: *Boreomysis rostrata* Illig; *Katerythrops oceanae* Holt and Tattersall.

St. 1755. 29. iv. 36 (day). South-south-east of Mauritius. N 450 B. 1700–0 m.: *Gnathophausia gigas* W.-Suhm.

St. 1761. 3. v. 36 (day). South of Madagascar. TYF 70 B. 1800–650 m.: *Gnathophausia ingens* (Dohrn); *Meterythrops picta* Holt and Tattersall.

St. 1763. 5. v. 36 (day). South-east of Durban. N 450 B. 2000–0 m.: *Gnathophausia ingens* (Dohrn).

St. 1764. 6. v. 36 (night). South-east of Durban. N 450 B. 1000–0 m.: *Gnathophausia ingens* (Dohrn).

St. 1765. 7. v. 36 (day). East of East London, South Africa. TYF 70 B. 1350–800 m.: *Eucopia sculpticauda* Faxon.

St. 1770. 21. v. 36 (night). West of Cape Town. N 100 B. 340–210 m.: *Gnathophausia ingens* (Dohrn).

St. 1775. 27. v. 36 (night). South-east of Gough I. N 70 V. 1500–1000 m.: *Gnathophausia gigas* W.-Suhm.

St. 1798. 12. vi. 36 (night). North-east of Bouvet I. N 70 V. 1000–750 m.: *Gnathophausia gigas* W.-Suhm.

St. 1802. 16. ix. 36 (day). Off Cape Town. N 70 V. 1000–750 m.: *Boreomysis rostrata* Illig.

St. 1838. 12. x. 36 (day). West-north-west of South Sandwich Is. TYF 70 V. 750–250 m.: *Dactylamblyops hodgsoni* Holt and Tattersall; *Euchaetomera zurstrasseni* (Illig).

St. 1855. 4. xi. 36 (day). Off South Georgia. TYF 70 B. 1050–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1866. 9. xi. 36 (night). Scotia Sea. N 100 B. 380–200 m.: *Antarctomysis maxima* Holt and Tattersall (Hansen in MS.).

St. 1869. 11. xi. 36 (day). Scotia Sea. TYFB. 1550–1000 m.: *Eucopia grimaldii* Nouvel; *Boreomysis brucei* Tattersall.

St. 1871. 12. xi. 36 (day). East of South Shetlands. TYFB. 1450–1000 m.: *Boreomysis brucei* Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1872. 12. xi. 36 (day). Scotia Sea. N 100 H. 247 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 1873. 13. xi. 36 (day). South of Falkland Is. DRR. 210–180 m.: *Antarctomysis maxima* Holt and Tattersall.

St. 1915. 2. xii. 36 (day). Scotia Sea. TYFB. 550–350 m. *Euchaetomera zurstrasseni* (Illig).

St. 1917. 3. xii. 36 (day). Off South Georgia. TYFB. 1400–1000 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1919. 4. xii. 36 (day). Off South Georgia. TYFB. 1800–1300 m.: *Eucopia australis* Dana; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1944. 2. i. 37 (day). North of South Orkneys. TYFB. 1500–1200 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1946. 3. i. 37 (day). West of South Orkneys. TYFB. 1700–1300 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1952. 11. i. 37 (day). South Shetlands. DLH. 367–383 m.: *Antarctomysis maxima* Holt and Tattersall (Hansen in MS.).

St. 1955. 29. i. 37 (day). South Shetlands. DLH. 440–410 m.: *Mysidetes posthon* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. 1957. 3. ii. 37 (day). Off South side of Clarence I., South Shetlands. DLH. 785–810 m.: *Pseudomma sarsi* (W.-Suhm); *Pseudomma antarcticum* Zimmer; *Amblyops antarctica* sp.n. ♀ Type; *Mysidetes posthon* Holt and Tattersall.

St. 1966. 16. ii. 37 (day). North of South Orkneys. TYFB. 1800–1500 m.: *Boreomysis brucei* Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1970. 18. ii. 37 (day). Scotia Sea. TYFB. 1800–1500 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1972. 28. ii. 37 (day). Scotia Sea. TYFB. 2100–1400 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1974. 1. iii. 37 (day). Scotia Sea. TYFB. 1600–1000 m.: *Eucopia unguiculata* (W.-Suhm).

St. 1989. 10. iii. 37 (day). East of South Georgia. TYFB. 1500–1200 m.: *Boreomysis plebeja* Hansen; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1991. 11. iii. 37 (day). South-east of South Georgia. TYFB. 1500–1000 m.: *Gnathophausia gigas* W.-Suhm; *Boreomysis brucei* Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1993. 12. iii. 37 (day). South-west of South Sandwich Is. TYFB. 950–650 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 1995. 13. iii. 37 (day). South-south-east of South Sandwich Is. TYFB. 1800–1300 m.: *Boreomysis brucei* Tattersall.

St. 1999. 15. iii. 37 (day). South-east of South Sandwich Is. N 100 B. 1000–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 2006. 19. iii. 37 (day). East of South Sandwich Is. TYFB. 1750–1400 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 2018. 26. iii. 37 (night). West of Bouvet Isle. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. 2022. 28. iii. 37 (night). North-west of Bouvet Is. N 100 B. 700–400 m.: *Gnathophausia gigas* W.-Suhm.

St. 2033. 6. iv. 37 (day). Off Cape Town. TYFB. 1350–1250 m.: *Boreomysis bispinosa* sp.n. ♀ Type.

St. 2034. 6. iv. 37 (night). West of Cape Town. N 100 B. 162–0 m.: *Boreomysis illigi* sp.n.

St. 2035. 7. iv. 37 (day). Off Cape Town. TYFB. 950–750 m.: *Eucopia unguiculata* (W.-Suhm); *Boreomysis rostrata* Illig.

St. 2038. 19. iv. 37 (day). West of Cape Town. TYFB. 1200–850 m.: *Boreomysis rostrata* Illig.

St. 2042. 22. iv. 37 (day). West of Saldanha Bay, South Africa. N 100 H. 0–5 m.: *Siriella thompsonii* (M.-Ed.).

St. 2044. 23. iv. 37 (day). Due west of Orange River estuary. N 100 H. 0–5 m.: *Siriella thompsonii* (M.-Ed.).

St. 2053. 27. iv. 37 (day). East-south-east of St Helena. TYFB. 900–550 m.: *Eucopia australis* Dana.

St. 2055. 28. iv. 37 (day). East of St Helena. TYFB. 2000–1400 m.: *Eucopia sculpticauda* Faxon; *Boreomysis acuminata* sp.n.

St. 2057. 29. iv. 37 (day). North-east of St Helena. N 450 B. 1450–700 m.: *Gnathophausia gracilis* W.-Suhm; *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis bispinosa* sp.n. ♂ TYPE.

St. 2059. 30. iv. 37 (day). North-north-east of St Helena. N 450 B. 1400–0 m.: *Gnathophausia gracilis* W.-Suhm. 1900–1400 m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel.

St. 2061. 1. v. 37 (day). East-north-east of Ascension I. N 450 B. 1900–1500 m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon.

St. 2063. 2. v. 37 (day). North-east of Ascension I. N 450 B. 600–0 m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Boreomysis microps* G. O. Sars. 1150–600 m.: *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Boreomysis microps* G. O. Sars.

St. 2064. 3. v. 37 (day). North-north-east of Ascension I. N 450 B. 1600–1050 m.: *Gnathophausia zoea* W.-Suhm; *Eucopia sculpticauda* Faxon; *Eucopia australis* Dana; *Eucopia grimaldii* Nouvel; *Boreomysis microps* G. O. Sars; *Boreomysis acuminata* sp.n.

St. 2065. 4. v. 37 (day). North of Ascension I. N 450 B. 1600–1400 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Eucopia grimaldii* Nouvel; *Boreomysis microps* G. O. Sars; *Boreomysis acuminata* sp.n.

St. 2066. 5. v. 37 (day). South-west of Monrovia. N 450 B. 1950–1550 m.: *Eucopia unguiculata* (W.-Suhm); *Eucopia australis* Dana; *Eucopia sculpticauda* Faxon; *Boreomysis acuminata* sp.n., TYPES. 1550–0 m.: *Eucopia sculpticauda* Faxon.

St. 2550. 23. i. 39 (night). 67° 27·8′ S., 06° 35·3° E., off Pack Ice. TYFB. 430–230 m.: *Euchaetomera zurstrasseni* (Illig).

St. 2682. 8. vi. 50 (night). South-east of Aden. N 70 V. 750–500 m.: *Eucopia unguiculata* (W.-Suhm).

St. 2685. 22. vi. 50 (night). 07° 03′ S., 90° 00′ E. N 70 V. 250–100 m.: *Euchaetomera typica* G. O. Sars.

R.R.S. 'WILLIAM SCORESBY'

St. WS 22. 30. xi. 26 (day). North of South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. WS 25. 17. xii. 26 (night). Undine Harbour (North), South Georgia. BTS. 18–27 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 26. 18. xii. 26 (dusk to dark). North of Bird Is., South Georgia. N 70 V. 1000–750 m.: *Boreomysis sibogae* Hansen.

St. WS 27. 19. xii. 26 (day). Off South Georgia. N 100 H. 107 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 28. 19. xii. 26 (day). Off South Georgia. N 100 H. 80 m. and 145–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 29. 19. xii. 26 (day). Off South Georgia. N 70 V. 50–0 m.: *Antarctomysis maxima* Holt and Tattersall; 600–500 m.: *Boreomysis rostrata* var. (with large eyes) Illig; *Boreomysis sibogae* Hansen.

St. WS 30. 19/20. xii. 26 (night). Off South Georgia. N 70 V. 100–50 m.: *Antarctomysis maxima* Holt and Tattersall. 250–100 m.: *Euchaetomera zurstrasseni* (Illig); *A. maxima* Holt and Tattersall. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. WS 31. 20. xii. 26 (day). South-east of South Georgia. N 100 H. 53 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 32. 21. xii. 26 (day). Mouth of Drygalski Fiord, South Georgia. BTS. 225 m.: *Antarctomysis maxima* Holt and Tattersall; *Antarctomysis ohlini* Hansen.

St. WS 33. 21. xii. 26 (day). South of Drygalski Fiord, South Georgia. N 100 H. 130 m. (bottom): *Antarctomysis maxima* Holt and Tattersall.

St. WS 35. 21/22. xii. 26 (night). South of South Georgia. N 100 H. 51 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 37. 22. xii. 26 (day). Off South Georgia. N 70 V. 300–250 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 38. 22/23. xii. 26 (night). East of South Georgia. N 70 V. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall.

St. WS 40. 7. i. 27 (day). Off South Georgia. N 70 V. 100–50 m. and 175–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 41. 7. i. 27 (day). Off South Georgia. N 100 H. 146 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 42. 7. i. 27 (dusk to dark). Off south of South Georgia. N 70 V. 170–100 m. (night). N 100 H. 99 m. and 198 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 43. 7/8. i. 27 (night). South of South Georgia. N 70 V. 50–0 m., N 100 H. 0–5 m., 70 m. and 141 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 44. 8. i. 27 (day). South of South Georgia. N 70 V. 750–500 m.: *Dactylamblyops hodgsoni* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall (no depth on label).

St. WS 45. 8. i. 27 (day). Off South Georgia. N 70 V. 100–50 m. and 175–100 m.; N 100 H. 51 m. and 102 m.: *Antarctomysis maxima* (Hansen MS.) Holt and Tattersall.

St. WS 46. 8. i. 27 (night). Off South Georgia. N 70 V. 50–0 m., 171–50 m., 100–50 m.; N 100 H. 73 m. and 146 m.: *Antarctomysis maxima* (Hansen MS.) Holt and Tattersall.

St. WS 47. 9. i. 27 (night). Off South Georgia. N 100 H. 0–5 m., 63 m. and 126 m.; N 70 V. 50–0 m., 100–50 m. and 150–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 48. 9. i. 27 (day). West of Cape Nunez, South Georgia. N 100 H. 96 m.; 192 m.; N 70 V. 50–0 m.; 224–100 m.: *Antarctomysis maxima* Holt and Tattersall (Hansen MS.).

St. WS 49. 9. i. 27 (day). Off South Georgia. N 100 H. 69 m.; 137 m.; N 70 V. 100–50 m.; 225–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 50. 9. i. 27 (day). Off South Georgia. N 100 H. 71 m.; 142 m.; N 70 V. 50–0 m.; 225–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 51. 9. i. 27 (day). Off South Georgia. N 100 H. 64 m.; 128 m.; N 70 H. 119 m.; N 70 V. 100–50 m.; 210–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 52. 10. i. 27 (day). North-west of South Georgia. N 100 H. 100 m.; N 70 V. 180–100 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 62. 19. i. 27 (day). Wilson Harbour, South Georgia. BTS. 26–83 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 89. 7. iv. 27 (day). 9 miles north 21° E. of Arenas Point Light, Tierra del Fuego. N 7-T. 23–21 m.: *Neomysis patagona* Zimmer; *Arthromysis magellanica* (Cunningham).

St. WS 110. 26. v. 27 (dusk to dark). Off South Georgia. N 70 V. 980–750 m.: *Boreomysis rostrata* Illig.

St. WS 133. 14/15. vi. 27 (night). Midway between Gough Is. and Cape Town. N 70 H. 0–5 m.: *Siriella thompsonii* (M.-Ed.).

St. WS 144. 19. ii. 28 (day). North-west of South Georgia. N 70 V. 270–100 m.: *Dactylamblyops hodgsoni* Holt and Tattersall; *Antarctomysis maxima* Holt and Tattersall.

St. WS 173. 6/7. iii. 28 (night). East of South Georgia. N 70 V. 500–250 m.: *Euchaetomera zurstrasseni* (Illig).

St. WS 177. 7. iii. 28 (day). South Georgia. N 100 B. 97–0 m.; *Antarctomysis maxima* Holt and Tattersall.

St. WS 210. 29. v. 28 (day). North of Falkland Is. NCS-T. 161 m.: *Mysidetes patagonica* sp.n.

St. WS 211. 29. v. 28 (day). North of Falkland Is. NCS-T. 161–174 m.: *Mysidopsis acuta* Hansen.

St. WS 212. 30. v. 28 (day). North of Falkland Is. N 4-T. 242–249 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes brachylepis* W. M. Tattersall; *Mysidetes macrops* sp.n.

St. WS 213. 30. v. 28 (day). North of Falkland Is. NCS-T. 249–239 m.: *Hansenomysis falklandica* sp.n., Types; *Pseudomma sarsi* (W.-Suhm); *Mysidetes macrops* sp.n.; *Mysidetes crassa* Hansen.

St. WS 214. 31. v. 28 (day). North of Falkland Is. NCS-T. 208–219 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes patagonica* sp.n.

St. WS 215. 31. v. 28 (dusk to night). North of Falkland Is. NCS-T. 219–146 m.: *Pseudomma calmani* sp.n.; *Mysidetes patagonica* sp.n.

St. WS 219. 3. vi. 28 (day). North of Falkland Is. NCS-T. 116–114 m.: *Pseudomma calmani* sp.n.; *Mysidetes posthon* Holt and Tattersall; *Mysidetes microps* sp.n. (doubtfully); *Mysidopsis acuta* Hansen.

St. WS 220. 3. vi. 28 (dusk to dark). North of Falkland Is. NCS-T. 108–104 m.: *Mysidopsis acuta* Hansen.

St. WS 222. 8. vi. 28 (day). North-west of Falkland Is. NCS-T. 100–106 m.: *Mysidopsis acuta* Hansen.

St. WS 226. 10. vi. 28 (day). North-west of Falkland Is. NCS-T. 144–152 m.: *Pseudomma calmani* sp.n.; *Mysidetes crassa* Hansen; *Mysidopsis acuta* Hansen.

St. WS 227. 12. vi. 28 (night to dawn). East of Falkland Is. NCS-T. 320–298 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes macrops* sp.n.

St. WS 229. 1. vii. 28 (day). North-east of Falkland Is. NCS-T. 210–271 m.: *Hansenomysis falklandica* sp.n.; *Pseudomma calmani* sp.n.; *Mysidetes posthon* Holt and Tattersall; *Mysidetes macrops* sp.n.

St. WS 233. 5. vii. 28 (day). North of Falkland Is. NCS-T. 185–175 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes patagonica* sp.n.; *Mysidetes macrops* sp.n.; *Mysidopsis acuta* Hansen.

St. WS 234. 5. vii. 28 (night). North of Falkland Is. NCS-T. 195–207 m.: *Hansenomysis falklandica* sp.n.; *Pseudomma sarsi* (W.-Suhm); *Mysidetes patagonica* sp.n.; *Mysidetes macrops* sp.n.

St. WS 235. 6. vii. 28 (day). North of Falkland Is. NCS-T. 155–155 m.: *Pseudomma calmani* sp.n.

St. WS 236. 6. vii. 28 (dusk to dark). North of Falkland Is. NCS-T. 272–300 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes patagonica* sp.n.; *Mysidetes macrops* sp.n.

St. WS 237. 7. vii. 28 (day). North of Falkland Is. NCS-T. 150–256 m.: *Antarctomysis maxima* Holt and Tattersall.

St. WS 239. 15. vii. 28 (night). West of Falkland Is. NCS-T. 196–193 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes posthon* Holt and Tattersall; *Mysidetes patagonica* sp.n.

St. WS 243. 17. vii. 28 (dusk to dark). West of Falkland Is. N 4-T. 144–141 m.: *Mysidetes intermedia* sp.n.; *Mysidopsis acuta* Hansen.

St. WS. 244. 18. vii. 28 (day). West of Falkland Is. N 4-T. 253–247 m. *Hansenomysis falklandica* sp.n.; *Mysidetes patagonica* sp.n., Types; *Mysidetes macrops* sp.n.

St. WS 245. 18. vii. 28 (night). South-west of Falkland Is. N 4-T. 304–290 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes macrops* sp.n.

St. WS 330. 27. xii. 28 (day). North-east of South Georgia. N 70 V. 900–760 m.: *Boreomysis rostrata* var. (with very large eyes) Illig.

St. WS 385. 16. ii. 29 (night). Bransfield Strait, South Shetland Is. N 70 V. 1000–750 m.: *Boreomysis brucei* W. M. Tattersall; *Dactylamblyops hodgsoni* Holt and Tattersall.

St. WS 552. 3. ii. 31 (day). Pack Ice, East of Weddell Sea. N 70 V. 250–200 m.: *Euchaetomera zurstrasseni* (Illig).

St. WS 582. 30. iv. 31 (day). Magellan Strait. BTS. 110 m.: *Boreomysis rostrata* Illig.

St. WS 583. 2. v. 31 (day). Magellan Strait. BTS. 14–78 m.: *Mysidetes patagonica* sp.n.

St. WS 748. 16. ix. 31 (night). Magellan Strait. NR. 300(–0) m.: *Hansenomysis falklandica* sp.n.; *Boreomysis rostrata* Illig; *Pseudomma magellanensis* sp.n., Types; *Amblyops* sp., near *kempi* (Holt and Tattersall); *Amblyopsoides obtusa* sp.n.; *Mysidetes patagonica* sp.n.; *Mysidetes intermedia* sp.n.; *Mysidetes anomala* sp.n. Types.

St. WS 749. 18. ix. 31 (day). Magellan Strait. NR. 40(–0) m: *Hansenomysis falklandica* sp.n.; *Boreomysis rostrata* Illig; *Mysidetes anomala* sp.n.; *Neomysis patagona* Zimmer; *Arthromysis magellanica* (Cunningham).

St. WS 758. 12. x. 31 (night). North of Falkland Is. NR. 94–0 m.: *Pseudomma calmani* sp.n.; *Mysidetes intermedia* sp.n., Types; *Mysidopsis acuta* Hansen. 112(–0) m.: *Mysidetes patagonica* sp.n.

St. WS 767. 19. x. 31 (night). North of Falkland Is. NR. 98(–0) m.: *Mysidopsis acuta* Hansen; *Pseudomma calmani* sp.n.

St. WS 772. 30. x. 31 (day). North of Falkland Is. NCS-T. 309–163 m.: *Pseudomma calmani* sp.n. (Types); *Mysidetes macrops* sp.n. (Types).

St. WS 773. 31. x. 31 (day). North of Falkland Is. NCS-T. 291–298 m.: *Hansenomysis falklandica* sp.n.; *Mysidetes crassa* Hansen.

St. WS 775. 2. xi. 31 (day). Patagonian Shelf, north-north-west of Falkland Is. NCS-T. 115–110 m.: *Pseudomma calmani* sp.n.

St. WS 781. 6. xi. 31 (day). Patagonian Shelf, north of Falkland Is. NCS-T. 148 m.: *Mysidopsis acuta* Hansen.

St. WS 782. 4. xii. 31 (day). North of Falkland Is. N 4-T. 141–146 m.: *Mysidopsis acuta* Hansen.

St. WS 784. 5. xii. 31 (day). North of Falkland Is. NCS-T. 170–164 m.: *Mysidetes intermedia* sp.n. (doubtful).

St. WS 786. 7. xii. 31 (day). Patagonian Shelf, north-west of Falkland Is. N 4-T. 134–119 m.: *Mysidopsis acuta* Hansen.

St. WS 787. 7. xii. 31 (day). Patagonian Shelf, north-west of Falkland Is. NCS-T. 106–110 m.: *Mysidopsis acuta* Hansen.

St. WS 798. 20. xii. 31 (day). Patagonian Shelf, north-west of Falkland Is. NCS-T. 49–66 m.: *Mysidopsis acuta* Hansen; *Neomysis monticellii* Colosi.

St. WS 801. 22. xii. 31 (day). Patagonian Shelf, north of Falkland Is. NCS.-T. 165 m.: *Pseudomma calmani* sp.n.; *Mysidetes intermedia* sp.n.; *Mysidopsis acuta* Hansen.

St. WS 802. 5. i. 32 (day). Patagonian Shelf, north of Falkland Is. Haul A. NCS-T. 128–132 m.: *Mysidopsis acuta* Hansen; Haul B. NCS-T. 132–139 m.: *Pseudomma minutum* sp.n.; *Mysidopsis acuta* Hansen.

St. WS 806. 7. i. 32 (day). Patagonian Shelf, north-west of Falkland Is. NCS-T. 123–130 m.: *Pseudomma minutum* sp.n. ♀ Types; *Mysidopsis acuta* Hansen.

St. WS 809. 8. i. 32 (day). Patagonian Shelf, north-west of Falkland Is. NCS-T. 108–104 m.: *Mysidopsis acuta* Hansen.

St. WS 816. 14. i. 32 (day). Patagonian Shelf, west of Falkland Is. N 4-T. 150–150 m.: *Mysidopsis acuta* Hansen.

St. WS 818. 17. i. 32 (day). Patagonian Shelf, west-south-west of Falkland Is. N 4–T. 272–278 m.: *Hansenomysis falklandica* sp.n.; *Pseudomma sarsi* (W.-Suhm in MS.) G. O. Sars; *Pseudomma minutum* sp.n.; *Mysidetes macrops* sp.n.

St. WS 820. 18. i. 32 (night). South-west of Falkland Is. N 4-T. 351–368 m.: *Hansenomysis falklandica* sp.n.

St. WS 821. 18. i. 32 (day). South of Falkland Is. N 4-T. 461–468 m.: *Hansenomysis falklandica* sp.n.

St. WS 834. 2. ii. 32 (day). Patagonian Shelf, west of Falkland Is. N 7-T. 27–38 m.: *Neomysis patagona* Zimmer.

St. WS 837. 3. ii. 32 (day). Patagonian Shelf. N 4-T. 102–102 m.: *Mysidopsis acuta* Hansen.

St. WS 839. 5. ii. 32 (night). Patagonian Shelf, south-west of Falkland Is. N4–T. 503–534 m.: *Hansenomysis falklandica* sp.n.; *Boreomysis rostrata* Illig; *Amblyopsoides obtusa* sp.n. Types; *Mysidetes macrops* sp.n.

St. WS 871. 1. iv. 32 (day). South-west of Falkland Is. BTS. 336–342 m.: *Mysidetes macrops* sp.n.

St. WS 976. 6. iii. 50 (day). Nearly 200 miles west of Walvis Bay. N 70 V. 100–50 m.: *Euchaetomera intermedia* Nouvel. 250–100 m.: *Euchaetomera zurstrasseni* Illig. 750–500 m.: *Boreomysis rostrata* Illig. 1000–750 m.: *Dactylamblyops hodgsoni* Holt and Tattersall; *Katerythrops oceanae* Holt and Tattersall.

St. WS 977. 6/7. iii. 50 (night). Nearly 200 miles north-west of Walvis Bay. N 70 V. 250–100 m.: *Euchaetomera tenuis* G. O. Sars. 500–250 m.: *Euchaetomera typica* G. O. Sars; *Caesaromysis hispida* Ortmann. 750–500 m.: *Boreomysis rostrata* Illig.

St. WS 978. 7. iii. 50 (day). 150 miles west of Walvis Bay. N 70 V. 100–50 m.: *Euchaetomera typica* G. O. Sars; *Euchaetomera intermedia* Nouvel. 500–250 m.: *Meterythrops* sp.?. 750–500 m.: *Boreomysis rostata* Illig.

St. WS 979. 7. iii. 50 (night). West of Walvis Bay. N 70 V. 100–50 m.: *Boreomysis insolita* sp.n.

St. WS 986. 10. iii. 50 (day). West of Spencer Bay, South-west Africa. N 70 V. 50–0 m.: *Arachnomysis leuckartii* Chun. 1000–750 m.: *Eucopia grimaldii* Nouvel; *Boreomysis rostrata* Illig.

St. WS 987. 10. iii. 50 (day). South-west of Walvis Bay. N 70 V. 50–0 m.: *Boreomysis insolita* sp.n. 250–100 m.: *Boreomysis insolita* sp.n. TYPES.

St. WS 996. 12. iii. 50 (day). 200 miles west of Orange River estuary. N 70 V. 1000–750 m.: *Boreomysis microps* G. O. Sars.

St. WS 998. 13. iii. 50 (day). West of Orange River estuary. N 70 V. 100–50 m., 175–100 m.: *Leptomysis megalops* Zimmer.

St. WS 1000. 13. iii. 50 (night). About 100 miles west of Orange River estuary. N 70 V. 50–0 m.: *Anchialina typica* (Kröyer). 100–50 m.: *Gastrosaccus sanctus* (van Beneden); *Anchialina typica* (Kröyer); *Leptomysis megalops* Zimmer. 150–100 m.: *Anchialina typica* (Kröyer).

St. WS 1001. 13/14. iii. 50 (night). West of Orange River estuary. N 70 V. 50–0 m.: *Leptomysis* larvae? *megalops.*

St. WS 1002. 14. iii. 50 (night). 8 miles off Orange River estuary. N 70 V. 50–0 m.: *Gastrosaccus sanctus* (van Beneden).

MARINE BIOLOGICAL STATION, SOUTH GEORGIA

St. MS 19. 9. iv. 25 (day). 3 miles south-west of Merton Rock, East Cumberland Bay. NC 50 V. 120–80 m.: *Mysidetes dimorpha* sp.n.

St. MS 20. 9. iv. 25 (day). $1\frac{1}{4}$ miles south-west × west of Merton Rock, East Cumberland Bay. NC 50 V. 200–160 m.: *Mysidetes microps* sp.n. 40–0 m.: *Antarctomysis maxima* Holt and Tattersall (Hansen MS.).

St. MS 22. 9. iv. 25 (day). 1·3 miles north of Dartmouth Point, East Cumberland Bay. NC 50 V. 40–0 m.: *Antarctomysis maxima* Holt and Tattersall.

St. MS 23. 12. iv. 25 (day). East Cumberland Bay. NC 50 V. 220–160 m.: *Mysidetes dimorpha* sp.n.

St. MS 26. 15. iv. 25 (day). East Cumberland Bay. Haul B. NC 50 H. 10 m.: *Antarctomysis maxima* Holt and Tattersall.

St. MS 27. 29. iv. 25 (day). $1\frac{1}{4}$ miles south-west × west of Merton Rock, East Cumberland Bay. NC 50 V 160–120 m.: *Mysidetes microps* sp.n.; *Antarctomysis maxima* Holt and Tattersall.

St. MS 32. 1. v. 25 (day). East Cumberland Bay, $4\frac{1}{2}$ cables north-east of Hobart Rock to $1\frac{1}{2}$ miles south-south-east of Hope Point. BTS. 40 m.: *Antarctomysis maxima* Holt and Tattersall.

St. MS 62. 24. ii. 26 (day). East Cumberland Bay. BTS. 31 m.: *Mysidetes dimorpha* sp.n.

St. MS 63. 24. ii. 26 (day). East Cumberland Bay, 1·3 miles south × east to 1·6 miles south-east × south of Hope Point. BTS. 23 m.: *Mysidetes dimorpha* sp.n. ♀ TYPES.

St. MS 65. 28. ii. 26 (day). East Cumberland Bay, 1·6 miles south-east of Hobart Rock to 1 cable north of Dartmouth Point. BTS. 39 m.: *Mysidetes dimorpha* sp.n.

St. MS 66. 28. ii. 26 (day). East Cumberland Bay. $2\frac{1}{4}$ miles south-east of King Edward Point Light to $1\frac{1}{2}$ cables west × north of Macmahon Rock. BTS. 18 m.: *Mysidetes dimorpha* sp.n. ♂ TYPES.

St. MS 67. 28. ii. 26 (day). East Cumberland Bay. BTS. 38 m.: *Mysidetes dimorpha* sp.n.

St. MS 68. 2. iii. 26 (day). East Cumberland Bay. NRL. 220–247 m.: *Pseudomma armatum* Hansen; *Mysidetes kerguelensis* Illig; *Mysidetes microps* sp.n.; *Mysidetes macrops* sp.n.; *Mysidetes dimorpha* sp.n.; *Antarctomysis maxima* Holt and Tattersall; *Antarctomysis ohlini* Hansen.

St. MS 71. 9. iii. 26 (day). East Cumberland Bay, $9\frac{1}{4}$ cables east × south to 1·2 miles east × south of Sappho Point. BTS. 110–60 m.: *Mysidetes microps* sp.n. *Antarctomysis maxima* Holt and Tattersall.

St. MS. 74. 17. iii. 26 (day). East Cumberland Bay, 1 cable south-east × south of Hope point to 3·1 miles south-west of Merton Rock. BTS. 22–40 m.: *Mysidetes dimorpha* sp.n.

GEOGRAPHICAL DISTRIBUTION

This very rich collection has considerably extended our knowledge of the geographical distribution of most of the species represented in it. Although many of the species have been recorded from both northern and southern hemispheres, there is no definite evidence of bipolarity. On the contrary, a closer examination of the species, which had been regarded as common to the two hemispheres, has proved in several instances that those from southern waters differ from those of northern waters so consistently as to leave no doubt that they belong to different species.

Hansen (1908, p. 100) suggested that as the specimens of *Boreomysis scyphops* G. O. Sars, which had been recorded from off the coasts of Finmark, did not agree with specimens which had been recorded under that name from the south-west of Australia, they should perhaps be referred to a different species. W. M. Tattersall (1951, p. 46), when studying the rich material of the United States National Museum, was able to confirm Hansen's observations and separated the southern specimens under the name *B. inermis*. He found that although this new species differed from the north European *B. scyphops*, it had a very wide distribution in the Pacific and occurred at many stations along the west coast of California and northward to the Behring Sea in the east, and in the Sea of Okhotsk in the north-west. The previous records were all from far south in the southern hemisphere, from the Weddell Sea, from near the Crozet Islands and from two stations to the south-west of Australia. The record in the Discovery collection is from South Georgia. *B. inermis* is bathypelagic and in all probability has a very wide distribution in the deep waters of the world. I think that the fact that it occurs so far north in the Pacific and so far south in the southern hemisphere points, not so much to an exhibition of bipolarity, but rather to the possibility that further exploration of the intermediate localities will reveal that it is present in the deeper waters. Its occurrence near South Georgia, so far north of its previous record from the Weddell Sea, supports this suggestion.

Fage (1942, pp. 7–39) thoroughly revised all the literature and records concerning *Lophogaster typicus*—a species which was originally recorded from North European waters and which has since been recorded from such widely separated localities that it has been regarded as having a world-wide distribution. He found certain well-defined differences whereby these animals could be separated into four distinct species, and he noted further that these could be correlated with their geographical distribution. One of his new species, *L. challengeri*, which previously was only known from off Cape Town, is represented in the present collection. It was taken by the ships of the Discovery Investigations at several stations around the south coast of South Africa and on three occasions off Cape Lopez. This extension northward of its known range may possibly be due to the influence of the Benguela Current, but until all the material recorded under the name of *L. typicus* has been re-examined, it is impossible to be sure that specimens of *L. challengeri* may not have been recorded from other localities as *typicus*. A careful comparison of the Discovery specimens with those of *L. typicus* from the west of Ireland fully bears out the observations made by Fage, and I accept *L. challengeri* as a valid species which is distinct from the northern *L. typicus*.

Zimmer (1914, p. 392) founded the species *Longithorax capensis* on a single adult male from South African waters. Nouvel (1943, p. 75) doubtfully referred a damaged immature specimen from deep water off the Azores to this species and W. M. Tattersall (1951, p. 121) referred specimens from the Bermudas to the same species. Both authors recorded certain differences between their specimens and Zimmer's description of the type, but attributed these, in the one case to the immaturity and damaged condition of the specimens, and in the other to immaturity and difference in sex. A close examination of the records and figures, together with a study of the present material, has convinced me that Nouvel's specimen from the Azores and Tattersall's from the Bermudas belong to the same species which is not the same as Zimmer's *Longithorax capensis* from the southern hemisphere. I have suggested the name of *Longithorax nouveli* sp.n. for this species from the northern hemisphere.

Many species in the Discovery collection are to be found in the tropical and temperate waters of both southern and northern hemispheres. A few, such as *Gnathophausia gigas*, *G. zoea*, *G. ingens*, *Eucopia unguiculata*, *E. grimaldi*, *E. australis* and *Boreomysis rostrata* appear to have a very wide distribution in all the oceans of the world, except the Arctic and Antarctic from which some of them have not yet been recorded. It is interesting to note that, at any rate as far as the Discovery collection is concerned, the species with the widest range are almost invariably very deep water forms and belong to the more primitive groups of the Mysidacea.

One of the most remarkable captures of the whole collection is that of four specimens of *Antarctomysis maxima* at station 274, just south of the equator off St Paul de Loanda, Angola. This species has always been regarded as a purely Antarctic form. Its capture at many stations around the coasts of South Georgia and the Falkland Islands has extended its known geographical range considerably to the northward, but its occurrence in tropical waters off the west coast of Africa is most surprising. One other capture is worthy of especial comment, that of a species of *Mysis* taken off the coast of South Georgia. This is the first time that any species of this genus has been recorded from the southern hemisphere.

In order to show how far the Discovery collection has extended our knowledge of the distribution of mysids in the southern seas, I have drawn up a list of new records and, for purposes of comparison, I give also lists of those species which are known so far from the Atlantic Ocean only, from the Antarctic and Southern Seas only and from the Atlantic and Indian Oceans only. Full details of localities and the vertical distribution of species are given in the List of Stations and a note on the distribution is given at the end of the record of each species.

NEW RECORDS IN THE DISCOVERY COLLECTION AND OTHER EXTENSIONS OF KNOWN RANGE

(Locality given in brackets)

Chalaraspidum alatum. New to South Atlantic (west of Cape Town).

Gnathophausia ingens. New to western South Atlantic (off La Plata); new to southern temperate waters (Prince Edward Is. and off South Africa).

Gnathophausia gigas. Range extended considerably to southward in South Pacific (Bellingshausen Sea).

Gnathophausia zoea. New to central South Atlantic (west of Tristan da Cunha).

Gnathophausia gracilis. New to southern hemisphere (off St Helena).

Lophogaster schmidti. New to Indian Ocean (Arabian Sea, off Ras Hafun).

Lophogaster challengeri. Range extended considerably northward in eastern South Atlantic (off Cape Lopez).

Eucopia sculpticauda. Range extended southward in Indian Ocean (off East London and Durban).

Boreomysis rostrata. First record from surface waters; range considerably extended southward in Indian Ocean (off Heard Island).

Boreomysis sibogae (doubtfully). New to South Atlantic (west of Cape Town and off South Georgia).

Boreomysis atlantica. New to southern hemisphere (off Cape Town and off South Georgia).

Boreomysis inermis. Range extended considerably northward in South Atlantic (South Georgia).

Rhopalophthalmus egregius. Range extended northward in eastern South Atlantic (off Cape Lopez) and westward (off South Georgia).

Gastrosaccus sanctus. New to southern hemisphere (off west coast of South Africa and off South Georgia).

Anchialina truncata. Range extended considerably northward in eastern South Atlantic (off Cape Lopez).

Anchialina typica. New to eastern South Atlantic (Benguela Current).

Gibberythrops acanthura. Range extended considerably southward in western Indian Ocean (off Durban).

Meterythrops picta. New to Indian Ocean (south of Madagascar).

Echinomysis chuni. Range extended southward in South Atlantic (Tristan da Cunha), new to western Indian Ocean (off Ras Hafun).

Longithorax capensis. Range extended westward in South Atlantic (off Tristan da Cunha).

Euchaetomera typica. Range extended considerably southward in Indian Ocean (north of Amsterdam Island).

Euchaetomera tenuis. Range extended considerably southward in South Atlantic (South Africa).

Euchaetomera glyphidophthalmica. New to southern hemisphere (off west coast of Africa from Orange River estuary to Cape Lopez).

Euchaetomera intermedia. Range extended very considerably southward in Atlantic. First record south of equator in Atlantic (South Africa).

Mysidetes kerguelensis. New to South Atlantic (South Georgia).

Leptomysis apiops. First record outside Mediterranean Sea (off Cape Lopez).

Leptomysis megalops. First record outside Mediterranean Sea (off west coasts of Central and South Africa from Cape Lopez to Cape Town).

Afromysis hansoni. First record free swimming in plankton—previous records from stomach of *Trigla capensis.*

Antarctomysis maxima. Range extended northward in South Atlantic (South Georgia and one record from St Paul de Loanda).

Antarctomysis ohlini. Range extended northward in South Atlantic (South Georgia).

RECORDS FROM THE ATLANTIC OCEAN (NORTH AND SOUTH) AND MEDITERRANEAN SEA

Species	Previous records	Discovery records, extending known range
Lophogaster challengeri	South of Cape of Good Hope	Around coasts of South Africa to Cape Lopez
L. spinosus	Warm waters of North and South Atlantic in open ocean	Open ocean east of Rio de Janeiro
Boreomysis atlantica	Azores	Cape Town, Tristan da Cunha, north-east of South Georgia
Gastrosaccus sanctus	Europe, Mediterranean, Morocco, Canaries, Gulf of Guinea	Cape Town, South-west Africa, South Georgia
Anchialina truncata	Off Cape Town	South and south-west coasts of Cape Province, Cape Lopez
Longithorax capensis	Off Cape Town and east of Cape Verde Is.	Cape Town to Tristan da Cunha
Pseudomma armatum	South Georgia	South Georgia and South Orkney Is.
Euchaetomeropsis merolepis	Mediterranean, Gulf of Guinea, South Atlantic	Eastern South Atlantic
Arachnomysis megalops	Gulf of Guinea, St Paul de Loanda, south-west of Sierra Leone	Widely distributed in South Atlantic
Leptomysis apiops	Mediterranean only	Off St Paul de Loanda, off Cape Lopez
L. capensis	South Africa and off Cape Lopez	Cape Lopez, coasts of Cape Province
L. megalops	Mediterranean only	West coasts of Central and South Africa from Cape Lopez to Cape Town
Afromysis hansoni	Stomach of fish in Walvis Bay	Stomach of fish in Walvis Bay and free off Cape Lopez
Mysidetes crassa	North and west of Falkland Is.	Falkland Is., Patagonian Shelf
Mysidopsis similis	Off Angra Pequena, off coast of Cape Colony	Off Cape Town
Mysidopsis acuta	Falkland Is., east of Cape Horn	Falkland Is., east of Strait of Magellan
M. schultzei	Off Angra Pequena	Off Cape Town
M. major	Off Angra Pequena	Off Cape Town
Neomysis monticelli	Strait of Magellan	East of Patagonia, east end of Strait of Magellan
N. patagona	East of South Patagonia, Strait of Magellan	East of Tierra del Fuego, Strait of Magellan
Arthromysis magellanica	Strait of Magellan	Strait of Magellan and east of Patagonia

RECORDS FROM THE SOUTHERN OCEAN AS FAR NORTH AS SOUTH GEORGIA

Species	Previous Records	Discovery records extending known range
Hansenomysis antarctica	Circumpolar distribution in very cold waters south of 64° S.	Schollaert Channel (within known range)
Boreomysis brucei	Weddell Sea	South Shetland Is., South Orkney Is. and Palmer Archipelago
B. inermis	Weddell Sea and ? South Pacific	South Georgia—extends known range to northward
Pseudomma armatum	South Georgia	South Georgia and South Orkney Is.
P. antarcticum	Bellingshausen Sea	South Shetland Is. and Palmer Archipelago
P. sarsi	Kerguelen Is., south of South Georgia	Patagonian Shelf, South Shetland Is. South Orkney Is., Palmer Archipelago
P. belgicae	Antarctic	Palmer Archipelago, Bay of Whales
Dactylamblyops hodgsoni	Circumpolar in very cold waters	South Shetlands, South Sandwich Is., Ice Edge, south of South Georgia
Euchaetomera zurstrasseni	South Georgia, Falkland Is. and ? off Seychelles	Graham Land, Bellingshausen Sea, Ice Edge, South Africa
Mysidetes posthon	Circumpolar in Southern Seas	South Georgia, South Shetland Is., Falkland Is., South Sandwich Is.
M. crassa	North and west of Falkland Is.	Falkland Is., Patagonian Shelf
M. brachylepis	Ross Sea	South Georgia, South Shetland Is., north of Falkland Is.
Mysidopsis acuta	Falkland Is., off Tierra del Fuego	Falkland Is., east of Strait of Magellan
Neomysis patagona	Magellan Strait, South Patagonian Shelf	Magellan Strait, north-east of Tierra del Fuego
N. monticellii	Strait of Magellan	East of Strait of Magellan
Antarctomysis maxima	Antarctic only	Falkland Is., Scotia Sea, Bay of Whales, off St Paul de Loanda
A. ohlini	Antarctic, Ross Sea, South Georgia	Falkland Is., Scotia Sea, South Orkney Is., Bay of Whales
Arthromysis magellanica	Strait of Magellan	Strait of Magellan and Patagonian Shelf

Indian Ocean only	Atlantic and Indian Oceans	Atlantic and Pacific Oceans	Pacific and Indian Oceans
Lophogaster rotundatus	*Petalophthalmus oculatus*	*Boreomysis plebeja*	*Lophogaster schmidti*
	Pseudomma sarsi	*B. rostrata*	*Boreomysis sibogae*
	Katerythrops oceanae		*Siriella gracilis*
	Echinomysis chuni		*S. aequiremis*
	Euchaetomera typica		*Gibberythrops acanthura*
	E. zurstrasseni		*Euchaetomera oculata*
	E. glyphidophthalmica		
	E. intermedia		
	Caesaromysis hispida		
	Arachnomysis leuckartii		
	Mysidetes kerguelensis		

LIST OF NEW GENERA AND SPECIES AND THE LOCALITIES WHERE THEY OCCURRED

Eucopia linguicauda. Open ocean west of Saldanha Bay, Natal.
Eucopia sp. West of Sierra Leone.
Hansenomysis falklandica. Around the Falkland Is.
Boreomysis illigi. Cape Verde Is., Canaries, Arabian Sea, Cape Town.
Boreomysis tattersalli. Arabian Sea.
Boreomysis bispinosa. Off Cape Town, St Helena, South Georgia.
Boreomysis insolita. Walvis Bay, South-west Africa.
Boreomysis acuminata. South and south-west of Sierra Leone, east and north-east of St Helena.
Pseudomma calmani. North of Falkland Is.
Pseudomma schollaertensis. Palmer Archipelago.
Pseudomma longicaudum. Schollaert Channel, Palmer Archipelago.
Pseudomma magellanensis. Strait of Magellan.
Pseudomma minutum. Falkland Is.
Amblyops durbani. Off Durban.
Amblyops antarctica. South Shetland Is. and Bay of Whales.
Amblyops sp. near *kempi.* Strait of Magellan.
Amblyopsoides obtusa. Strait of Magellan.
Paramblyops brevirostris. Schollaert Channel, Palmer Archipelago.
Gibberythrops megalops. West of Cape Town.
Katerythrops resimora. Off Cape Town.
Heteroerythrops purpura. Off Angra Pequena, South-west Africa.
Erythrops africana. Off Cape Lopez.
Mysidetes microps. South Georgia.
Mysidetes macrops. Falkland Is. and South Georgia.
Mysidetes intermedia. Falkland Is. and Strait of Magellan.
Mysidetes patagonica. Strait of Magellan, Patagonian Shelf, Falkland Is.
Mysidetes anomala. Strait of Magellan.
Mysidetes dimorpha. South Georgia and Palmer Archipelago.
Mysidopsis camelina. False Bay, South Africa.
Mysis australe. South Georgia.
Longithorax nouveli. Azores and Bermudas. (See pp. 126–127 for discussion.)

Order MYSIDACEA

The order Mysidacea falls naturally into two clearly distinct groups which differ so profoundly from one another that they have been given the status of suborders under the names Lophogastrida and Mysida.

The Lophogastrida show the following primitive characters which are absent in nearly all the Mysida:

(1) Large foliaceous gills present on the thoracic appendages.

(2) No statocyst on the endopod of the uropod.

(3) Pleopods of both sexes biramous, multiarticulate, natatory and unmodified.

(4) Marsupium composed of seven pairs of imbricating brood lamellae.

(5) Well-developed pleural plates present on the abdominal somites.

(6) A more or less well-marked transverse groove encircling the last abdominal somite and marking the incomplete fusion of the sixth and seventh abdominal somites of the embryo. A pair of lateral teeth immediately in front of this groove marks the postero-ventral angle of the sixth abdominal somite of the fossil forms and of the embryo.

The MYSIDA in some cases show traces of primitive characters as, for example, the presence of pleural plates on the first abdominal somite of the females in the Gastrosaccinae, and of the males in the genus *Rhopalophthalmus*, and the absence of a statocyst in the Petalophthalmidae.

The classification of the Mysidacea adopted in the present work is that drawn up by Hansen (1910, pp. 8–77), in which the more primitive forms are considered first and the more complex later according to their degree of specialization.

LIST OF MYSIDACEA IN THE DISCOVERY COLLECTIONS ARRANGED IN SYSTEMATIC ORDER

(with synonymies)

Order MYSIDACEA

Suborder LOPHOGASTRIDA

Family LOPHOGASTRIDAE

Genus *Chalaraspidum* W.-Suhm, 1895 (from MS. dated 1874) = *Chalaraspis* W.-Suhm, 1875 = *Eclytaspis* Faxon, 1895.

Chalaraspidum alatum W.-Suhm (in MS. 1874) = *Chalaraspis alata*.

Genus *Gnathophausia* W.-Suhm, 1873.

Gnathophausia ingens (Dohrn), 1870 = *G. inflata* W.-Suhm, 1873 = *G. calcarata* G. O. Sars, 1885 = *G. bengalensis* Wood-Mason and Alcock, 1891 = *G. doryphora* Illig, 1906.

Gnathophausia gigas W.-Suhm, 1873 = *G. drepanephora* Holt and Tattersall.

Gnathophausia zoea W.-Suhm, 1873 = *G. willemoësii* G. O. Sars, 1885 = *G. sarsi* Wood-Mason and Alcock, 1891.

Gnathophausia gracilis W.-Suhm, 1875 = *G. brevispinis* Wood-Mason and Alcock, 1891 = *G. dentata* Faxon, 1893 = *G. bidentata* Illig, 1906.

Genus *Lophogaster* M. Sars, 1857 = *Ctenomysis* Norman, 1862.

Lophogaster challengeri Fage, 1942 = *L. typicus* G. O. Sars, 1885.

Lophogaster spinosus Ortmann, 1906.

Lophogaster rotundatus Illig, 1930 = *L. typicus* var. Tattersall, 1911.

Lophogaster schmidti Fage, 1941.

Family EUCOPIIDAE

Genus *Eucopia* Dana, 1852.

Eucopia unguiculata (W.-Suhm), 1875 = *E. australis* (pars) G. O. Sars, 1885 = *E. hanseni* Nouvel, 1942.

Eucopia grimaldii Nouvel, 1942.

Eucopia australis Dana, 1852 = *E. major* Hansen, 1910.

Eucopia sculpticauda Faxon, 1893 = *E. equatoria* Spence-Bate, 1885 = *E. intermedia* Hansen, 1910.

Eucopia linguicauda sp.n.

Suborder MYSIDA

Family PETALOPHTHALMIDAE

Genus *Hansenomysis* Stebbing, 1893 = *Arctomysis* Hansen, 1887.

Hansenomysis antarctica Holt and Tattersall, 1906.

Hansenomysis falklandica sp.n.

Genus *Petalophthalmus* W.-Suhm, 1875.

Petalophthalmus oculatus Illig, 1906.

Family Mysidae

Subfamily Boreomysinae

Genus *Boreomysis* G. O. Sars, 1869 = *Petalophthalmus* (pars) W.-Suhm, 1875 = *Arctomysis* Czerniavsky, 1883 = *Pseudanchialus* Caullery, 1896.

Boreomysis rostrata Illig, 1906 = *B. inermis* Hansen, 1910.

Boreomysis illigi sp.n. = *B. rostata* (pars) Illig, 1906.

Boreomysis plebeja Hansen, 1910.

Boreomysis sibogae Hansen, 1910 = *B. spinifera* Coifmann, 1936.

Boreomysis brucei Tattersall, 1913.

Boreomysis atlantica Nouvel, 1942.

Boreomysis microps G. O. Sars, 1884 = *B. subpellucida* Hansen, 1905.

Boreomysis tattersalli sp.n.

Boreomysis bispinosa sp.n.

Boreomysis inermis (W.-Suhm) as *Petalophthalmus inermis* W.-Suhm, 1874 = *Petalophthalmus armiger* W.-Suhm, 1875 = *B. scyphops* G. O. Sars, 1884 = *B. suhmi* Faxon, 1893 = *B. distinguenda* Hansen, 1908.

Boreomysis insolita sp.n.

Boreomysis acuminata sp.n.

Subfamily Siriellinae

Genus *Siriella* Dana, 1850 = *Cynthia* Thompson, 1829 = *Cynthilia* White, 1850 = *Promysis* Kröyer, 1861 = *Protosiriella*, 1882 = *Siriellides*, 1882 = *Rhinomysis*, 1882 = *Heterosiriella* Czerniavsky, 1883 = *Pseudosiriella* Claus, 1884.

Siriella thompsonii (Milne-Edwards), 1837 = *S. vitrea* Dana, 1852 = *S. brevipes* Dana, 1852 = *C. inermis* Kröyer, 1861 = *S. edwardsii* Claus, 1868 = *S. indica* Czerniavsky, 1882.

Siriella gracilis Dana, 1852.

Siriella aequiremis Hansen, 1910.

Subfamily Rhopalophthalminae

Genus *Rhopalophthalmus* Illig, 1906.

Rhopalophthalmus egregius Hansen, 1910.

Subfamily Gastrosaccinae

Genus *Gastrosaccus* Norman, 1868 = *Acanthocaris* Sim, 1872 = *Haplostylus* Kossmann, 1880 = *Pontomysis* Czerniavsky, 1882 = *Chlamydopleon* Ortmann, 1892.

Gastrosaccus sanctus (van Beneden), 1861 = *Mysis sancta* van Beneden.

Genus *Anchialina* Norman and Scott, 1906 = *Anchialus* Kröyer, 1861.

Anchialina typica (Kröyer), 1861.

Anchialina truncata (G. O. Sars), 1884.

Subfamily Mysinae

Tribe *ERYTHROPINI*

Genus *Pseudomma* G. O. Sars, 1870.

Pseudomma armatum Hansen, 1913.

Pseudomma sarsi (W.-Suhm in MS.) G. O. Sars, 1884.

Pseudomma antarcticum Zimmer, 1914.

Pseudomma belgicae (Hansen in MS.) Holt and Tattersall, 1906.

Pseudomma calmani sp.n.

Pseudomma schollaertensis sp.n.

Pseudomma longicaudum sp.n.

Pseudomma magellanensis sp.n.

Pseudomma minutum sp.n.

Genus *Amblyops* G. O. Sars, 1872 = *Amblyopsis* G. O. Sars, 1869.
Amblyops durbani sp.n.
Amblyops antarctica sp.n.
Amblyops sp. near *A. kempi* Tattersall, 1905.

Genus *Amblyopsoides* gen.n.
Amblyopsoides obtusa sp.n.

Genus *Paramblyops* Holt and Tattersall, 1905.
Paramblyops brevirostris sp.n.

Genus *Dactylamblyops* Holt and Tattersall, 1906.
Dactylamblyops hodgsoni Holt and Tattersall, 1906 = *Dactylerythrops arcuata* Illig, 1906.

Genus *Gibberythrops* Illig, 1930.
Gibberythrops acanthura (Illig), 1906 = *Parerythrops acanthura* Illig, 1906.
Gibberythrops megalops sp.n.

Genus *Meterythrops* S. I. Smith, 1879 = *Parerythrops* (pars) G. O. Sars, 1879.
Meterythrops picta Holt and Tattersall, 1905.

Genus *Katerythrops* Holt and Tattersall, 1905.
Katerythrops oceanae Holt and Tattersall, 1905 = *K. dactylops* Illig, 1906.
Katerythrops resimora sp.n.

Genus *Heteroerythrops* gen.n.
Heteroerythrops purpura sp.n.

Genus *Erythrops* G. O. Sars, 1869 = *Nematopus* G. O. Sars, 1863.
Erythrops africana sp.n.

Genus *Echinomysis* Illig, 1905.
Echinomysis chuni Illig, 1905.

Genus *Longithorax* Illig, 1906.
Longithorax capensis Zimmer, 1914.

Genus *Euchaetomera* G. O. Sars, 1883 = *Brutomysis* Chun, 1896 = *Mastigophthalmus* Illig, 1906.
Euchaetomera typica G. O. Sars, 1884 = *B. vogtii* Chun, 1896 = *E. limbata* Illig, 1906 = *E. sennae* Colosi, 1918.
Euchaetomera tenuis G. O. Sars, 1883 = *Brutomysis* Chun, 1896 = *E. fowleri* Holt and Tattersall, 1905.
Euchaetomera zurstrasseni (Illig), 1906 as *M. zurstrasseni* = *E. pulchra* Hansen, 1913.
Euchaetomera glyphidophthalmica Illig, 1906.
Euchaetomera oculata Hansen, 1910.
Euchaetomera intermedia Nouvel, 1942.

Genus *Euchaetomeropsis* W. M. Tattersall, 1909.
Euchaetomeropsis merolepis (Illig), 1908.

Genus *Caesaromysis* Ortmann, 1893.
Caesaromysis hispida Ortmann, 1893.

Genus *Arachnomysis* Chun, 1887.
Arachnomysis leuckartii Chun, 1887.
Arachnomysis megalops Zimmer, 1914.

Tribe *LEPTOMYSINI*

Genus *Mysidetes* Holt and Tattersall, 1906 = ? *Mysidopsis* G. O. Sars, 1885 = *Mysideis* (pars) Holt and Tattersall, 1905 = *Metamysidella* Illig, 1906.
Mysidetes posthon Holt and Tattersall, 1906.
Mysidetes kerguelensis (Illig), 1906 as *Metamysidella kerguelensis*.
Mysidetes crassa Hansen, 1913.
Mysidetes brachylepis Tattersall, 1923.

Genus *Mysidetes microps* sp.n.
Mysidetes macrops sp.n.
Mysidetes intermedia sp.n.
Mysidetes patagonica sp.n.
Mysidetes anomala sp.n.
Mysidetes dimorpha sp.n.

Genus *Mysidopsis* G. O. Sars, 1864 = *Paramysidopsis* Zimmer, 1912.
Mysidopsis acuta Hansen, 1913.
Mysidopsis similis (Zimmer), 1912 as *Paramysidopsis similis.*
Mysidopsis major (Zimmer) as *Paramysidopsis major*, 1912.
Mysidopsis schultzei (Zimmer) as *Paramysidopsis schultzei*, 1912.
Mysidopsis camelina sp.n.

Genus *Leptomysis* G. O. Sars, 1869.
Leptomysis apiops G. O. Sars, 1877.
Leptomysis capensis Illig, 1906.
Leptomysis megalops Zimmer, 1915.

Genus *Afromysis* Zimmer, 1916.
Afromysis hansoni Zimmer, 1916.

Tribe *MYSINI*

Genus *Mysis* Latreille, 1802–3 = *Megalophthalmus* Leach, 1830 = *Onychomysis* Czerniavsky, 1882 = *Michtheimysis* Norman, 1902 = *Mesomysis* Norman, 1905 = *Pugetomysis* Banner, 1953.
Mysis australe sp.n.

Genus *Neomysis* Czerniavsky, 1882 = *Heteromysis* Czerniavsky, 1882.
Neomysis patagona Zimmer, 1907.
Neomysis monticellii Colosi, 1924.

Genus *Antarctomysis* Coutière, 1907.
Antarctomysis maxima (Hansen in MS.) Holt and Tattersall, 1906.
Antarctomysis ohlini Hansen 1908 = *Antarctomysis* sp. Tattersall, 1908.

Genus *Arthromysis* Colosi, 1924.
Arthromysis magellanica (Cunningham), 1871 as *Macromysis magellanica* = *Antarctomysis* sp. Zimmer, 1915*b* = *Arthromysis chierchiae* Colosi, 1924.

SYSTEMATIC REPORT

Order MYSIDACEA

Suborder LOPHOGASTRIDA

Family LOPHOGASTRIDAE

Genus Chalaraspidum W.-Suhm

1874 *Chalaraspis* W.-Suhm, p. 592.
1885*b* *Chalaraspis*, G. O. Sars, p. 50.
1895 *Chalaraspidum* W.-Suhm (in Murray, 1895, p. 521, from MS. dated 1874).
1895 *Eclytaspis* Faxon, p. 219.
1891 *Chalaraspidum*, W. M. Tattersall, p. 13.

REMARKS. The genus *Chalaraspidum* very closely resembles *Lophogaster*, but may be distinguished from it by the form of the rostral plate which is broad and relatively short, with the transverse anterior margin either quite straight or very slightly emarginate in its median region. There is no trace of the tridentate form which is so characteristic of *Lophogaster*, but the antero-lateral angles may, at least in the females, be produced into an acute process on each side. The anterior margin and the lateral margins which cover the eyes may be more or less serrated and there may be scattered spinules on the carapace behind and below the eyes.

The eyes are much reduced and very long, extending laterally at right angles to the main axis of the body, with the distal half of the cornea extending beyond the lateral margins of the rostral plate. There is a small, curved, finger-like ocular papilla on the inner distal margin of the eyestalk.

The uropods are relatively longer than in *Lophogaster* and the outer margin of the exopod is armed with two or three small spines in addition to the terminal one.

Only one species, *Chalaraspidum alatum*, has been recorded up to the present, but Zimmer (1914, p. 383) obtained a specimen from near the Azores which undoubtedly belongs to the genus. Owing to its damaged condition, Zimmer did not feel justified in founding a new species for it, but the form of the antennal scale which he figured and the shape of the telson indicate that in all probability it is a new species of *Chalaraspidum*.

Chalaraspidum alatum (W.-Suhm) in MS. 1874

(Fig. 1 A–E)

1874 *Chalaraspis alata* W.-Suhm, p. 592.
1885*b* *Chalaraspis alata*, G. O. Sars, p. 51, figs.
1895 *Chalaraspidum alatum* W.-Suhm (in Murray, 1895, p. 521 from MS. dated March, 1874).
1895 *Eclytaspis alata*, Faxon, p. 219.
1912 *Chalaraspis alata*, Hansen, p. 182, figs.
1939 *Chalaraspis alata*, Fage, p. 68, figs.
1941 *Chalaraspis alata*, Fage, p. 4, figs.
1951 *Chalaraspidum alatum*, W. M. Tattersall, p. 14.

OCCURRENCE:

St. 101. 14/15. x. 26 (night). West of Cape Town, 2580–2480 m., 1 imm. ♀, 28 mm., with very small oostegites.
St. 253. 21. vi. 27 (day). About 1000 miles west of Cape Peninsula, 1050–1000 m., 1 adult ♀, 38 mm.

REMARKS. Owing to the softness of the integument and to the great depths at which specimens have been taken, there are no records of a perfect example of this interesting species. The type had unfortunately been lost by the time Sars wrote his report on the Challenger Schizopods and his description of the species was compiled from the notes and letters written by Dr Willemoës-Suhm some eleven years earlier. The figures Sars gave were faithful copies of manuscript sketches made by W.-Suhm. Since its original discovery a few records of the species have been made from widely separated localities in the Pacific, and details of the morphology have been added. In some respects these later descriptions do not agree with that given by W.-Suhm and some suggestion has arisen that there may be more than one species involved.

The description of the rostral plate of the type is as follows: 'Anteriorly, it (the carapace) projects as a short, but very broad, frontal plate, abruptly truncate at the extremity, the anterior margin being slightly emarginate and finely serrate, the lateral corners somewhat extended.' Hansen (1912, p. 182), recording several immature specimens from the eastern Pacific off Peru, stated that the antero-lateral corners of the rostral plate were broadly rounded. He made no mention of any serrulations along the anterior or lateral margins and, if they were present, it is most unlikely that so meticulous a worker would have overlooked them. Fage (1939, p. 68), recording specimens from the China Sea and from the Gulf of Panama, stated that the antero-lateral angles were rounded and very finely serrulated. Both authors recorded that the outer margin of the antennal scale was armed with 9–12 teeth in addition to the distal terminal tooth.

Tattersall (1951) recorded three specimens captured in the Pacific by the 'Albatross'. He stated that one of these, taken in the East Pacific off the coast of California, agreed very closely with the descriptions and figures given by Hansen and Fage, but that the other two, which were captured off the south coast of Japan, differed as follows: '(1) The rostral plate has the outer antero-lateral angles drawn out into conspicuous spines; the margin between these spines is slightly concave in the centre and is microscopically serrulated; there are three or four spinules on the lateral margins of the rostral plate on each side and a prominent ocular spine on the carapace margin over the eye; there are also scattered microscopic spinules on the lateral area of the carapace below and behind the eyes. (2) The outer margin of the antennal scale has only three or four teeth in addition to the terminal tooth.'

A glance at Fig. 1 A will show how very closely the Discovery specimens agree with this description—the only difference being that in them the serrations, which adorn the margins of the rostral plate, would appear to be coarser and probably fewer in number than in Tattersall's specimens. My figure is taken from the smaller of my two specimens. The larger animal is badly damaged, but the margins of the rostral plate are quite clear and show that there are rather more serrulations than in the smaller specimen, but not so pronounced. It is probable that there is considerable individual variation in this character. In both my specimens the outer margin of the antennal scale bears only two or three teeth in addition to the terminal one.

Hansen (1912) recorded that the apex of the telson in his specimens was truncate and lacked spines or hairs, adding that it was possible that these may have been lost. Fage (1939, 1941) recorded that the apex of the telson in his specimens was straight and armed with four short spines. Tattersall (1951) stated that both of his Japanese specimens had seven spines on each of the lateral margins of the telson and that in one of them the armature of the apex was almost intact, showing 'four rather stout and closely set spines, the inner pair nearly twice as long as the outer pair'.

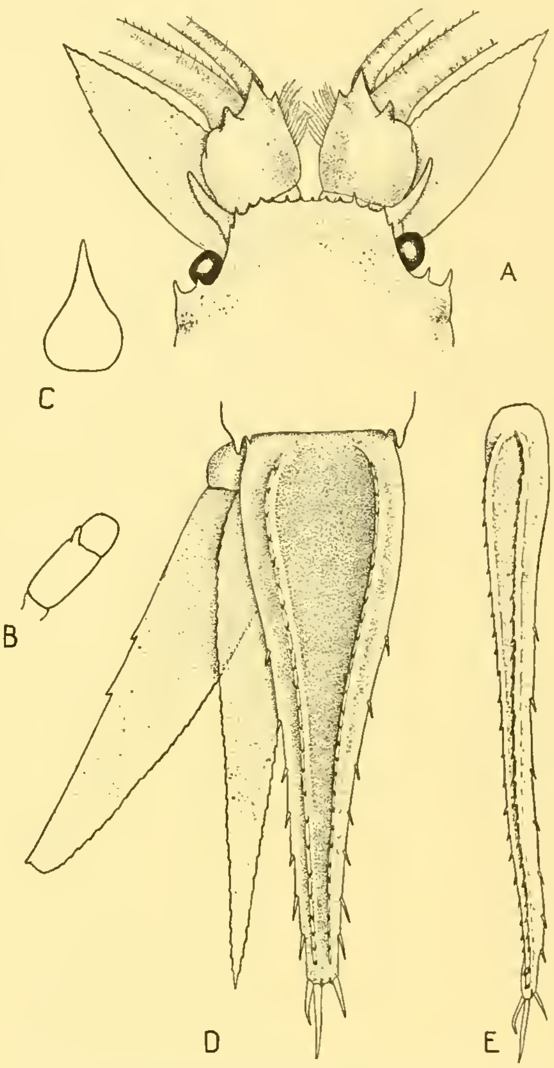

Fig. 1. *Chalaraspidum alatum* (W.-Suhm). A, anterior end of immature female; B, right eye in dorsal view; C, labrum; D, telson and left uropod in dorsal view; E, telson in lateral view. All × 9.

The two specimens in the Discovery collection indicate very strongly, at least as regards the telson, that previously recorded variations can be attributed to the damaged condition of the material available. In the larger Discovery specimen all the spines of the telson are missing, but there are seven notches on each lateral margin indicating where the spines were borne and the apex presents an appearance strikingly like that figured by Fage (1942) for his specimen. I feel convinced that the 'four small spines' which he noticed are really the broken pieces of the original armature of the telson apex. The smaller Discovery specimen has the telson intact, except for the loss of one of the larger apical spines. The high serrulated keels are in perfect condition and are exactly like those figured by Hansen (1912) for his specimen (Fig. 1 D–E).

It would thus appear that specimens hitherto referred to this species fall into two definite groups: (i) with the rostral plate serrulated along its anterior (and lateral) margins, the antero-lateral angles produced into acute processes and with the outer margin of the antennal scale armed with only

2–4 teeth, and (ii) with the anterior margin of the rostral plate smooth, the antero-lateral angles rounded (in Fage's description minutely serrulated) and with the outer margin of the antennal scale armed with 9–12 serrations. It may be that these two groups do represent two separate species, but Tattersall (1951) put forward the interesting suggestion that the differences between the groups might be sexual. He noted that the Challenger specimen was a female and that all the specimens examined by Hansen and Fage were male. All his own specimens were too immature for their sex to be ascertained, so that he was unable to obtain any evidence from them. Unfortunately both the Discovery specimens are female, but it is significant that they agree with the Challenger specimen, which was also a female.

The eyes in this species are very long and slender, nearly four times as long as broad. The cornea is no wider than the eyestalk and occupies about one-fourth of the whole organ. There is a well-marked finger-like ocular papilla on the distal inner margin of the eyestalk. Hansen figured a papilla in this position but made no mention of it in the text (Fig. 1 B). The labrum is flask-shaped and quite symmetrical, with its anterior end produced forward into a long acute process (Fig. 1 C).

DISTRIBUTION. *Chalaspidum alatum* is known to have a very wide distribution in the deep waters of the Pacific. Since the type was taken in the Indian Ocean, off Kerguelen Island it has been recorded from four stations in the East Pacific, off the west coast of Peru (Hansen, 1912), from the China Sea, north of New Guinea and from the Gulf of Panama (Fage, 1939, 1941) and from two stations to the south of Japan and one to the west of San Diego, California (Tattersall, 1951). Its occurrence in the South Atlantic considerably extends its known geographical range. The record of the type simply gives the depth as 1800 fm. and it is not stated whether a closing net was used. Hansen's specimens were taken in vertical hauls of 300 and 400 fm. to the surface. The records of the 'Dana', giving the length of the cable out and the depth of water over which it was fishing, indicate that the animals were living between depths of 300 m. and 2500 m. The capture of an immature female in a closing net fishing between 2400 m. and 2500 m. at Discovery station 101, and of an adult in a net fishing between 1050 m. and 1000 m. at Discovery station 253 proves that the species can live at great depths. The robust abdomen and the strongly developed pleopods suggest that it is a powerful swimmer and that in all probability its vertical range is considerable.

Genus Gnathophausia W.-Suhm, 1873

1873 *Gnathophansia* (*lapsus calami*) W.-Suhm, p. 400.
1874 *Gnathophausia*, Humbert, p. 206.

REMARKS. The genus *Gnathophausia* very closely resembles the fossil genus *Tellocaris* (Peach, 1908, p. 9) as regards the telson, but even more closely in the form and armature of the carapace with its anterior margin serrated and produced into a long dentate rostrum and the posterior margin produced into a long median dorsal spine which is also frequently dentate. This spine is always present in young specimens and usually persists as a long projection, but in some species it becomes progressively shorter as the animals approach maturity and in large specimens may almost disappear.

The chief generic characters are the tough, parchment-like integument; the large, shield-like carapace adorned with strong raised keels which are often toothed; rostrum long and sharp with three longitudinal, dentate ridges making it triangular in section; posterior margin of carapace produced into a strong median spine; pleural plates of abdominal somites bilobed; eyes with well-developed papilla; sixth abdominal somite with well-marked groove running around its median region; maxillule with a two-segmented, setose, backwardly reflexed endopod; first thoracic exopod absent or reduced to a small unsegmented plate; exopod of uropod broad, two-segmented, outer margin of proximal segment naked and terminated by a strong spine; telson entire with a strong constriction near the apex which is armed with two very strong curved spines which together form a backwardly directed crescent.

Eight species have up to the present been referred to this genus, *Gnathophausia ingens* (Dohrn), *gigas* W.-Suhm, *zoea* W.-Suhm, *gracilis* W.-Suhm, *elegans* G. O. Sars, *longispina* G. O. Sars, *affinis* G.O. Sars and *scapularis* Ortmann. These species fall very sharply into two groups according to the form of the antennal scale. In *ingens* and *gigas* the scale is lanceolate and unsegmented with an acutely pointed apex and with the outer margin armed with teeth. In the other six species the scale resembles that found in the Caridea. The outer margin is thickened to form a strong rib which is produced distally into a spine from the base of which an oblique suture runs across the scale. The outer margin bears a number of teeth and in one species the spine of the outer margin is dentate on both its margins.

A second character which separates *ingens* and *gigas* from the other species of the genus is the peculiar modification of the epimeral plates of the last abdominal somite. In the young, these are separate and distinct as in other species of *Gnathophausia*, but in *ingens* and *gigas*, as growth proceeds, they bend under the body to fuse eventually in the median line into a single epimeral plate.

The differences between the species are so marked that they might be considered as of generic significance, *ingens* and *gigas* being placed in a separate genus, were it not for the fact that another very profound difference occurs among the species which would divide the genus in quite another way. In *ingens*, *gigas* and *gracilis* the exopod of the first thoracic appendage is present in the form of a small, slender, unsegmented plate, adorned distally with a few very long plumose setae. In the remaining known species of the genus the exopod of this appendage is completely lacking, but its position is marked on the sympod by a shallow oval depression. If any subdivision of the genus were to be made, it would be logical to arrange the species into three distinct subgenera, separating *ingens* and *gigas* into a subgenus based on the form of the antennal scale, the ventral epimeral plate of the last abdominal somite and the presence of an exopod on the first thoracic appendage; placing *zoea*, *longispinis*, *elegans* and *scapularis* in a second based on the form of the antennal scale, the separate epimera of the sixth abdominal somite and the absence of an exopod on the first thoracic appendage; and *gracilis* in a third subgenus by itself, resembling the first in the form of the scale and epimera of the last abdominal somite and the second in having an exopod on the first thoracic appendage.

While so few species are included in the genus there is not much point in changing the present nomenclature, but if further exploration of the deep waters of the oceans should reveal many new forms there would be ample grounds for the division of the genus into subgenera.

The genus *Gnathophausia* includes the largest mysids which have ever been recorded. All the known species are bathypelagic and no specimen has ever been taken at the surface or in very shallow water.

Only four of the known species have been collected by the 'Discovery': *G. ingens* (Dohrn), *G. gigas* W.-Suhm, *G. zoea* W.-Suhm and *G. gracilis* W.-Suhm.

Gnathophausia ingens (Dohrn), 1870

1870 *Lophogaster ingens* Dohrn, p. 610, figs.
1873 *Gnathophausia inflata* W.-Suhm, in MS.
1885*a* *Gnathophausia ingens*, G. O. Sars, p. 30, figs.
1885*a* *Gnathophausia calcarata* G. O. Sars, p. 35, figs.
1891*b* *Gnathophausia bengalensis* Wood-Mason, J., and Alcock, A., p. 269.
1906*b* *Gnathophausia doryphora* Illig, p. 227; 1930, p. 407, figs. (as *G. ingens*).
1906 *Gnathophausia ingens*, Ortmann, p. 28.
1912 *Gnathophausia ingens*, Hansen, p. 184; 1927, p. 15, figs.
1951 *Gnathophausia ingens*, W. M. Tattersall, p. 25.

OCCURRENCE:

10. x. 25. 41° 37′ 15″ N., 12° 36′ 20″ W. North-east of Azores, 0–900 m., 1 juv. 92 mm.

St. 76. 5. vi. 26 (day). 39° 50′ 30″ S., 36° 23′ 00″ W., 1500(–0) m., 1 juv. 38 mm.

St. 81. 18. vi. 26 (day). 32° 45′ 00″ S., 8° 47′ 00″ W. Mid-Atlantic between Cape Town and Monte Video, 650(–0) m., 1 juv. 38 mm.

St. 86. 24. vi. 26 (day). 33° 25′ 00″ S., 6° 31′ 00″ E. West of Cape Town, 1000(–0) m., 1 ♂, 96 mm. (eye to telson). ('Deep scarlet red throughout, palest on scales, uropods and protopodites of pleopods'), 1 imm. ♀, 60 mm., 1 juv. 50 mm.

St. 100B. 3. x. 26 (night). West of Cape Town, 1000–900 m., 1 ♀, 132 mm. (from eye to telson, rostrum broken).

St. 100C. 4. x. 26 (day). West of Cape Town, 2500 (–0) m., 1 juv. 71 mm.

St. 101. 15. x. 26 (night). West of Cape Town, 2 hauls: (i) 350–400 (–0) m., 1 juv. ♂, 80 mm. (eye to telson) 1 juv. ♂, 73 mm., 1 ♂, 148 mm. (eye to telson); (ii) 2580–2480 m., 1 juv. 49 mm.

St. 107. 4. xi. 26 (day). South-south-west of Cape Town, 950–850 m., 1 imm. ♀, 70 mm. (eye to telson).

St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 1 juv. 41 mm.

St. 257. 24. vi. 27 (night). West of Cape Town, 250(–0) m., 1 juv. 57 mm.

St. 285. 16. viii. 27 (night). Gulf of Guinea, 175–125(–0) m., 1 juv. ♀, 84 mm., 5 juv. 37–74 mm.

St. 288. 21. viii. 27 (night), South-south-west of Monrovia, 250(–0) m., 5 juv. 40–82 mm., 2 too damaged to measure.

St. 289. 24. viii. 27 (night). South-west of Monrovia, 225–125(–0) m., 2 juv. 41 mm.

St. 296. 26. viii. 27 (night). South-south-west of Cape Verde, 500–450(–0) m., 1 ♂, 96 mm. (eye to telson).

St. 407. 12. vi. 30 (day). South-west of Cape Town, 950–800 m., 6 juv. 65–98 mm.

St. 440. 21. ix. 30 (dusk). East of Durban, 1000–0 m., 1 ♂, 103 mm., 1 juv. 68 mm.

St. 691. 8. v. 31 (night). Equator, south-west of Cape Verde, 400–0 m., 1 juv. 78 mm.

St. 1567. 10. iv. 35 (night). Between South Africa and Prince Edward Is., 1350–0 m., 1 juv. 35 mm.

St. 1571. 21. iv. 35 (night). South-west of Madagascar, 1400–1000 m., 1 juv. 30 mm. (eye to telson).

St. 1573. 22. iv. 35 (night). Mozambique Channel, 800–0 m., 1 ♂, 91 mm., 1 juv. (eye to telson), 20 mm.

St. 1575. 24. iv. 35 (night). Mozambique Channel. Two hauls: (i) 400–0 m., 2 juv. 71 mm. and 38 mm.; (ii) 800–550 m., 2 ♀♀, 146 mm. and 156 mm.

St. 1576. 25. iv. 35 (night). Between Madagascar and Mozambique, 400–0 m., 1 juv. 31 mm. (eye to telson).

St. 1578. 26. iv. 35 (night). Midway between Comoro Is. and Cape Delgado, 500–0 m., 1 juv., 52 mm. (eye to telson).

St. 1580. 27. iv. 35 (night). North of Comoro Is., 450–0 m., 3 ♂♂, 94–110 mm.

St. 1582. 29. iv. 35 (night). East of Zanzibar, 1900–1850(–0) m., 2 juv., 50 mm., 41 mm.

St. 1586. 2. v. 35 (night). North-west of Seychelles, 550–0 m., 1 juv. 49 mm.

St. 1590. 13. x. 35 (night). South of Canary Is., 400–320 m., 1 juv. 84 mm.

St. 1741. 18. iv. 36 (day). Indian Ocean, west of Perth, 900–0 m., 2 juv. 37 mm.

St. 1761. 3. v. 36 (day). East of East London, 1800–650 m., 1 juv. 37 mm. (Colour note, 'Deep orange brown'.)

St. 1763. 5. v. 36 (night). South-east of Durban, 2000–0 m., 1 ♂, 173 mm.

St. 1764. 6. v. 36 (night). South-east of Durban, 1000–0 m., 1 ♀, 124 mm., with very small oostegites.

St. 1770. 2. v. 26 (night). West of Cape Town, 340–210 m., 1 juv. 70 mm. (deep brilliant scarlet throughout), 1 juv. 38 mm. (orange brown).

REMARKS. The Discovery collection contains over sixty specimens of *Gnathophausia ingens*, ranging in length from 34 to 173 mm., measured from the tip of the rostrum to the apex of the telson. A complete series such as this shows the gradual changes which take place with growth and demonstrates clearly that only one species is involved. Not having access to such a series, workers in the past have founded new species on specimens which have subsequently been proved to be young forms of *G. ingens*. Ortmann (1906, pp. 27–52) was the first to show that several species of *Gnathophausia* had been founded in error in this way. It is now generally accepted that *G. calcarata* G. O. Sars (1885*a*, p. 35), *G. bengalensis* Wood-Mason and Alcock (1891*b*, p. 269) and *G. dorymorpha* Illig (1906*b*, p. 227) are all founded on different growth stages of *G. ingens* and if any further evidence were needed to prove this fact, it is amply afforded by the rich range of the species in the Discovery collection. The specimens described by these earlier workers varied considerably in size, but if their descriptions and figures are compared with animals of about the same length in the present material they agree closely in every particular.

Growth changes. In *G. ingens* the following growth changes take place: (1) in the relative length of the rostrum and the various spines which arm the carapace, (2) in the number of teeth on the outer margin of the antennal scale, and (3) in the shape and size of the epimeral plates of the sixth abdominal somite. (1) In young specimens of less than 32 mm., the rostrum is relatively very long, nearly 50% of the length of the animal. The branchiostegal spines are also very long and widely extended laterally; the posterior median spine extends backwards over the abdomen to the posterior margin of the sixth abdominal somite; and the postero-lateral spines are even longer, extending backwards in an arc to the level of the apex of the telson. As growth proceeds, the rostrum and all the spines on the carapace become relatively smaller, until in specimens of over 130 mm. the rostrum is only 16% of the length,[1] the branchiostegal spines become shorter and are directed backwards and less sideways and the posterior dorsal spine is very short and may be almost obsolete. The postero-lateral spines extend backwards only to the level of the second abdominal somite. (2) In young specimens the outer margin of the antennal scale bears at most two small teeth in addition to the terminal spine. The number of these teeth increases as the animal grows until there are from 6 to 8. (3) Interesting changes in the shape and relative size of the epimeral plates of the last abdominal somite have been described by Ortmann (1906). In some species of *Gnathophausia* (*ingens* among them) these epimera bend under the body and meet in the mid-ventral line. At first they are simply contiguous, but soon become united to form a rectangular plate covering the anterior half of the ventral surface of the somite. The posterior margin of this plate is somewhat concave, the posterior angles not very acutely pointed and the line of fusion is marked only by a faint ridge. Gradually the posterior margin becomes more emarginate and the distal end of the whole plate narrows, while the two angles lengthen to form two acutely-pointed lappets. As these lengthen, their inner margins become straighter and the fissure between them is reduced to a narrow slit which is slightly dilated at its proximal end.

When the animal has reached a length of about 65 mm. a small outgrowth begins to develop on the inner side of each lappet near the distal end and, so narrow is the fissure at this stage, that the two lappets actually overlap distally. This secondary tooth-like outgrowth continues to grow, but does not equal the lappet in length and in really large animals the lappets appear asymmetrically bifid with the larger fork on the outer side.

After a length of over 100 mm. has been reached, there is no further change in the form of the epimeral plate.

Some confusion has arisen in the past because in the Challenger female specimen of *G. ingens* Sars (1885*a*) figured the fissure of the epimeral plate as fairly wide with straight inner margins and no dilatation at its proximal end. The lappets are shown as bifid, with the larger and longer point on the *inner* side. Hansen (1927, p. 16), when recording a gigantic male of 210 mm. captured by 'Talisman' south of the Azores, noted that its epimeral plate differed from that of the Challenger specimen. The fissure was narrow, so that the inner margins of the lappets were touching except proximally, where there was a definite dilatation. The lappets were bifid with the larger prong on the *outer* side. A re-examination of the Challenger specimen revealed that Sars's figure was correct for the fissure, but incorrect as regards the lappets which were actually similar in every way to those of Hansen's males. In the largest males in the Discovery collection, the whole form of the epimeral plate is similar to Hansen's figure of the Talisman specimen, but in the largest Discovery females the

[1] Measured from the apex of the rostrum to the apex of the telson.

slit is somewhat wider and I can find no trace of a proximal dilatation. None of the Discovery females is fully mature and, although this difference may be due to immaturity, I am inclined to think there is a slight sexual dimorphism in this structure.

Specimens of all sizes from 34 mm. to 173 mm. are present in the Discovery material and from the tabulated measurements given in Table 1, it can be seen how the various growth changes progress.

The pleopods are alike in both sexes and no brush of setae is developed on the antennules of the males. Brood lamellae do not begin to develop until the females are about 60 mm. in length and it is difficult to see the male tubercle at the base of the eighth thoracic appendage until the males are even longer. Fage (1936, p. 146) recorded that in specimens of *Gnathophausia* each thoracic sternum bore a rounded boss, which differed in shape and armature in the two sexes. The Discovery specimens have been in preservative for a long time and any attempt to bend back the thoracic appendages to expose the sterna would cause damage to the animals. I have therefore not attempted to ascertain the sex of those specimens in which brood lamellae or the male tubercle are not easily visible.

Size. The largest specimen of *G. ingens* ever recorded was a male which measured no less than 210 mm. from the tip of the rostrum to the apex of the telson. The largest recorded female was adult with a very large empty brood sac and measured 157 mm. The largest male in the Discovery collection has the tip of the rostrum broken, but I estimate that its full length was about 176–7 mm. A slightly smaller undamaged male measures 173 mm. The largest female measures 156 mm., but is still quite immature with small narrow oostegites.

Colour. There is some evidence that the colour becomes more red and less orange-brown as the animals mature. At station 1761 a young specimen of 37 mm. is described as 'Deep orange-brown' and at station 177 another young specimen of 38 mm. is said to be 'Orange-brown'. A large male of about 130 mm. from station 86 is labelled 'Deep scarlet red throughout, palest on scales, uropods and protopodites of pleopods' and at station 1770 an immature specimen of 70 mm. is said to be 'Deep brilliant scarlet throughout'.

Distribution. *G. ingens* has been recorded from widely separated localities in the tropical and sub-tropical waters of the world. The type was taken off the west coast of Africa and the Challenger specimen from between North Australia and New Guinea. Since then it has been recorded on a number of occasions off the coast of California, near the Hawaiian Islands, the Philippines and New Guinea in the Pacific (W. M. Tattersall, 1951); the Central Arabian Sea, off Zanzibar and near the Seychelles in the Indian Ocean (W. M. Tattersall, 1939); from the Gulf of Mexico and south of the Azores in the western North Atlantic and from off the coast of South Africa in the eastern South Atlantic.

The Discovery records, most of them from around the coast of South Africa, extend its known range in the south-west Indian Ocean. The capture of a specimen from east of La Plata is the first record from the western side of the South Atlantic. Its occurrence in latitudes 41° 37′ N. and 37° 50′ S. proves that it extends into the temperate waters of both northern and southern hemispheres.

Where closing nets have been used and it is possible to tell the exact depth of capture, it has been found to be most common between 600 m. and 1500 m. At station 101 it was taken between 2480–2580 m. (Hansen, 1927, records it from 2470–3990 m.) while at station 1770 it was taken in a closing net fishing between 340–210 m. It is thus evident that it has a very considerable vertical range.

Table 1. *Measurements to show Growth Changes in* Gnathophausia ingens

Station no.	Tip of rostrum to apex of telson (mm.)	Tip of rostrum to level of eye (mm.)	Proportion of rostrum to total length (%)	Segment of abdomen over which dorsal spine extends	Segment of abdomen over which postero-lateral spines extend	No. of teeth on antennal scales
1567	35	14	40	4	5	2
1770	35	13	37	4	Whole abd.	2
1761	*(22)	Br.	—	4	Whole abd.	2
1741	37	15	40·5	4½	Whole abd.	2
81	38	15	39·47	3	5	2–3
76	38	15	39·47	3	5	3
285	40	18	45	3½	5	2–3
1575	*(23)	Br.	—	2½	4	2–3
288	40	16	40	3	Whole abd.	2
289	41	16	39	3	5	2–3
256	41	16	39	3	5	3
289	41	16	39	3	5	2–3
288	44	18	43	3	Whole abd.	2
1571	*(30)	Br.	—	2½	Whole abd.	4–5
1571	*(30)	Br.	—	2	4	4
1576	*(31)	Br.	—	2	4	4
101	49	17	34·7	2	Br.	4
1582	50	18	36	1½	4¼	3
1586	49	16	32·65	2	4½	2–3
285	56	18	32	2	4	4
257	57	17	29·8	2	3½	5
407	*(45)	Br.	—	2	3½	6
440	68	20	29	2	3½	6
285	69	18	27	2	4	4
86	70	20	28·5	1½	2½	5
1770	70	20	28·5	2	3	5
1575	*(50)	Br.	—	1¼	3	5–6
100 C	71	21	29	1½	3	5–6
288	71	21	29	1½	3	6
288	71	21	29	1½	3	5–6
288	71	21	29	1½	3	6
407	71	21	29	2	3¼	5–6
1578	*(52)	Br.	—	Br.	4	6
285	*(54)	Br.	—	1	3	6
407	78	20	25·6	1¼	2	5
691	83	25	30	1	3	7
86	83	23	27·7	1½	2½	6
1590	84	21	25	1½	2½	7
285	84	21	25	< 1	2¼	5–6
407	88	22	25	1	2½	5
407	90	23	25·5	1	2½	8
41° 37′ N., 12° 30° W.	92	25	26	1	2	5
1580	94	24	25·5	1	2	5
1585	97	22	22·7	1½	4	5
1580	97	21	21·7	1	2¼	5–6
407	99	21	21·2	< 1	2	8
101	*(80)	Br.	—	½	1½	6
1580	110	25	22·7	< 1	2	5–6
1585	113	25	22·1	1	3	6
1573	121	30	24·8	½	2	6
296	*(96)	Br.	—	1	1½	6
86	*(96)	Br.	—	1	1½	6
440	133	30	22·5	½	1½	8
1764	124	20	16·1	1	2	6
1575	146	28	19·8	½	2	7–8
1575	156	26	16·6	¼	1	6
100 B	159	27	16·9	¼	1	6
1763	173	28	15	¼	1	7
101	*(148)	Br.	—	¼	1	6–7

* Where the rostrum is broken the figure given in brackets is the length from the anterior margin of the eye to the apex of the telson and the animal occupies that place in the series which, from other measurements, it is estimated that it would have occupied.

Gnathophausia gigas W.-Suhm 1873

1873 *Gnathophansia gigas* (*lapsus calami*) W.-Suhm, p. 400, figs..
1875 *Gnathophausia gigas* W.-Suhm, p. 28, figs.
1885*a* *Gnathophausia gigas*, G. O. Sars, p. 33, figs.
1905 *Gnathophausia drepanephora* Holt and Tattersall, p. 113, figs.
1906 *Gnathophausia gigas*, Ortmann, p. 36, figs.
1941 *Gnathophausia gigas*, Fage, p. 24, fig.
1943 *Gnathophausia gigas*, Nouvel, p. 12, figs.
1951 *Gnathophausia gigas*, Tattersall and Tattersall, p. 77, figs.

OCCURRENCE:

St. 9. 11. ii. 26 (day). Midway between Gough I. and South Georgia, 1250(–0) m., 1 ♂, 110 mm., 1 juv. 48 mm.
St. 71. 30. v. 26 (day). North-east of Falkland Is., 2000(–0) m., 2 juv. 47 mm.
St. 72. 1 vi. 26 (night). North-east of Falkland Is., 2000(–0) m., 1 juv. 57 mm. (blood red), 1 juv. 46 mm. (more orange tone).
St. 76. 5. vi. 26 (day). Midway between Gough I. and Bahia, Argentine, 1500(–0) m., 1 juv. 65 mm.
St. 86. 24. vi. 26 (day). West of Cape Town, 1000(–0) m. 5 small specimens too damaged to measure.
St. 100. 4. x. 26 (day). West of Cape Town, 2500–2000 m., 1 juv. 40 mm.
St. 101. 15. x. 26 (day). West of Cape Town, 1310–1410, 3 juv. 60–34 mm.
St. 114. 12. xi. 26 (day). North-east of Bouvet I., 700–650 m., 1 juv. 38 mm.
St. 239. 2. vi. 27 (day). North-east of South Georgia, 1350–1050(–0) m., 3 juv. 37–38 mm.
St. 253. 21. vi. 27 (day). West of Cape Town, 1050–1000 m., 2 juv. 37 and 45 mm.
St. 391. 18. iv. 30 (day). Midway between South Georgia and Cape Horn, 1300–1200(–0) m., carapace only.
St. 413. 21. viii. 30 (day). West of Saldanha Bay, South Africa, 2200–1600(–0) m., 2 juv. 34–37 mm.
St. 1298. 2. iii. 34 (day). Ice Edge, Bellingshausen Sea, 1000(–0) m., 4 juv. 110–37 mm.
St. 1755. 29. iv. 36 (day). Indian Ocean, south-south-east of Mauritius, 1700–0 m., 1 juv. 46 mm.
St. 1775. 27. v. 36 (night). South-east of Tristan da Cunha, 1500–1000 m., 1 damaged juv. *ca.* 35 mm.
St. 1798. 12. 6. 36 (night). North-east of Bouvet I., 1000–750 m., 1 juv. (typical *drepanephora* stage) 39 mm.
St. 1991. 11. iii. 37 (day). South-east of South Georgia, 1500–1000 m., 1 damaged juv. *ca.* 35 mm.
St. 2022. 28. iii. 37 (night). North-west of Bouvet I., 700–400 m., 1 juv. 35 mm.

REMARKS. Growth changes similar to those which occur in *Gnathophausia ingens* take place in *G. gigas* also. The relative length of the rostrum and of the spines arming the carapace tends to decrease, the number of teeth on the outer margin of the antennal scale increases from one or two to five or six and the epimera of the sixth abdominal somite, which are separate in young animals, gradually become confluent and then fuse on the ventral surface of the somite to form a single epimeral plate. This plate is of the same shape as that of *G. ingens*, but its lappets are not bifid and are well separated with a tendency to curve outward at their distal ends.

The postero-lateral spine of the carapace is at no time as long as it is in *G. ingens*. Even in very small animals it does not extend beyond the posterior margin of the first abdominal somite and in really large specimens it is practically obsolete. None of the Discovery specimens is mature and I can see no trace of incubatory lamellae in any of them, although many of them are larger than specimens which have been recorded as definite females by other workers. In Table 2, I give measurements of the Discovery specimens.

DISTRIBUTION. *Gnathophausia gigas* is one of the most widely distributed of all mysids. The type was collected by 'Challenger' at 2200 fm. to the west of the Azores. Since then it has been recorded from many localities in the Atlantic from Greenland (Stephensen, 1933), the east coast of North America (Ortmann, 1906; W. M. Tattersall, 1951), the Azores, mid-Atlantic and Bermudas (Fage, 1941; Nouvel, 1943), west of Ireland (Holt and Tattersall, 1905), Madeira and Cape Verde Islands

(Fage, 1941) and off Sierra Leone (Illig, 1930); and from the South Atlantic, west of Cape Town (Tattersall, 1925), and south of Gough Island (Tattersall, 1913). It has been recorded from the north-west of the Indian Ocean (Tattersall, 1939) and from the south of the Indian Ocean between Kerguelen and South-West Australia (G. O. Sars, 1885*a*). In the Pacific it has been taken as far north as the Behring Sea and off the coasts of British Columbia and the west coast of the United States (Ortmann, 1906; W. M. Tattersall, 1951), from the Gulf of Panama (Fage, 1941), the Hawaiian Isles (Ortmann, 1906; W. M. Tattersall, 1951), from Japan (W. M. Tattersall, 1951) and from many places in the China Sea, the Philippines, New Hebrides, New Caledonia and New Zealand (Fage, 1941).

Table 2. *Measurements to show growth changes in* Gnathophausia gigas

Station no.	Length, tip of rostrum to apex of telson (mm.)	Rostrum tip to level of eye (mm.)	Percentage rostrum of total length	Abdominal somite over which postero-dorsal spine extends	Abdominal somite over which postero-lateral spines extend	No. of teeth on outer margin of antennal scale
101	34	8	23·5	1	2	3
1775	37	10	27	Br.	Br.	2
253	37	10	27	1	2	3
1298	37	10	27	1	2	3
237	27 (eye to telson)	Br.	—	1	2	3
239	38	10	26·2	$\frac{1}{2}$	2	3
	38	9·5	25	$\frac{1}{2}$	2	3
114	38	10	26·2	$\frac{1}{2}$	2	3
1798	39	11	28	1	3	2–3
100C	40	10	25	Br.	3	3
253	45	11	24·5	1	3	4
72	46	12	23·9	$\frac{1}{2}$	$1\frac{1}{2}$	3
71	47	13	25·5	1	2	3
413	47	13	25·5	1	2	3
9	48	11	22·9	$\frac{1}{4}$	2	2
101	51	11	21·6	$\frac{1}{4}$	$1\frac{1}{2}$	4
72	57	13	22·8	$\frac{1}{2}$	$1\frac{1}{2}$	3
101	60	13	21·7	$\frac{1}{4}$	$1\frac{1}{2}$	4
76	65	15	23	$\frac{1}{4}$	$1\frac{1}{2}$	5
1775	97	22	22·7	$1\frac{1}{4}$	4	5
1298	105	23	21·9	Very small	1	4
9	110	22	20·0	Very small	1	5
1298	110	20	18·2	Very small	1	4
1298	110	22	20·0	Very small	1	4–5

This species was taken by 'Discovery' and 'Discovery II' at eighteen stations of which sixteen were situated in the South Atlantic between latitudes 33° S. and 60° S., extending from the west of Cape Town in the east to the Falkland Is. and South Georgia in the west. A single immature specimen was captured at station 1755 in the central Indian Ocean and four immature specimens at station 1298 in the Bellingshausen Sea in latitude 69° 16′ S. This is the most southerly record yet made of the species.

G. gigas has usually been taken singly or in very small numbers and consequently, in spite of the many records of its capture, few specimens have been collected. Of these only very few have been adults. The type, 142 mm. in length, was an adult male and Tattersall (1913, p. 868) recorded a female, presumably adult, of 160 mm. from the South Atlantic. Ortmann (1906, p. 36) recorded a female of 119 mm. from the coast of Alaska, stating that it had a fully developed marsupium, while at the same time he recorded that a female of 90 mm. had very tiny oostegites. I can see no trace of brood lamellae in any of the Discovery specimens, although four of them measure over 100 mm. I can only conclude that these are immature males.

G. gigas is a bathypelagic form with a considerable vertical range. Captures by the use of closing nets which, while fishing at great depths, were still far from the bottom, prove that, at any rate when they are immature, the animals occupy levels between 650 m. and nearly 4000 m. The Challenger type and Tattersall's specimen from the Southern Ocean were captured in trawls at 1950 fm. and 1332 fm. respectively, and were presumably living at or close to the bottom. It would appear that, as the animals approach maturity, they occupy lower levels than the young.

Gnathophausia zoea W.-Suhm, 1873

1873 *Gnathophausia zoea* W.-Suhm, p. 400, fig.
1885*a* *Gnathophausia zoea*, G. O. Sars, p. 44, figs.
1885*a* *Gnathophausia willemoesii* G. O. Sars, p. 38, figs.
1891*a* *Gnathophausia sarsii* Wood-Mason and Alcock, p. 187.
1906*b* *Gnathophausia cristata* Illig, p. 319, figs.
1906 *Gnathophausia zoea, sarsi* Ortmann, p. 42.
1908 *Gnathophausia zoea*, Hansen, p. 93, figs.
1941 *Gnathophausia zoea*, Fage, p. 34, figs.
1943 *Gnathophausia zoea*, Nouvel, p. 15, fig.
1951 *Gnathophausia zoea*, Tattersall and Tattersall, p. 82, figs.

OCCURRENCE:

St. 245. 10. vi. 27 (day). West of Tristan da Cunha, 2000–1800 m., 1 juv. badly damaged, estimated length 30 mm.
St. 1582. 29. iv. 27 (night). East of Zanzibar, 1900–1850(–0) m. 1 juv. 40 mm.
St. 2064. 3. v. 37 (day). Just north of equator, north-north-east of Ascension I., 1600–1050 m., 1 ♂, 70 mm. (Colour note, 'brilliant scarlet'.)

REMARKS. *Gnathophausia zoea* is one of the commonest species of the genus and it is somewhat surprising that it was only taken at three stations by the ships of the Discovery Investigations. In common with other species of *Gnathophausia*, very considerable changes occur in the relative lengths of the rostrum and of the postero-dorsal spine of the carapace, which have led workers to regard young specimens of the species as new forms. By a *lapsus calami* Tattersall and Tattersall, 1951, p. 86, give *G. bidentata* Illig as a synonym of *G. zoea*. It is, of course, a synonym of *G. gracilis*.

DISTRIBUTION. *G. zoea* is widely distributed in the tropical and temperate waters of the globe. It has been recorded on many occasions from all parts of the North Atlantic, from Greenland, Iceland and the Faroes in the north; from the west of Ireland, the Bay of Biscay, off the Azores and Cape Verde Islands in the east; from mid-Atlantic and from the east coast of the United States, the Gulf of Mexico and off Dutch Guiana in the west. In the South Atlantic it has been recorded off the Cape Peninsula in the east and from off the coast of Brazil in the west. Its capture by the 'Discovery' at station 245 to the west of Tristan da Cunha and in the open ocean to the west of the Gulf of Guinea at station 2064 suggests that it is widely distributed in the South Atlantic.

It has been recorded from the middle of the Indian Ocean and from the Bay of Bengal and west of Sumatra in the east. Its capture to the east of Zanzibar at station 1582 considerably extends its known geographical range in this ocean.

There have been many records of the species from the North Pacific, especially in the west from Japanese waters, the China Sea, the Philippines and the East Indian Archipelago. In mid-Pacific it has been recorded from the Hawaiian Islands and in the east from the west coast of the United States, the gulf of Panama and the Galapagos Islands. In the South Pacific it has only been recorded from Fiji and from the north of New Zealand.

G. zoea is a bathypelagic and mesoplanktonic form and from the records it appears that young specimens tend to inhabit higher levels than the adults.

Gnathophausia gracilis W.-Suhm, 1875

1875 *Gnathophausia gracilis* W.-Suhm, p. 33, figs.
1885*a* *Gnathophausia gracilis*, G. O. Sars, p. 48, figs.
1891*a* *Gnathophausia gracilis* var. *brevispinis* Wood-Mason and Alcock, p. 187.
1891*b* *Gnathophausia brevispinis* Wood-Mason and Alcock, p. 269.
1893 *Gnathophausia dentata* Faxon, p. 217.
1895 *Gnathophausia brevispinis* Faxon, p. 216.
1900 *Gnathophausia* sp. Chun, pp. 289, 516, 531; 1903, p. 551, pl.
1906*b* *Gnathophausia bidentata* Illig, p. 229, figs.
1906 *Gnathophausia gracilis*, Ortmann, p. 39.
1912 *Gnathophausia gracilis*, Hansen, p. 185, fig.
1930 *Gnathophausia gracilis*, Illig, p. 409, figs.
1941 *Gnathophausia gracilis*, Fage, p. 27, figs.
1951 *Gnathophausia gracilis*, W. M. Tattersall, p. 28.

OCCURRENCE:

St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 juv. 24 mm.
St. 2057. 29. iv. 37 (day). North-east of St Helena, 1450–700 m., 1 imm. ♂, 47 mm. (rostrum 11 mm.).
St. 2059. 30. iv. 37 (day). North-north-east of St Helena, 1400–0 m., 1 ♂, 58 mm. (rostrum 13 mm.).

REMARKS. There is probably no species of *Gnathophausia* in which the differences between very young specimens and more mature ones are so extensive as they are in *G. gracilis*. This species was first recorded by Willemoës-Suhm from the 'Challenger' and was fully described and figured by G. O. Sars (1885*a*, p. 48). The material at his disposal was not in very good condition and did not show the dentate crest on the dorsal surface of the carapace in the gastric region, which is so marked a character as the animals increase in size. In the specimen from station 700 this crest is very small with very tiny teeth, but in the largest specimen from station 2059 it stands up as a large, somewhat triangular plate with one very well-developed apical spine and clearly marked denticles. The first and second abdominal somites are each armed with two strong spines on the dorsal surface in the median line. The anterior spine on the first abdominal somite is very small, but the posterior one is very large, as are both the spines on the second abdominal somite. In lateral view, the great development of these spines gives the animals a most grotesque appearance. Fage (1941, p. 28) has recorded a character which has been overlooked by previous workers—the presence of six very strong short curved teeth on the inner margin of the sympod of the uropods. These spines are directed somewhat obliquely downward and are difficult to detect when the appendage is *in situ*.

Fage also recorded that on each of the thoracic sterna in the males there is a stout, median, somewhat forwardly directed spine, the one on the first thoracic somite being very small. These spines are clearly present in the two larger specimens in the Discovery collection, but they become progressively smaller posteriorly and that of the eighth somite is almost imperceptible. My smallest specimen, measuring only 18 mm., from the base of the rostrum to the apex of the telson, shows no trace of these spines and, since Fage recorded that they were clearly developed in his smallest male which measured 23 mm., it is probable that mine is a young female.

The lower of the two postero-lateral spines of the carapace is small and quite well developed in all the Discovery specimens. In the smallest specimen the rostrum is 33·3% of the total length from its tip to the apex of the telson and in the other specimens it is 21·3% and 21·5% respectively.

DISTRIBUTION. *G. gracilis* is widely distributed in the tropical waters of the world. Apart from four localities situated between 25° 11′ N. and 34° 00′ N. and one from central California (Ortmann, 1906), it has never been taken north of the Tropic of Cancer. In the southern hemisphere it has never been taken south of 12° 09′ S. It has been recorded on many occasions in the North Atlantic from the Canaries and Cape Verde Islands in the east (Fage, 1941); from the Gulf of Guinea (Illig, 1930); from mid-Atlantic and from off the West Indies and south of the Bermudas (Fage, 1941). In the Indian Ocean it has been recorded from north of Madagascar, the south of Ceylon and the Cocos Isles (Fage, 1941) and from the Arabian Sea and the Bay of Bengal (Wood-Mason and Alcock, 1891 *b*). In the Pacific it has been recorded from many stations in the Gulf of Panama and around the Galapagos Islands (Hansen, 1912; Fage, 1941); twice in mid-Pacific and many times around the Philippines and East Indian Archipelago (Fage, 1941).

It has never, up to the present, been recorded from the South Atlantic and its capture at two stations to the N.E. and N.N.E. of St Helena considerably extends its known geographical range.

G. gracilis is essentially bathypelagic in habit. All the records of it are from between 1500 m. and 2000 m., with the exception of two very young individuals, recorded one by Fage and one by Hansen, which were taken at about 800 m. By comparing the size of adult females captured in various parts of the world, Fage (1941) discovered that there is considerable diversity in the length at which sexual maturity is attained in different localities. In the Pacific, and especially in the eastern Pacific, females were ovigerous at only 39 mm., while in the Indian Ocean they were still immature at 53–92 mm. In the Atlantic females of 84–95 mm. and even 100 mm. still had very small oostegites.

Genus Lophogaster M. Sars, 1857

1857 *Lophogaster* M. Sars, p. 160.
1862 *Ctenomysis* Norman, p. 151.

REMARKS. Workers in the past have had difficulty in deciding which characters could best be used in identifying the species of the genus *Lophogaster*. Most of these characters have subsequently been shown to be very variable, and specimens differing considerably from one another and collected from widely separated localities have been incorrectly referred to the type species *L. typicus*. Fage (1942, pp. 7–39) and Tattersall (1951, p. 16), have done much to clear up the existing confusion.

Four species of the genus are represented in the Discovery collection: *L. challengeri* Fage, *L. spinosus* Ortmann, *L. rotundatus* Illig and *L. schmidti* Fage.

Lophogaster challengeri Fage, 1942

(Fig. 2A–D)

1885*b* *Lophogaster typicus* G. O. Sars, p. 14, figs.
1942 *Lophogaster challengeri* Fage, p. 16, figs.

OCCURRENCE:

St. 277. 7. viii. 28 (night). Just off Cape Lopez. Two hauls: (i) 63–0 m., 8 juv., 5–5·5 mm., 3 juv. 4 mm.; (ii) 88–0 m., 4 juv. 5–6 mm.
St. 279. 10. viii. 27 (day). Just north of Cape Lopez, 58–67 m., 1 juv., 8 mm., 3 juv. 3–5 mm.
St. 424. 4. ix. 30 (night). Off Port Elizabeth, 59–0 m., 1 juv. 7·6 mm., 1 juv. 8·4 mm.
St. 443. 23. ix. 30 (night). South of Knysna, South Africa, 49–0 m., 1 imm. 11·5 mm.
St. 444. 24. ix. 30 (night). South-west of Cape Peninsula, 80–0 m., 1 juv. 8 mm.
St. 844. 8. iv. 32 (night). South of Cape Town, 155–0 m., 1 juv. 8 mm., 1 juv. 7·6 mm.

REMARKS. Characters used by M. Sars (1857) to define *Lophogaster typicus* have proved to be variable and unreliable. Fage (1942, pp. 7–39), in a survey of all the known material of the species, divided it into four distinct species: (1) *typicus* (for the forms from the northern hemisphere); (2) *challengeri* (for specimens collected by 'Challenger' in South African waters and described by G. O. Sars as *typicus*—the new specific name emphasizes the fact that these specimens are the true types of *challengeri*); (3) *pacificus* and (4) *hawaiiensis*.

Fage separated his four species on the following four salient characters of the carapace: (1) the tuberculation of the integument, (2) the presence or absence of a post-orbital spine, (3) the shape of the profile (in lateral view) of the dorsal margin of the free postero-lateral regions or 'wings', and (4) the size and angle of the postero-lateral spine. He showed, moreover, that these characters were correlated with geographical distribution and conditions of the habitat.

At first sight it may seem that these characters are too trivial to warrant the separation of *challengeri* from *typicus*, but examination side by side of specimens from the northern and southern hemispheres leaves no doubt that they do represent two different species and I have no hesitation in accepting *challengeri* as valid.

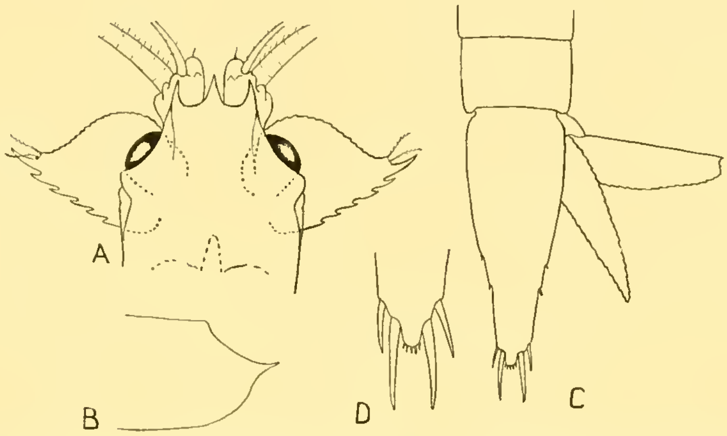

Fig. 2. *Lophogaster challengeri* Fage. A, anterior end in dorsal view, × 10; B, lateral view of postero-lateral region of carapace ('wing'); C, telson and right uropod in dorsal view, × 10; D, distal end of telson (enlarged), × 19. Imm. Spec. 8 mm.

The integument of the carapace, especially in the mid-dorsal area, is covered with more or less well-developed tubercles in both *typicus* and *challengeri*. This condition is much more pronounced in juveniles and as growth proceeds the tubercles tend to disappear. In the Discovery specimens these tubercles are comparatively few in number and very large. The animals are all small and very immature and since neither Sars nor Fage mentioned the tuberculation of the integument of the carapace in their larger specimens of *challengeri*, I assume that, as in *typicus*, the tubercles become less pronounced with growth.

In small juveniles of both species the margin of the carapace bordering the eye is fringed with a close row of fine teeth which disappear completely with growth. In *L. typicus* this pectination can still be seen in animals of 12 mm. in length but in *L. challengeri* it disappears much earlier. At station 277 (haul 1) all the specimens of less than 5 mm. in length had marked pectination but in those of 5–5·5 mm. only very faint traces of it remained. I could not see any sign of the pectination of the margins of the epimeral plates such as occurs in juveniles of *L. typicus*.

G. O. Sars (1885*b*, p. 14) neither mentioned nor figured a post-orbital spine in his Challenger specimens, although M. Sars made a special point of it in his original description of *L. typicus*. Examination of the Challenger specimens confirms that they have no such spine and I am unable to find one in the Discovery specimens, which I here refer to *challengeri*. In all the European specimens which I have examined, the post-orbital spine is so marked, even in juveniles, that it cannot be overlooked.

The spines at the postero-lateral angles of the carapace are larger than in *L. typicus* and as a result of the greater concavity of the dorsal margins of the free carapace lobes, they are directed somewhat upward (Fig. 2B). In *L. typicus* they are horizontal and so small that they can hardly be regarded as spines at all.

The lobes from the inner distal margins of the third segment of the antennular peduncle are well produced and evenly rounded at their anterior end, their margins smooth and each armed with a single small bristle (Fig. 2A).

The small apical plate between the two large apical spines of the telson is very pronounced and much longer than recorded by other workers, but this may be a sign of immaturity (Fig. 2C–D).

The length of adults of this species has been recorded as 25 mm. for males and 24 mm. for females.

Distribution. *L. challengeri* is essentially a coastal, shallow-water form. It has usually been taken at depths of 150–50 m. but has been captured at 274 m. It appears to prefer temperate conditions and the fact that it was taken by 'Discovery' as far north as Cape Lopez may be due to the cold waters of the Benguela Current. The Challenger specimens (referred to *L. typicus* by G. O. Sars) were taken off the south coast of South Africa.

Lophogaster spinosus Ortmann, 1906

1906 *Lophogaster spinosus* Ortmann, p. 26, figs.
1914 *Lophogaster spinosus*, Zimmer, p. 382.
1926 *Lophogaster spinosus*, Tattersall, p. 7 and 1937, p. 1.
1942 *Lophogaster spinosus*, Fage, p. 23, figs.
1951 *Lophogaster spinosus*, W. M. Tattersall, p. 21.

Occurrence:

St. 679. 29. iv. 31 (night). East of Rio de Janeiro, 300–0 m., 1 imm. (measured from tip of rostral spine to apex of telson) 14·4 mm., 1 small juv.
St. 680. 30. iv. 31 (night). South of Ilha da Trinidade, 260–0 m., 2 small juv. (one with telson missing).

Remarks. This species can readily be recognized by its extremely long, strong median rostral spine, by the very long spinous prolongation of the postero-lateral angles of the carapace, by the long spines on the postero-lateral angles of the tergum of the last abdominal somite and, especially, by the long triangular shape of the antennal scale with its almost straight internal margin. Tattersall (1951, p. 21) recorded that the postero-lateral spines of the carapace extend backward to 'the end of the second abdominal somite in the smaller specimens and to the end of the third abdominal somite in the larger specimens'. None of the Discovery specimens is mature, but in the largest, these spines extend well beyond the posterior margin of the second abdominal somite. The length of this specimen is 14·4 mm. from the tip of the rostrum to the apex of the telson and, since the type specimen measured 39 mm., it is obviously far from adult.

Distribution. *L. spinosus* has been recorded from the northern hemisphere at various stations in the West Atlantic between 34° N. and 19° N. and in the southern hemisphere in mid-Atlantic between 16° 54′ S. and 3° 21′ S. The two stations at which it was taken by 'Discovery II' are west of the stations from which it has previously been recorded in the South Atlantic. Both stations are far out to sea to the east of Rio de Janeiro (lat. 30° W.). Fage pointed out (1942, p. 25) that, although one cannot state categorically that it does not occur in equatorial waters, it is significant that 'Dana' in 1941 made collections at eighteen stations, while crossing the Atlantic from Cape Verde to Guiana, without taking a single *Lophogaster*. *L. spinosus*, in contrast to all the other species of the genus, inhabits the open ocean far from land, and it is remarkable that the species has not been taken in the equatorial waters between the northern and southern zones from which records are known.

The vertical distribution is significant and may explain to some extent its horizontal distribution. With one exception all the specimens of *L. spinosus* have been taken at relatively shallow levels over great depths, in the North Atlantic over the great North American trough which surrounds the Bermudas and in the South Atlantic over the Brazilian trough. The Discovery specimens were taken in oblique hauls of 300–0 m. and 260–0 m. over depths of 5095 m. and 5272 m. respectively. Fage states that the records from the northern hemisphere prove that adults of this species inhabit by preference levels of 330–700 m. over depths of about 5000 m., while juveniles inhabit somewhat higher levels. In the southern hemisphere the Dana captures were made in open vertical hauls, so that it was not possible to ascertain the actual depths at which the animals were living, but one haul was made at night from only 10 m. to the surface.

Both the hauls in which this species was captured by 'Discovery II' were taken at night and at somewhat shallower depths than most of the previous records. It may be that these animals perform vertical migrations to higher levels during hours of darkness as is the habit of many species of mysids.

Lophogaster rotundatus Illig, 1930

(Fig. 3 G–K)

1911 *Lophogaster typicus* var. Tattersall, p. 120.
1930 *Lophogaster rotundatus*, Illig, p. 405, figs.
1939 *Lophogaster rotundatus*, Tattersall, p. 224.
1942 *Lophogaster rotundatus*, Fage, p. 15, figs.

OCCURRENCE:

St. 440. 21. ix. 30 (day). East of Durban, 1050–950(–0) m., 1 imm., 14 mm.

REMARKS. Tattersall (1911 *a*, p. 120) recorded an ovigerous female of 20 mm. from south of the Saya de Malah Bank in the western Indian Ocean as *Lophogaster typicus* var. He pointed out certain differences between it and the published descriptions of *L. typicus* but, with only a single specimen available, he did not feel justified in instituting a new species for it. Illig (1930, p. 405) founded a new species, *L. rotundatus*, for a female of 17 mm. captured in the Zanzibar Channel and Tattersall (1939, p. 204), when recording three specimens of this species captured by the 'John Murray' Expedition, stated that on re-examination he found that his *L. typicus* var. belonged to the same species.

A single immature specimen captured in a vertical haul off the east of Durban by the 'Discovery' very closely resembles *L. rotundatus*, but shows some few differences which may be due to immaturity. The central rostral spine extends only slightly beyond the lateral ones and extends barely to the middle of the third segment of the antennular peduncle whereas in Illig's type it is longer than the lateral ones and extends beyond the distal margin of the antennular peduncle. The integument of the carapace is devoid of tubercles and the postero-lateral angles are evenly rounded as in the type. The antennal scale has the same very broad shape as in the type but, although the animal is immature, there are four teeth on the outer margin, whereas Illig's much larger specimen had only three (Fig. 3 H).

The lobe on the inner side of the distal margin of the third segment of the antennular peduncle is so short as to be almost obsolete and its anterior margin is very finely serrated (Fig. 3 G).

The uropods are relatively much shorter and the endopod stouter in this specimen than in the type and the armature of the telson is somewhat different. Illig figured two very small lateral spines and two very strong large spines at the distal end near the apical spine. Tattersall recorded that in his specimens there were three small spines along the lateral margins and only one large lateral spine at the distal end near the apical spine. The Discovery specimen has exactly the arrangement described by

Tattersall. The arrangement of the spinules arming the apex of the telson is somewhat irregular and asymmetrical. There is no prolongation of the apex between the two very long apical spines and the almost straight posterior margin bears six small, evenly spaced spinules with five tiny spinules interspersed irregularly among them (Fig. 3 J–K). The sub-apical spines of the telson are much smaller and more slender than those figured by Illig. In spite of these small differences, I somewhat dubiously refer the Discovery specimen to *L. rotundatus*.

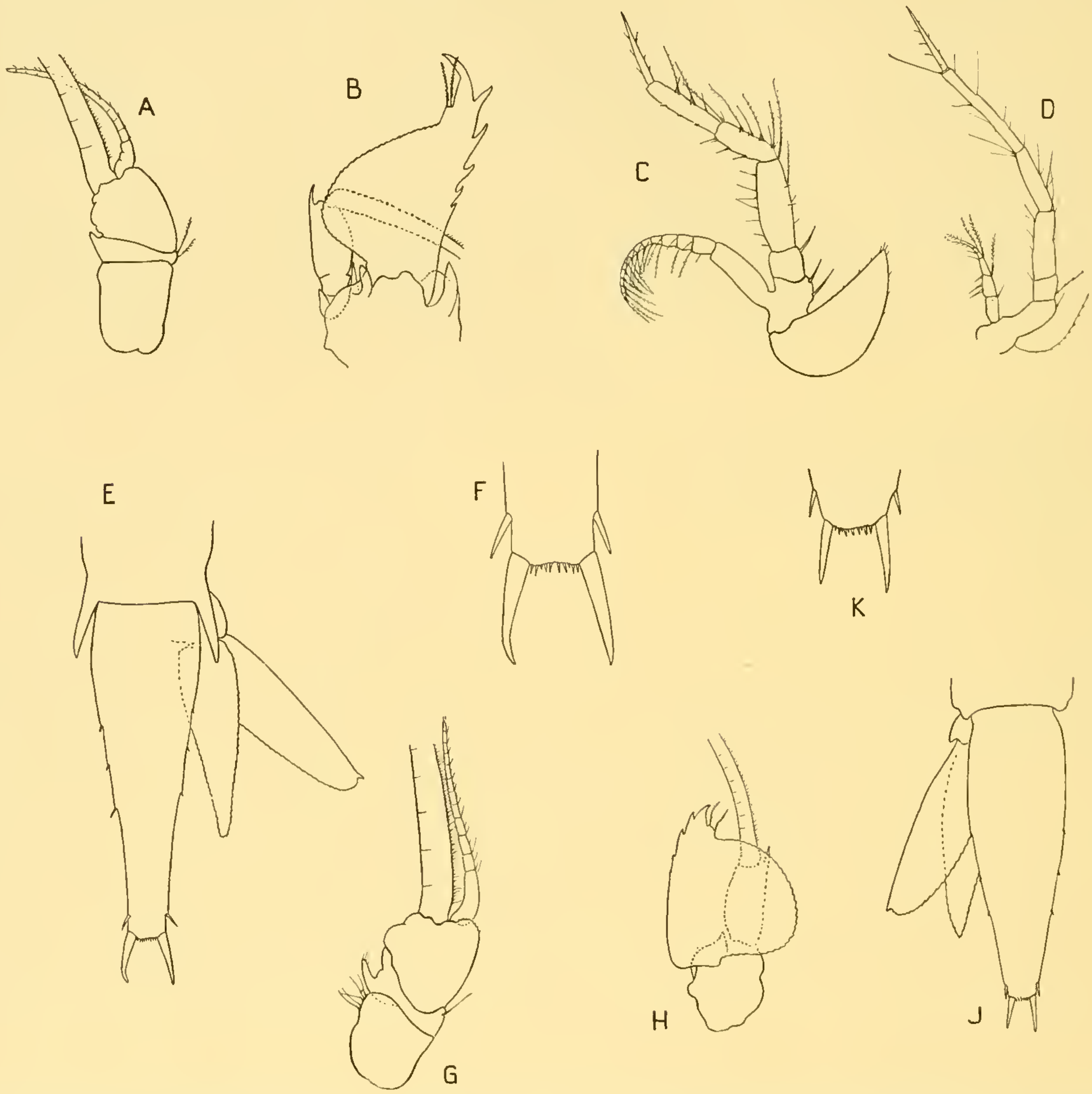

Fig. 3. *Lophogaster schmidti* Fage (A–F). A, antennular peduncle of immature female; B, right antenna; C, fourth thoracic appendage of immature female with oostegite; D, eighth thoracic appendage of immature female with oostegite; E, telson and right uropod in dorsal view. All × 16. F, distal end of telson (enlarged).

Lophogaster rotundatus Illig (G–K). G, antennular peduncle of immature male; H, left antenna; J, telson and left uropod in dorsal view. All × 16. K, distal end of telson (enlarged).

Distribution. This species has only been recorded on three occasions before the present record. All of these were from tropical waters of the western Indian Ocean and in each the captures were made at the bottom in depths between 263 m. and 463 m. The present record considerably extends both its horizontal and vertical range. Fage has suggested that temperature is the limiting factor in its distribution but, if I am right in referring the present specimen to *rotundatus*, the fact that it was taken in latitude 30° S. in a haul (in which the net failed to close) from 1050 m. proves that it can tolerate much lower temperatures than Fage supposed. It has previously been taken at the bottom and if it was taken at the bottom in the haul at station 440 it would have been living at a very much greater depth than has previously been known for it. The temperature at 1000 m. was 7·67° C. at the time of capture.

Lophogaster schmidti Fage, 1941

(Fig. 3 A–F)

1941 *Lophogaster schmidti* Fage, p. 34, figs.

OCCURRENCE:

St. 1585. 1. v. 35 (night). South east of Ras Hafun, 500–0 m., 1 ovig. ♀, 19·2 mm.
St. 1587. 3. v. 35 (night). Off Ras Hafun. Two hauls: (i) 450–0 m., 3 ♂♂, 14–16·4 mm., 3 ♀♀, with very small oostegites, 14 mm., 4 juv.; (ii) 1250–800 m., 1 juv., 11 mm.

REMARKS. These specimens agree in every respect with the types. Fage (1942, p. 34) stated that in the female there were 10–11 spinules arming the apex of the telson between the long apical spines but that in the male there were only 9–10. The three males in the Discovery collection are very immature but there are eight spinules on the apex of the telson with two minute traces of spinules. In most species of the genus the eighth thoracic appendage is smaller than the preceding ones. In *L. schmidti* the reduction of this appendage is particularly marked and its exopod is extremely small (Fig. 3 D, cf. C). The four pairs of spines arming the lateral margins of the telson are very small and in most cases the three anterior pairs can only be seen with difficulty, their presence being indicated by the small indentations which mark their sockets. When they do attain any length they are very fine and delicate. The penultimate pair near the apical spines are smaller than is usual in other species of the genus (Fig. 3 E–F).

DISTRIBUTION. The types were captured in tropical waters of the Pacific at several stations to the north and west of New Guinea. Fage records that they were pelagic at 100–200 m. over great depths. The Discovery specimens were taken in the West Arabian Sea, off Ras Hafun in oblique hauls from 500 m. and 450 m. to the surface. The depth of the sounding at these stations was 5046 m. and 5098 m. respectively, so that precisely the same conditions prevailed as those in which the type specimens were captured.

Family EUCOPIIDAE

Genus Eucopia Dana, 1852

1852 *Eucopia* Dana, p. 609.

REMARKS. A great deal of confusion has arisen in the identification of specimens of *Eucopia*, much of it due to the fact that as growth proceeds considerable changes take place in the proportions and armature of the various parts. Even after sexual maturity has been attained, growth and the accompanying growth changes continue.

I have discussed the validity of the various species of the genus in the 'Monograph on British Mysidacea' (Tattersall and Tattersall, 1951, pp. 97–9), especially with regard to those forms which occur in British waters. I regard the following four species as established: *australis*, *unguiculata*, *sculpticauda* and *grimaldii*. The Discovery material furnishes additional evidence of the variations due to growth which have caused so much confusion in the past, and includes forms not recorded from British waters. Some further remarks on the subject are therefore necessary.

Of the four species named above, *E. sculpticauda* is the most easily recognized, thanks to the careful work of Illig (1930, p. 400) who described and figured the growth changes which occur with the onset of maturity. These result in the clearly defined specific characters of the adults, which differ widely from those of very immature animals. *E. sculpticauda* can be readily identified at all ages by the absence of a spine or thorn at the distal end of the naked portion of the outer margin of the antennal scale, by the persistence of colour in the cornea of the eye even after prolonged preservation, by the shorter, more robust endopods of the 2nd to the 4th thoracic appendages and by the presence on the eighth thoracic appendages of well-developed branchiae (borne *in front* of the appendage instead of behind, as in the other limbs). The distinctive shape and ornamentation of the telson, whereby larger animals can at once be identified, does not develop until a length of 12–15 mm. has been reached and even in specimens of 20 mm. the well-known constrictions of the telson and its honeycomb ornamentation are only faintly marked.

Identification of the other three species presents greater difficulty. Owing to the softness of the integument and the fragility of the animals, well-preserved specimens are rarely obtained. Even in the extensive Discovery collections, I found (as have so many previous workers on other material) that, among all the hundreds of specimens of *Eucopia*, there was not one undamaged individual nor a single female with eggs or embryos in the brood sac.

The size of adult animals is one of the most useful guides in the separation of *australis*, *unguiculata* and *grimaldii*, although it must be borne in mind that in all three species the animals tend to be more precocious in warmer waters. In the Discovery collection females of *australis* 37–44 mm. in length, have small, not fully developed oostegites with the fringes only just beginning to appear and at station 245 a specimen of 47 mm. was still immature. At station 2065, however, a female of 45 mm. had fully developed oostegites. The average size of adult females of *australis* is 51 mm. *E. grimaldii* is a smaller form than *australis*; females of less than 27 mm. are quite immature and fully adult specimens range from 29 mm. to 38 mm. *E. unguiculata* is definitely a smaller, more slender form than either of the preceding species; females of 17 mm. to 23 mm. are immature but have well-formed oostegites and adult females range from 22 mm. to 29 mm.

Text-figs. 4–5 show the anterior end, the telson and a uropod of each of the three species. In the case of *australis* I have figured what might be described as an average specimen, for nearly all the animals which I have referred to this species have the telson as in Fig. 4D. However, there are a few individuals which, while agreeing with *australis* in all other respects, have the spines arming the telson arranged more like those of *grimaldii*. Other specimens show some characters intermediate between *australis* and *unguiculata* or *grimaldii*, affording further evidence of the variability of the three species.

Hansen (1910, p. 21) separated a species, *E. major*, from *E. australis* on three characters: (1) its smaller size, (2) eyes scarcely twice as long as broad, (3) terminal segment of the exopod of the uropod broader than long. In 1912 (p. 188) he referred specimens of over 60 mm. captured by 'Siboga', to *E. major*, and, although they were as large as adults of *australis*, he considered that the other characters were sufficient to justify the species. Fage (1942, p. 40) pointed out that the species *australis* possessed particularly thin chitin and that, since the animals were bathypelagic, the net brought them to the surface in poor condition. Consequently, accurate measurement of the various parts was very difficult, the eyes in particular being very distorted. Fage therefore considered that Hansen (1910) was not justified in separating the species *E. major* from *E. australis*.

Nouvel (1942*a*, *b*; 1943) followed Hansen in regarding the length/breadth ratios of the eye, the distal segment of the antennal scale and the distal segment of the exopod of the uropod as of specific significance. These characters are extremely variable and, after examining the Discovery material I can fully endorse Fage's opinion and I accept his view that *E. major* and *E. australis* are synonymous. Of seventy-five measured adult specimens, only eight could with certainty be referred to *australis* on Hansen's diagnosis and seven to *major*. It is obvious that these characters are too variable to be of specific value. Nor can the variations be attributed to geographical location, for the same diversity occurs among individuals in the same haul. My measurements are given in Table 3.

Having decided to refer all these specimens to *E. australis* I now submit the following broader definition of that species:

1. Anterior margin of the carapace evenly rounded or showing a slight tendency to develop an obtusely rounded median angle; the whole anterior margin markedly convex with an average ratio of length/breadth 0·3 (the breadth was measured at the deepest point before the margin curves forward towards the antero-lateral angles; the length was measured from the mid-point of this distance to the middle of the anterior margin).
2. Antennular peduncle robust; third segment articulated obliquely with the second, its inner margin sinuous, considerably longer than the distal margin and produced at its distal end into a strong setiferous lobe.
3. Antennal scale only very slightly longer than antennular peduncle; twice as long as its greatest breadth; showing marked sexual dimorphism—the outer margin in males and young females sinuous, very convex proximally, becoming concave in the middle of its length and less concave distally; in adult females convex proximally, thence almost straight to its distal end. Distal segment in both sexes about half as long as broad at the base; apex asymmetrical. Antennular peduncle relatively larger in males than in females (Fig. 4C).
4. Eyes robust, about half as broad as long; cornea terminal with its proximal margin either straight or very slightly oblique (Fig. 4C).

Table 3. *Measurements of seventy individuals to compare those characters given by Hansen for the separation of* E. australis *and* E. major

Eyes more than twice as broad as long			Eyes twice as broad as long			Eyes less than twice as broad as long		
Uropod longer than broad	Uropod as long as broad	Uropod shorter than broad	Uropod longer than broad	Uropod as long as broad	Uropod shorter than broad	Uropod longer than broad	Uropod as long as broad	Uropod shorter than broad
8 N.B. Typical *australis*	26	8	3 N.B. Typical *major*	2	5	4 N.B. Typical *major*	6	8

5. Endopods of 2nd–4th thoracic appendages long and slender; more robust than in *unguiculata* and *grimaldii* but much longer and more slender than in *sculpticauda*; 4th pair the largest with carpo-propodus more than three times as long as broad, its inner margin concave for the distal third of its length forming a depression into which the strong long dactylus and nail fold; third and second pairs progressively smaller and their nails relatively smaller.
6. Distal segment of exopod of uropod about as long as broad at its base (Fig. 4D).
7. Telson with narrowly rounded apex armed with a pair of long spines; proximal third of lateral margins unarmed; middle region armed with a few widely spaced spines; distal portion armed with many spines arranged in series composed of 5–9 long spines with small, slightly graduated spines in the spaces between them. The number of small spines occupying the distal space usually 9–18 but there may be fewer; slightly graduated, becoming progressively larger distally (Fig. 4D).
8. Size: Females are usually sexually mature at a length of about 50 mm. but specimens have been recorded up to nearly 70 mm.

Both Nouvel (1942*b*) and Fage (1942, pp. 43, 58) have described very interesting secondary sexual characters in the armature of the thoracic sterna in species of the genus. Fage in the same work made a careful analysis of the horizontal and vertical distribution of all the species of *Eucopia* and the present collections do not add materially to his findings.

I have added a fifth species, *E. linguicaudata*, to the genus. Unfortunately there is only one specimen of this interesting form, but the shape and armature of the telson are so distinctive, that it cannot be referred to any of the known species.

Eucopia australis Dana, 1852

(Fig. 4C–D)

1852 *Eucopia australis* Dana, p. 609, figs. (probably = *E. unguiculata*).
1885*a* *Eucopia australis* G. O. Sars (pars), p. 55, figs.
1905*a* *Eucopia australis*, Hansen, p. 6.
1910 *Eucopia australis*, Hansen, p. 20.
1910 *Eucopia major* Hansen, p. 21, figs. and 1912, p. 188.
1930 *Eucopia australis*, Illig, p. 404.
1942*a* *Eucopia australis*, Nouvel, pp. 1–7. 1943, p. 20.
1942 *Eucopia australis*, Fage, p. 41, figs.

OCCURRENCE:

St. 78. 12. vi. 26 (day). North-west of Tristan da Cunha, 1000(–0) m., 1 imm. ♀, 33 mm., 2 small juv.
St. 85. 23. vi. 26 (night). West of Cape Town, 2000(–0) m., 1 adult ♂, 51 mm., 4 adult ♀♀, 46–49 mm., fragments.
St. 100C. 4. x. 26 (day). West of Cape Town, 2500–2000 m., 2 ♂♂, 53 mm. and 58 mm., 2 imm. ♀♀, 37 mm., fragments.
St. 101. 14. x. 26. West of Cape Town. Two hauls: (i) 1410–1310 m. (day), fragments of about 6 specimens; (ii) 2580–2480 m. (night), 1 ♂, 50 mm., 2 adult ♀♀, 44 mm. and 50 mm., 1 juv. ♀, fragments.
St. 245. 10. vi. 27 (day). West of Tristan da Cunha, 1800–2000 m., 1 ♂, 60 mm. (broken), 1 ♂, 53 mm., 2 ♀♀ (not fully mature) larger 47 mm., fragments.
St. 281. 12. viii. 27 (day). West of Cape Lopez, 950–850(–0) m., 1 imm. ♀, 44 mm.
St. 287. 19. viii. 27 (night). Gulf of Guinea, 1000–800(–0) m., 2 ♂♂, 48 mm., 2 ♀♀, larger 46 mm., 2 imm. ♀♀. 38 mm. and 40 mm.
St. 295. 25. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 adult ♀, 47 mm.
St. 391. 18. iv. 30 (day). West of South Georgia, 1300–1200(–0) m., 6 ♂♂, largest 51 mm., 12 adult ♀♀, largest 53 mm., 26 juv.
St. 395. 13. v. 30 (day). North-east of South Georgia, 1600–1500 m., 5 ♂♂, largest 54 mm., 6 ♀♀, largest 53 mm., 13 juv., largest 38 mm.
St. 413. 21. viii. 30 (day). West-north-west of Cape Town, 1600–1000 m., 1 juv.
St. 590. 14. i. 31 (day). West of Graham Land, 1400–1150 m., 6 juv., largest 21 mm.
St. 661. 2. iv. 31 (night). South-east of South Georgia, 3000–2000 m., 1 adult ♀, 47 mm.
St. 675. 26. iv. 31 (day). West-north-west of Tristan da Cunha, 1500–1000 m., 1 imm. ♀.
St. 687. 5. v. 31 (day). South-east of Pernambuco, 1500–1000 m., 1 juv. 32 mm.
St. 693. 10. v. 31 (day). Mid-Atlantic, near equator, 2000–1500 m., 1 juv. 20 mm.
St. 699. 14. v. 31 (day). West of Cape Verde Islands, 1000–750 m., 1 juv.
St. 700. 18. v. 31 (day). North-east of Cape Verde Islands, 2025–0 m., 3 juv., largest 37 mm.
St. 1298. 2. iii. 34 (day). Ice Edge, Bellingshausen Sea, 1000(–0) m., 9 imm., largest 38 mm. with very small oostegites.
St. 1574. 23. iv. 35 (night). Mozambique Channel, 1100–450 m., 1 ♀, 43 mm.
St. 1576. 25. iv. 35 (night). Mozambique Channel, 1100–400 m., 1 ♂, 43 mm.
St. 1582. 29. iv. 35 (night). East of Zanzibar, 1900–1850(–0) m., 1 juv. ♀, anterior end only of very large ♀.
St. 1919. 4. xii. 36 (day). Off South Georgia, 1800–1300 m., 1 juv. ♀, 39 mm.
St. 1970. 18. ii. 37 (day). Scotia Sea, 1800–1500 m., 1 adult ♀, 50 mm. (Note on label, 'thin delicate integument, translucent and a lovely delicate purple pink'.)
St. 2053. 27. iv. 37 (day). South-east of St Helena, 900–550 m., 1 ♂, 45 mm. (Colour note, 'deep brilliant scarlet, delicate carapace, translucent.')
St. 2057. 29. iv. 37 (day). North-east of St Helena, 1450–700 m., 2 adult ♀♀, 45 mm. and 48 mm. (Colour notes, 'brilliant scarlet, integument translucent', 'orange red, translucent, especially carapace.')

St. 2059. 30. iv. 37 (day). North-north-east of St Helena, 1900–1400 m., 1 ♂, 50 mm.
St. 2061. 1. v. 37 (day). North-east of Ascension I., 1900–1500 m., 1 juv. ♀, 30 mm.
St. 2063. 2. v. 37 (day). North-east of Ascension I., 2 hauls: (i) 600–0 m., 1 imm. ♀, 41 mm.; (ii) 1150–600 m., 1 juv.
St. 2064. 3. v. 37 (day). North-north-east of Ascension I., 1600–1050 m., 1 juv. 30 mm.
St. 2065. 4. v. 37 (day). N. of Ascension I., 1600–1400 m. 1 adult ♀, 45 mm.
St. 2066. 5. v. 37 (day). South of Sierra Leone, 1950–1550 m., 1 juv.

REMARKS. Dana's original description of *E. australis* is short and not at all precise and his figures are small and lacking in detail.

I have given on p. 47 the main characters by which *E. australis* may be distinguished from *E. unguiculata* and *E. grimaldii*, but it must be stressed that the antennal scale is one of the most useful guides in the determination of the species. In *australis* it is relatively very broad, only twice as long as broad and is shorter than in the other species, extending forward for only about one-seventh of its length beyond the anterior margin of the antennular peduncle, while in *unguiculata* and *grimaldii* it is more than twice as long as broad and extends beyond the antennular peduncle for more than one-fourth of its length. The sexual dimorphism, shown in the sinuous curve of the outer margin of the scale in the male only and in the relative size of the antennular peduncle, does not occur in the other species (Fig. 4C). In some specimens of *australis* the dividing line between the cornea and the eyestalk is somewhat oblique, but never to the same extent as in the other two species. The specimens are very fragile; the eyes in particular are very liable to distortion and in a surprising number of individuals the cornea and distal end of the eyestalk are actually invaginated.

The antennular peduncle is much more robust than in *unguiculata* and its third segment is articulated very obliquely with the second. The inner margin of this segment is considerably longer than the distal margin and is produced at its distal end into a strong setiferous lobe, as in *grimaldii*.

The armature of the telson in the great majority of the specimens which I have here referred to *australis* is shown in Fig. 4D, and resembles that of *unguiculata* in having a large number of spines in the space between the distal large marginal spine and the apical spine. There are, however, some few specimens which agree with *australis* in all other points but have these spines arranged more as in *grimaldii*.

DISTRIBUTION. This species is, like *unguiculata* and *grimaldii*, a bathypelagic form, widely distributed in nearly all the oceans of the world. It was first recorded from the Antarctic and was for a long time regarded as essentially a southern form, but it has now been recorded, either as *australis* or as *major*, from all the oceans of the world except the North Atlantic, the Arctic Ocean and the Mediterranean. It has most frequently been recorded from the tropical and sub-tropical waters of the Atlantic and Pacific, but also as far north as the Behring Sea, the coasts of Japan and the coasts of California (Ortmann, 1906), and as far south as Graham Land and the Ice Edge in the Bellingshausen Sea.

Of the thirty-two stations at which it occurs in the Discovery Collection, ten are in the South Atlantic or the Antarctic, fifteen are in the tropical waters of the Atlantic (one of them in the West Atlantic off Pernambuco) and four from the Atlantic near Cape Town. Three stations occur in the Indian Ocean, off Madagascar. The greatest depth at which it was captured in this collection was between 2480 m. and 2580 m. at station 101 and the least at station 2063 between 600 m. and the surface. It has been recorded in very great depths in the western Pacific and was taken by 'Dana' at depths of over 6000 m. to the west of New Guinea.

Eucopia unguiculata (W.-Suhm) 1875

(Fig. 4A, B)

1852 *Eucopia australis* Dana, p. 609, figs.
1875 *Chalaraspis unguiculata* W.-Suhm, p. 37, fig.
1885*a* *Eucopia australis* (pars.) G. O. Sars, p. 55, figs.
1905*a* *Eucopia australis*, Hansen, p. 5; 1905*b*, p. 3.
1910 *Eucopia unguiculata*, Hansen, p. 19, figs.
1942*a* *Eucopia hanseni* Nouvel, p. 3; 1943, p. 30, figs.
1942 *Eucopia hanseni*, Fage, p. 47.
1951 *Eucopia unguiculata*, Tattersall and Tattersall, p. 101, figs.

OCCURRENCE:

13° 25′ N., 18° 22′ W. 28. x. 25. West of Gambia, 900–0 m., 1 adult ♀.
6° 55′ N., 15° 54′ W. 2. xi. 25. South-west of Monrovia, 800–0 m., 1 ♂, 23 mm., 4 adult ♀♀, 25–29 mm., 8 juv., fragments.
St. 86. 24. vi. 26 (day). West of Cape Town, 1000(–0) m., 1 juv.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 1 juv.
St. 100C. 4. x. 26 (day). West of Cape Town, 2500–2000 m., 1 adult ♀, 29 mm.
St. 253. 21. vi. 27 (day). West of Cape Town, 1050–1000 m., 1 juv.
St. 281. 12. viii. 27 (day). West of Cape Lopez, 950–850(–0) m., 1 adult ♀, 31 mm.
St. 295. 25. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 imm. ♀, 23 mm., anterior end of ♀.
St. 298. 29. viii. 27 (day). West of Cape Verde Is., 1200–900(–0) m., 4 ♂♂, 27–29 mm., 4 adult ♀♀, 25–27 mm., 1 juv. ♀, 4 small juv.
St. 405. 4. vi. 30 (day). West of Cape Town, 1200–0 m., 1 imm. ♀, 23 mm.
St. 407. 12. vi. 30 (day). South-west of Cape Town, 950–800 m., 1 imm. ♀ (damaged) 20·5 mm.
St. 440. 21. ix. 30 (day). East of Durban, 1050–950(–0) m., 1 juv. 16 mm.
St. 693. 10. v. 31 (day). Mid-Atlantic, equatorial zone, 750–500 m., 1 adult ♀, 23 mm., 6 very small juv.
St. 696. 12. v. 31 (day). South-west of Cape Verde Is., 1000–750 m., 1 very small juv.
St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 ♂, 32 mm., 2 adult ♀♀, 27–28 mm., 2 imm. ♀♀, 23 mm., 1 small juv.
St. 1574. 23. iv. 35 (night). Between Madagascar and Beira, 1100–450 m., 2 imm. ♀♀, 17 mm. and 21 mm., anterior end of adult ♀.
St. 1580. 27. iv. 35 (night). North of Comoro Is. 1300–750 m., 5 juv.
St. 1582. 29. iv. 35 (night). East of Zanzibar, 1900–1850(–0) m., 2 adult ♀♀, 28 mm., 1 imm. ♀, 24 mm., 1 juv.
St. 1585. 1. v. 35 (night). North-west of Seychelles, 1400–700 m., 1 ♂, 25 mm., 1 adult ♀, 23 mm., 2 imm. ♀♀, 22 mm. and 17 mm. 1 juv.
St. 1586. 2. v. 35 (night). North-west of Seychelles, 1650–950 m., 6 ♂♂, largest 30 mm., 8 adult ♀♀, 23–28 mm., 4 imm. ♀♀, 21 mm.
St. 1587. 3. v. 35 (night). Arabian Sea, south-east of Ras Hafun, 1250–800 m., 9 ♂♂, largest 28 mm., 10 adult ♀♀, 21–23 mm., 2 juv. ♀♀, fragments.
St. 1970. 18. ii. 37 (day). Scotia Sea, 1800–1500 m., 2 juv.
St. 1974. 1. iii. 37 (day). Scotia Sea, 1600–1000 m., 1 juv.
St. 2035. 7. iv. 37 (day). Off Cape Town, 950–750 m., 1 imm. ♀, 17 mm. (Colour note, 'orange red'.)
St. 2065. 4. v. 37 (day). North of Ascension I., 1600–1400 m., 1 adult ♀, 25 mm., 1 anterior end.
St. 2066. 5. v. 37 (day). West of Gulf of Guinea, 1950–1550 m., 2 adult ♀♀, 26 mm. and 25 mm., 1 nearly adult ♀, 23 mm.
St. 2682. 8. vi. 50 (night). South of Aden, 750–500 m., 1 imm. ♀, 22 mm.

REMARKS. This species closely resembles *E. grimaldii* in the shallow convexity of the anterior margin of the carapace and in the size and shape of the eyes, with the corneal elements occupying the outer distal region of the eyestalk, so that they look essentially outward and the proximal margin of the cornea is decidedly oblique (cf. Figs. 4A and 5A). It may be distinguished from *grimaldii* (i) by its smaller, more slender form, (ii) by the shorter inner margin of the third segment of the antennular peduncle with its small setiferous distal lobe, (iii) by the straighter outer margin of the antennal scale, and (iv) by the armature of the telson. In addition, the apex of the antennal scale is, as a rule, more rounded than in *grimaldii* and is almost symmetrical (cf. Figs. 4A and 5A).

The form of the telson is one of the easiest methods of recognizing this species. The spines arming the distal portion of the lateral margins are arranged in a series of a few very long spines with a varying number of small spines in the spaces between them. These small spines are sub-equal in size and the number in the distal space varies between 8 and 24. In *grimaldii*, the smaller spines are not very much shorter than the long spines and there are rarely more than three or four of them in the distal space (Figs. 4B and 5B).

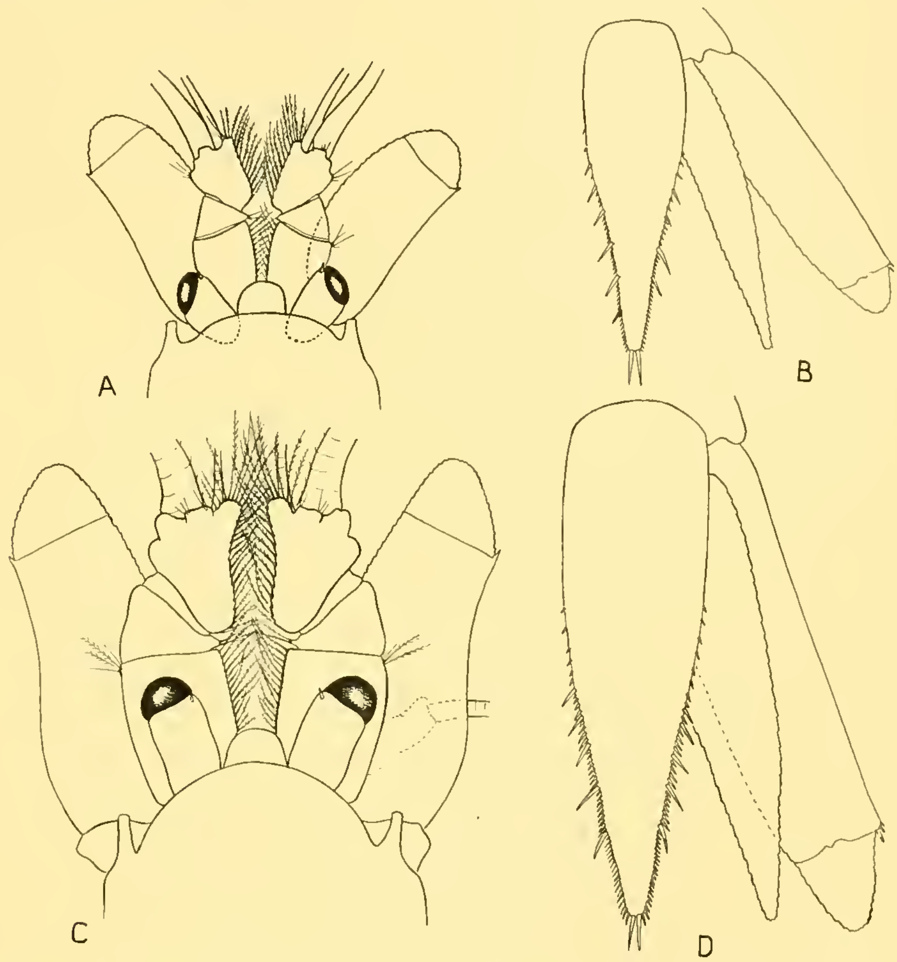

Fig. 4. *Eucopia unguiculata* (W.-Suhm) (A, B). A, anterior end of male in dorsal view, × 6; B, telson and right uropod in dorsal view, × 6.
Eucopia australis Dana (C, D). C, anterior end of male in dorsal view, × 6; D, telson and right uropod in dorsal view, × 6.

Distribution. I think that in all probability the specimen described by Dana as *E. australis* was really *E. unguiculata* and it is certain that a re-examination of the material, which in the past has been referred to various species of the genus *Eucopia*, would reveal that in many cases the animals have not been correctly assigned. Nouvel showed that specimens previously referred to *unguiculata* can be separated into two distinct species, *unguiculata* and *grimaldii*. I have myself confirmed his observations by an examination of the material labelled *E. unguiculata* in my late husband's collections from the waters of the North Atlantic. It is therefore not possible to accept early records as reliable guides for the geographical distribution of this species. On the other hand the distribution of the three species *unguiculata*, *australis* and *grimaldii* seems to be very much the same. In the Discovery collection, *E. unguiculata* was taken at twenty-five stations. At ten of these it was captured with *E. australis*, at nine with *grimaldii* and at three stations all three species were taken together in the same haul.

The Discovery records show that the species is widely distributed in the waters of the Atlantic, from the Scotia Sea to the N.E. of Cape Verde Islands. It has been recorded from British waters and from the Greenland and Iceland coasts, but the majority of captures have been made in tropical and sub-tropical waters of the Atlantic and Indian Oceans.

E. unguiculata is bathypelagic in habit and is most abundant at about 2000 m., though it may occur in much shallower water. The greatest depth at which it was taken in the Discovery collection was between 2000 m. and 2500 m. at station 101 C and the least between 700 m. and 500 m. to the surface at station 281.

Eucopia sculpticauda Faxon, 1893

1885*a* *Eucopia australis* (pars) G. O. Sars, p. 55, figs.
1885 *Eucopia equatoria* Spence-Bate, see G. O. Sars, *ibid.* p. 55, *nomen nudum.*
1893 *Eucopia sculpticauda* Faxon, p. 218.
1895 *Eucopia sculpticauda*, Faxon, p. 292, figs.
1905*a* *Eucopia intermedia* Hansen, p. 5, figs.
1905*a* *Eucopia sculpticauda*, Hansen, p. 7, fig.
1930 *Eucopia sculpticauda*, Illig, p. 400, figs.
1942 *Eucopia sculpticauda*, Fage, p. 56, figs.
1951 *Eucopia sculpticauda*, Tattersall and Tattersall, p. 109, figs.

Occurrence:

41° 37′ 15″ N., 12° 36′ 20″ W. 10. x. 25. West of Portugal, 900–0 m., 1 ♂, 35 mm.
13° 25′ N., 18° 22′ W. 28. x. 25. West of Gambia, 900–0 m., 1 adult ♀, 44 mm.
6° 55′ N., 15° 54′ W. 2. xi. 25. South-east of Monrovia, 800–0 m., 1 imm. ♀, 33 mm., 1 juv., 25 mm., fragment.
St. 86. 24. vi. 26 (day). West of Cape Town, 1000(–0) m., 1 adult ♀, 51 mm., fragments of smaller female.
St. 100C. 4. x. 26 (day). West of Table Bay, 2500(–0) m., 5 small juv.
St. 101. 15. x. 26 (day). West of Cape Town. Three hauls: (i) 950–850 m., 1 ♂, 55 mm.; (ii) 1410–1310 m., anterior end only of very large specimen; (iii) 2580–2480 m., night, large ♀ with telson missing.
St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 1 ♂, 47 mm.
St. 281. 12. viii. 27 (day). West of Cape Lopez, 950–850(–0) m., 2 ♂♂, larger, 32 mm., 8 ♀♀, largest, 38 mm., 10 juv. and fragments.
St. 287. 19. viii. 27 (night). Gulf of Guinea, 1000–800(–0) m., 4 adult ♀♀, largest 36 mm., 4 juv., fragments.
St. 295. 25. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 juv. ♀, 1 small juv.
St. 298. 28. viii. 27 (day). West of Cape Verde, 1200–900(–0) m., 1 ♂, 38 mm., 3 ♀♀, largest 32 mm., 8 juv.
St. 414. 28. viii. 30 (night). South of Cape Town, 1700–1000 m., 1 juv.
St. 440. 21. ix. 30 (day). East of Durban, 1050–950(–0) m., 1 ♂, 36 mm., 1 ♀, 43 mm., 1 juv.
St. 696. 12. v. 31 (day). Mid-Atlantic, south-west of Cape Verde Is., 1000–750 m., 1 ♀, 44 mm., 2 small juv.
St. 699. 14. v. 31 (day). West of Cape Verde Is., 1000–750 m., 2 small juv. and fragment.
St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 ♀, 41 mm., 1 juv.
St. 1574. 23. iv. 35 (night). Between Beira and Madagascar, 1100–450 m., 1 ♀, 40 mm., fragments of smaller ♀.
St. 1576. 25. iv. 35 (night). West of Madagascar, 1100–400 m., 1 ♀, 42 mm., 1 small ♀.
St. 1580. 27. iv. 35 (night). North of Comoro Is., 1300–0 m., 1 adult ♀, 47 mm.
St. 1582. 29. iv. 35 (night). East of Zanzibar, 1900–1850(–0) m., 1 adult ♀, 37 mm., 1 adult ♀ with telson missing, 7 juv., fragments.
St. 1585. 1. v. 35 (night). East of Kismayu, 1400–700 m., 2 ♀♀, 43 mm., 1 juv. ♀, 3 small juv.
St. 1586. 2. v. 35 (night). East of Mogadishu, 1650-950 m., 1 ♀, 35 mm., 2 juv.
St. 1587. 3. v. 35 (night). South-east of Ras Hafun, 1250–800, 2 ♂♂, larger 41 mm., 1 imm. ♀, 3 small juv.
St. 1765. 7. v. 36 (day). East of East London, 1350–800 m., 1 small juv. (Colour note, 'brilliant scarlet'.)
St. 2055. 28. iv. 37 (day). East-north-east of St Helena, 2000–1400 m., 1 ♂, 28 mm., 2 small juv. (Colour note, 'deep scarlet'.)

St. 2057. 29. iv. 37 (day). North-east of St Helena, 1450–700 m. Four tubes: (i) 1 juv., 'crimson, anterior part of thorax and anterior thoracic legs darker'; (ii) 1 ♀, 36 mm., 'rich deep scarlet', 1 juv.; (iii) 1 ♀, 35 mm., 'deep scarlet'; (iv) 1 juv. ♀, 'bright scarlet'.

St. 2059. 30. iv. 37 (day). North-north-east of St Helena, 1900–1400 m. Six tubes: (i) 1 ♂, 36 mm., 'deep scarlet'; (ii) 1 imm. ♂, 1 imm. ♀, both 33 mm., 'deep crimson'; (iii) 1 ♂, 40 mm., 'brilliant scarlet'; (iv) 1 ♀, 34 mm., 'deep scarlet'; (v) 1 ♂, 37 mm., 'brilliant scarlet'; (vi) 1 juv. ♀, 23 mm., 3 small juv.

St. 2061. 1. v. 37 (day). North-east of Ascension I., 1900–1500 m., 1 adult ♀, 37 mm., 2 imm. ♀♀, 1 juv. Second tube, 1900–1500 m., 1 juv.

St. 2063. 2. v. 37 (day). North-east of Ascension I., Two hauls: (i) 600–0 m., 1 ♂, 31 mm., 1 imm. ♀, 27 mm.; (ii) 1150–600 m., 1 ♀, 32 mm. (with large empty brood sac).

St. 2064. 3. v. 37 (day). Open ocean west of Gulf of Guinea, 1600–1050 m., 1 adult ♀, 32 mm.

St. 2065. 4. v. 37 (day). South-south-west of Monrovia, 1600–1400 m., 2 ♂♂, 6 ♀♀, 30–37 mm., 2 juv. ♀♀. (Colour note, 'very deep rich purple red; partially translucent'.)

St. 2066. 5. v. 37 (day). South of Sierra Leone. Two hauls: (i) 1550–0 m., 1 adult ♀, 52 mm. (Colour note, 'crimson; carapace and mouth parts very deep crimson'). (ii) 1950–1550 m., 1 large adult ♀ (broken), 2 ♂♂, 30 mm. and 31 mm., 1 juv. ♀, 27 mm., 1 small juv.

Remarks. *E. sculpticauda* differs so profoundly from all the known species of the genus that, although considerable growth changes do occur after sexual maturity has been attained, there is no difficulty in recognizing it. The anterior region of the carapace is deeply vaulted and produced forward into a definite obtuse triangle; there is no tooth or spine terminating the unarmed portion of the outer margin of the antennal scale; the eyes are well developed with the deeply pigmented cornea situated terminally on the eyestalks. It is interesting to note that in the Discovery material, much of which has been preserved for nearly thirty years, the members of this species may be picked out readily from among other species of the genus by the colour of the eyes. The second to the fourth thoracic endopods are much more robust and shorter than in any of the other species and it seems clear that the figures given by Sars (1885*a*, pl. x, figs. 14 and 16) for a young female of *E. australis* were, in fact, taken from an immature female of *E. sculpticauda*. The most outstanding character of the adults of this species is the shape of the telson and the elaborate sculpturing of its dorsal surface.

In young animals the telson is similar in shape to that of *E. australis*, but differs in that the rounded apex and the distal portion of the lateral margins are armed with only 8–10 small regular spines. In addition, the pair of long apical spines, which are present in all the other known species of *Eucopia*, are lacking. As growth proceeds the surface of the telson becomes raised up into ridges, arranged in a honeycomb pattern in the median region, with radiating ridges running outward to the base of each of the large spines arming the lateral margins. At the same time, a constriction appears just behind the apex and proximal to the insertion of the last pair of large lateral spines. In older animals, a second constriction may develop proximal to the first in the next space between the large marginal spines. The apex of the telson remains evenly rounded and although the spines upon it increase in number to as many as 18–20, they are approximately of equal size. Illig (1930, p. 402) gave a full account with figures of these growth changes. Fage (1942, p. 58) observed that the oostegites in adult females of *E. sculpticauda* were much longer, more slender and more acutely pointed than in other species of the genus. After a close examination of the very large number of specimens collected by 'Dana', he found that there were no sexual differences to be found in the form of the antennular peduncle and the antennal scale in this species, but that the sterna of the thoracic somites were armed with long silky hairs, which were quite different in the sexes. In this respect they closely resembled the conditions found in species of *Gnathophausia*.

In the Discovery material the specimens are very broken and I have not found a single female carrying eggs or embryos. Small females, only 30–32 mm. in length, which appeared to be adult with large oostegites with well-developed fringes, occurred at stations 281 (32 mm.), 287 (30 mm.), 298 (32 mm.), 2063 (32 mm.), and 2064 (32 mm.), while at other stations adult females of over 50 mm. were taken. This difference in size does not appear to be correlated with locality in any way and apparently it is normal for considerable growth to take place long after sexual maturity has been reached.

DISTRIBUTION. *E. sculpticauda* is essentially a warm-water species and has been recorded on many occasions in the tropical waters of the Atlantic and Pacific Oceans. It has occasionally been taken in temperate waters and has been recorded as far north as the west of the British Isles,[1] possibly under the influence of the Gulf Stream. In the southern hemisphere there has been only one previous record as far south as Cape Town. The Discovery records do not extend its known geographical range in the Atlantic, but its occurrence around Madagascar, off Durban and off East London is considerably farther south than any previous records in the Indian Ocean. Of the thirty-two stations at which it was taken by 'Discovery' and 'Discovery II', twenty-four are in tropical waters of the Atlantic and Indian Oceans, seven are situated around the coast of South Africa and one is in the North Atlantic, west of Portugal.

E. sculpticauda is a bathypelagic form and has been taken at great depths. Many of the captures in the Discovery collection were made with nets open to the surface from depths of 2500 m. and less. The greatest depth at which it was taken in a closing net was 2580–2480 m. at station 101 and the least was 950–850 m. at the same station. In each case the haul yielded a single large adult female. All the captures made by the ships were at shallower depths than those recorded by 'Dana' and it is evident that the species has a considerable vertical range in the deeper waters of the warmer regions of the world. At station 2063 two immature specimens of this species were taken in a vertical haul from only 600 m. to the surface.

Eucopia grimaldii Nouvel, 1942

(Fig. 5A, B)

1942*a* *Eucopia grimaldii* Nouvel, p. 5, figs.; 1942*b*, p. 10.
1942 *Eucopia grimaldii*, Fage, p. 47, figs.
1943 *Eucopia grimaldii*, Nouvel, p. 40, figs.
1951 *Eucopia grimaldii*, Tattersall and Tattersall, p. 106, figs.

OCCURRENCE:

St. 71. 30. v. 26 (day). North of Falkland Is., 2000(–0) m., 2 ♂♂, 29 mm. and 30 mm., 1 ♀, 21 mm.
St. 86. 26. vi. 26 (day). West of Cape Town, 1000(–0) m., 1 adult ♀ (broken). Estimated length 33 mm.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 2 adult ♀♀, 31 and 33 mm.
St. 101. 15. x. 26. North of Cape Town. Two hauls: (i) 950–850 m. (day), 1 adult ♂, 32 mm., 1 adult ♀, broken, 1 imm. ♀; (ii) 2580–2450 m. (night), 1 adult ♀, 36 mm., fragments.
St. 151. 16. i. 27 (day). North of South Georgia, 1275–1025 m., 1 ♂, 32 mm.
St. 239. 2. vi. 27 (day). North-east of South Georgia, 1350–1050(–0) m., 2 adult ♀♀, 38 mm. and 35 mm.
St. 253. 21. vi. 27 (day). West of Cape Town, 1050–1000 m., 1 adult ♀, 34 mm.
St. 256. 23. vi. 27 (day). West of Cape Town, 1000–850(–0) m., 1 adult ♀, 33 mm., 1 small juv.
St. 281. 12. viii. 27 (day). West of Cape Lopez, 950–850(–0) m., 6 adult ♂♂, 30–37 mm., 3 adult ♀♀, 30–35 mm., 3 juv. ♀♀, 22–26 mm., 1 small juv.
St. 287. 19. viii. 27 (night). Gulf of Guinea, 1000–800(–0) m., 2 ♀♀, 27 mm., 1 juv. ♀.
St. 298. 29. viii. 27 (day). West of Cape Verde Is., 1200–900(–0) m., 2 adult ♀♀, 30 mm., 2 juv.
St. 395. 13. v. 30 (day). North-east of South Georgia, 1600–1500 m., 1 adult ♀, 37 mm.
St. 679. 29. iv. 31 (night). East of Rio de Janeiro, 2000–1500 m., 1 adult ♀, 35 mm.

[1] Fage (footnote on p. 60) noted that Tattersall (1939, p. 228) had in error given the northern limit of this species as the east of Greenland based on a record of Stephensen. This record was in fact of *E. unguiculata*. Unfortunately in Tattersall and Tattersall (1951, p. 112) I repeated this error.

St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 imm. ♂, 25 mm., 1 very imm. ♀, 23 mm.

St. 1582. 29. iv. 35 (night). East of Zanzibar, 1900–1850(–0) m., 1 juv.

St. 1585. 1. v. 35 (night). North-west of Seychelles, 1400–700 m., 3 ♂♂, 26 mm., 1 juv., 23 mm., 1 small juv.

St. 1586. 2. v. 35 (night). North-west of Seychelles, just north of equator, 1650–950 m., 2 ♂♂, 29 mm., 1 imm. ♀, with parasite.

St. 1869. 11. xi. 36 (day). Scotia Sea, 1550–1000 m., 1 ♂, 33 mm. (Colour note, 'A delicate purple pink throughout'.)

St. 2057. 29. iv. 37 (day). North-east of St Helena, 1450–700 m., 1 juv., 23 mm. (Colour note, 'Brilliant scarlet, integument translucent'.)

St. 2059. 30. iv. 37 (day). North-north-east of St Helena, 1900–1400 m., 1 ♂, 28 mm., 1 imm. ♀, 27 mm., 1 badly damaged juv.

St. 2064. 3. v. 37 (day). North-north-east of Ascension I., 1600–1050 m., 1 ♂, 30 mm.

St. 2065. 4. v. 37 (day). North of Ascension I., 1600–1400 m., 1 ♀, 29 mm., 2 juv.

St. WS 986. 10. iii. 50 (day). West of South-west Africa, 1000–750 m., 1 small juv.

REMARKS. My figures of the anterior end, the telson and a uropod of an adult female of this species are drawn to the same scale as the corresponding parts of adult specimens of *Eucopia unguiculata* and

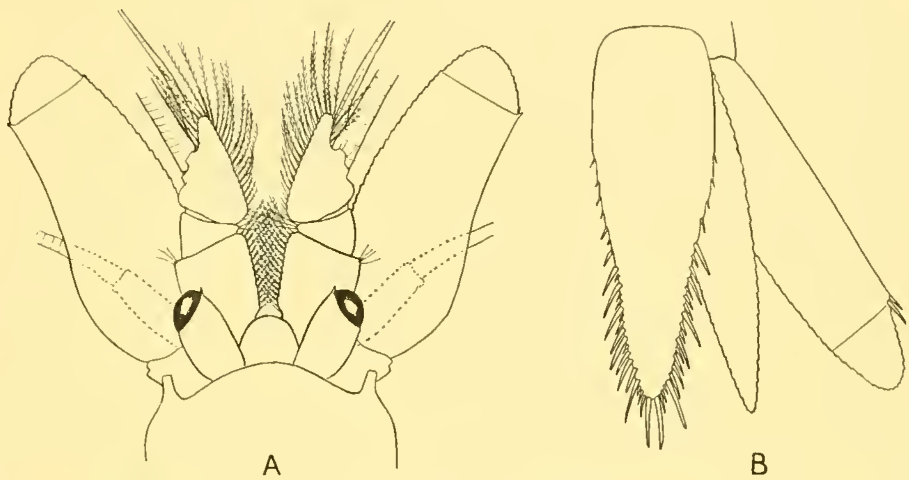

Fig. 5. *Eucopia grimaldii* Nouvel. A, anterior end of female in dorsal view, × 6; B, telson and right uropod of female in dorsal view, × 6.

E. australis in order to show the salient differences between the three species. The thoracic endopods resemble those of *unguiculata*, being long and comparatively slender, but in *australis* the carpo-propodus of the fourth thoracic endopod is markedly stronger and more robust than that of the second and third appendages.

In many respects this species occupies an intermediate position between *unguiculata* and *australis*. It is larger and more robust than the former, but does not attain to a size comparable with the latter. The antennular peduncle resembles that of *australis*, the inner margin of the third segment being much longer than the distal margin and produced distally into a pronounced setiferous lobe. It is less robust, however, than in *australis* and the articulation of the second and third segments is not so oblique (cf. Figs. 4C and 5A). The antennal scale has much the same proportions as in *unguiculata*, but its outer margin is markedly sinuous. I cannot find any definite sexual dimorphism, such as is found in the scale of *australis*. The apex is asymmetrical. The most outstanding difference between this species and the other two lies in the shape and armature of the telson. This is more rounded at the apex and the lateral spines are very long. The small spines are not much shorter than the long ones and there are only two or three in the distal space between the distal long lateral spine and the long apical spines (cf. Figs. 4B, D and 5B). The spines at the distal end of the proximal segment of the exopod of the uropod are very long.

Distribution. *E. grimaldii* was taken at twenty-two stations by the ships of the Discovery Investigations. At nine of these it was taken with *E. unguiculata* and at nine with *australis*, while at three stations the three species were taken together. It would thus appear that there is very little difference between its distribution and that of the other two species. Many records of *E. unguiculata*, made before Nouvel separated *grimaldii* from it in 1942 (1942*a*, pp. 5–8), refer in all probability to the latter species and it is not possible to define its geographical distribution accurately until all this earlier material has been re-examined. From Nouvel's records of the extensive Monaco material and from the present records, it is evident that *E. grimaldii* is widely distributed in the tropical and temperate waters of the Atlantic and Indian Oceans, occurring less frequently as far south as the Scotia Sea. Nouvel records that it does not occur in the Mediterranean, although *E. unguiculata* has been taken there. Its vertical distribution is similar to that of *unguiculata*. The greatest depth at which it occurs in the Discovery Collection was between 2450 m. and 2580 m. at station 101 and the shallowest water in which it was captured was from 850 m. to 950 m. at the same station.

Eucopia linguicauda sp.n.

(Fig. 6A–H)

Occurrence:

St. 413. 21. viii. 30 (day). Open ocean, west of Saldanha Bay, 1600–1000 m., 1 imm. ♀, 41 mm. Type.

Description. *Carapace* extremely soft and transparent; anterior margin convex, evenly rounded; antero-lateral angles bluntly pointed and well produced (Fig. 6A). Anterior region of head produced to beyond half the length of the eyes. *Antennular peduncle* robust with the first segment longer than the second and third together and very broad; second segment triangular in dorsal view with its distal margin markedly oblique; third segment with inner margin only slightly concave with the inner distal angle produced forward into a large, well-developed setiferous lobe; distal margin considerably shorter than the inner margin; proximal margin oblique (Fig. 6A). *Antennular peduncle* small, less than half as long as the scale; *scale* short and broad, only slightly longer than the antennular peduncle; more than twice as long as broad at its broadest point; outer margin somewhat sinuous. Both scales are damaged in the only specimen available, but in one there appears to be a trace of a small spine or tooth at the distal end of the outer margin. Distal segment asymmetrical; slightly less than half as long as broad at its base (Fig. 6A). *Eyes* more than twice as long as broad; cornea large, occupying the whole of the distal region of the organ; small ocular papilla present on the inner distal margin of the eyestalk. This papilla is very difficult to see as it is slender and small and only reaches to one-third of the length of the cornea (Fig. 6A). *Mandibles* of the type usual in the genus, but with particularly slender palps. *Maxillule* and *maxilla* as in other species of the genus (Fig. 6B, C). *First thoracic appendage* with very large epipod and of the same form as in other species of the genus (Fig. 6D). *Second to fourth thoracic appendages* very long and strong, especially the third and fourth; carpo-propodus of the fourth pair robust; inner margin with deep emargination one-third from its proximal end; dactylus and nail one-third as long as the carpo-propodus (Figs. 6E, F). The inner margin of the emargination is armed with about twenty short peculiar spines (Fig. 6G). *Uropod* exopod longer than the telson; terminal segment slightly shorter than broad at the base; only one spine at distal end of outer margin of first segment, but the specimen is damaged and there appears to be the scar of a second spine which has been lost. Only one exopod has the terminal segment present and both endopods are broken (Fig. 6H). *Telson* broad and linguiform with the apex broadly and evenly rounded; no trace of sculpturing on dorsal surface, but the whole telson is hollowed from above like a trowel; lateral margins unarmed distally for nearly half their length, then armed with many small spines which become more crowded towards the apex. These spines appear to be of two kinds. Some of them are short and thick, showing a slight tendency to be arranged in series, but there is little difference in their size. Among these spines there are longer spines which are soft and membranous and as these are bent or twisted, the margin of the telson appears to be armed with a ragged short fringe. In the middle of the apex there is a small rounded protuberance which may be a distorted spine (Fig. 6H).

Length of immature female, 41 mm. The oostegites are moderately large but the fringes are only just beginning to develop (Fig. 6E).

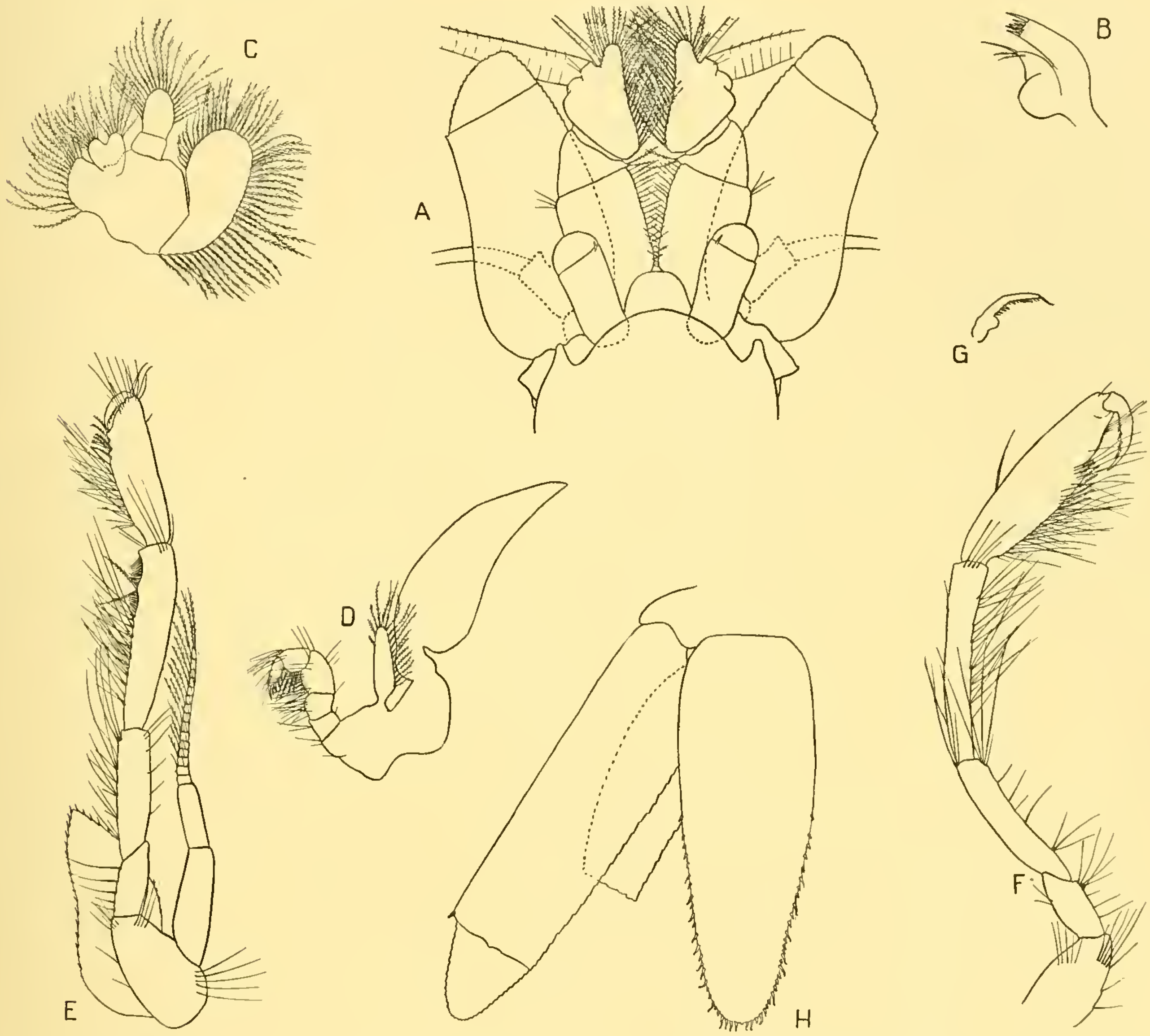

Fig. 6. *Eucopia linguicauda* sp.n. A, anterior end in dorsal view, × 10; B, maxillule, × 16; C, maxilla, × 16; D, first thoracic appendage with epipod, × 10; E, third thoracic appendage with oostegite, × 10; F, fourth thoracic endopod, × 10; G, enlarged spine from inner margin of distal end of carpo-propodus of fourth thoracic appendage; H, telson and exopod of left uropod in dorsal view, × 10.

REMARKS. This species differs from all the other known species of the genus in the shape and armature of the telson. It resembles *E. sculpticauda* in having no long spines arming the apex but, although the specimen is nearly adult, there is no trace of the constrictions and the sculpturing which are so characteristic of *sculpticauda*. It might be thought that these features are not present because the specimen is immature, but the length and proportions of the second to the fourth thoracic endopods serve to distinguish it at once from *sculpticauda*. The specimen is in very bad condition and in the circumstances I have removed some of the appendages in order to make accurate drawings of them.

Distribution. Open ocean to the west of Saldanha Bay, South Africa, captured in a closing net fishing between 1600 m. and 1000 m.

Eucopia sp.

(Fig. 7A–C)

Occurrence:

St. 295. 26. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 damaged imm. specimen, estimated length 12 mm.

Remarks. This specimen is too damaged to be described fully. The anterior end of the carapace and the eyes are distorted so that their normal form cannot be ascertained. The *antennule* is somewhat slender, articulation between second and third segments not oblique; inner margin of third segment slightly longer than the distal margin with only a very small setiferous lobe at the distal end. The *antennal scale* is less broad than is usual in other species of the genus; the spine marking the distal end of the unarmed portion of the outer margin is extremely small, but quite clearly developed; distal articulation very oblique; apex bluntly pointed and markedly asymmetrical (Fig. 7A). *Endopods of the second to the fourth thoracic appendages* long and slender with the dactylus and nail relatively very long (Fig. 7B). *Uropods* with the exopods shorter than the endopods and the terminal segment half as long again as broad at its proximal end. *Telson* slightly longer than the uropods; apex bluntly and evenly rounded. (Fig. 7C).

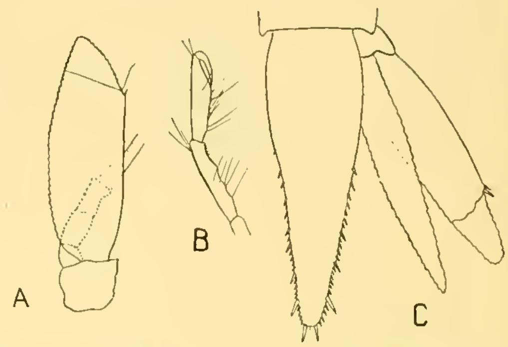

Fig. 7. *Eucopia* sp. A, right antenna; B, distal end of endopod of fourth thoracic appendage; C, telson and right uropod in dorsal view.

Suborder Mysida

Family Petalophthalmidae Czerniavsky

This family is characterized by the absence of gills on the thoracic appendages; the presence of seven pairs of oostegites in the female; the undivided propodus of the thoracic endopods; the biramous pleopods of the male (with the endopod of the fifth pair modified in the genus *Hansenomysis*) and the reduced pleopods of the female; the absence of a statocyst on the endopod of the uropod; the two-segmented exopod of the uropod and (with the one exception of *Petalophthalmus oculata* Illig), by the rudimentary eyes, lacking all traces of visual elements and reduced either to flat plates or to more or less spiniform processes.

I should like to take this opportunity of correcting a typographical error which occurs on p. 114 of the recently published monograph on British Mysidacea (Tattersall and Tattersall, 1951). The sentence beginning 'A second species...' should read 'Only one species of the family Petalophthalmidae, *Petalophthalmus oculata* Illig (1906, p. 194), has the eyes...'.

Genus Hansenomysis Stebbing, 1893

1887 *Arctomysis* Hansen, p. 210.
1893 *Hansenomysis* Stebbing, p. 268.

Remarks. Only two species are at present included in this genus, *H. fyllae* Hansen and *H. antarctica* Holt and Tattersall. I am now able to add a third species *H. falklandica*, which agrees with the other two species in the rudimentary form of the eyes. It would appear that this character can be regarded as of generic significance and the definition of the genus may be summarized as follows: Anterior margin of carapace rounded and uptilted, forming a very short upturned rostrum; proximal segments of the outer flagellum of the antennule in the male very enlarged; antennal scale oval, unsegmented, outer margin armed with spines among the setae or with an evenly graduated row of spines and no setae; exopods of first pair of thoracic appendages absent; endopods of third to fifth pairs slender, each terminating in a minute 'chela', formed by the dactylus impinging on a strong spine at the distal end of the propodus; endopods of sixth to eighth pairs terminating in a long slender claw; pleopods in the male biramous with the endopod modified in the first and fifth pairs, in the female reduced and uniramous; outer margin of proximal segment of the exopod of the uropod armed with spines among the setae, or with a close row of spines and no setae.

In all the known species of the genus there is a peculiar rounded depression partially covered by a thin membranous flap on the dorsal surface of the proximal end of the first segment of the antennular peduncle.

The genus has certain primitive characters, such as the absence of an exopod on the first thoracic appendage, the absence of a statocyst on the uropods and the presence of seven pairs of oostegites in the marsupium of the female. It is less primitive than genera of the family Lophogastridae in the absence of gills on the thoracic appendages and in the reduction of the pleopods in the female and the modification of certain pairs in the male.

Hansenomysis antarctica Holt and Tattersall, 1906

(Fig. 8A–F)

1906*b* *Hansenomysis antarctica* Holt and Tattersall, p. 6.
1908 *Hansenomysis antarctica*, Tattersall, p. 23, figs.
1913 *Hansenomysis antarctica*, Hansen, p. 8, fig.
1914 *Hansenomysis antarctica*, Zimmer, p. 385, fig.

OCCURRENCE:

St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 335–160 m., 1 adult ♂ (the distal end of the telson is missing and the length from the anterior margin of the carapace to the fractured margin of the telson is 23 mm.).

REMARKS. Tattersall (1908, p. 23) gave a very full account and clear figures of this species, which had been founded on two adult females, captured off Coulman Island in the Antarctic. Unfortunately the posterior end of the telson was missing in both specimens and the figure of this organ given by Tattersall was a composite one built up from these specimens and from fragments of the same species taken in the same haul. Since then only two specimens of the species have been recorded, an adult male off Graham Land (Hansen, 1913, p. 8) and a single specimen, of which the sex was not recorded, in 66° 2′ S., 89° 38′ E. (Zimmer, 1914, p. 385). In Hansen's specimen the distal portion of the telson was missing. Zimmer's record was very brief and no mention was made of the form of the telson.

Only one specimen of the species was collected by 'Discovery', an adult male from the Schollaert Channel in the Palmer Archipelago, and, unfortunately, in this specimen also the distal portion of the telson is lacking. However, a considerable portion is present and shows the lateral margins to be straight and almost parallel with no sign of a broadening towards the apex, such as is shown in Tattersall's figure.

The Discovery specimen shows certain differences from the published descriptions and figures and, had the species been based upon perfect animals, I should have hesitated to refer this present example to *H. antarctica*. However, I think that these differences can be attributed to the mutilation of previous material. In the Discovery specimen the form of the antennule agrees precisely with that found in males of *H. fyllae*, the proximal 16–18 segments of the outer flagellum being enormously enlarged, especially proximally (Fig. 8A). The antennal scale agrees closely with that of Tattersall's specimens, but the antennal peduncle differs in that the third segment is larger than the second and in his description the reverse is the case (Fig. 8A, C). The thoracic appendages and, as far as can be ascertained without dissection, the mouth parts are similar to Tattersall's description. The endopods and exopods of the uropods are sub-equal in length. The outer margin of the proximal segment of the exopod bears no setae, but is armed along the distal two-thirds of its length with a row of 25–26 evenly graduated spines which increase in size distally (Fig. 8 F). The portion of the telson which is present differs in shape from Tattersall's figure, but he himself pointed out that his representation of this organ was largely conjectural (Fig. 8 F).

The chief difference shown by this specimen is in the form and armature of the carapace and of the posterior somites of the thorax. The carapace is extremely short, leaving the whole of the last three thoracic somites completely exposed. The anterior end is evenly arcuate with distinctly upturned rim. The antero-lateral angles, which Tattersall describes as 'evenly rounded', are produced into acute angles which extend forward beyond the anterior margin of the rostrum. The most remarkable feature of this specimen is the moulding of the surface of the carapace. On each flank it is thickened and rises into two distinct longitudinal keels. Posterior to the cervical sulcus, there is an oval, level, depressed region, marking the area of attachment of the carapace with the thoracic somites, bounded by a curved keel on each side. Half-way along this keel, there is a sharp spine. The keel is marked at its anterior end by a second spine and then turns and runs transversely downward toward the lateral margin of the carapace. A second keel runs longitudinally, close to the posterior half of the lateral margin. In addition a number of spines adorn the carapace as shown in Fig. 8 A, B.

The large hepatic spines are particularly robust and appear to be freely articulated in a kind of ball-and-socket joint (Fig. 8A, B). The dorsal anterior margin of the sixth thoracic somite is produced forward into a strong membranous flap, which appears in lateral view as a robust blunt process. The terga of the seventh and eighth somites are enlarged and thickened and override the posterior margins of the preceding somites (Fig. 8B). The first abdominal somite is larger and longer than the others and thickened on its dorsal surface to form a saddle similar to that described by Tattersall. The remaining abdominal somites taper considerably towards the telson.

The spines (Fig. 8A, B) on the carapace and the four very strong, median denticles are so conspicuous that it is surprising that other workers mention only a median tooth with a smaller one posterior to it. It may well be that, as all previous specimens were mutilated, some of the spines had been broken off, but it is difficult to understand why neither Tattersall nor Hansen commented upon the strong keels, which are so conspicuous a feature of the Discovery specimen.

Hansen (1913, p. 8), who described the first male seen, stated that the eyes were reduced to two separate, extremely small triangular lappets barely extending beyond the anterior margin of the rostrum. He suggested that the differences between them and the type specimens might be sexual. In the Discovery specimen, which is also an adult male, the eyes are almost precisely as described and figured by Tattersall for his females and it seems probable that the eyes of Hansen's male had been partially torn away.

The male pleopods of this specimen have not previously been figured, but Hansen (1913, p. 8) recorded that they are similar to those of *H. fyllae*, except that in the fifth pair the endopod is considerably longer than the exopod (Fig. 8E). The first pair of pleopods in the Discovery specimen appears to differ from the other species in the genus in having the endopod two-segmented, but I have not dissected it and it may be that the articulation is incomplete (Fig. 8D).

Distribution. *H. antarctica* has never been recorded north of 64° S. and would appear to have a circumpolar distribution in very cold waters. It has a relatively small vertical range. The types were taken at a depth of 100 m., Hansen's specimen at 400 m., Zimmer's at 385 m. and the Discovery specimen between 160 m. and 385 m.

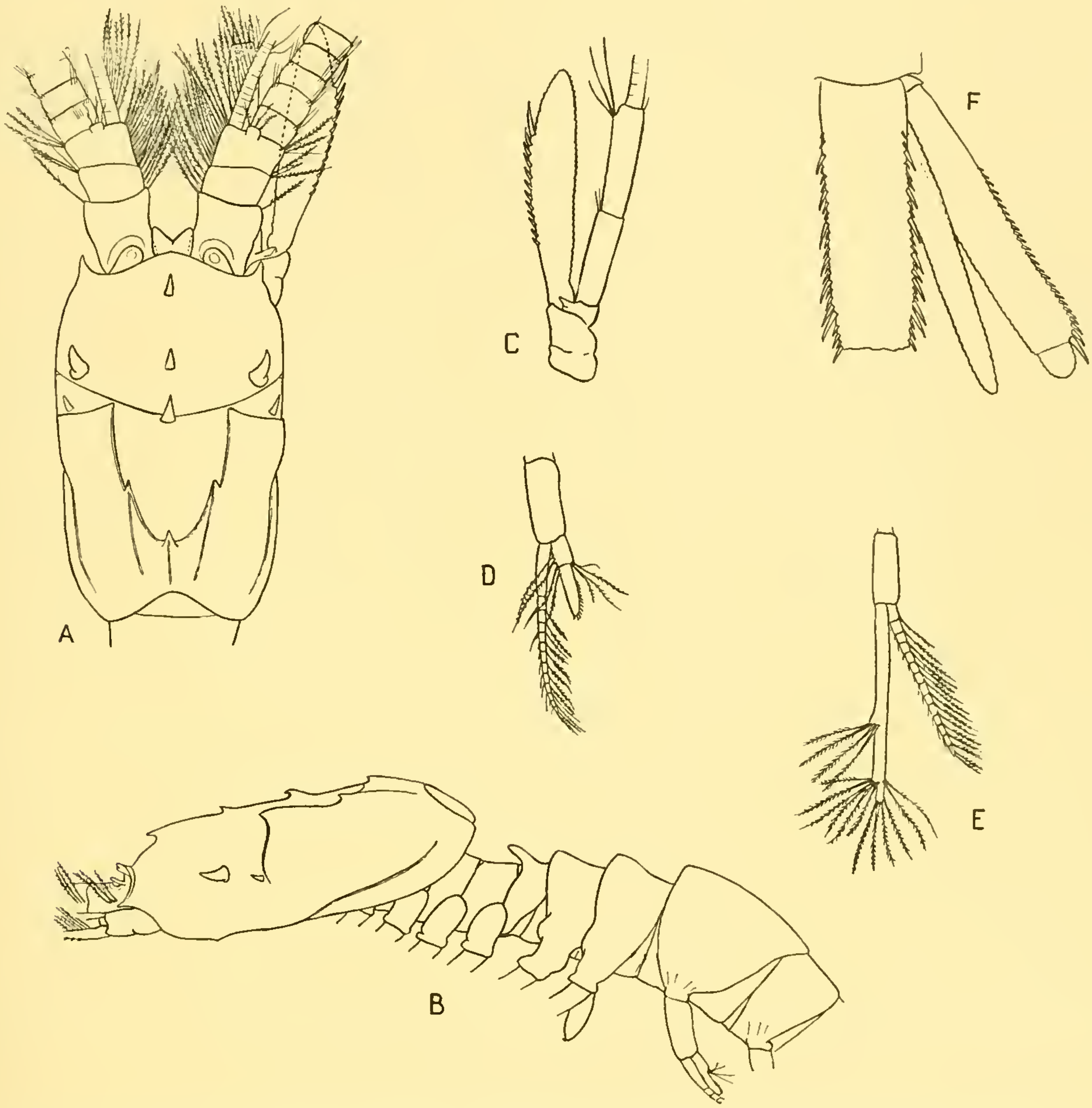

Fig. 8. *Hansenomysis antarctica* Holt and Tattersall. A, anterior end in dorsal view (adult male); B, anterior two-thirds of male in lateral view; C, left antenna; D, first pleopod of adult male; E, fifth pleopod of adult male; F, anterior end of telson and right uropod in dorsal view. All × 12.

Hansenomysis falklandica sp.n.

(Fig. 9A–P)

Occurrence:

St. WS 212. 30 v. 28 (day). North of Falkland Is., 242–249 m. 8 ♂♂, 28 ♀♀ (largest 12·5 mm.), 11 imm.

St. WS 213. 30. v. 28 (day). North of Falkland Is., 249–239 m., 2 ♂♂, 14 mm.; 6 ♀♀, 14·4 mm. Types.

St. WS 214. 30. v. 28. (day). North of Falkland Is., 208–219 m., 1 ♂, 14 mm.; 4 ♀♀, largest 15·5 mm., carrying eggs; 1 imm.

St. WS 227. 12. vi. 28 (night to dawn). East of Falkland Is., 320–298 m., 8 ♂♂, 9 ♀♀, largest 13·2 mm. (ovig.), 3 imm. and fragments.

St. WS 229. 1. vii. 28 (day). North-east of Falkland Is., 210–271 m., 3 ♂♂, 2 ♀♀ (1 ovig.), 23 imm., largest adult 15 mm.

St. WS 233. 5. vii. 28 (day). North-east of Falkland Is., 185–175 m., 1 ♀, 12 mm.

St. WS 234. 5 vii. 28 (night). 195–207 m, 2 ♂♂, 1 ♀, 36 imm. (largest adult 12 mm.).

St. WS 236. 6. vii. 28 (dusk to night). North of Falkland Is., 272–300 m., 2 ♂♂, larger 12·2 mm., 7 ♀♀, largest 13·5 mm.

St. WS 239. 15. vii. 28 (night). West of Falkland Is., 196–193 m., 1 ♀, 12 mm.

St. WS 244. 18. vii. 28 (day). West of Falkland Is., 253–247 m., 2 ♂♂, 2 ♀♀, 2 imm., largest adult 12 mm.

St. WS 245. 8. vii. 28 (night). South-west of Falkland Is., 304–290 m., 1 damaged ♀ probably about 14 mm.

St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 4 ♂♂, 11·2 mm.; 3 juv. ♂♂ about 10 mm.; 3 ♀♀, 12·8 mm.; 7 juv. ♀♀ up to 10 mm.

St. WS 749. 18. ix. 31 (day). Magellan Strait, 40(–0) m., 2 fragments.

St. WS 773. 31. x. 31. (day). North of Falkland Is., 291–298 m., 1 ♂, 1 ♀, 11·2 mm., not fully adult.

St. WS 818. 17. i. 32 (day). Patagonian Shelf, west-south-west of Falkland Is., 272–278 m., 3 ♂♂, 2 ♀♀, all about 14 mm.

St. WS 820. 18. i. 32 (night). South of Falkland Is., 351–368 m., 1 ♀, 15 mm.

St. WS 821. 18. i. 32 (day). Haul A, South of Falkland Is., 461–468 m., 1 ♀, 14 mm.

St. WS 839. 5. ii. 31 (dusk to night). South-west of Falkland Is., 503–534 m., 1 ♀, 15 mm., and 1 ♀ in two pieces.

DESCRIPTION. *General form* very long and slender, not tapering markedly towards the posterior end. *Carapace* short, leaving the whole of the last two thoracic somites exposed; anterior end evenly convex with no rostral projection, but with a well-defined upturned rim; antero-lateral angles bluntly pointed and produced forward beyond the centre of the anterior margin; carapace inflated anterior to the well-marked cervical sulcus and rising to a definite peak in the median line just behind the anterior margin. Posterior to the sulcus, the lateral regions of the carapace are thickened up to the level of two longitudinal keels, which rise to a strong tooth-like projection in the middle of their length and turn with a sharp angle at their anterior end to run downwards and forwards in a shallow concave arc as seen in Fig. 9A. The dorsal median region of the carapace is somewhat hollowed, but there are two elevated portions which appear as blunt projections in lateral view. I can see no trace of hepatic or gastric spines (Fig. 9A). The anterior margins of the exposed thoracic somites are produced upwards and forwards, so that they override the posterior margins of the preceding somites. *Pleon* not so tapering posteriorly as in *H. antarctica*, first somite with the tergum thickened and raised above the level of the neighbouring somites giving the appearance of a saddle; sixth somite half as long again as the fifth (Fig. 9A). *Antennular peduncle* robust, with the first segment in both sexes larger than either of the other two, and bearing at the proximal end of the dorsal surface a very well-marked pit-like depression, similar to that found in other species of the genus. In *H. falklandica* this peculiar organ shows three denser areas within the pit and these stain more darkly than the surrounding tissues. From the region of the insertion of the antennule, a well-developed rounded flap projects forward and forms a kind of shield or lid, partially covering the depression. The flagella are not very long; in the female they are about equal in thickness, but in the male the proximal fourteen or fifteen segments of the outer flagellum are enormously thickened and densely hirsute, especially on their outer margins (Fig. 9A–D). *Antennal scale* long and narrow, $6\frac{1}{2}$ times as long as broad and half as long again as the antennular peduncle; outer margin armed with 9–10 strong spines among the setae; peduncle four-fifths as long as the scale; second segment $1\frac{1}{2}$ times as long as the third; strong spine present on the outer distal corner of the sympod (Fig. 9F). *Eyes*. The fleshy pad which represents the eyes is relatively wider than in *H. antarctica* and the projecting distal corners more widely apart. The slightly bilobed anterior margin of the head projects and can be seen below and a little beyond the distal margin of the eyes (Fig. 9B). *First thoracic appendage* very similar in form to that of *H. fyllae*, consisting of a short robust endopod and no exopod. The three large spines arming the distal end of the endopod are unusually large and robust (Fig. 9G). *Second thoracic appendage* similar to that of *H. fyllae*

(Fig. 9H). *Third to the fifth thoracic appendages* rather short and very slender, terminating, as in other species of the genus, in a minute chela which is hidden by a dense mass of fine setae (Fig. 9J). *Sixth to the eighth thoracic appendages* very long and slender, dactylus fused with the long nail to form a long slender claw (Fig. 9 K).

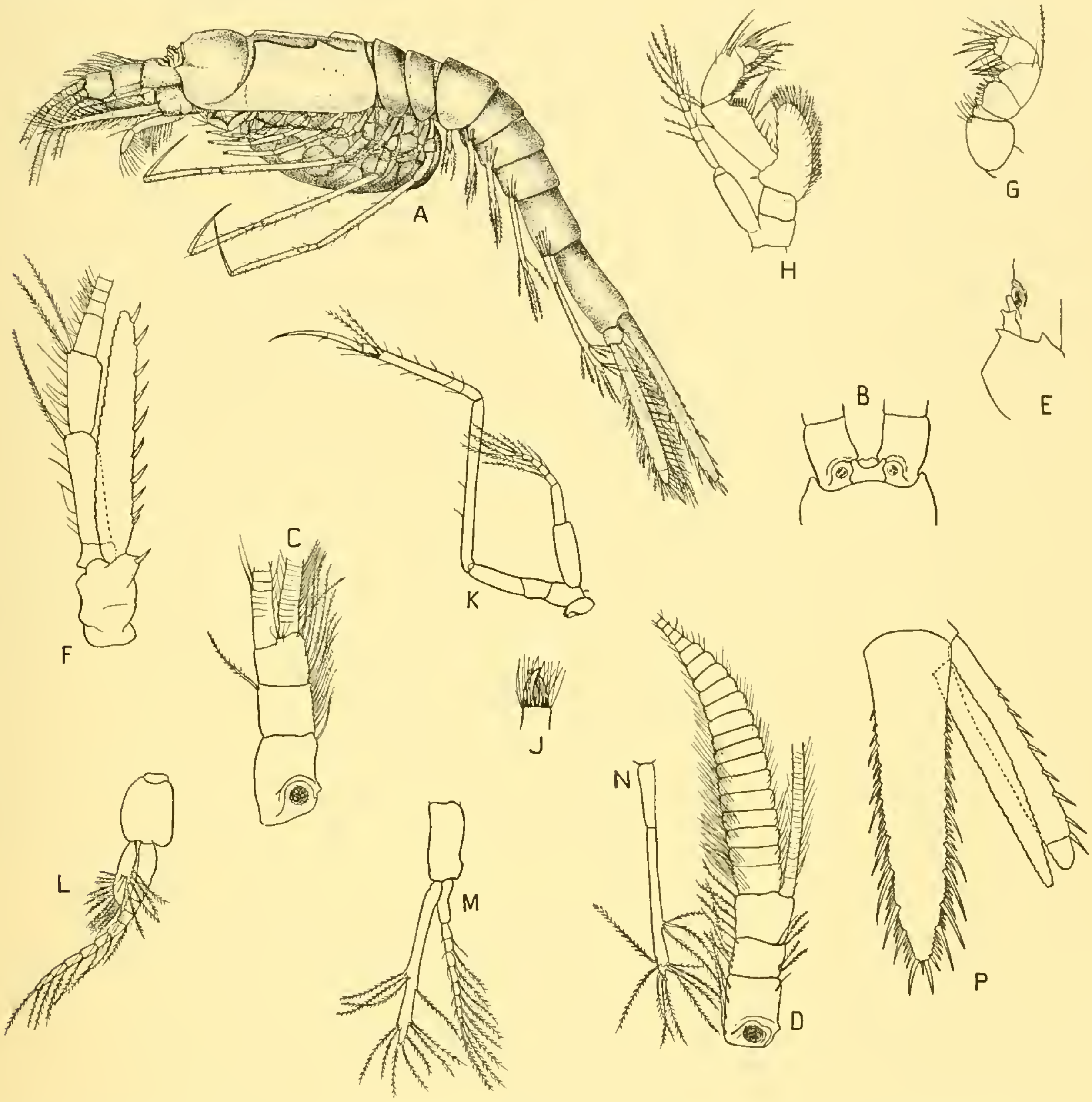

Fig. 9. *Hansenomysis falklandica* sp.n. A, ovigerous female in lateral view, × 10; B, anterior end of carapace and bases of antennules in dorsal view, × 12; C, peduncle of left antennule of adult female, × 16; D, peduncle of left antennule of adult male, × 16; E, proximal end of antennule in lateral view, × 16; F, right antenna, × 16; G, endopod of first thoracic appendage, × 20; H, second thoracic appendage, × 20; J, distal end of third thoracic appendage (enlarged); K, eighth thoracic appendage of male, × 13; L, first pleopod of the male, × 20; M, fifth pleopod of the male, × 20; N, fifth pleopod of the female, × 13; P, telson and right uropod in dorsal view, × 16.

In the published descriptions of *H. fyllae* and *H. antarctica*, no mention is made of the form of the carpo-propodus of the thoracic endopods. Figures of these appendages given by the authors, Hansen (1887, p. 210, fig. VII, 5–5*e*) and Tattersall (1908, p. 23, pl. V, figs. 1–19) show the carpo-propodus as a single segment with no trace of secondary articulations. I can find no comment on these appendages in any subsequent literature. In the endopods of the sixth to the eighth thoracic appendages of *H. falklandica*, there are three distinct segments distal to the 'knee', in addition to the dactylus which is fused with the nail. The proximal two of these segments are short and the articulation by which they are separted is oblique as seen in Fig. 9 K. On close examination of stained preparations, a strong flexor muscle can be clearly seen inserted on the outer margin of the third segment and running obliquely through the segment to the inner base of the claw. No definite musculature appears in the other two segments, though in one preparation there seems to be a feeble muscle running unbroken through them. Following the procedure adopted by Hansen (1925, p. 110) of determining the homology of the segments in the thoracic endopods of the Mysidacea by their musculature, it would seem that here we have the very unusual arrangement of a distinct unsegmented propodus and it is the carpus which has become secondarily divided by an oblique articulation. I have examined specimens of *H. fyllae* from the west coast of Ireland and find that in them also the endopods of the posterior three pairs of thoracic appendages have three segments distal to the 'knee' precisely similar to those of this species. The male genital organ is small and bulbous and faintly two-lobed at its distal end (Fig. 9L). *Pleopods of the male* differ only in small details from those of *H. fyllae*; the fifth pair has a slender sympod and the endopod in adult males is longer than the exopod (Fig. 9 M); *of the female* first pair composed of a single segment; remaining four pairs two-segmented, becoming progressively longer on the posterior somites; fifth pair very long, more than one-fourth as long again as the long sixth abdominal somite (Fig. 9 N). *Uropods* small and slender, only three-fourths as long as the telson; exopod with the proximal fourth of the outer margin of the proximal segment naked; remaining three-fourths armed with about nine spines among the setae, the spines becoming progressively longer posteriorly; distal segment equal in length to the terminal spine of the outer margin; endopod slender and tapering, slightly longer than the exopod (Fig. 9 P). *Telson* very long and narrow, more than twice as long as the sixth abdominal somite, nearly four times as long as broad at the base; lateral margins almost parallel for over half their length, then narrowing in a slightly convex curve to the narrowly-rounded, entire apex, armed on the distal four-fifths of their length with a dense row of spines arranged in a series of large spines with small ones in the intervals between them. These large spines are extremely long and slender, especially towards the apex of the telson and the margin shows marked constrictions at their points of insertion; apex armed with two long spines with a single shorter spine between them (Fig. 9P).

Length. Largest male 14 mm.; ovigerous females from 12·2 mm. to 15 mm.

REMARKS. This species shows a closer resemblance to the northern species *H. fyllae* than to the antarctic species, *H. antarctica*. The size, proportions and armature of the antennae and the uropods are very similar in the two species and differ from *H. antarctica* in bearing both spines and setae on the outer margin of the scale and of the exopod. All the recorded specimens of *H. antarctica* have lost the distal end of the telson, but from the proximal portions which are present it is evident that the armature of this organ in *H. falklandica* more closely resembles *H. antarctica* than *H. fyllae*. The spines of the lateral margins form a close series almost from the base to the narrowly rounded apex, whereas in *H. fyllae* they are confined to the distal fourth of the margins.

This new Antarctic species may readily be distinguished from the northern *H. fyllae* by the well-marked ridges or keels which outline the hepatic area of the carapace and by the absence of an hepatic spine on each side; by the larger number of spines on the outer margin of the scale and of the exopod of the uropod; by the larger eyes forming a median eyepad with the antero-lateral angles produced into bluntly rounded, diverging processes; by the more developed pit-like structure on the proximal dorsal surface of the antennular peduncle; by the form of the slender fifth pair of pleopods in the male with the exopod shorter than the endopod, whereas in *H. fyllae* it is considerably longer; and, finally, by the armature of the telson. In *H. fyllae*, the proximal two-thirds or more of the lateral margins are unarmed and the distal third is armed with only three, or occasionally four, long spines on each side with small spines in the spaces between them. In *H. falklandica* the lateral margins are armed along the distal four-fifths of their length with spines in series and there may be seven or eight very long spines with smaller ones between them on each side. The armature of the distal fourth of the telson in the two species is almost identical.

DISTRIBUTION. Of the eighteen stations at which this species has been taken, sixteen are situated around the Falkland Isles. It was not until after I had described and named the species, that I received a further instalment of material and found that it had been taken also at two stations in the Magellan Strait. The material is not in very good condition and it has not been easy to find perfect specimens. Although the types, from which the details of the appendages are taken, came from station WS 213, the drawing of the adult female (Fig. 9A) is reconstructed from specimens from stations WS 214 and WS 229. The majority of the animals occurred at depths ranging from around 200 m. to about 400 m. Only at station WS 749, where two fragments were taken at a depth of 40(–0) m. were any captures made at a depth of less than 195 m. The greatest depth at which they were taken was 403–430 m. at station WS 839.

Genus Petalophthalmus W.-Suhm, 1875

1875 *Petalophthalmus* W.-Suhm, p. 23.

REMARKS. The name of this genus is derived from the peculiar leaf-like form of the eyes in the type species, *P. armiger*. A second species, *P. oculatus*, in which the eyes are better developed with functioning ocelli has since been added to the genus. The most outstanding character of the genus is the long, very powerful, prehensile mandibular palp.

Petalophthalmus oculatus Illig, 1906

(Fig. 10)

1906*a* *Petalophthalmus oculatus* Illig, p. 194, figs.
1930 *Petalophthalmus oculatus*, Illig, p. 411, text-figs.
1939 *Petalophthalmus oculatus*, Tattersall, p. 229, fig.

OCCURRENCE:

St. 1586. 2. v. 35 (night). North-west of Seychelles Is. 550–0 m., 1 ♀ imm., 9·6 mm.

REMARKS. This is the only species of the genus, or indeed of the family at present known, in which normal functioning eyes are present. It was founded by Illig for a single female specimen of 18 mm. with well-developed marsupium, captured in 1200 m. near Aden. Though it is by no means adult I have no hesitation in referring this specimen taken by 'Discovery' II to this species. It agrees very closely with the description and figures given by Illig as regards general form, the shape of the rostrum and carapace, the form of the antennal scale, the uropods and the telson. Such variations as it shows in armature may be attributed to its immaturity.

The apex of the telson is emarginate as shown by Illig, the spines arming the lateral margins are fewer and confined to the distal half of the telson leaving the proximal half of the margin naked. In Illig's specimen there were seventeen spines evenly spaced along the whole margin on each side, but in the Discovery specimen there are only seven. The apex is armed with five pairs of spines on each side and a strong median spine. There are also two pairs of long plumose setae with somewhat bulbous bases borne in the spaces between the median spine and the innermost spines and between these and the next pair. The main difference between this specimen and Illig's lies in the number and length of these apical spines. The outermost pair is extremely long, measuring rather more than one-third of the length of the telson, the next two pairs are progressively shorter and the inner two pairs are small and almost equal in length. Illig figures these spines as much smaller, the longest being less than one-fourth of the length of the telson, and he describes and figures three pairs of very small spines along the middle of the apex flanking the median spine, making six pairs in all. All these apical spines are finely spinulose in the Discovery specimen.

Tattersall (1939, p. 230, text-fig. 3) referred an immature specimen of 7 mm., taken from N.E. of Seychelles, to this species. In his specimen the apex of the telson was truncate with no trace of emargination. It bore five pairs of spines like the Discovery specimen but the outer two pairs were almost equal in length, while the inner three pairs were all of equal length and very small with plumose setae in the spaces between them (Fig. 10).

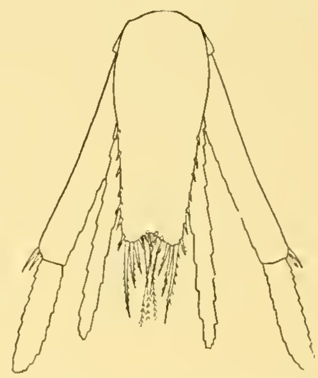

Fig. 10. *Petalophthalmus oculatus* Illig. Telson and uropods of female in dorsal view, × 26.

The Discovery specimen measures 9·6 mm. The brood lamellae are not yet developed and the differences it shows from Tattersall's smaller specimen and from the adult of Illig are due probably to growth changes.

The eyes are well developed with normal ocelli and a golden brown pigment. They appear to be somewhat shorter and thicker than those figured by Illig. I am unable to make out the small finger-like process which Tattersall recorded on the inner face of the eye.

Distribution. With the exception of the one record by Tattersall (1937, p. 1) from the Caribbean Sea, all records of this species are from deep water in the Indian Ocean near Aden or from the N.E. of Seychelles. The Discovery specimen was taken in much shallower water at a depth of 550–0 m., at station 1586 half-way between Seychelles and Obbia on the coast of Africa.

Family Mysidae

Subfamily Boreomysinae

Genus Boreomysis G. O. Sars, 1869

1869 *Boreomysis* G. O Sars, p. 330.
1873 *Petalophthalmus* (pars), W.-Suhm, p. 40, figs.
1883 *Arctomysis* Czerniavsky, p. 8.
1896 *Pseudanchialus* Caullery, p. 368.

Remarks. Seven of the species which have been referred to the genus *Boreomysis* are represented in the Discovery collections. In addition I am obliged to add five new species, *B. illigi*, *B. acuminata*, *B. tattersalli*, *B. insolita* and *B. bispinosa*. There has been, and still is, much confusion in this difficult genus due, to some extent, to the fact that several of the described species have been founded on one, or possibly two, immature individuals. A close study of the genus proves that there is considerable variation among its members and, unless a very large number of species is to be erected, the species must be defined along broad lines, with a good deal of latitude allowed as regards minor features. The species *B. rostrata* is an outstanding example (see p. 70).

I accept the suggestions of previous workers that the following synonymies occur in the genus:

B. sibogae Hansen = *B. spinifera* Coifmann.
B. californica Ortmann = *B. media* Hansen = [1]*B. kinkaidi* Banner.
B. rostrata (pars) Illig = *B. inermis* Hansen.
B. arctica (Kröyer) = *B. tregouboffi* Băcesco.

[1] See footnote on page 67.

I can find no valid reason for separating *B. kinkaidi* Nouvel from *B. californica* Zimmer and, since they were taken in approximately the same localities, I suggest that they are synonymous.[1] *B. richardii* was founded on two immature females and has not since been recorded. In the type specimens the distal portion of the telson was missing so that the form of the cleft could not be ascertained. *B. vanhoeffeni* was founded on a single adult female and the distal end of both the antennal scales was missing. It was, therefore, impossible to make a complete comparison between the two forms and such small differences as they show can, in my opinion, be attributed to growth changes.

The genus is thus reduced to twenty species which have already been described, in addition to the five new species mentioned above. I have drawn up an artificial key to these species and hope that it may help workers to identify them.

Key to the species of the genus Boreomysis

Spines arming the lateral margins of telson arranged in series; cleft with dilatation at its base. 1
Spines arming lateral margins of telson sub-equal or in weak series; cleft without dilatation at base. 5

1 Carapace smooth. 2
Carapace covered with small tubercles. B. verrucosa Tattersall

2 Distal segments of 2nd thoracic endopod modified to form a sub-chela. 3
Distal segments of 2nd thoracic endopod not sub-chelate; rostral plate narrow and produced into long acute rostrum. B. rostrata Illig = B. inermis Hansen

3 Inner distal margin of propodus of 2nd thoracic endopod emarginate. 4
Inner distal margin of propodus of 2nd thoracic endopod not emarginate but armed distally with two large spines with the dactylus fitting down between them; rostral plate very short. B. bispinosa sp.n.

4 Emargination of propodus of 2nd thoracic endopod armed proximally with one strong spine among a group of plumose setae; eyes small and downwardly directed. B. microps G. O. Sars
Emargination of propodus of 2nd thoracic endopod marked proximally with a hump armed with plumose setae but no spine; rostral plate well produced with distinct shoulders. B. tattersalli sp.n.

5 Distal segments of 2nd thoracic endopod sub-chelate. 6
Distal segments of 2nd thoracic endopod not sub-chelate. 7

6 Emargination of 2nd thoracic endopod armed proximally with a group of plumose setae and one slender barbed spine; cornea occupying only half of distal end of eyestalk. B. semicaeca Hansen
Emargination of 2nd thoracic endopod very deep with no spine at proximal end; rostrum long and acute; lateral spines of telson sub-equal. B. incisa Nouvel

7 Eyes without pigment or visual elements; eyestalks cup-shaped. 8
Eyes normal with functioning visual elements. 9

8 Eyestalk cup with thin marginal rim (northern form). B. scyphops G. O. Sars
Eyestalk cup quadrangular with thick marginal rim (southern form). B. inermis (W.-Suhm)

9 Anterior margin of carapace with upturned rim and no rostral projection; antennal peduncle four-segmented; telson lobes with one very long spine at apex. B. insolita sp.n.
Anterior margin of carapace not produced; rounded with extremely small rostral projection. 10
Anterior margin of carapace produced into well-developed rostral projection. 13

10 Apex of antennal scale much longer than spine terminating outer margin; ocular papilla large; cornea small, not wider than eyestalk. B. vanhoeffeni Zimmer = B. richardii Nouvel
Apex of antennal scale shorter, equal to, or only very slightly longer than spine terminating outer margin; ocular papilla small or absent; cornea large and globular. 11

[1] Since writing the above I have heard from Dr Banner that he is withdrawing *B. kinkaidi* as a synonym of *B. californica*. [O.S.T.]

11 Eyes extremely large; no ocular papilla; rostral projection nearly obsolete; propodus of 3rd–8th thoracic endopods undivided. **B. megalops** G. O. Sars
Eyes with large cornea somewhat flattened dorso-ventrally; small ocular papilla; propodus of 3rd–8th thoracic endopods two-segmented. 12

12 Lateral margins of telson concave with narrowest part just proximal to base of cleft; small ocular papilla. **B. atlantica** Nouvel
Lateral margins of telson almost straight with few spines; apical spines not longer than lateral ones; no ocular papilla recorded. **B. obtusata** G. O. Sars

13 Rostral projection tridentate. **B. tridens** G. O. Sars
Lateral margins of rostral projection mostly convex but concave distally forming distinct shoulders. 14
Rostral projection with lateral margins only slightly convex and without shoulders. 17

14 Lateral spines of telson sub-equal with only a tendency to an arrangement in series; ocular papilla, when present, shorter than cornea. 15
Lateral spines of telson arranged in more or less definite series; ocular papilla extending beyond anterior margin of eyes. 16

15 Eyes large; no ocular papilla; rostrum long, acute, horizontal; scale acutely pointed with apex obsolete; lateral margins of telson almost straight. **B. nobilis** G. O. Sars
Eyes small; cornea narrower than eyestalk; small ocular papilla; apex of scale slightly longer than terminal spine of outer margin; rostrum uptilted; lateral margins of telson somewhat concave. **B. plebeja** Hansen

16 Rostrum long, extending forward almost to anterior margin of 1st segment of antennular peduncle; eyes large; ocular papilla very long; telson cleft to more than 1/4th of its length; lateral spines with only a tendency to arrangement in series. **B. illigi** sp.n. = **B. rostrata** Illig (♂ only)
Rostrum only reaching 1/4th of the length of the first segment of the antennular peduncle; apex of scale slightly longer than spine terminating outer margin; eyes moderately large; papilla finger-like; telson cleft to 1/6th of its length with lateral spines arranged in series.
B. californica Ortmann = **B. media** Hansen = **B. kinkaidi** Banner

17 Cornea narrower than eyestalk; ocular papilla very long. 18
Cornea equal to or wider than eyestalk; ocular papilla small or finger-like. 19

18 Rostrum acute and very long, especially in ♀, extending to anterior margin of eyes or beyond; apex of scale shorter than spine of outer margin; eyestalks very wide distally; lateral spines of telson sub-equal; cleft 1/3·5 of length of telson. **B. acuminata** sp.n.
Rostrum extending half-way along eyestalks; apex of scale equal in length to terminal spine; eyestalks very wide distally; lateral spines of telson in series; cleft 1/5th of length of telson. **B. fragilis** Hansen

19 Rostrum extending to anterior margin of eyes; spines arming lateral margins of telson proximally in weak series but equal distally. 20
Rostrum extending only half-way along eyestalks. 21

20 Apex of scale shorter than spine terminating outer margin; ocular papilla almost obsolete. **B. arctica** (Kröyer) = **B. tregouboffi** Băscesco
Apex of scale longer than spine terminating outer margin; ocular papilla small but well developed. **B. brucei** Tattersall

21 Apex of scale shorter than spine terminating outer margin; ocular papilla very small; lateral spines of telson arranged in definite series. **B. sibogae** Hansen = **B. spinifera** Coifmann
Apex of scale longer than spine terminating outer margin; ocular papilla long and finger-like; lateral spines of telson almost equal. **B. dubia** Coifmann

Boreomysis rostrata Illig, 1906

1906*a* *Boreomysis rostata* Illig, p. 196, fig. 2; 1930, p. 414, figs. 22–35 (♀ only).
1910 *Boreomysis inermis* Hansen, p. 26, pl. 2, figs. 4*a*–4*c*.
1951 *Boreomysis rostrata*, W. M. Tattersall, p. 56, figs. 11*a*–*b*, 12*a*–*d*, 13.

OCCURRENCE:

St. 71. 30. v. 26 (day). Open ocean north of Falkland Is., 2000(–0) m., 1 imm. ♂.
St. 78. 12. vi. 26 (day). Mid-Atlantic, west of Cape Town, 1000(–0) m., 5 adult ♂♂, largest 17 mm., 3 juv. ♂♂; 7 adult ♀♀, largest 17·5 mm., 2 juv. ♀♀, fragments.
St. 81. 18. vi. 26 (day). North of Tristan da Cunha, 650(–0) m., 1 very damaged ♀, doubtfully.
St. 83. 21. vi. 26 (night). North-east of Tristan da Cunha, 650(–0) m., 1 adult ♀, 14·5 mm.
St. 86. 24. vi. 26 (day). Open ocean, west of Cape Town, 1000(–0) m., 1 damaged ♀.
St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 6 adult ♂♂, largest 16·4 mm., 8 juv. ♂♂, 6 adult ♀♀, largest 17·5 mm., 3 juv. ♀♀. (Colour note, 'Pinkish red throughout—eyes black'.)
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 2 adult ♂♂, 20 mm., 2 ♀♀, 15 mm.
St. 100. 2/3. x. 26 (night). West of Cape Town, 475(–0) m., 2 juv., 5 mm., probably *rostrata.*
St. 100B. 3/4. x. 26 (night). West of Cape Town, 1000–900 m., 3 adult ♀♀, largest 17 mm.
St. 100C. 4. x. 26 (day). West of Cape Town, 2500–2000 m., 2 juv. and posterior end of large ♀.
St. 100D. 2. x. 26 (day). West of Cape Town, 675–625 m., 1 badly damaged specimen.
St. 101. 14. x. 26 (day). West of Cape Town, 1410–1310 m., posterior end of large ♂.
St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 1 adult ♂, 17·5 mm., 3 juv. ♂♂, 6 adult ♀♀, largest 17 mm., 3 juv. ♀♀.
St. 267. 23. vii. 27 (night). North-west of Angra Pequena, 550–450(–0) m., 3 very small juv. probably *rostrata.*
St. 405. 4. vi. 30 (day). Off Cape Peninsula, 1200–0 m., 4 ♂♂, largest 18 mm., 2 ♀♀, larger 16·5 mm.
St. 407. 12. vi. 30 (day). South-west of Cape Town, 950–800 m., 2 adult ♂♂, 17 mm., 2 ♀♀, 17·5 mm.
St. 413. 21. viii. 30 (day). West of Saldanha Bay, South Africa, 1600–1000 m., 2 ♀♀, larger 17 mm.
St. 663. 5. iv. 31 (day). East-north-east of South Georgia, 500–250 m., 1 juv., bad condition.
St. 671. 22. iv. 31 (night). Open ocean, west of Gough Island, 1000–0 m., 1 adult ♀, 17·8 mm.
St. 673. 24/25. iv. 31 (night). West of Tristan da Cunha, 1500–1100 m., 1 badly damaged ♀.
St. 942. 31. viii. 32 (night). East of Cook Strait, New Zealand, 350–110 m., 2 imm. ♂♂, 1 imm. ♀.
St. 1566. 9. iv. 35 (night). North of Prince Edward Is., 1350–0 m., 2 juv. ♀♀.
St. 1568. 11. iv. 35 (night). South of South Africa, 1400–0 m., 1 juv. ♂, 1 adult ♀, 14·4 mm., 1 juv. ♀.
St. 1602. 27. x. 35 (night). West of South Africa, 470–300 m., 1 imm. ♂, 12·8 mm.
St. 1604. 29. x. 35 (night). West of South Africa, 620–500 m., 1 imm. ♂, 14 mm.
St. 1606. 31. x. 35 (night). West of Orange River estuary, South Africa, 600–500 m., 6 juv. and fragments.
St. 1753. 27. iv. 36 (day). South Indian Ocean, 2900–1400 m., 2 imm. ♀♀, 12 mm.
St. 1802. 16. ix. 36 (day). Off Cape Town, 1000–750 m., 1 imm. ♀, 12·5 mm.
St. 2035. 7. iv. 37 (day). Off Cape Town, 950–750 m., 1 adult ♀, 16·2 mm. (Colour note, 'deep orange'.)
St. 2038. 19. iv. 37 (day). West of Cape Town, 1200–850 m., 1 imm. ♀, 12 mm. (Colour note, 'brilliant red'.)
St. WS 110. 26. v. 27 (dusk to dark). Off South Georgia, 980–750 m., 1 large adult ♀, 20 mm., 1 juv. ♀.
St. WS 582. 30. iv. 31 (day). Magellan Strait, 110 m., 1 imm. ♀, 15 mm.
St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 74 ♂♂, 134 ♀♀, largest 21 mm., 20 juv.; second tube: 12 small juv.
St. WS 749. 18. ix. 31 (day). Magellan Strait, 40(–0) m., 1 ♀, 18 mm., fragments of imm. ♂ and ♀♀.
St. WS 839. 5. ii. 31 (night). South-west of Falkland Is., 503–534 m., 1 adult ♀, 20 mm.
St. WS 976. 6. iii. 50 (day). West of Walvis Bay, 750–500 m., 1 juv. in very bad condition (doubtfully).
St. WS 977. 6/7. iii. 50 (night). West-north-west of Walvis Bay, 750–500 m., 1 juv. ♂, 10 mm.
St. WS 978. 7. iii. 50 (day). West-north-west of Walvis Bay, 750–500 m., 3 ♀♀, 9·4–12 mm.
St. WS 986. 10. iii. 50 (day). West of Spencer Bay, South-west Africa, 1000–750 m., 1 adult ♂, 14·5 mm.

REMARKS. The literature of *B. rostrata* has been confused by the fact that Illig (1930, p. 414), when more fully describing the species which he had founded in 1906, was evidently dealing with material which included more than one species.

Tattersall (1951, p. 57) drew attention to the striking differences between the males and females in Illig's description and figures, and concluded that these differences were not sexual, but specific. He accepted Illig's female as the type for *B. rostrata* and suggested that the males should be referred to another species.

The Discovery material contains some specimens which closely conform to the description and figures which Illig had given for the males of *B. rostrata* and I have followed Tattersall's suggestion and founded a new species, *B. illigi* for them (see p. 72).

Even within the narrower definition of *B. rostrata*, Tattersall found that considerable variation occurred. He recorded: 'The female specimens have a longer rostral process than the male though in no case is it as long as shown by Illig. Incidentally the rostral plate is relatively longer in young specimens than in adults and appears to undergo progressive reduction with growth.'

In the Discovery collection I have not found such a definite sexual difference as Tattersall described, although a considerable amount of individual variation in the length of the rostrum exists. At station WS 748 many adults of both sexes occurred, among which no appreciable difference in rostral length was found. At stations 78 and 87, however, specimens showed definite sexual differences and in all the females the rostrum was longer than in the males. The collection provided additional evidence of the growth changes which were noted by Tattersall. In immature specimens from stations 942, 1566 and 1753, the rostrum was long and extended forward beyond the anterior margin of the cornea.

The specimens, which I have here referred to *B. rostrata* Illig, show a certain amount of deviation from the description given by Illig (for his females) in the length of the rostrum and the apex of the antennal scale and considerable variation in the relative size of the eyes. I have examined the rich Discovery collection with the greatest care and find that the animals show every gradation in these characters, it being quite impossible to separate them into definite groups. I have tried, with very little success, to correlate the variations with geographical distribution, since wide variation may occur among individuals from the same localities. In view of the very constant form of the tail fan, the endopods of the thoracic appendages and the pleopods, I feel that the simplest solution is to refer them all to *rostrata* and to accept a certain amount of latitude in the definition of that species in respect of these variable characters. I therefore put forward the following five definitive characters as a guide to identification: (1) rostral process of the male relatively short, usually shorter than the eyes, with acutely pointed apex and anterior margin of carapace with no definite 'shoulders'; of the female, long and acutely pointed and no trace of 'shoulders'; (2) large eyes with well-developed ocular papilla and cornea wider than eyestalks; (3) a non-chelate termination to the endopod of the second thoracic appendage; (4) a long telson with the spines arming the lateral margins arranged in series, cleft narrow and marked by a distinct 'dilatation' at its base; (5) unarmed portion of the outer margin of the exopod of the uropod very short. There is, however, much variation in all these characters.

The uropods are very long and slender with the exopod only slightly longer than the endopod. The unarmed portion of the outer margin of the exopod of the uropod is only one-tenth, or less, of the total length and is terminated distally by a single small spine. The endopod is armed on its inner margin, just distal to the statocyst, with a single long, slender, curved spine. The telson is quite characteristic, long and narrow, equal in length to the last three abdominal somites together. The lateral margins are unarmed for the proximal fourth of their length, the remaining three-fourths being densely armed with a series of eight to ten long, strong spines with graduated series of from four to eight small spines in the spaces between them. The cleft is deep and narrow with a characteristic dilatation at its base.

In most of the specimens the eyes are as figured in Illig's type, but the relative size varies considerably. The colour of the pigment in these preserved animals ranges from black to golden brown.

Hansen (1910, p. 26) founded a new species, *B. inermis*, on a single male specimen from near the Dutch East Indies. Tattersall (1951, p. 57) pointed out that the only real difference between this species and the descriptions of *B. rostrata* was in the length of the rostral plate. Since the type of *rostrata* was a female, he suggested that the difference shown by Hansen's specimen was a sexual one and that the two species should be united. Although I have found no specimen in the Discovery collection with the rostrum quite so short or its margins quite so convex as shown in Hansen's figure (1910, p. 11, fig. 4*a*) for *B. inermis*, I have found so much variation in this character that I agree with Tattersall's suggestion that the two species are synonymous.

I doubtfully refer three specimens from station 492 to *rostrata*. In them the rostrum is unusually long, extending beyond the anterior margin of the eyes, the ocular papilla is unusually large and the apex of the antennal scale is considerably shorter than the spine terminating the naked portion of the outer margin. The dilatation at the base of the cleft of the telson is present, but is not very clearly marked. None of the specimens is adult and the variations may be due to their immaturity.

DISTRIBUTION. Illig's females were taken at three stations in the Atlantic—off Bouvet Island, off Cape Town and west of Angra Pequena—and at one in the Indian Ocean, N.E. of New Amsterdam. Hansen's *B. inermis*, which I regard as synonymous with *B. rostrata*, was taken in the waters of the Dutch East Indies. W. M. Tattersall (1951, p. 56) recorded the species from Alaska and Japanese waters. Of the thirty-eight stations at which it was taken by 'Discovery', 'Discovery II' and 'William Scoresby', thirty-two are situated in the South Atlantic between 25° S. and 55° S., three are in the Strait of Magellan and one in the Pacific to the east of New Zealand. Most of the hauls in which it was taken were oblique from varying depths to the surface, but captures in closing nets prove that it is mesoplanktonic with a considerable vertical range between 300 m. and 1300 m.

I have recently, through the courtesy of Dr P. G. Law, Director of the Antarctic Division of the Department of External Affairs, Australian National Antarctic Research Expedition, had an opportunity of examining some mysids collected in plankton off Heard Island by Mr E. H. M. Ealey. There were six specimens in all, only one of which was adult, and, although in the smallest specimens the rostrum is unusually long, I have no hesitation in referring them to *B. rostrata*. The single adult is a male measuring 19 mm. and is in perfect condition. It is interesting that these specimens occurred in plankton taken at or very near to the surface and thus the record extends its known vertical range into shallower depths than hitherto known.

Boreomysis rostrata var. Illig

Variety with unusually large eyes and small ocular papilla.

OCCURRENCE:

St. 42. 1. iv. 26 (day). Off Cumberland Bay, South Georgia, 120–204 m., 1 adult ♀, 20 mm.
St. 129. 19. xii. 26 (dusk to dark). Off South Georgia, 950–750 m., 1 adult ♀, 24 mm.
St. 146. 8. i. 27 (day). Off South Georgia, 728 m., 4 adult ♂♂, 20–24 mm., 2 adult ♀♀, 21·6 mm.
St. WS 29. 19. xii. 26 (day). Off South Georgia, 600–500 m., 2 small juv.
St. WS 330. 27. xii. 28 (day). Off South Georgia, 900–760 m., 1 adult ♂, 27 mm.

REMARKS. The specimens from the five stations given above agree closely with *B. rostrata* except in the unusually large size of the eyes and the small ocular papilla. The eyes are so conspicuous, nearly twice the size of those in other specimens which I have referred to *rostrata*, that the animals can be recognized at once with the naked eye. The cornea is globular and is considerably wider than the eyestalk; in all the specimens the pigment is a pale golden yellow. The papilla is unusually small and insignificant and may easily be overlooked. Nevertheless, I do not feel that there is sufficient justification for the foundation of a new species, especially as among the many specimens which I have already referred to *B. rostrata*, there is a great deal of variation in the relative size of the eyes.

Since all these animals with unusually large eyes come from the waters off South Georgia, I suggest that they may represent a geographical race. All the specimens except those from station WS 29 are fully adult and are considerably larger than adults from other localities—their average length being 22·47 mm. compared with an average of about 18 mm. from other stations.

Boreomysis illigi sp.n.

(Fig. 11 B–E)

1930 *Boreomysis rostrata* Illig, pp. 214–19, figs. 28–35 (♂♂ only).

OCCURRENCE:

St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 1 imm. ♀, 14 mm.

St. 298. 29. viii. 27 (day). West of Cape Verde, 1200–900(–0) m., 1 imm. ♂, 2 adult ♀♀, 16 mm. (Colour note, 'Clear scarlet throughout'.) TYPES.

St. 696. 12. v. 31 (day). Between Cape Verde Is. and St Paul's Rock, 1000–750 m., 1 badly damaged imm. ♀.

St. 1602. 27. x. 35 (night). West of Cape Frio, 470–300 m., 2 imm. ♂♂.

St. 2034. 6. iv. 37 (night). West of Cape Town, 162–0 m., 1 damaged ♀, 16 mm.

DESCRIPTION. *Rostrum* acutely pointed with the lateral margins convex for most of their length but concave near the distal end; extending forward slightly beyond the middle of the eyes (Fig. 11 B, C). *Eyes* well-developed; papilla very long, extending forward beyond the anterior margin of the cornea (Fig. 11 C). *Antennal scale* four times as long as broad at its widest part; outer margin slightly sinuous; apex well-developed and extending beyond the tooth which terminates the unarmed outer margin (Fig. 11 D). *Thoracic appendages* small and slender; distal portion of the endopod of the second pair not prehensile but exactly as figured by Illig (1930, p. 417). *Uropods* long and slender; exopod longer than the endopod; unarmed portion of the outer margin nearly one-fifth of the total length, terminated by two small unequal spines, the inner nearly twice as long as the outer; endopod slightly longer than the telson, armed with two long slender spines on the inner margin distal to the statocyst (Fig. 11 E). *Telson* three times as long as broad at the base; spines arming the lateral margins slightly unequal, but with no trace of the eight or ten very long spines which are present in *B. rostrata*; cleft deep and narrow, one-fourth of the length of the telson in depth, base of the cleft without the lateral notches, which produce the characteristic dilatation at the proximal end of the cleft of the telson in *B. rostrata* (Fig. 11 E).

Length of adult female, 16 mm.; none of the males is adult.

Colour. Clear scarlet throughout.

REMARKS. When Illig (1906*a*, p. 196; 1930, pp. 414–19) founded the species *B. rostrata*, he recorded and figured quite considerable differences between the males and the females. He regarded these as sexual variations. Later workers considered that these differences were too fundamental to be explained on these grounds and it has long been felt that Illig was really dealing with two distinct species. W. M. Tattersall (1951, p. 58) accepted Illig's female specimens as the types of *B. rostrata*, but considered that the males should be referred to another species, although he did not suggest a name for it.

In the Discovery collections there are a few specimens of both sexes, which agree remarkably closely with the description and figures given by Illig for the male of *B. rostrata*. The larger females are adult with the brood sac fully developed and the males, though not mature, are sufficiently well-grown to show that there are no appreciable differences between the sexes, and to leave no doubt that they belong to the same species, which is distinct from *B. rostrata*. I suggest that these specimens should be placed in a new species under the name of *B. illigi*, since I regard the males of Illig's *B. rostrata* as the prototypes of the species.

In *B. rostrata* the lateral margins of the telson are armed with eight to ten very long strongly developed spines, the spaces between them being occupied with a number of much smaller spines in graduated series. In *B. illigi* the lateral spines are shorter and relatively stout and, although they do show some arrangement in series, there is no very marked difference between the sizes of the large spines and the small ones. The form of the cleft of the telson is the most striking difference between the two species. In *B. illigi* it is deeper than in *B. rostrata* and its proximal end is rounded without lateral slits or a dilated area. The unarmed portion of the outer margin of the exopod of the uropod is relatively much longer than in *B. rostrata* and its distal end is marked by two spines instead of one. The endopod

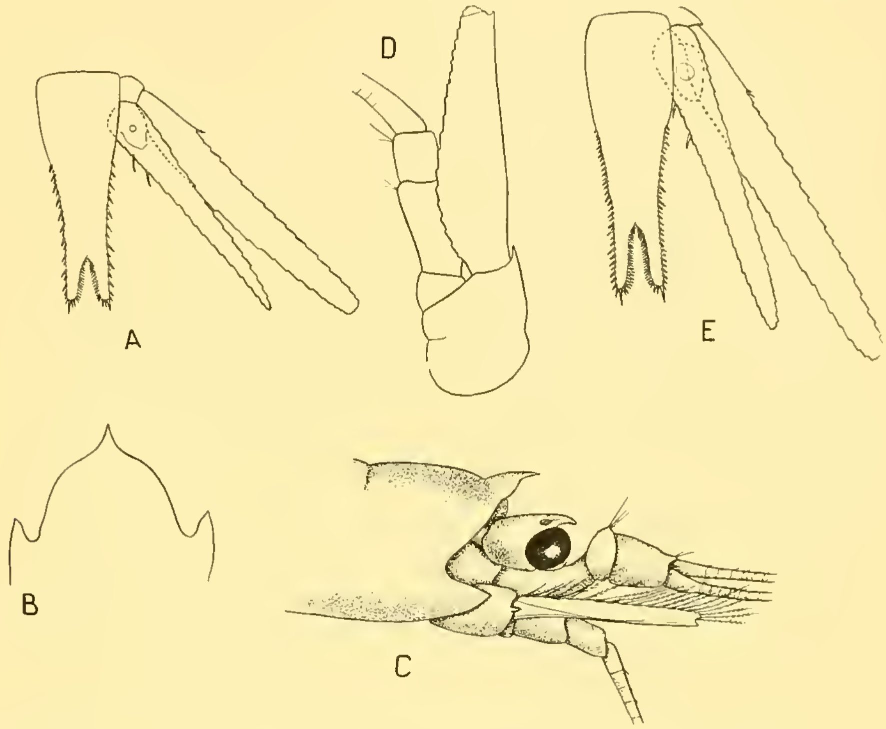

Fig. 11. *Boreomysis plebeja* Hansen. A, telson and right uropod of male in dorsal view, × 16.
Boreomysis illigi sp.n. (B–E). B, anterior margin of carapace of female in dorsal view, × 12; C, anterior end of female in lateral view, × 12; D, right antenna, × 16; E, telson and right uropod in dorsal view, × 16.

is armed with two long spines distal to the statocyst; in *B. rostrata* there is only one spine. The form of the eye is very characteristic in *B. illigi*. It is larger than in *B. rostrata* and the long, strong ocular papilla, with a large ganglion clearly visible at its base, projects forward beyond the anterior margin of the cornea.

Distribution. Illig's male specimens were taken at two stations in the Atlantic, one to the south of the Canary Isles and the other to the south of Sierra Leone, and at one station in the Indian Ocean near Ras Hafun. The Discovery records extend its known geographical range considerably to the southward in the eastern waters of the South Atlantic.

It appears to have a considerable vertical range. Illig's specimens were all taken in vertical hauls, but at Discovery station 696 it was taken in a closing net fishing between 1000 and 750 m. and at station 1602 in a closing net fishing between only 300 and 470 m. At station 2034 an adult female was captured in a night haul from 162 m. to the surface.

Boreomysis plebeja Hansen, 1910

(Fig. 11 A)

1910 *Boreomysis plebeja* Hansen, p. 24, pl. II, figs. 2*a*–2*d*.
1930 *Boreomysis plebeja*, Illig, p. 414.

OCCURRENCE:

St. 1604. 29. x. 35 (night). West of Walvis Bay, 620–500 m., 1 nearly adult ♂, 12·4 mm.
St. 1606. 31. x. 35 (night). West of Orange River estuary, 600–500 m., 1 imm. ♂, 1 imm. ♀, 14 mm.
St. 1989. 10. iii. 37 (day). Off S. Georgia, 1500–1200 m., 1 juv. ♀, 8·8 mm. (Colour note 'rich red head anteriorly, shading off posteriorly to very pale pink; eyes brilliant orange'.)

REMARKS. This species was founded by Hansen on a single immature female with the marsupium not yet developed. The Discovery collection contains one adult male (unfortunately with the pleopods badly damaged), one immature male and an immature female with small but well-developed marsupium. These specimens are considerably larger than the type and the slight differences in proportions which they show are probably due to growth changes.

The species can be recognized by the long acute rostrum, the small eyes with very long ocular papillae (which in these specimens extend considerably beyond the anterior margin of the cornea), the long slender uropods and the comparatively broad telson with no trace of a dilatation at the base of the cleft. In these specimens the antennal scale is broader than in the type, being only three times as long as broad at its widest part. The apex, however, agrees with the type, being relatively long and extending clearly beyond the tooth which terminates the unarmed outer margin of the scale.

Hansen did not figure the uropods, but recorded that the exopods were long and slender and that the proximal fourth of the outer margin was naked and terminated by a single spine. The Discovery specimens agree with this description and I can now add the fact that the endopods, which are also very slender, are armed on the inner margins, just distal to the statocyst, with two long delicate spines (Fig. 11 A).

DISTRIBUTION. The type was taken off the west of the Moluccas. Illig (1930, p. 414) recorded a single small immature female from the Benguela Current to the north-west of Cape Town. The Discovery specimens were also taken in the Benguela Current, somewhat farther north—from west of the Orange River estuary and from west of Walvis Bay.

Boreomysis sibogae Hansen, 1910

1910 *Boreomysis sibogae* Hansen, p. 25, pl. ii, figs. 3*a*–*c*.
1951 *Boreomysis sibogae*, Tattersall, p. 51.

OCCURRENCE:

St. 85. 23. vi. 26 (night). West of Cape Town, 2000(–0) m., 1 imm. ♀, 18 mm.
St. 693. 10. v. 31 (day). Mid-Atlantic, equatorial zone, 250–0 m., 1 imm. ♀, 20 mm.
St. WS 26. 18. xii. 26 (night). North of Bird I., South Georgia, 1000–750 m., 1 imm. ♀, 7 mm.
St. WS 29. 19. xii. 26 (day). North-west of South Georgia, 50–0 m., 1 imm. ♀, 22 mm.

DISTRIBUTION. This species has been recorded from the Dutch East Indies (Hansen, 1910), Indian Ocean off Ras Hafun (Illig, 1930) and the Sea of Okhotsk (Tattersall, 1951). I somewhat doubtfully refer the specimens from stations 85 and WS 29 to *B. sibogae*. They are damaged, but they appear to resemble this species more closely than any other. If my identification of them is correct, the known geographical range of the species is considerably extended to the southward.

Boreomysis brucei Tattersall, 1913

1913. *Boreomysis brucei* W. M. Tattersall, p. 869, figs. 11–13.

OCCURRENCE:

St. 208. 7. iv. 27 (day). Off Livingstone I., South Shetlands, 800(–0) m., 1 imm. ♀, 25 mm.

St. 590. 14. i. 31 (day). West of Graham Land, 1400–1150 m., 1 very young ♀, 14 mm. (Colour note, 'Red with golden eyes'.)

St. 661. 2/3. iv. 31. South Sandwich Is., three hauls: (i) 3000–2000 m. (night), 1 adult ♀, 31 mm.; (ii) 2000–1500 m. (night), 1 juv. ♂, 16 mm.; (iii) 1500–1000 m. (day), 1 very young specimen, 9 mm.

St. 1702. 17. iii. 36 (day). Ice Edge off Wilkes' Land, 2000–1250 m., 1 badly damaged juv. ♀.

St. 1869. 11. xi. 36 (day). East of South Shetlands, 1550–1000 m., 1 adult ♀, 25 mm., 2 juv. ♀♀. (Colour note, 'Bright orange red throughout'.)

St. 1871. 12. xi. 36 (day). East of South Shetlands, 1450–1000, 3 small imm. ♀♀.

St. 1966. 16. ii. 37 (day). Scotia Sea, 1800–1500 m., 1 imm. 25 mm. (Colour note, 'Red, dark head'.)

St. 1991. 11. iii. 37 (day). South-east of South Georgia, 1500–1000 m., 3 very badly damaged immature specimens. (Colour note, 'Deep red anteriorly, shading off to abdomen which is pale red; eyes dull yellow ochre'.)

St. 1995. 13. iii. 37 (day). South of South Sandwich Is., 1800–1300 m., 1 adult ♂, 32 mm.

St. WS 385. 16. ii. 29 (night). Bransfield Strait, South Shetlands, 1000–750 m., 1 almost adult ♀, 30 mm.

REMARKS. These specimens differ only in one small detail from the description of *B. brucei*. Tattersall (1913, p. 869) stated that there were no spines arming the inner margin of the endopod of the uropod. In the Discovery specimens there is one small very inconspicuous spine just distal to the statocyst.

DISTRIBUTION. The types of this species were taken in the Weddell Sea by the Scottish National Antarctic Expedition. The Discovery records indicate that it is a deep-water form confined to the Antarctic and the colder waters of the South Atlantic.

Boreomysis atlantica Nouvel, 1942

1942*c* *Boreomysis atlantica* Nouvel, p. 3, figs. 5–8.

1943 *Boreomysis atlantica*, Nouvel, p. 55, figs. 66–76.

OCCURRENCE:

St. 100C. 4. x. 26 (day). West of Cape Town, 2500–2000 m., 1 ♀, 17 mm.

St. 245. 10. vi. 27 (day). West of Tristan da Cunha, 2000–1800 m., 1 imm. ♂, 22 mm.

St. 395. 13. v. 30 (day). North-east of South Georgia, 1600–1500 m., 1 adult ♀, 21 mm.

REMARKS. Nouvel's type was a very badly mutilated adult female whose length he estimated as approximately 23 mm. The only detail in which the Discovery specimens differ from the type is in the cleft of the telson which is slightly deeper—rather more than one-fifth of the length of the telson compared with one-sixth in Nouvel's female.

DISTRIBUTION. The Discovery records from the South Atlantic considerably extend its known geographical range, the type having been captured off the Azores.

Boreomysis inermis (W.-Suhm) 1874

1874 *Petalophthalmus inermis* W.-Suhm, p. xv; 1876, p. 575.

1875 *Petalophthalmus armiger* (♀) W.-Suhm, p. 7, pl. 41, figs. 1, 3–14.

1884 *Boreomysis scyphops* G. O. Sars, p. 34; 1885*a*, p. 178, pl. 32, figs. 10–20.

1893 *Boreomysis suhmi* Faxon, p. 218.

1908 *Boreomysis distinguenda* Hansen, p. 100, fig. 2*a–b*.

1913 *Boreomysis distinguenda*, W. M. Tattersall, p. 869.

1951 *Boreomysis inermis* W. M. Tattersall, p. 46.

Occurrence:

St. 146. 8. i. 27 (day). Off South Georgia, 728 m., 1 imm. ♂, 24 mm.

Remarks. W.-Suhm gave a description of a very large mysid collected off the Crozet Islands by the Challenger Expedition in 1873. On account of the peculiar form of the eyes he referred it to the genus *Petalophthalmus* and, because it lacked the strong prehensile mandibular palp found in that genus, he provisionally gave it the specific name *inermis*.

G. O. Sars later founded the species *Boreomysis scyphops* on some specimens from the waters to the north-west of Finmark and gave a very full description and figures of it (1885*b*, p. 56, pl. vi, figs. 1–22). When writing the Challenger Report (1885, *c* p. 178) he referred W.-Suhm's specimen to this new species and, although he admitted that the name *inermis* had priority, he decided that in view of the fact that W.-Suhm had referred it to the genus *Petalophthalmus* and that the specific name he had suggested could have no significance if the specimen did not belong to that genus, he retained his own name of *scyphops*=cup-like eyes. At the same time he referred specimens from two Challenger stations in latitudes 53° S. and 50° S., south-west of Australia, to *Boreomysis scyphops*. Records under this name have since been made from various localities in the North Atlantic and the Arctic seas.

In 1908 Hansen, who did not accept the idea of bipolarity, made a complete study of all the specimens available from the northern hemisphere and compared them very carefully with those from Antarctic waters. He found (1908, p. 100) that there were consistent differences between them in respect of the shape of the eyes and in the proportions of the antennal scale and concluded that there were in fact two separate species. He retained the name of *B. scyphops* for those of the northern hemisphere, since these were the first to be fully described, and instituted the name *B. distinguenda* for the Antarctic form.

From his study of the rich material of the United States National Museum, W. M. Tattersall (1951, p. 46) endorsed Hansen's finding that the specimens from the south Pacific and the Weddell Sea (W. M. Tattersall, 1913) belonged to a different species from those from the northern hemisphere. He found that the Antarctic form was by no means confined to southern waters but that it had in fact a very wide distribution in the deep waters of the eastern Pacific from California to the Behring Sea and westward to the Sea of Othotsk. Tattersall considered that, since it is possible to identify the Challenger specimens from the Antarctic with W.-Suhm's *Petalophthalmus inermis*, that specific name has priority over the later name of *distinguenda* even though no formal and complete description of it was given at first and he recorded the American captures under the name of *Boreomysis inermis*.

Boreomysis microps G. O. Sars, 1884

1884 *Boreomysis microps* G. O. Sars, p. 35.
1885*a* *Boreomysis microps*, G. O. Sars, p. 184, pl. 33, figs. 7–10.
1905*a* *Boreomysis subpellucida* Hansen, p. 8, figs. 5–8.
1933 *Boreomysis microps*, Stephensen, p. 11.
1951 *Boreomysis microps*, W. M. and O. S. Tattersall, p. 138, figs. 21 D, 25 A–F.
1951 *Boreomysis microps*, W. M. Tattersall, p. 55.

Occurrence:

St. 100 B. 3/4. x. 26 (night). West of Cape Town, 1000–900 m., 1 imm. ♀, 15 mm.
St. 287. 19. viii. 27 (night). Gulf of Guinea, 1000–800(–0) m., 3 ♂♂, 21 mm.; 2 ♀♀, 19 mm.
St. 2063. 2. v. 37 (day). North-east of Ascension I. 2 hauls, (i) 600–0 m. fragments of ♀, (ii) 1150–600 m., 4 adult ♀♀, largest 20·8 mm., juv. ♂.
St. 2064. 3. v. 37 (day). South of Monrovia, 1600–1050 m., 1 ♂, 1 ♀, both juv., 15 mm. (Colour note, 'Deep orange'.)

St. 2065. 4. v. 37 (day). South-west of Sierra Leone, 1600–1050 m., 1 ♂, with large parasite, 18 mm. (Colour note, 'Orange pink'.)

St. WS 996. 12. iii. 50 (day). Open ocean west of Orange River estuary, 1000–750 m., 1 imm. ♀, in two pieces, 12 mm. (Benguela Current Survey).

REMARKS. This species is widely distributed in the warmer waters of the Atlantic Ocean from Britain in the north to the south of South Africa in the south and has not been taken in any ocean other than the Atlantic.[1]

With the specimens from stations 2063 and 2064 there is a colour-note 'deep orange' and with the specimen from station 2065 a colour-note 'orange pink'. W. M. Tattersall (1951, p. 56) records that one bottle containing specimens of *B. microps* from the West Atlantic, to the east of New York, had a label 'coloured orange'.

Boreomysis tattersalli sp.n.

(Fig. 12A–G)

1939 *Boreomysis microps* Tattersall, p. 231, figs.

OCCURRENCE:

St. 1585. 1. v. 35 (night). On equator, Western Arabian Sea, 1400–700 m., 1 ♀ not quite adult, 13·2 mm.

St. 1587. 3. v. 35 (night). Western Arabian Sea, north of equator, 1250–800 m., 1 badly damaged ♀ and 1 ♀ not quite adult, 14·8 mm. TYPE.

DESCRIPTION. *Carapace* very short anteriorly; anterior margin sinuous, being mostly convex but concave distally forming an acute apex which extends forward almost as far as the anterior margin of the eyes (Fig. 12A and C). Last abdominal somite unusually long, measuring very nearly as much as the third, fourth and fifth somites together. *Antennular peduncle* rather long and slender; first segment longer than the second and third segments together with a well-developed setose tubercle on the middle of its dorsal surface; base of the outer flagellum swollen and armed with very long plumose setae (Fig. 12A). *Antennal peduncle* robust, somewhat shorter than the antennular peduncle; *scale* short, extending for one-fifth of its length beyond the antennular peduncle; $3\frac{1}{2}$ times as long as its greatest breadth; spine terminating the unarmed outer margin very long, equal in length to the apex (Fig. 12A, B). *Eyes* moderately large, set widely apart; eyestalks somewhat barrel-shaped with a well-marked short ocular papilla on the dorsal surface; cornea a little wider than the eyestalks and situated terminally. *First thoracic appendage* similar to that of *B. microps*. *Second thoracic appendage* with the distal third of the inner margin of the carpo-propodus concave with the proximal end of the emargination produced into a blunt 'hump' which is armed with a group of five or six long plumose setae but with no spines; dactylus, armed along its inner margin with a close graduated row of spinous spines, bending inward to fit into the concavity of the carpo-propodus to form a strong sub-chela (Fig. 12D, E). *Remaining thoracic appendages* rather slender and similar in form to those of *B. microps*. *Uropods*. Proximal unarmed portion of the outer margin of the exopod one-tenth of the total margin and marked distally with a single slender spine; endopod slightly longer than the telson, bearing a single long slender spine on the under side of the inner margin just distal to the statocyst (Fig. 12F). *Telson* longer than the last abdominal somite, $3\frac{1}{2}$ times as long as broad at the base; lateral margins nearly straight so that the telson appears broader and is not so 'waisted' as in *B. microps* and *B. rostrata*; armed along the distal three-fourths of their length with a large number of spines which are arranged in series with eight or nine very long spines on each side and groups of graduated smaller spines in the spaces between them. *Cleft* less than one-sixth of the telson in depth, armed with

[1] Specimens from the Central Arabian Sea recorded by Tattersall (1939, p. 231) as *microps* are here referred to a new species, *tattersalli* (*vide infra*).

a regular row of strong teeth which become smaller proximally; near the base the margins become strongly concave forming an angle on each side and giving rise to a marked dilatation similar to that found in *B. microps* and *B. rostrata* (Fig. 12F, G). *Length.* None of the Discovery specimens is fully mature. The largest female, measuring 14·8 mm. has small incubatory lamellae. A female (recorded as *B. microps*) by Tattersall (1939, p. 231) measured 17 mm. The male of the species has not been seen.

Remarks. *B. tattersalli* closely resembles *B. microps* but may be distinguished from it by the following characters: (1) the longer, more acutely pointed rostrum; (2) the larger eyes, with the cornea wider than the eyestalk and situated terminally, occupying the whole of the distal end of the organ (in *B. microps* the cornea is small and confined to the outer region of the distal end of the eyestalk so that the visual elements look essentially outward and, in dorsal view, the cornea appears as a narrow band); (3) the absence of a spine at the proximal end of the emargination on the carpo-propodus of the second thoracic endopod.

Nouvel (1943, p. 57, pl. III, figs. 77–84) described a new species, *B. incisa*, in which also there is no spine at the proximal end of the emargination of the second thoracic endopod, but this species can be distinguished from *B. tattersalli* by the longer, sharper rostrum, the much larger, globular eyes and, especially, by the form of the telson which does not have a dilatation at the base of the cleft and in which the spines arming the lateral margins are almost equal in length.

Distribution. The Discovery specimens were taken in equatorial waters of the West Arabian Sea in closing nets fishing between 1400 m. and 700 m. The John Murray specimens were taken in the Central Arabian Sea in two vertical hauls to the surface and in one closing net fishing between 400 m. and 645 m.

Tattersall (1939), in his report of the mysids of the John Murray Expedition, referred four female specimens from the Middle Arabian Sea to *Boreomysis microps.* When making the figures for this report, I failed to find in these specimens the strong spine marking the proximal end of the emargination of the inner margin of the carpo-propodus of the second thoracic endopod, which is a characteristic feature of *B. microps.* Tattersall did not comment on this point in his text. In the Discovery material there are some immature females taken in the West Arabian Sea, which agree precisely with the specimens from the John Murray collection. Through the courtesy of Dr Isobel Gordon of the British Museum of Natural History, I have been able to re-examine the John Murray specimens and have found that they agree completely with the Discovery specimens. I have therefore referred them all to a new species and, since my late husband was the first to see it, I have great pleasure in naming it *Boreomysis tattersalli* in honour of him.

Boreomysis bispinosa sp.n.

(Fig. 12H–L)

Occurrence:

St. 85. 23. vi. 26 (night). West of Cape Town, 2000(–0) m., 1 badly damaged ♀ specimen, too broken to measure.

St. 86. 24. vi. 26 (day). West of Cape Town, 1000(–0) m., anterior end of large ♀.

St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 1 juv. ♂.

St. 239. 2. vi. 27 (day). North-east of South Georgia, 1350–1050(–0) m., 1 adult ♀, 26 mm.

St. 2033. 6. iv. 37 (day). West of Cape Town, 1350–1250 m., 1 adult ♀, 23 mm. (Colour note, 'Deep brilliant orange red'.) ♀ Type.

St. 2057. 29. iv. 37 (day). North east of St Helena, 1450–700 m., 1 adult ♂, 22 mm. (Colour note, 'Brilliant orange generally; thoracic limbs and antennae tinged with rose red'.) ♂ Type.

Description. *Carapace* very short anteriorly, anterior margin rounded with extremely short, upturned rostral projection not reaching the bases of the eyestalks; antero-lateral angles produced forward almost level with the rostrum (Fig. 12 H). *Antennular peduncle* robust; first segment long with well-developed setose tubercle in the middle of the dorsal surface. *Antennal peduncle* sub-equal in length to the antennular peduncle; *scale* broken in all the specimens (Fig. 12 H). *Eyes* large, with thick, cylindrical eyestalks; large, well-developed ocular papilla; cornea terminal, rounded, not wider than the eyestalks (Fig. 12 H). *Second thoracic endopod* very robust and large; inner margin of carpo-propodus not emarginated but armed near the distal end with two long, powerful spines, which are

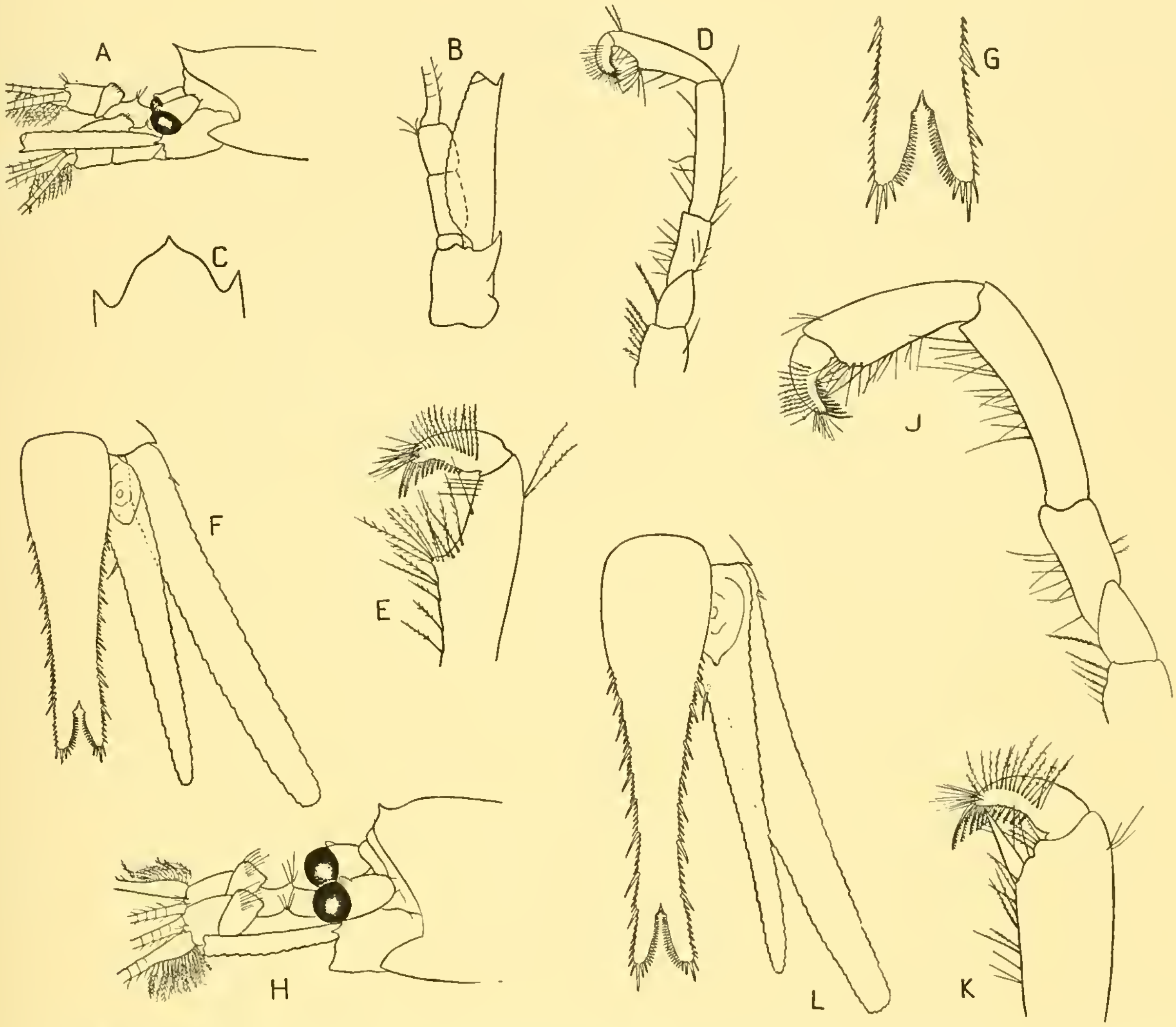

Fig. 12. *Boreomysis tattersalli* sp.n. (A–G). A, anterior end of female in lateral view, × 10; B, right antenna, × 12; C, anterior margin of carapace in dorsal view, × 10; D, endopod of second thoracic appendage, × 12; E, distal end of second thoracic endopod, × 28; F, telson and right uropod in dorsal view, × 12; G, distal end of telson in dorsal view, × 28.

Boreomysis bispinosa sp.n. (H–L). H, anterior end of adult female in lateral view, × 10; J, endopod of second thoracic appendage, × 12; K, distal end of second thoracic endopod, × 28; L, telson and right uropod in dorsal view, × 12.

placed side by side and directed slightly away from each other, so that the robust, well-armed dactylus fits down between them to make a strong prehensile ending to the limb (Fig. 12 J, K). *Pleopods of the male.* Exopods of the second, third and fourth pairs stouter than the corresponding endopods and armed with shorter setae. In the third pair only, the exopod is considerably longer than the endopod—in the other pairs the two rami are of equal length. *Uropods.* Exopod longer and broader than the endopod and slightly bowed outward; unarmed portion of the outer margin very short, less that one-sixteenth of the total length, and terminated by two unequal spines; *endopod* slightly longer than the telson; armed with a single long slender spine distal to the statocyst. In one specimen there is a second spine distal to the first on the inner margin of the endopod; it may be that this character is variable (Fig. 12 L). *Telson* long and relatively slender; longer than the last abdominal somite; lateral margins convex, narrowest portion of telson slightly proximal to the base of the cleft; armed with a large number of spines arranged in a series as in *B. rostrata*. The large spines of the series are particularly long and slender. *Cleft* less than one-seventh of the telson in depth with a marked dilatation at the base (Fig. 12 L).

Length of adult ♂, 22·3 mm., of adult ♀, 23 mm.

REMARKS. This beautiful mysid can be recognized at once by its extremely short upturned rostral projection; by its robust form; by the stout, powerful endopods of the second thoracic appendages with their strong sub-chelate termination and the two strong spines between which the dactylus fits down; by the very short unarmed portion of the outer margin of the exopod of the uropod terminating in two spines and by the long 'waisted' telson with a dilatation at the base of the cleft. Corresponding parts of *B. tattersalli* and *B. bispinosa* are figured on the same scale and a comparison of the second thoracic endopods will show how robust this appendage is in the latter species (Fig. 12). The other thoracic appendages are also relatively longer and stouter than in *B. tattersalli*.

DISTRIBUTION. *B. bispinosa* is a bathypelagic form and has been taken at four stations in the eastern waters of the South Atlantic. The two adult specimens were taken in closing nets fished at 1350–1250 m. and 1400–700 m. respectively.

Boreomysis insolita sp.n.

(Fig. 13 A–J)

OCCURRENCE:

St. WS 979. 7. iii. 50 (night). West of Walvis Bay, South Africa, 100–50 m., 1 adult ♀, 8·2 mm., 1 imm. ♀, 2 small juv. ♀♀.

St. WS 987. 10. iii. 50 (day). South-west of Walvis Bay. Two hauls: (i) 50–0 m., 1 adult ♂, 9 mm., 1 imm. ♂, 7·6 mm., 1 imm. ♀, 7·3 mm., 1 small juv.; (ii) 250–100 m., 3 adult ♂♂, largest 8·2 mm., 3 imm. ♂♂, 4 adult ♀♀, largest 8·4 mm., 3 imm. ♀♀, 4 juv. TYPES.

DESCRIPTION. *General form* small and very slender. *Carapace* somewhat inflated anterior to the cervical sulcus; very short in front with the anterior margin evenly rounded and uptilted to form a delicate, transparent, almost vertical rim and leaving the eyes completely uncovered; no trace of any rostral angle or projection; antero-lateral angles small and not produced (Fig. 13 A–C). *Antennular peduncle* relatively robust; second and third segments turned outward from the plane of the first. In lateral view the dorsal margin of the first segment is almost straight and does not display the concave contour which is usual in the genus (Fig. 13 A, D). *Antennal scale*, slender, four times as long as its greatest breadth; outer margin straight with a very long tooth marking the distal end and extending considerably beyond the truncate apex; *peduncle* nearly two-thirds as long as the scale; composed of four segments, the third of which is set in a different plane from the others giving the peduncle a peculiar distorted appearance. A similar condition is found in some species of the genus *Amblyops*. Outer distal angle of the sympod produced into a strong sharp spine (Fig. 13 B, E). *Eyes* relatively large, globular; cornea occupying half the whole organ; ocular papilla small and inconspicuous (Fig. 13 A–C). *Thoracic appendages* small and very slender; second pair with the distal segment of the endopod rather swollen and not forming a sub-chela (Fig. 13 F). *Second pleopod of the male*, exopod nearly twice as long as the endopod and stouter; distal three segments armed with short modified setae (Fig. 13 G). *Third pleopod of the male* smaller than the second; exopod longer and stouter than the endopod; modified setae at the distal end fewer and longer than in the second pair (Fig. 13 H). *Uropods* slender; unarmed portion of outer margin of the exopod one-fourth of the total margin and terminated by two spines, the inner of which is long and nearly twice as long as the outer; endopod very slender and curving inward somewhat distally; armed with a single small spine on the ventral surface near the margin distal to the statocyst (Fig. 13 J). *Telson* slightly longer than the sixth abdominal somite; lateral margins almost straight and converging distally; armed along the distal five-ninths of their length with 10–13 long slender spines of almost equal size; *apical lobes* each armed with a single very long slender spine which is nearly one-eighth of the length of the telson. There is no trace of the two spines which in other species of *Boreomysis* flank the terminal apical spine on its inner side. *Cleft* less than one-sixth of the length of the telson; no proximal dilatation; margins convex distally; armed with 11–12 long slender teeth which are progressively shorter towards the base (Fig. 13 J).

Length, largest adult male, 9 mm.; females with fully developed brood sacs, 8·4 mm.

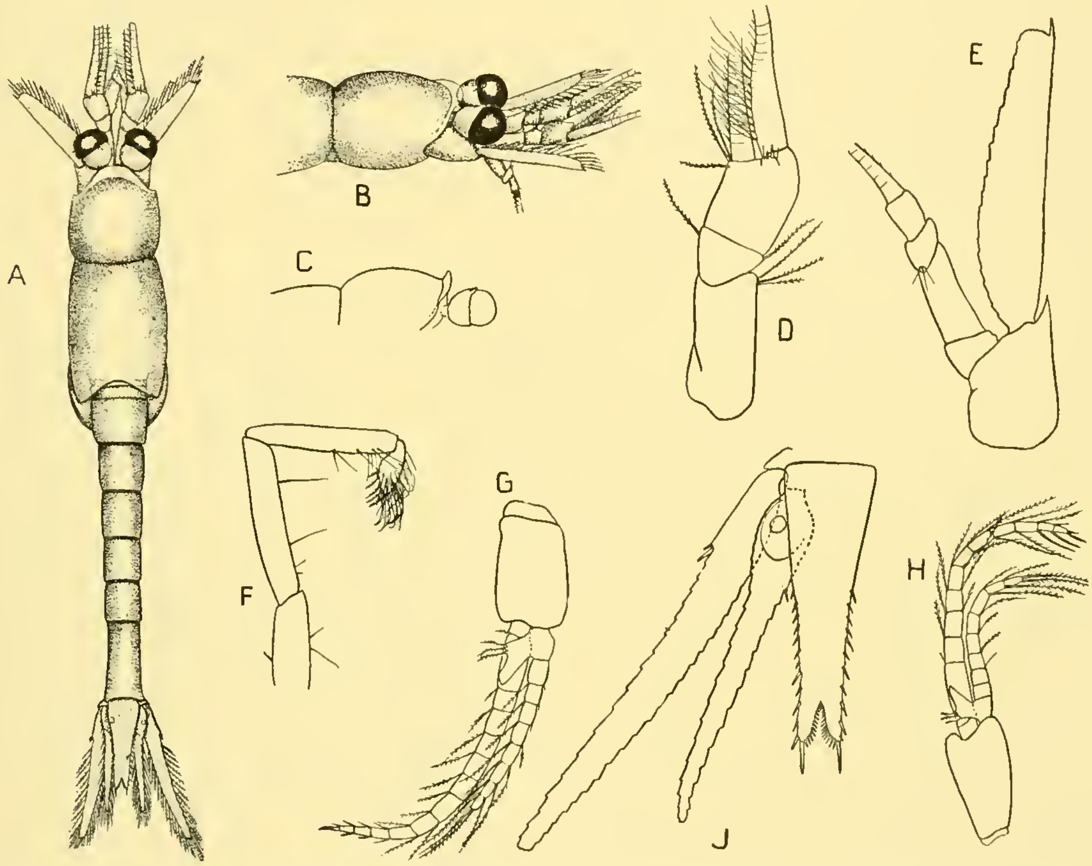

Fig. 13. *Boreomysis insolita* sp.n. A, adult female in dorsal view, × 10; B, anterior end of adult female in lateral view, × 10; C, profile of anterior end of carapace and eye, × 10; D, right antennular peduncle of adult female, × 30; E, right antenna of adult female, × 30; F, endopod of second thoracic appendage, × 30; G, second pleopod of male, × 30; H, third pleopod of male, × 30; J, telson and left uropod in dorsal view (adult female), × 30.

REMARKS. This species can readily be recognized by its small size and delicate slender form and by the rounded uptilted anterior margin of the carapace showing no trace of a rostral angle. The form of the antennal peduncle is quite distinctive and I know of no other species in the genus which has a similar form. The unusually long spine at the distal end of the outer margin of the scale and the long terminal spine arming the apical lobes of the telson together with the few spines arming the lateral margins of the telson make the species readily recognizable. Few and relatively long spines on the margins of the telson are frequently a sign of immaturity, but in the present material there are several definitely adult specimens of both sexes.

DISTRIBUTION. The specimens were taken in depths of 250–100 m., 100–50 m. and 50–0 m. at two stations in the Benguela Current to the west and the south-west of Walvis Bay, South Africa.

Boreomysis acuminata sp.n.

(Fig. 14A–D)

OCCURRENCE:

St. 2055. 28. iv. 37 (day). East of St Helena, 2000–1400 m., 2 badly damaged juv.

St. 2064. 3. v. 37 (day). Just south of equator, north-north-east of Ascension I., 1600–1050 m., 2 adult ♀♀, 15–16 mm.

St. 2065. 4. v. 37 (day). North of equator and south of Sierra Leone, 1600–1400 m., 1 badly damaged adult ♀. (Note on label, 'orange pink'.)

St. 2066. 5. v. 37 (day). South-west of Sierra Leone, 1950–1550 m., 1 adult ♂, 18·2 mm., 1 adult ♀, 19 mm. TYPES.

DESCRIPTION. *General form* slender and very transparent. *Carapace* produced anteriorly into a narrow, very sharply pointed rostrum extending in the female to the middle of the second segment of the antennular peduncle. In the male it is shorter and extends only very slightly beyond the anterior margin of the eyes (Fig. 14A–C). *Antennules* showing marked sexual dimorphism—in the male the peduncle is almost twice as stout as in females of the same size and the flagella are more robust. The base of the outer flagellum in the female is expanded on its inner side and armed with a number of very long, finely plumose setae, but in the male there is little expansion in this region and the setae are comparatively short. The hirsute lobe is long and slender and densely setose (Fig. 14A–C). *Antennal scale* slightly more than 3½ times as long as its greatest breadth; tooth terminating the unarmed outer margin extending well beyond the small apex. *Antennal peduncle* more robust in the male than in the female (Fig. 14A–C). *Eyes* very peculiar and characteristic in both sexes. *Eyestalk* expanded distally especially on its inner side, forming a large triangular projection which terminates in a small rounded papilla. The eyestalk is so transparent that a ganglion at the base of the papilla and the nerves running from it and from the cornea are clearly visible. The *cornea* is small and is confined to a small area on the distal outer area of the eyestalk—its proximal margin is straight giving it a semicircular shape in lateral view (Fig. 14A–C). *Thoracic endopods* rather slender; the distal segments of the second pair do not form a sub-chela. Exopods of both second and third pairs of *pleopods* in the male modified. *Uropods* slender, only slightly longer than the telson; unarmed portion of the outer margin of the *exopod* nearly one-fourth of the total length and terminated by two small spines; *endopod* very slender, distally curving slightly inward; inner margin armed with one delicate spine just distal to the small statocyst (Fig. 14D). *Telson* three times as long as the breadth at the base; lateral margins converging gradually towards the apex and very slightly concave; armed with 35–37 short, somewhat robust spines which are almost regular, but which in some places show a tendency to seriation. *Cleft* deep and narrow; nearly one-third of the telson in depth; lateral margins straight for the greater part of their length, but very convex at the distal end so that the apical lobes are evenly rounded; armed with about twenty-six unusually long fine teeth on each side (Fig. 14D).

Length of adult male, 18·2 mm.; of adult females, 17–19 mm.

Colour. In the tube from station 2064 there is a note, 'deep orange', and in that from station 2065, 'orange pink'.

REMARKS. This species can at once be recognized by the very sharply pointed rostrum and by the peculiar eyes. I was in some doubt as to whether these specimens should be referred to *B. fragilis* Hansen, because the material is not in good condition and I thought that the form of the eye might be due to distortion. Hansen's description is not very detailed and he only gives two figures. Accordingly, I asked Dr Waldo L. Schmitt whether it might be possible to have the types examined. This was very kindly done by Dr Fenner A. Chace, Jr., who further lent me a few specimens which had been identified as *B. fragilis* by Hansen himself. From his report on the male holotype and from my own examination of the other material, it was clear that the Discovery specimens did not belong to *B. fragilis*.

I found one or two points, however, in which Hansen's figures do not fully agree with the specimens of *B. fragilis* which I examined. He neither records nor figures any spines arming the inner margin of the endopod of the uropod, but on close examination I found that in every case there was a single slender spine just distal to the statocyst and, in two cases, there was a second spine distal to the first. In the report on the holotype male, Dr Chace states, 'I find that there is not only a spine on the lower

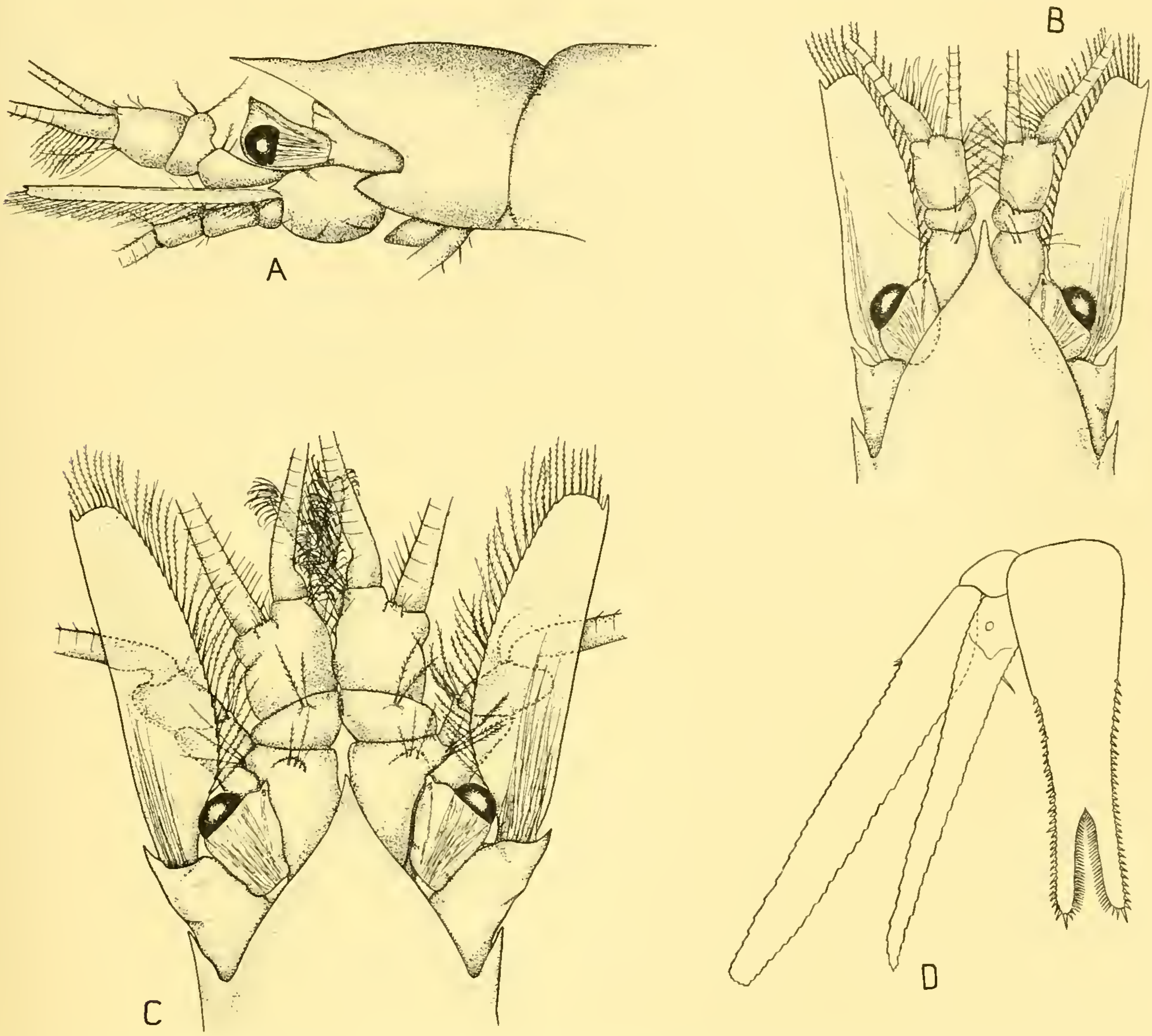

Fig. 14. *Boreomysis acuminata* sp.n. A, anterior end of female in lateral view; B, anterior end of female in dorsal view; C, anterior end of male in dorsal view; D, telson and left uropod in dorsal view. All × 15.

surface of the inner branch of the uropod just inside the median margin and just distal to the statocyst, as mentioned in your specimens from the south-eastern Atlantic, but there is also a second similar spine about the same distance distal to the first as the latter is from the base of the inner branch of the uropod.' He goes on to say that on one uropod he could find only one spine and suggests that the other may have been knocked off. The material is in poor condition and the specimens are fragile, as Hansen evidently recognized, and it may be that normally there are two spines arming the under side of the inner margin of the endopod and in those cases where only the proximal one is present the distal one, being more exposed, has been broken off.

In Hansen's figure of the anterior end of *B. fragilis* (1912, pl. I, fig. 3*a*), the apex of the antennal scale is equal in length to the spine terminating the outer margin, but in the specimens which I examined from Albatross stations 4676 and 4655 the apex extends well beyond the terminal spine. Hansen mentions that the lateral margins of the cleft of the telson are divergent, but in his figure (pl. II, fig. 1*a*) the cleft is very much narrower than in the specimens which I saw.

B. acuminata may be distinguished by the very acutely pointed rostrum, which is longer in the female than in the male, by the broad antennal scale with its very short apex and longer terminal spine of the outer margin, by the peculiar form of the eyes with the small cornea looking essentially outward, by the relatively broad telson with its very deep, narrow cleft and by the short, robust, almost regular spines arming the lateral margins of the telson.

DISTRIBUTION. At all the stations where this species was taken by 'Discovery II', it was captured in deep water between 1400 m. and 2000 m. It is evidently a bathypelagic form. Three of the stations were near the equator in the west of the Gulf of Guinea and the fourth was to the west of St Helena.

Subfamily SIRIELLINAE

Genus Siriella Dana, 1850

1829 *Cynthia* J. V. Thompson, p. 57.
1850 *Siriella* Dana, p. 129.
1850 *Cynthilia* White, p. 46.
1861 *Promysis* Kröyer, p. 70.
1882*a* *Protosiriella*, p. 27; *Siriellides*, p. 32; *Rhinomysis*, p. 35; *Heterosiriella*, p. 38, Czerniavsky.
1884 *Pseudosiriella* Claus, p. 275.

Siriella thompsonii (Milne-Edwards) 1837

1837 *Cynthia thompsonii* H. Milne-Edwards, p. 462.
1852 *Siriella vitrea* Dana, p. 656, pl. 43.
1852 *Siriella brevipes* Dana, p. 658, pl. 44.
1861 *Cynthia inermis* Kröyer, p. 44, fig. 6*a–g*.
1868 *Siriella edwardsii* Claus, p. 278, figs.
1882*a* *Siriellides indica* Czerniavsky, p. 103, figs.
1885*a* *Siriella thompsoni* G. O. Sars, p. 205, pl. 36, figs. 1–24.
1910 *Siriella thompsonii*, Hansen, p. 31.
1911*a* *Siriella thompsonii*, W. M. Tattersall, p. 193.
1912 *Siriella thompsonii*, Hansen, p. 192.
1943 *Siriella thompsoni*, Nouvel, p. 62.
1951 *Siriella thompsonii*, W. M. Tattersall, pp. 7, 9, 10, 60.

OCCURRENCE:

St. 34° 23′ N., 14° 32′ W. 14. x. 25 (day). East of Madeira, surface, 4 adult ♀♀ (1 ovig.), 1 juv. ♀, 4·5–5 mm.
St. 87. 25. vi. 26 (day). South Atlantic, West of Cape Town, 1000(–0) m., 1 ovig. ♀, 5 mm., 1 juv. ♂, 1 juv. ♀.
St. 89. 28. vi. 26 (day). Off Cape Town, 2 hauls: (i) 1000(–0) m., 1 adult ♂, 10 mm., 1 small juv. ♀; (ii) 1000(–0) m., 1 ♂, 9·5 mm., not fully adult.
St. 256. 23. vi. 27 (day). South Atlantic, west of Cape Town, 850–1100(–0) m., 3 very small juv.
St. 257. 24. vi. 27 (night). West of Cape Town, 250(–0) m., 3 adult ♂♂, 11 mm., 1 adult ♂, 8·5 mm., 3 ovig. ♀♀, largest 10 mm., 3 ♀♀ juv.
St. 258. 25. vi. 27 (night). West of Cape Town, 450–320 m., 1 imm. ♂, 7·5 mm.
St. 268. 25. vii. 27 (night). Off Cape Frio, 1000–150(–0) m., 9 adult ♂♂, largest 10·5 mm., 2 adult ♀♀, 7·5 mm.
St. 437. 20. ix. 30 (night). East of Durban, 123–0 m., 1 adult ♂, 10 mm.
St. 441. 22. ix. 30 (night). South-east of Durban, 180–0 m., 1 adult ♂, 9 mm.
St. 448. 10. x. 30 (night). South-west of Cape Town, 161–0 m., 1 adult ♂, 11 mm.
St. 673. 25. iv. 31 (night). West of Tristan da Cunha, 340–0 m., 2 ♂♂, larger 11 mm., 1 juv. ♂.

St. 677. 27/8. iv. 31 (night). North-west of Tristan da Cunha, 420–0 m., 5 adult ♂♂, 7–8 mm., 4 adult ♀♀, 5–6 mm. (2 ovig.), 1 damaged ovig. ♀, 5 mm.

St. 679. 29. iv. 31 (day). South-east of Rio de Janeiro, 2 hauls: (i) 300–0 m. (night), 2 adult ♂♂, larger 11 mm., 1 imm. ♀.; (ii) 500–250 m., 1 ovig. ♀, 4·5 mm.

St. 685. 3. v. 31 (night). East of Pernambuco, 350–0 m., 8 adult ♂♂, largest 7·5 mm.

St. 689. 6. v. 31 (night). East of Pernambuco, 410–0 m., 5 adult ♂♂, largest 7·4 mm., 4 juv. ♂♂; 3 adult ♀♀, largest 6·2 mm., 2 juv. ♀♀.

St. 694. 10. v. 31 (night). Mid-Atlantic, north-west of St Paul's Rocks, 210–0 m., 1 juv. ♂, 3·5 mm.

St. 695. 11. v. 31 (night). South-south-west of Cape Verde Is., 370–0 m., 10 adult ♂♂, largest 7·2 mm., 1 juv. ♂; 1 adult ♀, 5 mm., 3 juv. ♀♀.

St. 697. 12. v. 31 (night). South-west of Cape Verde Is., 460–0 m., 1 adult ♂, 8·5 mm.

St. 698. 13. v. 31 (night). South-west of Cape Verde Is., 470–0 m., 3 adult ♂♂, largest 9 mm., 2 adult ♀♀, with empty brood sacs, 7·5 mm.

St. 699. 14. v. 31 (night). West-south-west of Cape Verde Is., 370–0 m., 1 adult ♂, 11·2 mm.

St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 2 ♂♂, 10 mm., 1 ♀ adult, 6 mm.

St. 703. 18. x. 31 (night). South-south-west of Cape Verde Is., 358–0 m., 1 adult ♂, 11 mm.

St. 704. 19. x. 31 (night). South-west of Cape Verde Is., 231–0 m., 7 imm. ♂♂, largest 6·4 mm., 6 adult ♀♀ (1 ovig.), 5·5–6·8 mm., 1 small juv. ♀.

St. 705. 20. x. 31 (night). On equator north-east of Pernambuco, 150–0 m., 1 adult ♀, 7 mm.

St. 706. 21. x. 31 (night). North-east of Pernambuco, 354–0 m., 1 adult ♀ with large empty brood sac, 7 mm.

St. 709. 24. x. 31 (night). Off Abrolhos Is., 216–0 m., 1 adult ♂, 5·5 mm.

St. 713. 29. x. 31 (night). East of Porto Alegra, 200–0 m., 1 imm. ♀, 5 mm.

St. 1371. 19. v. 34 (night). South-east of Port Elizabeth, South Africa, 146–0 m., 13 adult ♂♂, largest 11 mm., 4 juv. ♂♂, 13 adult ♀♀ (7 ovig.), largest 9 mm., 6 juv. ♀♀, smallest ovig. ♀, 5 mm.; ♂♂ of 7 mm. quite immature.

St. 1372. 20. v. 34 (night). East of East London, South Africa, 102–0 m., 2 adult ♂♂, 10 mm., 1 adult ♀, ovig., 8·5 mm., 1 juv. ♀.

St. 1567. 10. iv. 35 (night). North of Prince Edward I., 1350–0 m., 4 adult ♀♀ with large empty brood sacs, 10–10·2 mm.

St. 1571. 21. iv. 35 (night). Midway between Durban and the south of Madagascar, 500–0 m., 1 adult ♀, 7·5 mm., 1 juv. ♀.

St. 1602. 27. x. 35 (night). West of Cape Frio, 175–0 m., 1 adult ♂, 11·5 mm.

St. 2042. 22. iv. 37 (day). On meridian 0° of Greenwich due west of Saldanha Bay, South Africa, 0–5 m., 1 adult ♀, 5 mm.

St. 2044. 23. iv. 37 (day). Due west of Orange River estuary, 0–5 m., 1 adult ♂, 5·5 mm., 1 juv. ♀.

St. WS 133 'T'. 14/15. vi. 27 (night). Midway between Gough Is. and Cape Town, 0–5 m., 1 adult ♂, 11·5 mm.

REMARKS. The species of the genus *Siriella* present great difficulties to the systematist, because in most of them growth and, with growth, changes in form, continue long after sexual maturity has been reached. As a result, individuals may be fully adult and yet show considerable variation from the published description of the species. In his report on the Challenger Schizopods G. O. Sars (1885*a*, p. 205) commented on the variations in size among the specimens of *S. thompsonii*, but he did not record any differences correlated with size in the armature of the telson and uropods. In the Discovery material also there is great variation in the size of adult individuals. Ovigerous females of 4·5–5 mm. are common, but they may be as much as 10 mm. in length. It appears that the males attain a greater length than the females before they become sexually mature. Only once (station 709) did I find a male of 5·5 mm. which seemed to be sexually mature with well-developed hirsute lobes on the antennules. For the most part males of 7 mm. were obviously immature.

In juveniles and small adults the number of spines arming the outer margin of the exopod of the uropod varies from one to three, in larger animals there may be four, with the beginnings of a fifth, and only in the largest specimens are there six to seven as described in the types. This variation is obviously due to growth changes.

A much more puzzling problem is raised by the form of the telson in specimens from stations 268, 685, 689, 704, 705, 706, 709, 713 and 1602 in this collection. Except for an adult male of 11 mm. from station 1602, in all these specimens, both small ovigerous females (ranging from 4·5 mm. to 7 mm.) and adult males (averaging 7 mm. in length) the exopod of the uropod is armed with only two or three spines. In the descriptions of the type and in all figures given for *S. thompsonii*, the apex of the telson is armed with three pairs of spines with three small median spinules and a pair of plumose setae. These spines are regularly graduated, the outermost pair being shortest and the innermost pair markedly longest. In the specimens from the above-mentioned stations, however, the innermost spines on the telson are shorter than the next pair, often measuring less than half their length. This gives the telson a much more truncate appearance than in the typical *thompsonii*. Were it not for the large male from station 1602, I would have thought that the three characters of small size, number of spines on the exopod of the uropod and the proportions of the apical spines of the telson were sufficient grounds for the formation of a new species. But this specimen is as large as the largest specimens of *thompsonii* and the exopods of the uropods are armed with the typical six spines, leaving only the form of the telson as a constant specific character which does not vary with the growth of the animals. Since there is the closest possible agreement with the typical *thompsonii* in all other respects, I do not feel that there is a valid case for the formation of a new species. All the stations at which these specimens occurred are situated in the West Atlantic, off the coast of South America, from Rio de Janeiro to Pernambuco, and in mid-Atlantic south-west of the Cape Verde Islands. I would suggest that these forms with the short inner pair of apical spines on the telson represent a geographical race of the species *S. thompsonii*. It may be that further research will reveal forms intermediate between them and the typical members of the species.

The following notes on colour are given: station 2042: 'Generally colourless and transparent but thoracic region and head blue and purple translucent', and station WS 133 'T': '*Colour* semi-translucent blue (sky blue) with lavender antennal scales.'

Distribution. *S. thompsonii* is a pelagic oceanic form widely distributed in the upper layers of the warmer waters of the Atlantic, Indian and Pacific Oceans. It has only once been recorded from the Mediterranean (Colosi, 1922, p. 13). This species is most frequently captured at or near the surface at night and is only rarely taken in the same waters by day. This suggests a diurnal migratory rhythm—the animals migrating upward at nightfall and descending to greater depths at the approach of dawn.

The Discovery collection does not extend its known geographical range.

Siriella gracilis Dana, 1852

1852 *Siriella gracilis* Dana, p. 658; 1855, pl. 44, figs. 1*a–g*, 2*a–c*.
1885*a* *Siriella gracilis*, G. O. Sars, p. 209, pl. 36, figs. 25–28.
1910 *Siriella gracilis*, Hansen, p. 31.

Occurrence:

St. 1585. 1. v. 35 (night). Indian Ocean, north-west of Seychelles, 500–0 m., 1 adult ♂, 4·4 mm.

Distribution. This is an oceanic form widely distributed in the warmer waters of the Indian and Pacific Oceans and has not been recorded from the Atlantic.

Siriella aequiremis Hansen, 1910

1910 *Siriella aequiremis* Hansen, p. 40, pl. 3, figs. 4*a–c*; pl. 4, figs. 1*a–l*; 1912, p. 194.
1919 *Siriella aequiremis*, Colosi, p. 6; 1920, p. 236, fig. 1*a*.
1937 *Siriella aequiremis*, Coifmann, p. 3.
1951 *Siriella aequiremis*, W. M. Tattersall, p. 78.

OCCURRENCE:

St. 1578. 26. iv. 35 (night). Midway between Comoro Is. and African coast, 500–0 m., 1 adult ♀, with large empty brood pouch, 9·8 mm.

St. 1585. 1. v. 35 (night). Indian Ocean, north-west of Seychelles, 500–0 m., 1 ♂, 8·8 mm., 1 juv. ♀.

St. 1586. 2. v. 35 (night). Midway between Seychelles and Obbia, 550–0 m., 2 adult ♂♂, 9·5 mm.

DISTRIBUTION. An oceanic species widely distributed in the upper and surface waters of the tropical regions of the Pacific and Indian Oceans from the Arabian Sea to the east of China.

Subfamily RHOPALOPHTHALMINAE

Genus Rhopalophthalmus Illig, 1906

1906*a Rhopalophthalmus* Illig, p. 207.

REMARKS. This genus closely resembles *Gastrosaccus* but may be distinguished from it by the absence of spines arming the outer margin of the exopod of the uropod, by the dimorphism of the reduced endopod of the eighth thoracic appendage, by the absence of a cleft in the telson and by the absence of pleural plates on the first abdominal somite of the female. In recording *R. egregius* from South African waters (1952, p. 161) I drew attention to the fact that pleural plates were present on the first abdominal somite of the males of both the known species of *Rhopalophthalmus* and, since the males in the Discovery collections show the same character, I consider that it can be regarded as of generic significance.

Of the two known species of the genus only one, *R. egregius*, is present in the Discovery collections.

Rhopalophthalmus egregius Hansen, 1910

1910 *Rhopalophthalmus egregius* Hansen, pp. 48–50, figs.

1915 *Rhopalophthalmus egregius*, Tattersall, p. 151.

OCCURRENCE:

St. 149. 10. i. 27 (day). Mouth of Cumberland Bay, South Georgia, 200–234 m., 3 ♂♂, largest 10·2 mm.

St. 274. 4. viii. 27 (day). Off St Paul de Loanda, Angola, 65–64 m., about twenty very badly damaged specimens and many fragments. This tube had dried up. (Colour note on label, 'Quite transparent except for black eyes and a dark red median spot at base of telson'.)

St. 279. 10. viii. 27 (day). Off Cape Lopez, French Congo, 58–67 m., 1 adult ♀, 10 mm.

REMARKS. This species can be distinguished from the only other species of the genus, *R. flagellipes*, by the shorter, more robust eyes and by the presence of a very strong spine on the endopod of the uropod at the distal end of the statocyst.

DISTRIBUTION. The species is widely distributed in the shallow coastal waters of the Pacific and Indian Oceans, and has been recorded from the Great Barrier Reef and New South Wales (Tattersall, 1936, p. 147 and 1940, p. 330). It has twice been found in the open ocean, once in the Torres Strait and once near Norfolk Island (Colosi, 1920, p. 237). I have myself recorded it from eight localities from the coasts of South Africa extending from Richard's Bay on the east coast to Langebaan Bay on the west coast (O. S. Tattersall, 1952, p. 161). The three stations at which it was taken by the 'Discovery' considerably extend its known geographical range. In particular its occurrence off South Georgia proves that it can inhabit much more southerly waters than was hitherto supposed.

R. egregius is a euryhaline, eurythermic species living as a rule in swarms at or very near the bottom. It has usually been taken in large numbers in brackish waters of very low salinity which are subject to a considerable range of temperature and it now appears to be widely distributed in the South Atlantic as well as the Indian and Pacific Oceans.

Subfamily GASTROSACCINAE

Genus Gastrosaccus Norman, 1868

1868 *Gastrosaccus* Norman, p. 438.
1872 *Acanthocaris* Sim, p. 4.
1880 *Haplostylus* Kossmann, p. 95.
1882 *Pontomysis* Czerniavsky, p. 79.
1893 *Chlamydopleon* Ortmann, p. 23.

REMARKS. Norman (1868, p. 438) founded this genus for those mysids in which the pleura of the first abdominal somite in the female were produced to form part of the marsupium. The genus is otherwise characterized by having the outer margin of the antennal scale naked and ending in a thorn, the first and second pairs of pleopods of the male well-developed and biramous, third pair with the exopod extremely long and the endopod variable, telson with large apical cleft armed with spines and lateral margins also armed with spines, outer margin of the exopod of the uropod armed with spines and no setae, and the inner margin of the endopod armed with few or many spines. An interesting feature of the genus *Gastrosaccus* is the variation shown in the form of the posterior margin of the carapace. In some forms this is simply emarginate, but in others there may be a pair of median reflexed lobes or large quadrangular lobes, or there may be a number of filiform prolongations forming a fringe.

Gastrosaccus sanctus (van Beneden), 1861

1861 *Mysis sancta* van Beneden, p. 27.
1877 *Gastrosaccus sanctus* G. O. Sars, p. 64.
1882*a* *Gastrosaccus sanctus*, Czerniavsky, 1, p. 85.
1892 *Gastrosaccus sanctus*, Norman, p. 155.
1951 *Gastrosaccus sanctus*, Tattersall and Tattersall, p. 162.

OCCURRENCE:

St. 90. 10. vii. 26 (day). Off Simon's Town, South Africa, 10–12 m., 2 ♀♀, larger nearly adult, 11·5 mm.
St. 149. 10. i. 27 (day). Mouth of Cumberland Bay, South Georgia, 234–200 m., 1 damaged ♀, estimated length 11 mm.
St. 443. 23. ix. 30 (night). South of Knysna, South Africa, 49–0 m., 1 ♂, 11 mm.
St. WS 1000. 13. iii. 50 (night). About 100 miles west of Orange River estuary, 100–50 m., 1 very small juv.
St. WS 1002. 14. iii. 50. Eight miles out to sea off Orange River estuary, 50–0 m., 20 ♂♂, 24 ♀♀ ovig., largest 9 mm.; 350 juv. 3–7 mm.

REMARKS. These specimens do not differ in any essential from the published descriptions and figures of *G. sanctus*. The well-developed reflexed lappets on the hinder margin of the carapace are rather narrower than those I have seen in specimens from British waters and the spines arming the apical lobes and lateral margins of the telson are unusually large, but I do not consider that these slight differences are of specific importance.

DISTRIBUTION. This species is widely distributed in coastal waters of Europe, from the southern parts of the North Sea, the British Isles, the Mediterranean to Suez and the Black Sea. It has been recorded from the west coast of Morocco and from the west coast of Africa, as far south as Casablanca Harbour and the Cameroons (Tattersall, 1927, p. 316). It has also been recorded from the Canary Isles. The Discovery records from the extreme south of South Africa and from South Georgia very considerably extend its known geographical range.

G. sanctus is essentially a shallow water littoral form and has never been recorded from the open ocean. It is markedly euryhaline in northern waters and in the Black Sea lives in a salinity as low as 18‰ while in the Atlantic, near the Canary Islands, it has been found in salinities of 37‰.

Genus Anchialina Norman and Scott, 1906

1861 *Anchialus* Kröyer, pp. 53, 71.
1906 *Anchialina* Norman and Scott, p. 24.

Anchialina typica (Kröyer), 1861
(Fig. 15A–M)

1861 *Anchialus typicus* Kröyer, p. 53, figs.
1910 *Anchialina typica* Hansen, p. 52, figs.
1912 *Anchialina typica*, Hansen, p. 196.
1951 *Anchialina typica*, W. M. Tattersall, p. 100.

OCCURRENCE:

St. 704. 19. x. 31 (night). Mid-Atlantic just north of the equator, 231–0 m., 1 imm. ♂, 4·4 mm.
St. WS 1000 (Benguela Current Survey). 13. iii. 50 (night). West of Orange River estuary. Three hauls: (i) 50–0 m., 5 small juv., 3–3·4 mm.; (ii) 100–50 m., 4 small juv., largest 3 mm.; (iii) 150–100 m., 1 adult ♂, 7·2 mm.

REMARKS. The adult male from station WS 1000 and the smaller male from station 704 conform very closely to the published descriptions and figures of *A. typica*. The small specimens from hauls (i) and (ii) at station WS 1000 show certain differences which I attribute to their immaturity. In them the rostral plate is hollowed from above, but its anterior end is produced between the eyes into an evenly rounded rostrum (Fig. 15G). Hansen (1910, p. 52) explained that in *A. typica* the apparently truncate anterior margin of the carapace with its distinct median emargination is in fact only the profile of the downwardly bent rostrum. The rostral plate is hollowed from above and its anterior tip is bent sharply down between the eyes, but if one raises it with a needle the anterior margin can be seen to be shaped exactly as in the juvenile specimen which I have figured (Fig. 15G).

The spines arming the lateral margins of the telson and the outer margin of the exopod of the uropod in the immature specimens are few in number and are confined to the distal portion only of these margins. This condition is usual in many species of mysids and is a common phenomenon in young animals which are not fully grown (Fig. 15M).

All the specimens taken at station WS 1000 are markedly hispid on the peduncles of the antennae, on the eyestalks, on the pleopods of the males and, more sparsely, on the anterior portion of the carapace and on some of the proximal segments of the thoracic appendages. The specimen from station 704 shows only an indication of this character and I can find no mention of it in earlier descriptions of the species. Neither does it appear in specimens, which I have seen, from Hawaii and the Great Barrier Reef. The only other difference which the Discovery adult male shows is that the modified setae arming the distal end of the exopod of the third pleopod are curved and not straight as figured by Hansen (1910, pl. vii, figs. 2*h* and 2*j*). (Fig. 15E, F.)

On account, however, of their very close conformity in all other respects with the descriptions of *A. typica* I have no hesitation in referring them to this species.

DISTRIBUTION. *A. typica* has been recorded on numerous occasions from the warmer waters of the world—the East Indies, Philippines, Great Barrier Reef, Hawaii, the West Indies and from the tropical regions of the Atlantic, from the coast of America to mid-Atlantic. The Discovery records extend its known geographical range to the eastern waters of the Atlantic. W. M. Tattersall (1951, p. 102) gave a very full account of the geographical distribution of this species and drew attention to the fact that, where large numbers were taken together in night tow-nettings with the use of electric light, the males far outnumbered the females. In some cases they formed 90% of the catch and in others all the specimens were males. It is significant that all the Discovery captures were made at night and that most of the specimens taken were males.

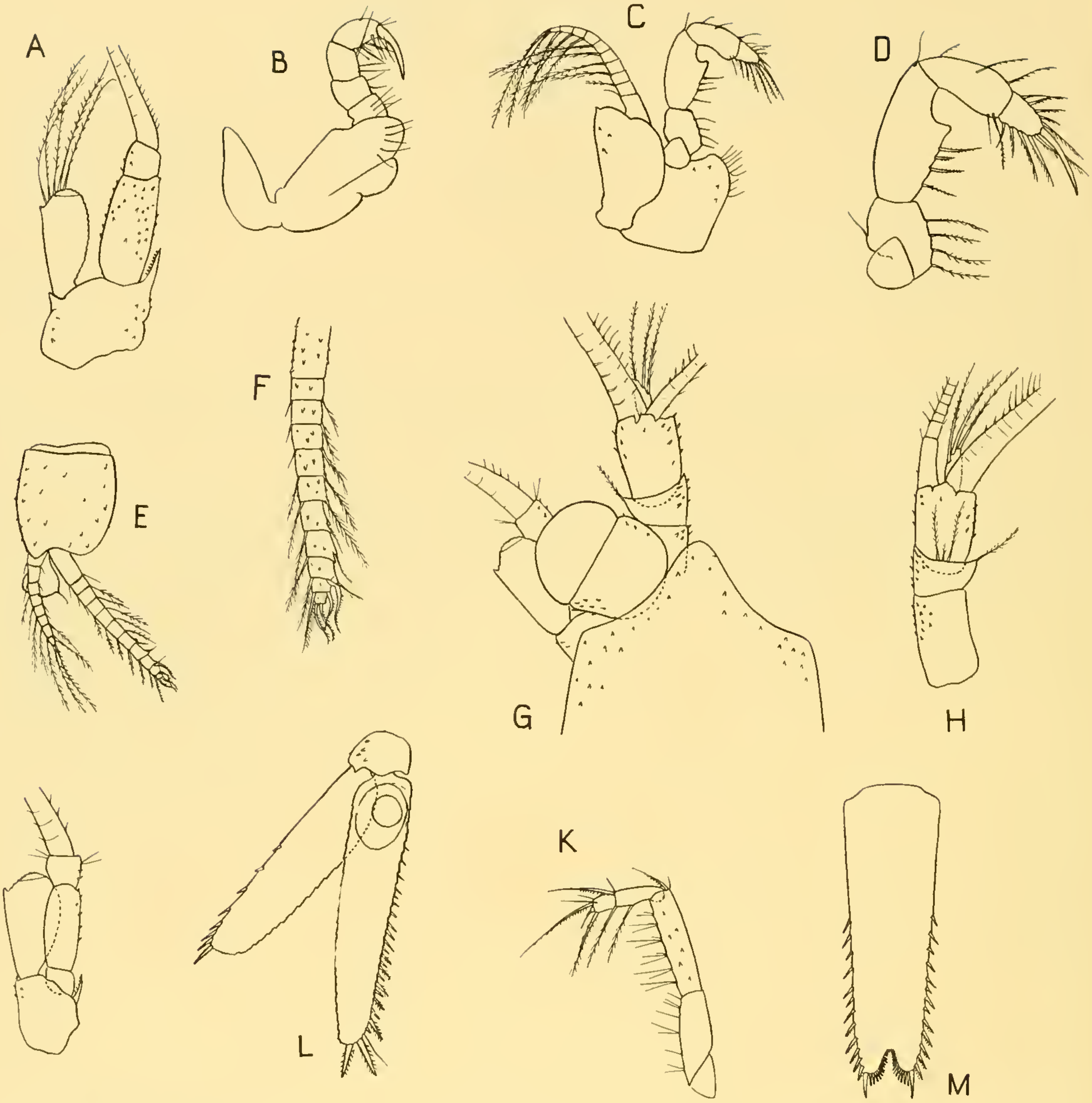

Fig. 15. *Anchialina typica* (Kröyer) (A–F). A, left antenna of adult male, × 35; B, endopod of first thoracic appendage with epipod, × 35; C, second thoracic appendage of male, × 35; D, distal end of second thoracic endopod of male, × 58; E, third pleopod of adult male, × 35; F, expod of third pleopod of male, × 58.

Juvenile male specimen (G–M). G, anterior end of immature male in dorsal view; H, right antennular peduncle, J, left antenna; K, endopod of fourth thoracic appendage; L, left uropod; M, telson in dorsal view. All × 38.

Anchialina truncata (G. O. Sars), 1884

1883 *Anchialus truncatus* G. O. Sars, p. 38.
1885*a* *Anchialus typicus* G. O. Sars, p. 193, figs.
1910 *Anchialina truncata* Hansen, p. 52.
1912 *Anchialina truncata*, Zimmer, p. 10.

Occurrence:

St. 90. 10. vii. 26 (day). Basin of Dockyard, Simonstown, South Africa, 10–12 m. 1 adult ♀ (ovig.).
St. 91. 8. ix. 26 (day). Half a mile off Roman Rock, False Bay, South Africa, 35 m., 1 adult ♂, 1 juv. ♀, fragments.
St. 277. 7. viii. 27 (night). Off Cape Lopez, West Africa, 63(–0) m., 3 adult ♂♂, 8 adult ♀♀ (1 ovig.), 1 juv. ♀.

St. 406. 5. vi. 30 (day). Off Roman Rock, Cape Peninsula, South Africa, 29 m., 1 adult ♂, 3 adult ♀♀ (2 ovig.), 4 juv. ♀♀.
St. 423. 3. ix. 30 (night). Off Port Elizabeth, South Africa, 56–0 m., 28 ♂♂, 6 ♀♀, 2 juv.
St. 424. 4. ix. 30 (night). Off Port Elizabeth, South Africa, 59–0 m., 12 adult ♂♂, 4 juv. ♂♂, 27 adult ♀♀, 5 juv. ♀♀.
St. 443. 23. ix. 30 (night). West-south-west of Port Elizabeth, South Africa, 49–0 m., 34 adult ♂♂, 5 juv. ♂♂, 27 adult ♀♀ (5 ovig.), 4 juv. ♀♀.
St. 444. 24. ix. 30 (night). West of Cape Peninsula, 80–0 m., 13 adult ♂♂, 10 adult ♀♀ with empty brood sacs.
St. 844. 8. iv. 32 (night). Just south of Cape Town, 155–0 m., 2 imm. ♂♂, 6·5 and 5·5 mm.

DISTRIBUTION. Up to the present this species has only been recorded with certainty on two occasions—both from surface water off Cape Town (G. O. Sars, 'Challenger' 1883 and Zimmer, 1912, p. 10). Eight of the nine stations at which it was taken by 'Discovery' and 'Discovery II' are situated off the southern shores of South Africa from Port Elizabeth to Cape Peninsula. At five of these stations it was captured in night hauls and it is interesting to note that the three hauls in which it was taken by daylight were all taken very close in shore. Its occurrence off Cape Lopez considerably extends its known geographical range to the northward. The species is a shallow-water form and all the captures were made at the surface or in vertical hauls from depths of 155–49 m. to the surface.

Subfamily MYSINAE

This subfamily is very rich in genera and for convenience it has been divided by Hansen (1910, p. 12) into four Tribes, Erythropini, Leptomysini, Mysini and Heteromysini.

Tribe *ERYTHROPINI*

1910 Hansen, p. 13.

DEFINITION. Antennal scale usually with the proximal portion of the outer margin naked and terminating in a tooth. In a few genera the scale is reduced or even absent. Thoracic endopods generally with carpus distinct, unsegmented and separated from the propodus by a more or less oblique articulation (transverse in *Arachnomysis*). Propodus usually subdivided into two segments by a transverse articulation. Pleopods of the male well developed, fourth pair with the exopod slightly elongated in a few genera and occasionally armed with modified setae.

Of the twenty-seven genera which are already included in this Tribe, fourteen are represented in the Discovery material and I have added one new genus.

Genus Pseudomma G. O. Sars, 1870

1870 *Psuedomma* G. O. Sars, p. 154.
1870–9 *Psuedomma* G. O. Sars, vol. 1, p. 47.
1930 *Psuedomma* Illig, p. 571.

This genus may readily be recognized by the distinctive form of the eyes. These are rudimentary with no trace of visual elements or pigment and are united in the median line to form a broad, flat, hemispherical plate on the dorsal surface of the head, covering all or part of the bases of the antennular peduncles and antennae. The anterior and lateral margins of this plate may be either more or less serrated, or unarmed. In the anterior median line there is a well-defined cleft, indicating the line of fusion of the two rudimentary eyes which make up the eyeplate.

The antennal scale is unarmed along the proximal portion of its outer margin, the naked region terminating in a more or less strong tooth; the apex of the scale is very varied in the genus, being greatly produced in some species, while in others it is actually shorter than the thorn terminating the outer margin.

The endopods of the third to the eighth thoracic appendages are long and slender, the carpus articulated with the two-segmented propodus: this articulation is usually oblique, but may be transverse; nail setiform. The male genital organ on the eighth thoracic appendage in most species is long and tubular, unarmed except for a strong curved bristle. The pleopods of the male are well-developed and show little modification. In some species the rami of the fourth pair may be of unequal length and there may be some modification of the setae on one or both of them.

The endopods of the uropods are usually considerably shorter than the exopods and generally bear no spines along their inner margins, though there may be a single spine in the region of the statocyst. The telson is entire and linguiform, usually short with an obtusely rounded or truncate apex, the lateral margins usually armed with a limited number of small spines, which are confined to the (at most) distal two-thirds of the margins. The apex of the telson is armed with from two to five pairs of long spines and there is usually a pair of median setae. There are, however, one or two species in which the telson does not conform to the above description and the safest guide to the genus is the form of the eyes.

The identification of the species in this genus in the Discovery material has given me a great deal of trouble and I have come to the conclusion that a considerable amount of individual variation in each species must be accepted unless a large number of new species are to be instituted. In most species the animals are not particularly common or, at least, they are not gregarious in habit for the number taken at each station rarely exceeds one or two. As the specimens are not as a rule in very good condition, I have referred many which do not agree in all points to the same species and have discussed their characters later when describing the species.

Pseudomma armatum Hansen, 1913

1913 *Pseudomma armatum* Hansen, p. 12, figs.
1930 *Pseudomma armatum*, Rustad, p. 7.

OCCURRENCE:

St. 42. 1. iv. 26 (night). Off Cumberland Bay, South Georgia, 204–120 m., 2 ♀♀, 18 mm.
St. 45. 6. iv. 26 (day). East of Jason Light, South Georgia, 270–238 m., 5 ♂♂, 3 ♀♀, largest 18 mm., 4 juv.
St. 123. 15. xii. 26 (day). Off Cumberland Bay, South Georgia, 250–230 m., 1 ♂, 8 ♀♀, 18–20·5 mm.
St. 142. 30. xii. 26 (day). East Cumberland Bay, South Georgia, 273–88 mm., 16 ♂♂, 73 ♀♀, largest 19 mm., 2nd tube, 2 ♂♂, 6 ♀♀, largest 12 mm., all imm.
St. 148. 9. i. 27 (day). Off Cape Saunders, South Georgia, 148–132 m., 1 ♂, 20 mm., 1 ♂ juv.
St. 154. 18. i. 27 (day). Jason Harbour to Larsen Point, South Georgia, 160–60 mm., 18 ♂♂, 16–18 mm., 8 ♂♂ juv., 63 ♀♀, 18–20 mm. (many ovig.), 18 ♀♀ juv.
St. 162. 17. ii. 27 (day). Off Signy Is., South Orkneys, 320 m., 1 ♂, 16 mm. (juv.), 1 ovig. ♀, 22·5 mm., 2 non-breeding ♀♀, 17·5 mm.
St. 167. 20. ii. 27 (day). Off Signy Is., South Orkneys, 344–244 m., 8 ♂♂, juv., 16–19 mm., 2 ♀♀, 19–20 mm., with empty brood pouches, 3 ♀♀ juv. 16 mm.
St. MS 68. 2. iii. 26 (day). East Cumberland Bay, 247–220 m., 3 ♀♀, largest 19 mm. (ovig.), 21 juv.

REMARKS. These specimens are larger than any of this species which have hitherto been recorded. Males of 16–17 mm. have well-developed lobes on the antennular peduncles, but these are not hirsute and each pleopod is not more than three-quarters of the length of the succeeding abdominal somite. Females of 16 mm. are obviously immature. The largest specimen is an ovigerous female from station 162 measuring 22·4 mm.

There is some variation in the length of the apex of the antennal scale. In all specimens from South Georgia it is markedly longer than the tooth terminating the outer margin of the scale (as in *P. belgicae*), but in the specimens from the South Orkneys the apex and the terminal tooth are almost equal in length. The form of the eyeplate is, however, quite typical of *P. armatum* and the form and armature of the telson so closely resemble the descriptions of that species, that, in spite of the differences in the scale, I have no hesitation in referring them to *armatum*.

DISTRIBUTION. Type specimens from 54° 11′–54° 24′ S., 36° 18′–36° 22′ W., South Georgia (Hansen, 1913, p. 12) and three records from Cumberland Bay, South Georgia (Rustad, 1930, p. 7).

If the specimens from the South Orkneys are accepted as belonging to this species, the slight differences between them and the specimens from South Georgia could be attributed to the distance of their place of capture from the area in which all the other records were made.

P. armatum has previously been recorded in temperatures ranging from −0·25° C. to 1·45° C. The Discovery material extends these limits—the lowest temperature being −0·8° at station 162 and the highest 2·08° C. at station 42.

Pseudomma sarsi (W.-Suhm in MS.) G. O. Sars, 1884

1884 *Pseudomma sarsi* G. O. Sars, p. 37.
1885*a* *Pseudomma sarsi*, G. O. Sars, p. 189, figs.
1913 *Pseudomma sarsi*, Hansen, p. 13.
1930 *Pseudomma sarsi*, Rustad, p. 7, figs.

. OCCURRENCE:

St. 45. 6. iv. 26 (night). East of Jason Light, South Georgia, 270–238 m., 1 juv. ♂ (broken).
St. 140. 23. xii. 26 (day). South Georgia, 136–122 m., fragments.
St. 142. 30. xii. 26 (day). East Cumberland Bay, South Georgia, 273–88 m., 1 adult ♀, 9·8 mm., 2 juv. ♀♀.
St. 149. 10. i. 27 (day). Cumberland Bay, South Georgia, 200–234 m., 1 adult ♀, 11 mm.
St. 154. 18. i. 27 (day). South Georgia, 160–60 m., 3 adult ♀♀, 10–11 mm.
St. 162. 17. ii. 27 (day). South Orkneys, 320 m., 1 imm. ♂, 10·8 mm.
St. 167. 20. ii. 27 (day). South Orkneys, 344–244 m., 1 adult ♀ with empty brood pouch, 13·5 mm.
St. 1957. 3. ii. 37 (day). South Shetlands, 785–810 m., 1 juv. ♂, 1 ♀, 11 mm.
St. WS 213. 30. v. 28 (day). North of Falkland Is., 239–249 m., 1 ♀, 9 mm.
St. WS 234. 5. vii. 28 (night). North of Falkland Is., 207–195 m., 1 ♂, 9·5 mm., 1 juv. ♀.
St. WS 818. 17. i. 32 (day). Patagonian Shelf, 272–278 m., 1 adult ♂ (damaged).

REMARKS. In many respects this species closely resembles both *P. roseum* G. O. Sars and *P. truncatum* S. I. Smith, but may be distinguished by the form of the antennal scale and by the armature of the apex of the telson. Although there appears to be some variation in the relative length of the apex of the antennal scale in *P. sarsi*, it never measures more than one-fifth of the total length of the scale, and may be less, while in *P. roseum* it occupies from one-third to one-half of the total length and in *P. truncatum* one-third to one-fourth of the total length.

I find that in these specimens the apex of the telson is more rounded than in Sars's figures, but it is almost precisely as figured by Rustad (1930, p. 8) and in this respect the species may readily be distinguished from *P. truncatum*. It can be distinguished further by the arrangement of the apical spines. These are set closely together and increase regularly in size towards the middle line. There are usually four pairs of these spines; the most distal lateral spine is set close to the apex and is intermediate in length between the large apical spines and the small lateral ones. In both *P. roseum* and *P. truncatum*, there are usually two pairs of apical spines and they are more spaced than in *P. sarsi*.

The specimens which I have here referred to *P. sarsi* have been difficult to identify. Although they agree in general form, they show variation in the serrulation of the eyeplate, in the length of the apex of the antennal scale, in the relative lengths of the rami of the uropods and in the number of small spines arming the lateral margins of the telson. The material is not sufficiently well preserved nor are there enough specimens to decide whether these variations are of specific value.

The specimen recorded by Rustad was taken from water of a temperature of 0·55° C. and he states that it can probably thrive in temperatures as low as 0·37° C. The Discovery material proves that his surmise was correct, for the species was taken in waters ranging in temperature from over 6° C. at station 226 down to −0·8° C. at station 162.

DISTRIBUTION. Off Kerguelen Island, 120 fm.; South Georgia, 75 m. and 250 m.; Cumberland Bay, South Georgia, 140–0 m.; South Shetlands, 785–810 m.

Apart from Sars's original record from Kerguelen Island, until now this species has been recorded only from off the north-east and north coasts of South Georgia. (Sars's specimen from the Antarctic from 65° 42′ S., 79° 49′ S. was much larger and in all probability belonged to *P. belgicae.*) The present records very considerably enlarge its known geographical range to the west in the South Atlantic.

All the specimens referred to this species have been taken in depths of 75–320 m. except at station 1957 (785–810 m.).

Pseudomma antarcticum Zimmer, 1914

1914 *Pseudomma antarcticum* Zimmer, p. 389, figs.

OCCURRENCE:

St. 182. 14. iii. 27 (day). Schollaert Channel, South Shetlands, 500–278 m., 1 adult ♀, 18 mm., 1 ♀ (damaged) and fragments.

St. 1957. 3. ii. 37 (day). South Shetlands, 785–810 m., 1 ♂, 20 mm., 1 ovig. ♀, 21·5 m., 2 juv.

REMARKS. These specimens agree remarkably closely with the description and figures given by Zimmer, the only difference being a slight variation in the shape of the anterior margin of the eye-plates and in the number of serrulations on the antero-lateral borders. The anterior borders of the eye-plate are not evenly arcuate, but show a slight concavity at about one-third of their length from the median line. From the median cleft up to this concavity the margin is naked and onwards from it the antero-lateral margins are armed with about 20–25 very fine serrulations. The long plumose setae on the inner margins of the second and third segments of the antennular peduncles are particularly noticeable.

DISTRIBUTION. The only previous record of this species is of the type from 65° 15′ S., 80° 0′ E. at a depth of 3425 m. The Discovery specimens were taken nearly as far south, but in much shallower water, depth 278–500 m.

Pseudomma belgicae (Hansen in MS.), Holt and Tattersall, 1906

1906*b* *Pseudomma belgicae* Holt and Tattersall, p. 8.
1908 *Pseudomma belgicae*, Hansen, p. 12, figs.
1908 *Pseudomma belgicae*, Tattersall, p. 27, figs.
1913 *Pseudomma belgicae*, Hansen, p. 11, figs.

OCCURRENCE:

St. 181. 13. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 160–335 m., 4 imm. ♂♂, 20–22 mm., 1 adult ♀ with abdomen missing.

St. 182. 14. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 278–500 m., 1 ♂, 23·5 mm., 1 juv. ♀ and fragments.

St. 1644. 15. i. 36 (day). Bay of Whales, 626 m., 2 ♀♀, 22·4 mm.

REMARKS. This species may be distinguished by the large ocular plate, which shows no trace of serrulations and has only a small median cleft on the anterior margin, which is almost straight without any kind of protuberances; by the comparatively long antennal scale with its apex extending only very slightly, if at all, beyond the particularly strong tooth which terminates the naked outer margin;

by the very long exopods of the uropods; and by its large size. *P. belgicae* is larger than any other species of the genus which has been recorded. The four whole specimens from station 181 are immature and measure more than 20 mm. The male from station 182 is not fully adult and measures 23·5 mm. The females from station 1644 are not breeding, although they seem to be adult. The female from station 181 is adult but, unfortunately, the posterior portion of the body is missing. From the proportions of the anterior end, I think that the animal must have measured about 30 mm. Hansen (1913, p. 12) recorded a male specimen measuring 27 mm.

P. frigidum is the only other species of the genus to attain a comparable size, but it can be distinguished from *P. belgicae* by the marked serrulations on its eyeplate and by the considerably elongated apex of the antennal scale.

DISTRIBUTION. This species is an entirely antarctic form with a circumpolar distribution in relatively shallow waters. It was first recorded from 78° 25′ 40″ S., 165° 39′ 6″ E. (Holt and Tattersall, 1906*b*, p. 8) and has since been taken by 'Belgica' and by the Swedish and German Antarctic Expeditions in depths between 150 and 400 m. The type specimen was taken at 300 fm. In his 'Challenger' Report, G. O. Sars (1885*a*, p. 191) recorded a large damaged female specimen and, when referring it to *P. sarsi*, noted that it was much larger than recorded specimens of that species. It is possible that this specimen was really *P. belgicae.* If this is the case, this species can occupy much greater depths than any at which succeeding records have occurred since the Challenger specimen was taken from 1675 fm.

Pseudomma calmani sp.n.

(Fig. 16A–G)

OCCURRENCE:

St. 51. 4. v. 26 (day). East of Falkland Is., 105–115 m., two tubes: (i) 3 ♀♀ (dried up); (ii) 1 ♀, 7·6 mm.
St. WS 215. 31. v. 28 (dusk to dark). North of Falkland Is., 219–146 m., 1 adult ♀, non-breeding, 6 mm.
St. WS 219. 3. vi. 28 (day). North of Falkland Is., 116–114 m., 1 ♂, 6 mm., 5 ♀♀, breeding, 6 mm.
St. WS 226. 10. vi. 28 (day). North-west of Falkland Is., 144–152 m., 1 ♀, with empty brood sac, 7 mm.
St. WS 229. 1. vii. 28 (day). North-east of Falkland Is., 210–271 m., 1 ♂, 7 mm., 2 ♀♀, 7 mm., 2 damaged ♀♀, abdomen of adult ♂.
St. WS 235. 6. vii. 28 (day). North of Falkland Is., 155–155 m., 1 imm. ♀, 5·8 mm.
St. WS 758. 12. x. 31 (night). North of Falkland Is., 94–0 m., 2 very damaged specimens.
St. WS 767. 19. x. 31 (night). North of Falkland Is., 98(–0) m., 1 ♂, 7 mm., 1 fragment.
St. WS 772. 30. x. 31 (day). North of Falkland Is., 309–163 m., 8 ♂♂, 7–7·5 mm., 3 imm. ♂♂, 2 ♀♀, 7 mm. TYPES.
St. WS 775. 2. xi. 31 (day). North of Falkland Is., 115–110 m., fragments.
St. WS 801. 22. xii. 31 (day). North of Falkland Is., 165–165 m., 1 ♀, 8 mm.

DESCRIPTION. *General form* short and compact with the anterior end relatively more robust than in other species of the genus. *Carapace* not greatly emarginate posteriorly. *Antennular peduncle* short and thick, especially in the male; third segment longer than the first and second segments together. Male lobe large and very densely hirsute in the adult (Fig. 16A). *Antennal peduncle* slightly longer than the antennular peduncle and rather more than half as long as the scale. *Scale* more than twice as long as the antennular peduncle, $3\frac{1}{2}$ times as long as broad, apex produced well beyond the tooth terminating the outer margin and occupying one-fifth of the total length of the scale (Fig. 16A, B). *Eyeplate* with well-marked median anterior cleft. No trace of serrations or teeth on the anterior lateral margins (Fig. 16C). *Thoracic endopods* as described for the genus, except that the articulation between the carpus and the propodus appears to be quite transparent and not oblique, when the limb is not flexed at the joint. The nail is setiferous and very long (Fig. 16 D–E). Male genital organ very large, cylindrical and tipped with a short, strong curved seta (Fig. 16 D). *Fourth pleopod of the male* with the exopod seven-segmented and slightly longer than the six-segmented endopod. The setae are broken in all the male specimens at my disposal, but the remnants do not appear to be modified (Fig. 16 F). *Uropods* short and compact with the endopod extending only slightly beyond the distal end of the apical spines of the telson; exopod truncate distally and only slightly longer than the endopod (Fig. 16G). *Telson* in the shape of a trapezium, which is symmetrical about its long axis; twice as broad at the base as at the apex; lateral margins convex at the base, but somewhat concave along the distal two-thirds of their length; armed with 5–6 small spines on each side; penultimate lateral spine larger than the more proximal ones, the most distal one twice as long as the penultimate and half as long as the outermost apical spine on each side. These two spines are

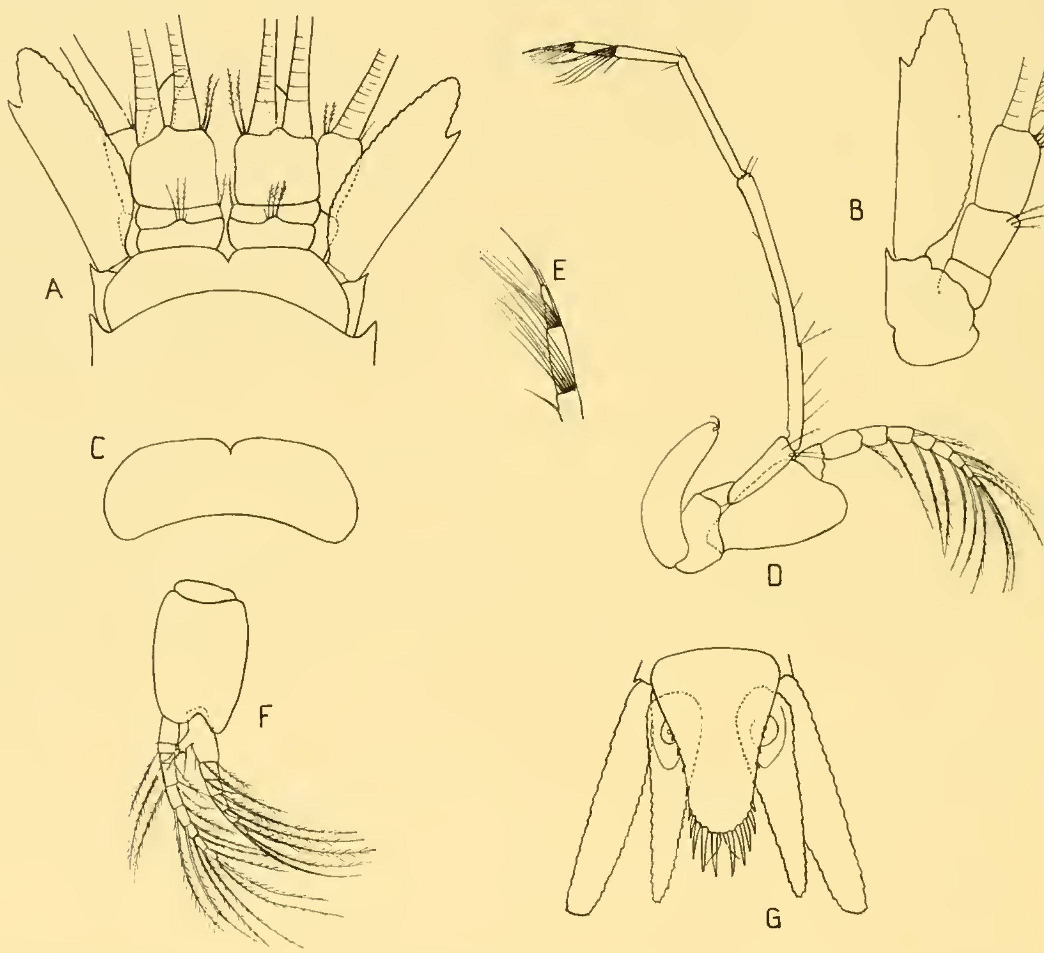

Fig. 16. *Pseudomma calmani* sp.n. A, anterior end of adult male in dorsal view; B, left antenna; C, eyeplate; D, eighth thoracic appendage of male; E, distal end of endopod of eighth thoracic appendage (enlarged); F, fourth pleopod of male; G, telson and uropods of adult male in dorsal view. All × 26.

borne close to the apex and form, with the graduated apical spines, a regularly graduated series. Apex armed with three pairs of long spines, which increase in length towards the middle line; median pair of spines about one-fifth of the length of the telson; pair of median setae present (Fig. 16G).

Length. Adult breeding females from station 219 measured 5·5 mm. from the anterior margin of the eyeplate to the apex of the telson and two adult females from station 229 measured just over 7 mm. The largest specimens were two males which measured 8·5 mm., from station 801.

REMARKS. This species has been taken with *P. sarsi*, but may be readily distinguished from it by its smaller size, by its comparatively shorter and thicker antennules and antennae, by the longer apex of the antennal scale and, above all, by the entire margins of the eyeplates. I have been much worried over the specimens which I have referred to this species, because they display individual differences in the proportions of the various parts. The material is not in good condition and there is not a single perfect specimen. Also the number taken at any one station is very small. It may well be that we have here more than one species, but until further material comes to hand, I do not feel justified in splitting the present species on the small points of variation which I have mentioned. I have great pleasure in naming the species after the late Dr W. T. Calman to whom I owe so much for help and guidance in the past.

DISTRIBUTION. All the specimens of this species in the Discovery collection were taken in depths of from 94–219 m. at stations situated to the north of the Falkland Islands. It would not appear to be a gregarious form, because at four stations only a single individual was taken and only a few at the other stations.

Pseudomma schollaertensis sp.n.

(Fig. 17A–G)

OCCURRENCE:

St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago. 64° 21° S., 63° 01′ W. 160–335 m., 2 ♂♂, 15 mm., 1 juv. ♂, 2 ♀♀, 14·5 and 15 mm., 1 juv. ♀. TYPES.

DESCRIPTION. *General form* slender. *Antennular peduncle* robust, with the third segment longer than the first and second together (Fig. 17A). *Antennal peduncle* long and slender; equal in length to the antennular peduncle or slightly longer and fully three-quarters as long as the scale. *Scale* five times as long as broad; tooth terminating the outer margin unusually strong and long, extending a little beyond the short apex; very strong spine on the outer, distal corner of the sympod (Fig. 17A, B).

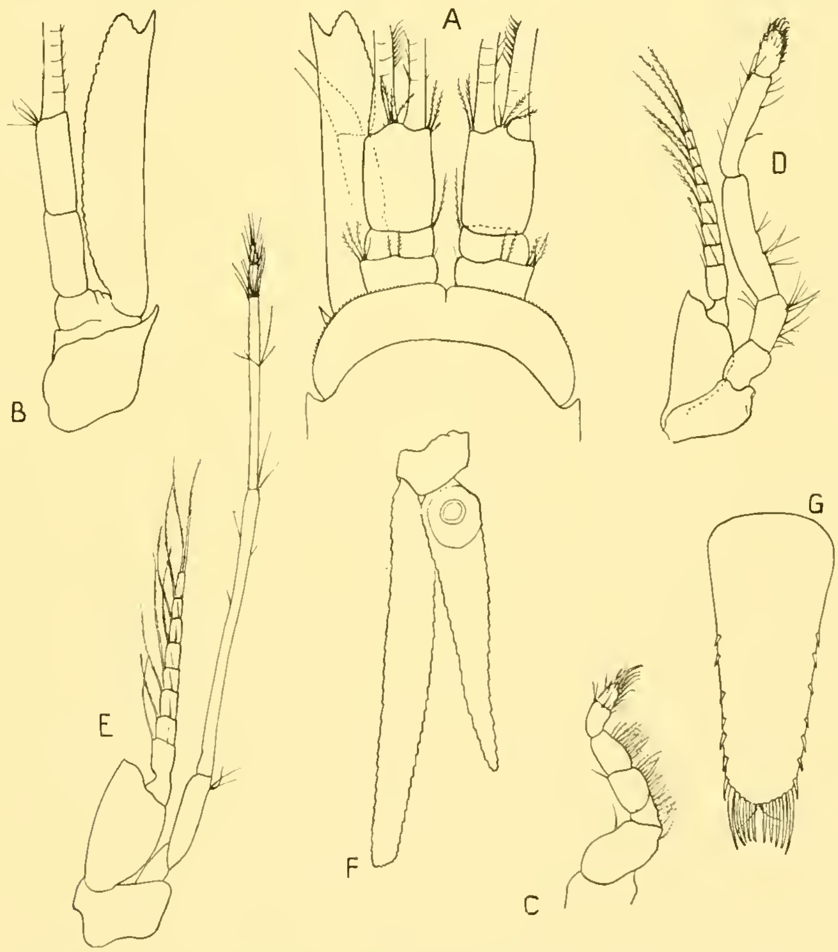

Fig. 17. *Pseudomma schollaertensis* sp.n. A, anterior end of adult female in dorsal view; B, right antenna; C, endopod of first thoracic appendage; D, second thoracic appendage; E, fourth thoracic appendage; F, left uropod; G, telson in dorsal view. All × 20.

Eyeplate very wide, equal in width to the anterior portion of the carapace; well-marked median cleft; anterior and lateral margins evenly rounded without protuberances, but armed with about twenty-three small teeth on each side extending from about half-way along the anterior margins nearly to the posterior end of the lateral margins. These teeth are very regular except that the two or three at each end of both series are smaller than the rest (Fig. 17A). *First and second thoracic appendages* as described for the genus (Fig. 17C, D). *Endopods of the third to the eighth thoracic appendages* long and slender, twice as long as their exopods; articulation between the carpus and the two segmented propodus distinctly oblique (Fig. 17E). Genital organ of the male large and conical, tapering distally and armed at the tip with a strong hook-like seta. *Uropods* long and slender, endopod extending beyond the distal end of the very long apical spines of the telson (Fig. 17F). *Telson* equal in length to the last abdominal somite; lateral margins straight and nearly parallel, armed along the distal two-thirds of their length with seven small strong spines, the most distal of which is very close to the outermost apical spine. Apex broadly rounded and armed with five pairs of long, slender, slightly incurved spines which, unlike other species of the genus, are progressively shorter towards the middle line. A pair of median setae present (Fig. 17G).

Length, adult male 15 mm., adult female 14·5–15 mm.

Breeding. One ovigerous female of 15 mm. was carrying 18 well-developed eggs in the brood pouch.

REMARKS. This species can be distinguished by the long, rather narrow antennal scale with its unusually large terminal tooth and the small apex; by the broad eyeplates and the comparatively large part of the free margin which show serrations but, most of all, by the shape and armature of the telson.

DISTRIBUTION. Schollaert Channel, Palmer Archipelago in a net fishing at a depth of 160–355 m.

Pseudomma longicaudum sp.n.

(Fig. 18A–G)

OCCURRENCE:

St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 160–325 m., 1 imm. ♂, 15·4 mm., 1 adult ♀, with empty brood sac, 21 mm. TYPES.

DESCRIPTION. *General form* similar to that of *P. schollaertis* except that the anterior end is rather more swollen. *Carapace* very short, emarginate posteriorly, leaving the whole of the last two and most of the third posterior thoracic somites exposed in dorsal view; cervical sulcus feebly marked; the portion of the carapace anterior to it somewhat inflated; antero-lateral angles obtusely rounded (Fig. 18A, B). *Eyeplate* broad with its anterior margin almost straight with distinct median notch, antero-lateral angles evenly rounded; armed with about 23–24 small even spinules extending from about the middle of the anterior margin of each half of the eyeplate to more than half-way along the lateral margin (Fig. 18A). *Antennule* much less robust than is usual in the genus. The male specimen is immature and the male lobe is very small with no setae. First segment of peduncle considerably broader than the second with the outer distal angle produced bluntly and armed with a group of long plumose setae; anterior distal margin with a blunt projection quite near the median line and armed with a row of five setae with swollen bases; third segment as long as the first and second together, armed in the female with four very long, densely plumose setae along its inner margin and with a group of two or three similar setae at the inner distal angle. I cannot see these setae in the male but this may be due to its immaturity. In both sexes the blunt projection in the middle of the dorsal surface of the anterior margin of the third segment is very well developed and is armed with four graduated spines and three or four long setae with swollen bases (Fig. 18A–D). *Antennal scale* long and narrow, more than five times as long as broad; tooth terminating the outer margin very strong; apex extending only a short distance beyond the tip of the tooth; *peduncle* slender, very slightly longer than the antennular peduncle and half as long as the scale (Fig. 18A, E). *Thoracic appendages.* As far as can be ascertained without dissection there appears to be nothing unusual in the form of the first and second pairs of thoracic appendages and, unfortunately, the endopods of all the others are missing. The genital organ of the male is already well developed and is of the usual form found in the genus. *Uropods* slender and shorter than the unusually long telson. In the adult specimen, the endopod is less than three-quarters of the length of the telson excluding the apical spines and the exopods are both broken, so that

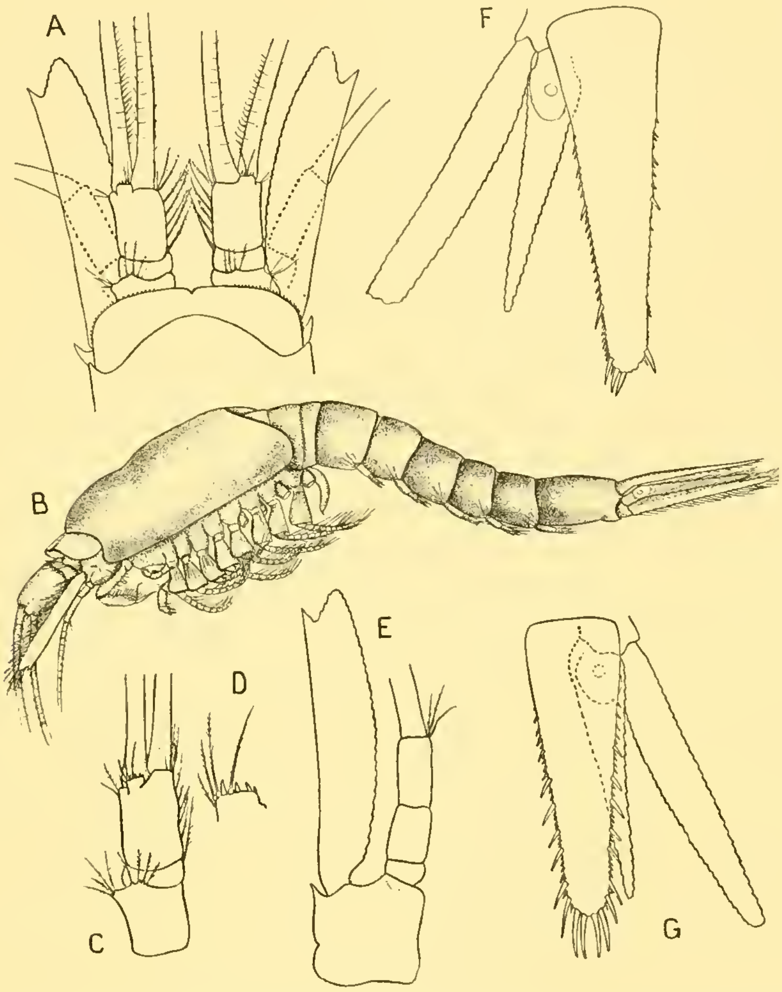

Fig. 18. *Pseudomma longicaudum* sp.n. A, anterior end of female in dorsal view, × 13; B, immature male in lateral view, × 7; C, antennular peduncle of immature male, × 16; D, process from distal dorsal margin of third segment of antennular peduncle; E, left antenna of immature male, × 16; F, telson and left uropod of adult female, × 13; G, telson and right uropod of immature male, × 18.

it is not possible to tell their length. In the juvenile specimen, the endopod extends almost to the apex of the telson and the exopod extends to the tips of the apical spines, so that probably either the telson becomes proportionally longer as the animal approaches maturity, or the relative lengths of the telson and the uropods differ in the two sexes (Fig. 18F, G). *Telson* very long and narrow, nearly twice as long as the last abdominal somite; almost three times as broad at the base as at the apex; lateral margins almost straight and converging evenly towards the apex; armed with many spines arranged in series of larger spines with smaller spines in the spaces between them, extending from the level of the statocyst to the apex. Apex armed with two pairs of long, strong spines and, I think, a pair of median setae. There are no setae present on the apex of either of the specimens, but there appears to be a small median protuberance between the innermost pair of spines and the setae may have been broken off (Fig. 18F, G).

Length of adult female 21·5 mm.

REMARKS. The length and armature of the telson is so unusual and the apparent division of the eye-plates so pronounced, that at first I felt that it would be necessary to found a new genus for this species. On closer examination it is apparent that the eyes are fused along the posterior portion of their inner margins and are therefore in conformity with the definition of the genus *Pseudomma* in this respect. The telson is different from that of any other described species of the genus. Its unusual length in proportion to the lengths of the last abdominal somite and the uropods and the arrangement of the lateral spines, in a series of large spines with smaller ones between them, differentiates *P. longicaudum* from all the known species of the genus. The male specimen shows no modification in the rami or in the setae of the fourth pair of pleopods but, as they are obviously not fully developed, it may be that modifications may appear in older animals. The telson of the adult female is not in good condition and many of the spines arming its lateral margins are missing. Those which are present indicate that there is less difference in size between the large lateral spines and the smaller ones between them than there is in juvenile animals and that the apical spines are relatively much shorter. In the young specimen these spines are very long, measuring nearly one-sixth of the length of the telson, but in the adult female they only measure about one-fourteenth of the length of the telson.

DISTRIBUTION. This species was taken at only one station by 'Discovery'—in the Schollaert Channel, Palmer Archipelago, in a net fishing at 160–336 m.

Pseudomma magellanensis sp.n.

(Fig. 19A–C)

OCCURRENCE:

St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 1 adult ♂, 9·25 mm., 1 adult ♀, with well-developed empty brood sac, 9·4 mm. TYPES.

DESCRIPTION. This species very closely resembles *P. sarsi* in general appearance. *Carapace* with the anterior margin short and only very slightly convex, leaving the whole of the eyeplate exposed (Fig. 19A). *Antennule* with the third segment longer than broad and longer than the first and second segments together; well-marked rectangular lobe in the middle of the distal margin on the dorsal surface between the bases of the flagella. On the outer side of the anterior margin of this process, there is a strong spine; the inner half of this margin is armed with two very small spines and one or two setae whose bases are not swollen (Fig. 19A). *Antennal scale* small, three times as long as broad, extending beyond the distal margin of the antennular peduncle for about one-third of its length; apex only very slightly longer than the large tooth which terminates the unarmed outer margin (Fig. 19A). *Eyeplate* large and very long, extending forward to the proximal margin of the second segment of the antennular peduncle; the eyeplate is not evenly convex from side to side, but rises along the middle line of each of its halves to a marked ridge. This ridge is so distinct that it might almost be regarded as a keel running backward from a small protuberance on the anterior margin and curving backward and downward to a shallow trough, which extends backward from the cleft of the anterior margin. This trough is so well marked and the cleft so deep, that the rudimentary eyes appear to be only contiguous. Close examination, however, reveals that they are of the true *Pseudomma* pattern. Lateral margins armed with 9–10 coarse teeth extending from the antero-lateral angles for three-quarters of the length of the lateral margins (Fig. 19A). *Thoracic endopods* missing. *Fourth pleopod of the male* with the exopod longer than the endopod; composed of eight segments; distal segment armed with two very long plumose setae which are slightly modified at their tips; endopod composed of seven segments and without any modified setae. All the male pleopods have long slender sympods and very slender rami (Fig. 19B). *Uropods* with the endopod small and tapering, extending for nearly half its length beyond the short telson; exopod broader and considerably longer than the endopod (Fig. 19C). *Telson* short, lateral margins concave, armed with 8–10 small spines, which are confined to the distal two-thirds of the margin and form an evenly graduated row increasing in size distally; apex broad and truncate with a very slight emargination in the median line; armed with three pairs of long, slender spines, which become progressively longer towards the median line, and a pair of plumose setae borne on a small papilla. The apex is so broad and the spines arming it are so slender that they are unusually spaced—the space between the innermost pair being especially wide. (Fig. 19C).

Length of adult male 9·25 mm., of adult female 9·4 mm.

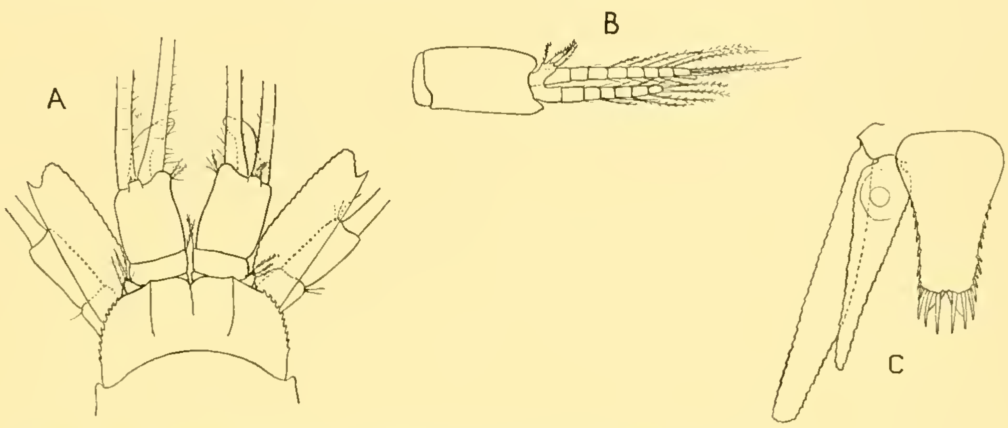

Fig. 19. *Pseudomma magellanensis* sp.n. A, anterior end of adult male in dorsal view; B, fourth pleopod of male; C, telson and left uropod in dorsal view. All × 20.

REMARKS. This species differs from *P. sarsi* in its smaller size; in its very deep eyeplate with the two well-marked dorsal ridges and the shallow trough between them; in the fewer, coarser teeth arming the lateral margins of the eyeplate; in the modified exopod of the fourth pleopod of the male and, especially, in the small telson with its broad truncate apex and concave lateral margins. The telson resembles that of *P. truncatum* in some respects, but in *truncatum* there are only two pairs of long spines arming the apex.

DISTRIBUTION. This species has been taken on only one occasion—by 'William Scoresby' in the Strait of Magellan to the east of the northern end of Dawson Island, in a bottom tow-net during daylight working at 300 m. and which failed to close.

Pseudomma minutum sp.n.

(Fig. 20A–G)

OCCURRENCE:

St. 51. 4. v. 26 (day). East Falkland Is., 105–115 m., 2 ♂♂, 4·0–4·4 mm., 4 ♀♀, largest 4·4 mm., ovigerous. ♂ TYPES. Second tube, 2 ♀♀ adult with empty brood sacs, 4·2 mm.

St. WS 802. 5. i. 32 (day). North of Falkland Is., haul A, 132–139 m., fragments of ♀.

St. WS 806. 7. i. 32 (day). North-west of Falkland Is., 130–123 m., 1 ♂, 4·4 mm., 2 adult ♀♀, larger 4·6 mm. ♀ TYPES.

St. WS 818. 17. i. 32 (day). West-south-west of Falkland Is., 272–278 m., 1 ♂, 4 mm., 2 ♀♀, larger 4·5 mm., ovigerous.

DESCRIPTION. *General form* small and slender; anterior margin of carapace not produced and only slightly convex. *Antennular peduncle* short, rather more robust in the male than in the female

(Fig. 20A, B). *Antennal peduncle* comparatively robust, extending slightly beyond the distal margin of the antennular peduncle; *scale* ovate; outer margin short, terminating in a strong tooth; apex long, comprising more than half of the total scale and extending for more than half its length beyond the antennular peduncle; outer distal angle of the sympod produced into a strong tooth (Fig. 20A, B). *Eyeplates* large and deep with a small median cleft; margins entire with no trace of serrulations. In the male the anterior margin is straight and there is a suggestion of a protuberance or angle in the antero-lateral region. In the female both the anterior and lateral margins are evenly arcuate (Fig. 20A, B). *Labrum* large, with evenly rounded anterior margin. *Endopods of third to eighth thoracic appendages* shorter than in most species of the genus (Fig. 20C). *Male genital organ* long and cylindrical, armed at the apex with a single long seta (Fig. 20D). *Pleopods of the male* as described for the genus; exopod of fourth pair slightly longer than the endopod (Fig. 20E). *Uropods* with no spines

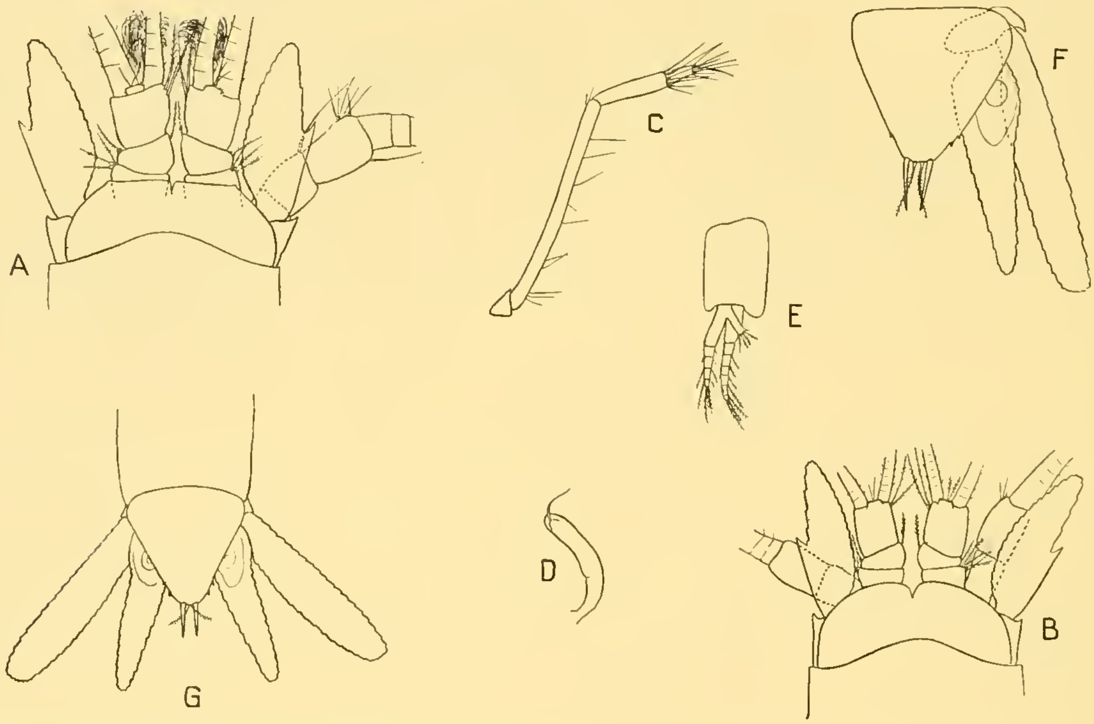

Fig. 20. *Pseudomma minutum* sp.n. A, anterior end of immature male in dorsal view, ×45; B, anterior end of adult female in dorsal view, ×36; C, endopod of fourth thoracic appendage, ×45; D, genital organ of male, ×45; E, fourth pleopod of immature male, ×45; F. telson and right uropod of immature male, ×45; G, telson and uropods of adult female, ×34.

arming the inner margin of the endopods (Fig. 20F, G). *Telson* triangular, very short, length equal to its breadth at the base and only slightly more than half as long as the sixth abdominal somite; lateral margins straight, converging evenly to the small apex; each armed with 2–3 very small spines, which are confined to the distal third of the length; apex narrowly rounded, armed with a pair of long spines nearly one-third of the telson in length, and a pair of median plumose setae (Fig. 20F, G).

Length of largest ♂, 4·4 mm.; of ♀, 4·6 mm.

Remarks. This species closely resembles *P. roseum* G. O. Sars in the form and proportions of the anterior end, the anterior end of the carapace, the eyeplates, and the antennal scale, but differs in having no serrulations on the antero-lateral margins of the eyeplates. It may at once be distinguished from all other species of the genus by its small size and by the very short triangular telson which in shape recalls those usually found in the genus *Erythrops*.

Distribution. *Pseudomma minutum* was taken at four stations in the present collection, all situated near the Falkland Is. All the captures were made by day in water of 105–278 m. in depth.

Genus Amblyops G. O. Sars

1869 *Amblyopsis* G. O. Sars, p. 328.
1872 *Amblyops* G. O. Sars, vol. II, p. 3.

REMARKS. The chief difference between this genus and *Pseudomma* is in the form of the eyes. In both genera these are rudimentary and reduced to immovable, flat plates with no trace of visual elements. In *Pseudomma*, they are fused along their inner margins to form a single thin oblong plate covering the bases of the antennules and antennae. The anterior and lateral margins of this plate may be entire or more or less serrulated. In *Amblyops* the two eyeplates are thicker and, although they may lie very close together, they are always separate. Their margins are not serrulated, but the anterior dorsal region may be adorned with very fine spinules or bristles. A more or less well-developed ocular papilla is present on the dorsal surface of each eyeplate and, although there are no visual elements, the plates may be diffused with a faint colour or have flecks of reddish pigment on the dorsal surface.

In the past, six species have been referred to the genus *Amblyops*, *A. abbreviata* (M. Sars) 1869, *A. crozetii* (W.-Suhm) G. O. Sars, 1885*a*, *A. kempii* (Holt and Tattersall), 1905, *A. tenuicauda* Tattersall, 1911*b*, *A. tattersalli* Zimmer, 1914, and *A. ohlinii* W. M. Tattersall, 1951. These species fall into two groups based on differences in the form of the antenna, which I consider to be of generic significance.

In *A. crozetii* and *A. ohlinii* the antennal scale is oval with its outer margin short and terminated by a very strong tooth which has no supplementary tooth on its inner face. The apex is very long and occupies nearly half the whole scale. The antennal peduncle is composed of three segments which lie in the same plane and are articulated in the normal manner. In the other four species the outer margin of the scale is very long and the strong spine which marks its distal end usually extends well beyond the small apex. This spine usually bears one or two very small supplementary spines on its inner face. An articulation marks off a very small distal segment of the apex. The antennal peduncle is composed of four segments, the second very short and bent upward from the plane of the first. The third segment is somewhat swollen and is articulated with the second on its ventral proximal surface and is bent downward so that its proximal end overrides and almost covers the anterior end of the second segment.

In dorsal view the whole of the second segment may be covered and the peduncle appears to consist of the normal three segments but in lateral view the articulation of the segments gives it a peculiar distorted appearance as though the segments were dislocated.

In his description of *A. tenuicauda* Tattersall (1911, p. 44) states that the antennal peduncle is composed of 'three joints roughly subequal'. I have re-examined specimens of the species from the west of Ireland and find that in dorsal view the peduncle appears as described and figured by Tattersall but in lateral view it can be seen that there are in fact four segments which are articulated as described above.

Three (and possibly four) new species are represented in the Discovery collection. Two of these, *A. durbani* and *A. antarctica*, have the antennal scale and peduncle similar to that in *A. abbreviata*, *A. kempii*, *A. tenuicauda* and *A. tattersalli*; the third has a scale and peduncle similar to that in *A. crozetii* and *A. ohlinii*. I suggest that this second group might be placed in a new genus *Amblyopsoides* and that the definition of the genus *Amblyops* as regards the antenna should be as follows: *Antennal scale* long and usually narrow; unarmed outer margin terminated by a strong spine or tooth (beyond which the small apex does not extend) which may be armed on its inner face with one or two small supplementary teeth. Small distal suture present. *Antennal peduncle* composed of four segments. The second and third segments lie in different planes and are articulated, so that the proximal end of the third segment extends over the distal end of the second segment and may entirely cover it in dorsal view.

The genus *Amblyops* therefore now contains six species, *A. abbreviata*, *A. kempii*, *A. tenuicauda*, *A. tattersalli* and two new species *A. durbani* and *A. antarctica*.

Amblyops durbani sp.n.

(Fig. 21 A–H)

OCCURRENCE:

St. 436. 20. ix. 30 (day). Off Durban, 416(–0) m., 1 ♂, 9·2 mm., 6 ♀♀, largest 10·2 mm. TYPES.

DESCRIPTION. *General form* short and more robust than is usual in the genus; all the parts anterior to the cervical sulcus are particularly short, the broadly rounded rostral plate covers more than half the eyeplates, which themselves are very short and cover the whole of the first segments of the antennular peduncles, these again are very short. As a result the anterior part of the animal looks as though it had been telescoped. *Carapace* short and wide; anterior margin very slightly convex; antero-lateral angles broadly rounded; posterior margin only slightly emarginate but the carapace is so short that the last two thoracic somites are completely uncovered in dorsal view (Fig. 21 A). *Antennular peduncle* very short and broad; outer distal angle of first segment strongly produced and tipped with a group of plumose setae; second segment short with a single long plumose seta on its inner margin; third segment nearly square in dorsal view, almost as long as the second and first segments together, armed along the inner margin with six strong plumose setae with bulbous bases and a group of setae at the inner distal angle at the base of the inner flagellum; outer flagellum twice as stout as the inner (Figs. 21 A, B). *Antennal scale* rather broad towards the proximal end, thence tapering evenly towards the apex; outer margin straight with no serrations at the distal end; scale $3\frac{1}{2}$ times as long as its greatest breadth, apex very small and evenly rounded, equal in length to the tooth terminating the outer margin, no subsidiary spine on the inner face of the terminal tooth, small distal suture present. *Peduncle* less than half as long as the scale, four-segmented, of the form described for the genus. Strong spine present on the ventral side of the outer distal corner of the sympod (Fig. 21 A, C). *Eyeplates* nearly twice as broad as long with a well-developed papilla projecting forward in the median line beyond the anterior margin of each plate; anterior region densely spinulose especially on the antero-lateral angles, the spinules being long and slender (Fig. 20 A, D). Endopods of thoracic appendages rather more robust and shorter than is usual in the genus; the male genital organ on the eighth thoracic appendage short and thick, its proximal half swollen; distal half tubular and tipped with three strong setae (Fig. 21 E). *Uropods:* exopods, $1\frac{1}{2}$ times as long as the telson; endopods shorter but extending beyond the tips of the long apical spines of the telson; armed on the inner margin near the statocyst with three long slender graduated spines. In one specimen there were only two spines on one of the uropods though the other had the normal three (Fig. 21 A, F). *Telson* linguiform, $1\frac{3}{4}$ times as long as broad at the base; lateral margins concave near the rounded base and thence nearly parallel to the broadly rounded, almost truncate apex; breadth just proximal to the apex one-fourth of the total length; lateral margins armed along the distal half of their length with about twelve graduated spines, which increase regularly towards the apex and form a continuous series with the long apical spines. Apex armed with three pairs of extremely long spines, of which the innermost pair is the longest and measures one-fourth of the length of the telson. This pair of spines is set close together, so that there is no apparent break in the series running round the telson as in *Amblyops obtusa*. Under a high magnification two small spinules can be seen in the median line and these are set so closely together that they may appear like a single spinule with a bifid tip. A pair of long plumose setae arises immediately above these spinules (Fig. 21 A, G, H).

Length, largest ♂, 9·2 mm.; largest ♀, 10·2 mm.

REMARKS. This species very closely resembles *A. kempii*, but may be distinguished by its shorter robust form with the 'telescoped' anterior end; by the almost straight anterior margin of the carapace; by the form of the eyeplates with the well-marked papilla in the middle of each plate, by the absence of serrations on the outer margin of the antennal scale and the absence of an auxiliary tooth; by the presence of three spines on the inner margin of the endopod of the uropod; and, particularly, by the

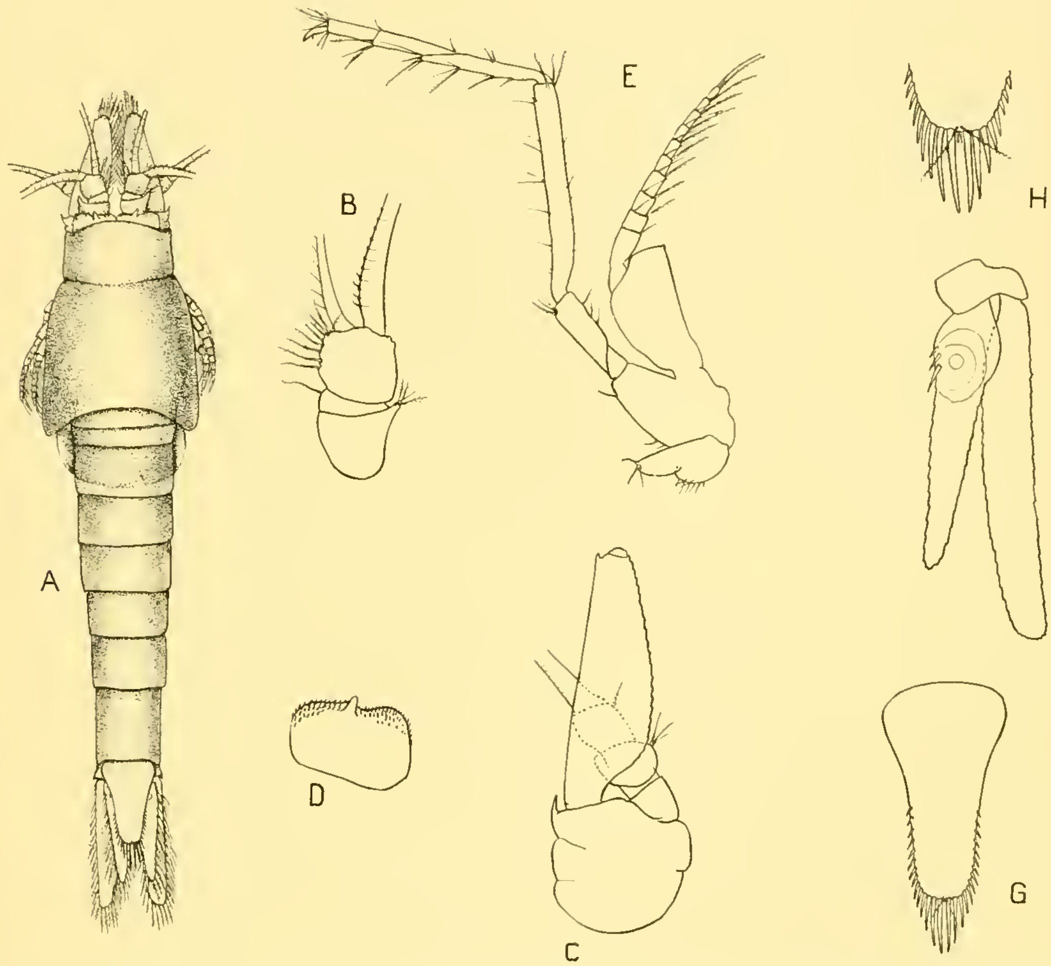

Fig. 21. *Ambylops durbani* sp.n. A, adult female in dorsal view, × 8; B, right antennule, × 22; C, left antenna, × 22; D, right eyeplate in dorsal view, × 22; E, eighth thoracic appendage of male, × 22; F, right uropod, × 22; G, telson, × 22; H, distal end of telson, × 36.

shape and armature of the telson. In *A. kempii* the telson is much longer and more slender, the lateral margins being armed with a row of 27–28 graduated spines, which extend over the distal five-sixths of their length, while in *A. durbani* there are only 10–11 spines, extending along rather less than half of the lateral margins. The apex in *A. kempii* is more rounded, narrower and bears only two pairs of long spines, which are shorter than those of *A. durbani*, but the minute median spinules and the plumose setae are precisely alike in both species.

DISTRIBUTION. The species has at present been taken on only one occasion—in a day oblique haul, 416(–0) m. off Durban. It would thus appear to be a meso-planktonic form.

Amblyops antarctica sp.n.

(Fig. 22 A–G)

Occurrence:

St. 1652. 23. i. 36 (day). Bay of Whales, 567 m., 1 imm. ♀, 13·2 mm.
St. 1957. 3. ii. 37 (day). South of Clarence I., South Shetlands, 785–810 m., 1 imm. ♀, 12·2 mm. Type.

Remarks. These specimens so closely resemble the description and figures of *A. abbreviata* (G. O. Sars in M. Sars, 1869, p. 262), that I was at first inclined to refer them to that species. They do, however, show three differences, which I do not consider to be attributable to their immaturity and these, together with the vast difference in geographical distribution, have convinced me that they do represent a new species.

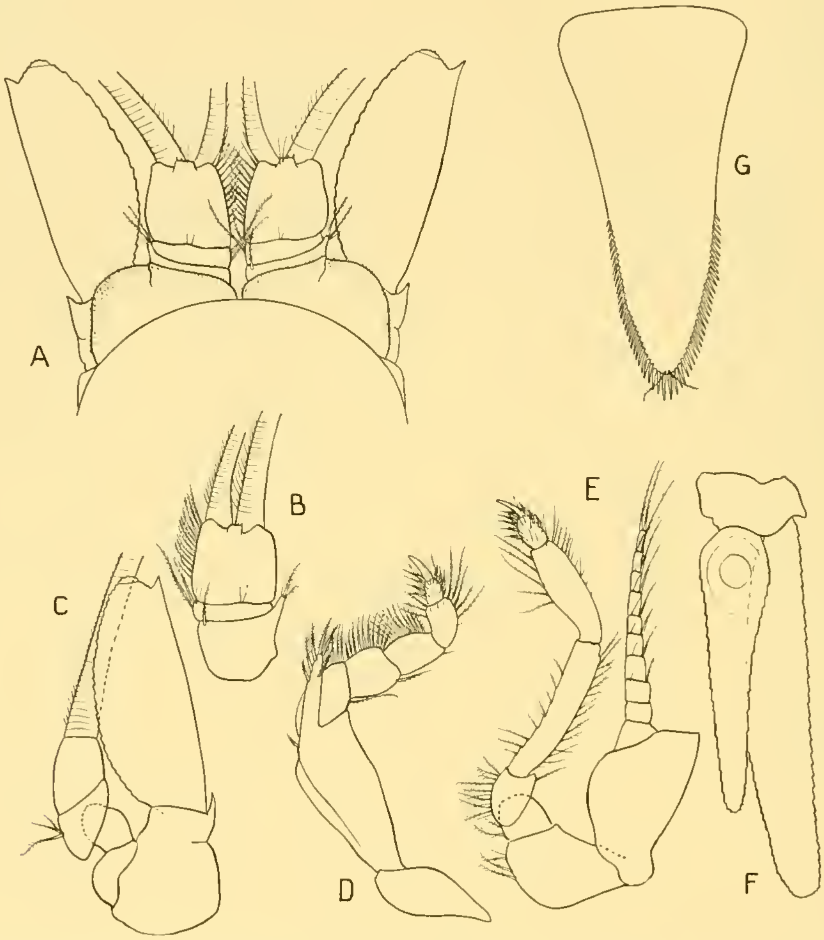

Fig. 22. *Amblyops antarctica* sp.n. A, anterior end of immature female in dorsal view; B, right antennule; C, right antenna; D, endopod of first thoracic appendage with epipod; E, second thoracic appendage; F, right uropod; G, telson. All × 20.

A. abbreviata has a wide distribution in the northern waters of the northern hemisphere and has been recorded in the North Atlantic, North Pacific and Arctic Oceans. *A. antarctica* may be distinguished by its broader antennal scale, the shorter broader eyeplates and by the larger, more crowded spines arming the lateral margins of the telson. In *A. abbreviata* the antennal scale is at least $3\frac{1}{2}$ times as long as broad at its widest part, but in *A. antarctica* it is less than $2\frac{1}{2}$ times as long. In the specimen from station 1652, the small supplementary spine on the inner margin of the terminal spine of the outer margin of the scale, which is characteristic of *A. abbreviata*, is present and well-developed, but I am unable to find it in the other specimen. The eyeplates are shorter and proportionally broader in this species than in *A. abbreviata*, but they show precisely the same microscopic spinulation as in that species (Fig. 22A). The *telson* presents the most noticeable difference between the two species, although its proportions and shape are similar. The spines in *A. antarctica* are confined to less than the distal half of the lateral margins and, except for two or three at the proximal end of the series, they are nearly of the same size throughout. There are from 27–29 on each side (Fig. 22G). In *A. abbreviata* there are approximately the same number of spines on each side, but they extend over the distal two-thirds of the margins and are graduated, those at the apex being long and those on the more proximal part of the margins becoming progressively smaller. As a result of the greater size and the closer crowding of these spines, the telson in *A. antarctica* presents a very characteristic appearance. I do not think that with increased age these differences will disappear, for my specimens are nearly mature and have well-developed though small oostegites.

The first and second thoracic appendages are essentially the same in both species, but the other thoracic endopods are missing (Fig. 22D, E). I am unable to find any spines on the endopod of the uropods (Fig. 22F).

DISTRIBUTION. Bay of Whales at 167 m. and South Sandwich Isles 785–810 m.

Amblyops sp. near Amblyops kempi (Holt and Tattersall), 1905

(Fig. 23A, B)

1905 *Pseudomma kempi* Holt and Tattersall, p. 126.
1906*a* *Pseudomma kempi* Holt and Tattersall, p. 33, figs.
1911*b* *Amblyops kempi* Tattersall, p. 42, figs.
1951 *Amblyops kempi*, Tattersall and Tattersall, p. 251, figs.

OCCURRENCE:

St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 1 imm. ♂, 7·2 mm.

REMARKS. The single damaged specimen from station WS 748 very closely resembles *Amblyops kempi*. The form of the anterior margin of the carapace, the antennular peduncles, the eyeplates, the endopods of the uropods and the armature of the telson conform nearly with the descriptions and figures of the types of *A. kempi* (Fig. 23A, B). Unfortunately both antennal scales and the exopods of the uropods are broken, but the portion of these appendages which remains also conforms with *A. kempi*. The endopods of the third to the eighth thoracic appendages are missing and the pleopods are too immature to have developed any secondary sexual characters.

The only differences from *A. kempi* which this specimen shows lie in the position of the protuberance on the eyeplates and in the shape of the telson. In *A. kempi* each eyeplate is drawn out into a lobe at the antero-lateral angle, while in this specimen the protuberance is situated in the median line. In lateral view there is no difference to be seen. The telson shows the only noticeable difference and, had the present specimen been adult, I would have founded a new species for it. The telson is much broader in proportion to its length than in *A. kempi* and the lateral margins not so deeply concave near the base. There are fewer spines arming the lateral margins—22 on each side as against 27–28 in *A. kempi*—but the arrangement of the spines at the apex is precisely alike in the two species (Fig. 23B). As changes in the number of spines arming the lateral margins of the telson and in the proportions of its length to breadth are known to take place with growth and, since the antennal scales, which usually have marked specific characters, are missing, I do not feel justified in forming a new species for this immature specimen.

There is one interesting feature in the eyeplates which may be due merely to faulty preservation. All over the plates there are rounded darker areas which may represent imperfect ocular elements. I can see no trace of any innervation.

DISTRIBUTION. Strait of Magellan in 300–0 m. *A. kempi* is known only from the west of Ireland in depths of 1200–1600 m. With no intermediate records it would be an astonishing geographical range for one species to have, if it also occurred as far south as the Strait of Magellan.

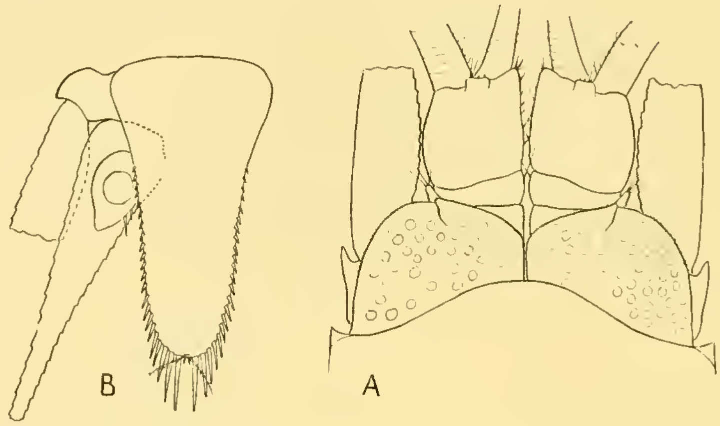

Fig. 23. *Amblyops* sp. near *kempi*. A, anterior end of immature male in dorsal view, × 28; B, telson and left uropod in dorsal view, × 28.

Genus Amblyopsoides gen.n.

DEFINITION. *Form of body* robust. *Carapace* deeply produced laterally with ventral margins sinuous; anterior margin feebly convex or produced into a very short obtusely angled rostral plate; posterior margin emarginate leaving the last two or three thoracic somites exposed in dorsal view. *Antennular peduncle* short and robust; outer lateral margin of first segment only slightly produced. *Antennal scale* oval with the apex produced beyond the spine marking the distal end of the unarmed outer margin to a distance equal to nearly half the total length of the scale; no secondary tooth on the inner face of the terminal tooth of the outer margin; small distal suture may be present. *Antennal peduncle* three-segmented with the segments all in the same plane. *Eyes* rudimentary, in the form of two large, quadrangular, separate, immovable plates without visual elements; anterior and lateral regions smooth or adorned with minute spinules; well-marked ocular papilla present near anterior margin in the median region. *Pleopods* in the male as in *Amblyops*; in the female, reduced to unsegmented plates which are larger than those usually found in *Amblyops*. *Uropods* with exopod considerably longer than endopod; single spine present on inner margin of endopod in the region of the statocyst. *Telson* trapeziform with posterior margin slightly emarginate in median line; lateral margins and apex armed with a close row of spines, which are evenly graduated and not arranged in series; apex armed with two or three pairs of spines and a pair of median plumose setae.

REMARKS. Three species are at present included in this genus, *A. crozetii* ((W.-Suhm) G. O. Sars) which has been recorded from near the Crozet Islands in the southern Indian Ocean, *A. ohlinii* (W. M. Tattersall) from near the mouth of the Delaware River and *A. obtusa* sp.n. from the waters of Patagonia.

Amblyopsoides obtusa gen.n., sp.n.

(Fig. 24 A–J)

OCCURRENCE:

St. WS 748. 16. ix. 31 (night). Strait of Magellan, 300(–0) m., 1 ♀, 20·8 mm.

St. WS 839. 5. ii. 31 (night). Patagonian Shelf, south-west of Falkland Is., 503–534 m., 4 ♂♂, largest 20 mm.; 8 ♀♀, largest 22·2 mm., many fragments. TYPES.

DESCRIPTION. *General form* long with a firm robust abdomen. *Carapace* deeply emarginate posteriorly, leaving the whole of the last two thoracic somites exposed in dorsal view; cervical sulcus particularly deep and well-marked; lateral margins sinuous as shown in Fig. 22A; antero-lateral corners produced into a right-angle from which a distinct ridge or keel runs obliquely backward to fade away near the cervical sulcus; anterior margins straight, produced forward to meet at an angle of about 120° forming a very short rostral plate, which covers the posterior margins of the eyeplates (Fig. 22B). *Abdomen* strong and muscular with the sixth somite half as long again as the fifth (Fig. 22A). *Antennule* very short and stout, particularly in dorsal view; third segment as long as the first and second combined (Fig. 22A–C). *Antennal scale* with the naked outer margin relatively short, terminating in a strong tooth, which extends to beyond the distal margin of the third segment of the antennular peduncle; apex very long, occupying nearly one-half of the whole scale; small distal suture present (Fig. 22B, D). *Antennal peduncle* less than half as long as the scale; second and third segments sub-equal, armed along their outer margins with a regular row of plumose setae; no spine on outer distal angle of the sympod. *Eyeplates* large and quadrangular with the ocular papilla well developed and extending beyond the anterior margin of the eyeplate; antero-lateral region densely spinulose; the spinulation extends along the lateral region but becomes more sparse proximally; the anterior margin on the inner side of the papilla is also sparsely spinulose, but the spinules give place to dense, very minute bristles on and around the antero-median borders (Fig. 24A, B, J). *Mandibular palp* particularly long and strong (Fig. 24A). *Third to the eighth thoracic appendages* with very large, well-developed exopods; endopods long and slender with the two-segmented propodus separated from the carpus by a very oblique articulation; dactylus well-developed with a comparatively strong curved nail (Fig. 24A, E). *Pleopods* as in the other species of the genus in the male; those of the female unusually long (Fig. 24A). *Uropods* with the exopods very long, nearly twice as long as the telson and half as long again as the endopods; a single long spine present near the inner distal border of the statocyst (Fig. 24F). *Telson* in the form of a long trapezium with lateral margins straight and converging regularly to the broadly truncate apex; three times as wide at the base as at the apex; hollowed from above in the form of a trowel, so that in dorsal view when attached to the animal it appears much narrower than it actually is; lateral margins armed along the distal three-fifths of their length with a close, evenly spaced row of regularly graduated spines, which increase in size distally and become of such a length that the long apical spines form the natural culmination of the graduated series; apex truncate with a suspicion of emargination in the median region; armed with two pairs of very long spines, of which the inner are slightly longer than the outer, and a pair of minute spines flanking a median pair of long plumose setae. The gap in the regular sequence of spines running along the margins and around the apex caused by the presence of these tiny spines is very striking and serves as a ready means of distinguishing the species from the two other species of the genus (Fig. 24G, H).

Length of adult male, 20 mm.; of adult female, 22·2 mm.

Remarks. In its general form and particularly in the form of the antennal scale and the telson, *A. obtusa* closely resembles the two other species of the genus, *A. crozetii* ((W.-Suhm) G. O. Sars) and *A. ohlinii* (W. M. Tattersall). But *A. obtusa* can at once be distinguished from these species by its obtuse-angled anterior end of the carapace, because in both of them this margin forms an evenly rounded curve with no trace of a median angle, and by the armature of the telson. In *A. crozetii* the apex of the telson is armed with about 14 spines and a pair of median plumose setae. The posterior margin of the telson is definitely emarginate so that the innermost pair of spines do not extend so far back as those next them, although in fact they are slightly longer. The other apical spines are of about equal length, the outermost ones a little shorter and merging into the graduated series of the lateral margins (Sars, 1885*a*, pl. xxxiii, fig. 16). The effect of this arrangement of the apical spines in *A. crozetii* is to make the telson appear to be much more sharply truncate than in the present species.

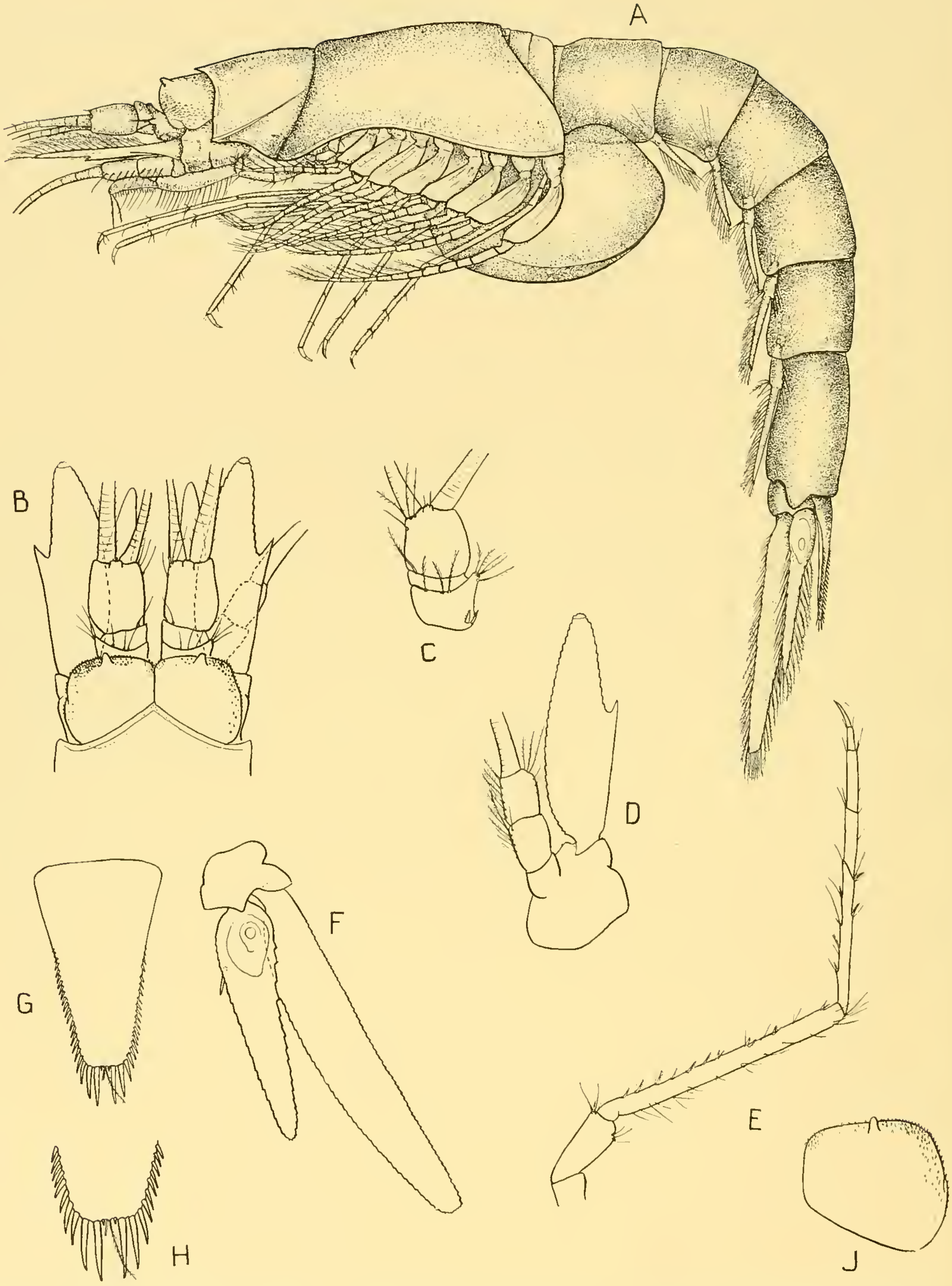

Fig. 24. *Amblyopsoides obtusa* gen.n., sp.n. A, adult female in lateral view, × 11; B, anterior end of male in dorsal view, × 15; C, right antennular peduncle of female, × 15; D, right antenna, × 15; E, endopod of fourth thoracic appendage, × 15; F, right uropod, × 15; G, telson, × 15; H, apex of telson (enlarged); J, right eyeplate enlarged.

In *A. ohlinii* the posterior margin of the telson is very slightly emarginate and is armed with three pairs of long spines, the innermost of which is only very slightly longer than the two outer pairs, but as a result of the emargination of the margin their tips reach the same level. There is no gap in the median line. The only specimens which we had at our disposal, when I figured the telson (W. M. Tattersall, 1951, fig. 45*c*), were badly damaged and not one had a complete set of spines around the apex, but the scars, where they had been broken off, proved that they had formed a complete sequence with the graduated spines of the lateral margins. The size of the scars of the innermost spines indicates that these had been large and there was no trace of the small median spines which are so characteristic a feature of *obtusa*. I do not think it likely that such tiny median spines would have been broken off had they ever been present.

The Discovery material is in bad condition and the larger spines arming the apex of the telson are often missing, but the tiny median pair is present in all the specimens. The spinulation of the eyeplates is another useful guide to the identification of the species. In *A. crozetii*, the only other species from southern waters, the eyeplates are smooth and in *A. ohlinii* there is very fine, sparse spinulation, confined to a small region at the extreme antero-lateral angle of each plate.

Distribution. The types were taken on the Patagonian Shelf to the west of the Falkland Islands in 403–430 m. and a single adult female was captured in the Strait of Magellan in a night haul with a net, fishing at 300 m., which failed to close. It would thus appear that *A. obtusa* is a mesoplanktonic form inhabiting more shallow waters than either of the other species of the genus.

Genus **Paramblyops** Holt and Tattersall, 1905

1905 *Paramblyops* Holt and Tattersall, p. 124.

Remarks. This genus, closely resembling *Amblyops*, was instituted for the reception of a new species, *Paramblyops rostrata* Holt and Tattersall, which differed from *Amblyops* as follows: (1) Carapace of only moderate size, its anterior margin produced into a long, acutely pointed rostrum partially covering the eyeplates. (2) Eyes of the same degenerate form as in *Amblyops*, consisting of separate, rounded flat plates without visual elements or pigment, but with the outer, distal angle of each drawn out into a sharp process. (3) Telson large, linguiform with a broadly truncate apex armed with spines but no median setae. Tattersall (1911 *b*, p. 48) added a second species, *Paramblyops bidigitata*, to the genus, its main point of difference being that there were two finger-like processes on each eyeplate.

Three specimens from station 181 and two from station 182 in the Discovery collection must undoubtedly be referred to a new species of this genus. They show some small differences from the original definition of the genus and a re-examination of specimens of *P. rostrata* has revealed one important feature overlooked by Holt and Tattersall. In his description of *P. bidigitata* Tattersall (1911 *b*, p. 48) described sternal processes in the males and young females. Holt and Tattersall (1905) had not mentioned any such processes in *P. rostrata* and Tattersall, when summarizing the differences between the two species, cites the presence of sternal processes in *bidigitata* as one of the distinguishing characters of the species. When I found that similar processes were present in the new species, *P. brevirostris*, I re-examined specimens of *P. rostrata* in my husband's collection and found that in all the males and in young females, in which the oostegites were only just beginning to appear, there were sternal processes precisely as in *bidigitata* and *brevirostris*. There was no trace of them in more mature females. I have therefore added this character to the definition of the genus which should be revised as follows: *Carapace* of moderate size with anterior margin produced into a triangular rostrum of greatly varying length; *antennal scale* long, with the terminal spine of the outer margin extending beyond the truncate apex; one or two spines on the outer distal angle of the sympod; eyeplates separate, in the form of flat, rounded plates without visual elements or pigment, the anterior margin produced, either on the outer angle only or on both anterior angles, into spine-like processes; margins of eyeplates may be spinulose. *Labrum* broader than long, produced anteriorly into a short, more or less pointed, projection. A long spear-like outgrowth, arising from the anterior end of the head in the vertical plane, extends forwards between the antennular peduncles almost to the distal end of the third segment. In dorso-ventral view this outgrowth appears very slender, but in lateral view it is quite broad proximally. Strong, curved, forwardly directed, spinulose *sternal processes* on the second to the eighth thoracic sterna in males and immature females. Thoracic appendages and pleopods as in *Amblyops*. *Telson* large, linguiform, with broad, truncate apex armed with 5–6 pairs of spines of varying size, with or without median setae; lateral margins armed with 12–23 short strong spines.

Three species are now included in this genus, two from Irish waters and one from the Antarctic.

Paramblyops brevirostris sp.n.

(Fig. 25 A–F)

OCCURRENCE:

St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 160–335 m., 3 ♀♀, 2 ovig., largest 16 mm. ♀ TYPES.

St. 182. 14. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 278–500 m., 1 ♂, imm., 13 mm., 1 ♀, adult, 15 mm. ♂ TYPE.

DESCRIPTION. *Carapace* short, produced anteriorly into a blunt right-angled rostrum partially covering the eyeplates but not extending forward as far as their distal margins; deeply emarginate posteriorly, leaving the last three thoracic somites exposed in dorsal view; very shallow laterally leaving the bases of the thoracic appendages exposed. I am unable to make out any spinules on the margins of the rostrum (Fig. 25 A, B). *Antennular peduncles* short and not very robust; the hirsute lobe of the male is large although the specimen is not mature and the pleopods not well developed (Fig. 25 A, B). *Antenna* with the peduncle long and extending considerably beyond the antennular peduncles; composed of three segments which do not overlap in any way; *scale* large and broad with the apex less oblique than in the other two species of the genus; two strong spines at the distal outer corner of the sympod, one on either side of the base of the outer margin of the scale (Fig. 25 A, B). *Eyeplates* rather widely separated, anterior margins somewhat convex, minutely and sparsely spinulose; antero-lateral angle produced into a strong pointed process (Fig. 25 A). *Labrum* broader than long; anterior margin produced into a strong point (Fig. 25 C).

Immediately anterior to the labrum, arising from the median line running over the anterior end of the head, there is a very strong spear-shaped process, which projects forward between the antennules extending almost to the distal end of the antennular peduncle. In dorso-ventral view, this process is very slender, but if the antennules are moved aside it is seen to be wide at its base, tapering off to a fine point distally. It was at first thought to be a prolongation of the anterior margin of the labrum and was erroneously described as such in the original description of *P. rostrata*.

On each of the second to the eighth thoracic sterna in the male specimen, there is borne in the median line a very strong, forwardly curved, hispid, transparent process. These processes are not present in any of the female specimens, which are all fully adult (Fig. 25 B). *Endopods of the third to the eighth thoracic appendages* long and extremely slender; carpus nearly three times as long as the two-segmented propodus and separated from it by a very oblique articulation; dactylus forming a strong claw with the nail. The distal end of the endopod is densely covered with long non-plumose setae (Fig. 25 D). *Uropods* only slightly longer than the telson. I can find no trace of the single spine on the endopod, which has been recorded in both *P. rostrata* and *P. bidigitata* (Fig. 25 E). *Telson* large, broadly linguiform with broad, truncate apex; lateral margins armed throughout with a regular row of 17–23 strong short spines, which extend to the apex leaving no gap between the lateral and apical spines; distal two or three spines on each side becoming progressively longer, so that the outermost apical spine forms the natural culmination of a series. The number of lateral spines seems to increase with the growth of the animals, for the immature specimen has but eighteen, while the largest has twenty-three on each side (Fig. 25 E, F); apex armed with five pairs of large spines, which are regularly graduated with the longest on the outer side and the shortest in the middle; between the innermost pair there is a pair of very small spines but no median plumose setae (Fig. 25 E, F).

Length of adult female, 16 mm.

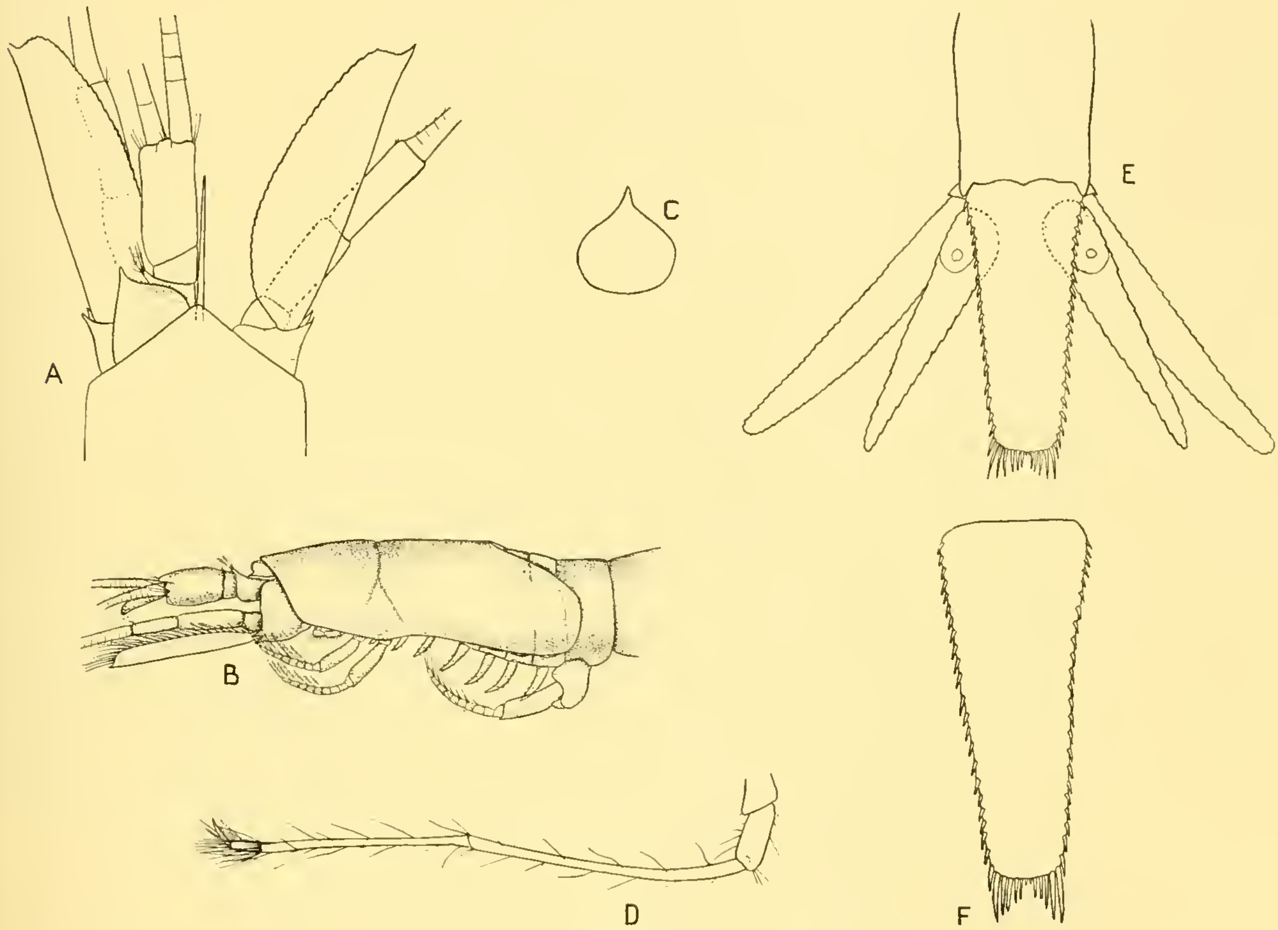

Fig. 25. *Paramblyops brevirostris* sp.n. A, anterior end of female in dorsal view, × 20; B, anterior end of immature male in lateral view with thoracic appendages dissected away to expose sternal processes, × 10; C, labrum; D, endopod of seventh thoracic appendage, × 16; E, posterior end (telson and uropods) of smallest female in dorsal view, × 20; F, telson of largest female in dorsal view, × 20.

Remarks. This species can at once be recognized by the short, rectangular rostrum, by the convex, spinulose anterior margins of the eyeplates, the large antennal scale, the large number of spines arming the lateral margins of the telson and by the armature of its apex.

Distribution. The species has been taken only in the Schollaert Channel in the Palmer Archipelago and is the only representative of the genus to have been recorded from the southern hemisphere. From the character of the thoracic endopods, it would appear to be a bottom-living form, living on mud and this suggestion is borne out by the facts that the specimens are very dirty, and at both stations they were captured in a tow-net attached to a trawl.

Genus Dactylamblyops Holt and Tattersall, 1906

1906*b* *Dactylamblyops* Holt and Tattersall, p. 8.

Dactylamblyops hodgsoni Holt and Tattersall, 1906

1906*b* *Dactylamblyops hodgsoni* Holt and Tattersall, p. 9.
1906*a* *Dactylerythrops arcuata* Illig, p. 200.
1908 *Dactylamblyops hodgsoni*, Tattersall, p. 30, pl. vi, figs. 9–16.
1914 *Dactylamblyops hodgsoni*, Zimmer, p. 391, pl. xxiv, figs. 17–19.

OCCURRENCE:

St. 138. 22. xii. 26 (day). Off South Georgia, 1000–750 m., 1 ♀, 11·6 mm.
St. 151. 16. i. 27 (day). Off South Georgia, 1275–1025 m., 1 ♂, 1 ♀.
St. 169. 22. ii. 27 (day). West of South Orkneys, 1100–1000 m., 2 ♀♀, 12 mm.
St. 204. 6. iv. 27 (day). Bransfield Strait, South Shetlands, 750–500 m., 1 adult ♀, 22 mm.
St. 208. 7. iv. 27 (day). Off Livingstone I., South Shetlands, 800(–0) m., 1 ♂, 13 mm., 2 ♀♀, 13·5 mm., 23 juv., 6–7 mm.
St. 300. 20. i. 30 (day). South Georgia, 750–500 m., 1 juv., 6·2 mm.
St. 302. 21. i. 30 (day). South Georgia, 1000–750 m., 1 juv. ♀, 5 mm.
St. 303. 21. i. 30 (day). South Georgia, 750–500 m., 1 juv., 6 mm.
St. 305. 21/22. i. 30 (night). South Georgia, 750–500 m., 1 juv., 4·5 mm.
St. 322. 31. i. 30 (day). South Georgia, 750–500 m., 2 juv., 6·5 mm.
St. 323. 31. i. 30 (day). South Georgia, 750–500 m., 3 juv., 5–6 mm.
St. 334. 4. ii. 30 (day). South Georgia, 750–500 m., 2 small juv.
St. 337. 5. ii. 30 (day). South Georgia, 750–500 m., 1 juv. ♀, 4·5 mm.
St. 344. 7/8. ii. 30 (night). South Georgia. Two hauls: (i) 750–500 m., 1 juv., 7 mm.; (ii) 1000–750 m., 1 juv., 4·5 mm.
St. 353. 9. ii. 30 (day). South Georgia, 1000–750 m., 1 ♀, 12·4 mm.
St. 357. 10. xi. 30 (dusk to night). South Georgia, 750–500 m., 1 juv.
St. 358. 11. ii. 30 (night). South Georgia, 1000–750 m., 1 juv., 6 mm.
St. 590. 14. i. 31 (day). West of Graham Land, Bellingshausen Sea, 1400–1150 m., 9 ♂♂, 11 ♀♀, 1 juv.
St. 661. 2. iv. 31. West of Sandwich Isles. Three hauls: (i) 750–500 m. (day), 1 ♂, 1 ♀, 12 juv.; (ii) 2000–1500 m. (night), 1 ♂, 1 ♀, both adult; (iii) 3000–2000 m. (night), 1 adult ♀, 12 mm.
St. 663. 5. iv. 31 (day). South Georgia. Two hauls: (i) 1500–1000 m. (2 tubes), 4 ♀♀; 2 ♂♂, 14 mm. and 16 mm., 1 ♀, 9·5 mm., 4 small juv.; (ii) 2000–1500 m. (3 tubes), 1 adult ♀, 9·2 mm., 4 juv.; 1 ♂, 13 mm., 2 ♀♀, 12·5–10 mm., 4 juv. 6–7 mm.; 2 ♂♂, 14·5–16 mm.
St. 666. 17. iv. 31 (day). North-east of South Georgia, 1000–750 m., 8 juv., 6·5–7 mm.
St. 671. 22/23. iv. 31 (night). West of Gough I., 1500–1000 m., 1 ♀, 10 mm.
St. 1561. 4. iv. 35 (night). East of Marion I., 1250–0 m., 2 juv.
St. 1633. 29. xi. 35 (day). South-east of Heard I., 1100–875 m., 4 ♂♂, 5 ♀♀, all adult, largest 3·5 mm., 1 juv. (locality doubtful, tube broken).
St. 1702. 17. iii. 36 (day). Ice Edge, off Wilke's Land, 2000–1250 m., 1 adult ♀.
St. 1715. 23. iii. 36 (night). Ice Edge, off Budd's High Land, 1400–1100 m., 1 adult ♂.
St. 1838. 12. x. 36 (day). West of South Sandwich Is., 750–250 m., 3 ♂♂, 1 ♀, 4 small juv. ♀♀.
St. 1855. 4. xi. 36 (day). Scotia Sea, 1050–500 m., 12 ♂♂, 13 mm., 9 ♀♀, largest 12·5 mm.
St. 1871. 12. xi. 36 (day). East of South Shetland Is., 1450–1000 m., 4 ♀♀, with large empty brood sacs.
St. 1917. 3. xii. 36 (day). Off South Georgia, 1400–1000 m., 1 ♀.
St. 1919. 4. xii. 36 (day). Off South Georgia, 1800–1300 m., 1 imm. ♀.
St. 1944. 2. i. 37 (day). North of South Orkney Is., 1500–1200 m., 2 ♂♂.
St. 1946. 3. i. 37 (day). West of South Orkney Is., 1700–1300 m., 1 ♂, 3 ♀♀.
St. 1966. 16. ii. 37 (day). North of South Orkney Is., 1800–1500 m., 2 adult ♂♂, 1 juv.
St. 1970. 18. ii. 37 (day). Scotia Sea, 1800–1500 m., 1 adult ♂, 10·5 mm.
St. 1972. 28. ii. 37 (day). Scotia Sea, 2100–1400 m., 4 damaged ♂♂.
St. 1989. 10. iii. 37 (day). East of South Georgia, 1500–1200 m., 6 ♀♀, 2 breeding.

St. 1991. 11. iii. 37 (day). West of South Sandwich Is., 1500–1000 m., 3 ♂♂, 1 ♀, 1 juv.
St. 1993. 12. iii. 37 (day). South of South Sandwich Is., 950–650 m., 1 ♂, 2 ♀♀, fragments.
St. 1999. 15. iii. 37 (day). Ice Edge, south of South Sandwich Is., 1000–500 m., 1 adult ♂.
St. 2006. 19. iii. 37 (day). Ice Edge, south-east of South Sandwich Is., 1750–1400 m., 1 adult ♀.
St. 2018. 26. iii. 37 (night). West of Bouvet I., 1000–750 m., 1 ♂, 2 ♀♀, all adult.
St. WS 22. 30. xi. 26 (day). Off South Georgia, 1000–750 m., 1 juv.
St. WS 30. 19/20. xii. 26 (night). Off South Georgia, 750–500 m., 1 small juv., 6·5 mm.
St. WS 38. 22. xii. 26 (night). East of South Georgia, 1000–750 m., 3 juv., 7 mm.
St. WS 44. 8. i. 27 (day). South Georgia, 750–500 m., 1 small juv.
St. WS 144. 19. i. 28 (day). Off South Georgia, 270–100 m., 1 juv.
St. WS 385. 16. ii. 29 (night). Bransfield Strait, South Shetland Is., 1000–750 m., 1 adult ♀, 18 mm.
St. WS 976. 6. iii. 50 (day). 200 miles west of Walvis Bay, 1000–750 m., 1 juv. ♂, 6 mm. (Bad condition.)

REMARKS. This species may be recognized by its small pear-shaped eyes with the well-developed finger-like process from the inner distal margin of the eyestalk, by the comparatively long antennular peduncles which are only slightly shorter than the antennal scale, by the bluntly rounded rostrum with its convex lateral margins and by the linguiform telson armed around its distal half with a regularly graduated row of spines with the largest at the apex. The only other species of the genus at present known from Antarctic waters is *D. antarctica* Hansen, 1913. This species has large, short, very broad, obliquely set eyes, which are quite far apart, with a broadly rounded rostrum between them and a small antennal scale which has no tooth at the distal end of the naked outer margin.

DISTRIBUTION. The Discovery collections prove that this species has a circumpolar distribution south of 50° S. The type was dredged at about 3700 m. in the Ross Sea. Zimmer (1914) recorded it from several stations south-west of Heard Island in the South Indian Ocean and Illig (1930) from seven stations around Bouvet Island in the South Atlantic.

It was taken at forty-two stations by 'Discovery' and 'Discovery II' and at seven by 'William Scoresby' (sometimes in more than one haul at a station), mostly around South Georgia and the South Sandwich Group ranging from the South Orkneys and South Shetlands to the Ross Sea and along the Ice Edge of the South Pacific and Indian Oceans.

It most commonly occurs between depths of 1000–500 m. but has been taken at over 3500 m. On one occasion only has it been captured at less than 500 m., at station WS 144. The species has always occurred in small numbers, usually only one or two specimens appearing in a haul.

Genus Gibberythrops Illig, 1930

1930 *Gibberythrops* Illig, p. 431.

REMARKS. Only one of the previously described species of the genus, *G. acanthura*, is represented in the present material, but in a haul taken by 'Discovery II' to the west of Cape Town, there is a single immature male specimen which closely resembles *G. philippinensis*, differing only in the much less convex anterior margin of the carapace, which is produced forward to form a broad rostral plate; in the very large peculiar eyes; in the form of the antennal scale and in details in the armature of the uropods and telson. This specimen is in very bad condition and the endopods of the third to the eighth thoracic appendages are missing. The pleopods are small and very immature. It would, nevertheless, seem to represent a new species which I refer, somewhat doubtfully, to the genus *Gibberythrops*.

Gibberythrops acanthura (Illig), 1906

1906*a* *Parerythrops acanthura* Illig, p. 197, figs.
1930 *Gibberythrops acanthura* (Illig), p. 431, figs.
1936 *Erythrops* (*Gibberythrops*) *acanthura* Coifmann, p. 32, figs.
1951 *Gibberythrops acanthura*, W. M. Tattersall, p. 122, figs.

OCCURRENCE:

St. 1568. 11. iv. 35 (night). South-east of Durban, 1400–0 m., 1 ♂, 6·8 mm. (in very bad condition).
St. 1586. 2. v. 35 (night). North-west of Seychelles, 550–0 m., 1 imm.
St. 1587. 3. v. 35 (night). South of Cape Guardafui, 450–0 m., 1 adult ♀, 7·6 mm.

REMARKS. The Discovery specimens agree closely in all particulars with the published descriptions and figures, except that there is only one spine on the inner margin of the endopod of the uropod near the statocyst. Coifmann recorded that there were two spines in this position in her specimens but Illig made no mention of this point nor did he figure any armature on the endopod of the uropod. I am able to add one more detail to the published description of the eyes in this species. These organs are badly damaged in the specimen from station 1568, but are quite well preserved in the other specimen. In shape and size they are precisely as figured by Illig (1930, p. 431) with the widest part near the distal margin of the eyestalk and with the small cornea occupying only about one-third of the whole organ. There is a distinct ocular papilla on the middle of the dorsal surface near the cornea. I can find no record of this in any of the literature, but as the specimen agrees so closely in all essential particulars with *G. acanthura*, I can only regard the papilla as an individual variation, or conclude that it has escaped the observation of previous workers.

DISTRIBUTION. *G. acanthura* has been recorded from the Arabian Sea and from the south-west of Ceylon (Illig, 1906*a* and 1930); from south of the Red Sea (Coifmann, 1936); the Gulf of Aden and central Arabian Sea (Tattersall, 1939) and the Philippines (Tattersall, 1951). Its capture to the south-east of Durban by 'Discovery II' considerably extends its known geographical range to the southward.

Gibberythrops megalops sp.n.

(Fig. 26A–C)

OCCURRENCE:

St. 100C. 4. x. 26 (day). West of Cape Town, 2500(–0) m., 1 imm. ♂, 6 mm. TYPE.

DESCRIPTION. *Carapace* very inflated anterior to the cervical sulcus; anterior margin produced into a broad, bluntly rounded rostral plate, which covers the bases of the eyestalks and extends beyond the distal margin of the first segment of the antennular peduncles; antero-lateral angles rounded (Fig. 26A). No sternal processes on the thoracic somites. *Antennular peduncle* short and robust; third segment equal in length to the first and second together; distal margin of first segment straight (Fig. 26A). *Antennal scale* slender, shorter than the antennular peduncle; distal half of outer margin setose, forming large apex; no thorn marking the termination of the naked outer margin. This may be due to the immaturity of the specimen, for in *G. acanthura* a female of 7 mm. has a well-developed tooth at the distal end of the naked outer margin of the scale, but a male of 5·5 mm. has no trace of one. *Antennal peduncle* nearly twice as broad as the scale. No spine on outer distal angle of the sympod (Fig. 66A). *Eyes* very large. Possibly owing to poor preservation, the eyes appear as large dark masses with no definite division into cornea and eyestalks, each surrounded by a wide transparent border of very thin chitin (Fig. 26A). *Pleopods* very undeveloped, consisting of a sympod bearing two, as yet unsegmented, rami. *Uropods:* exopods half as long again as the telson; endopods only slightly shorter, armed with a single very slender spine on the inner margin near the statocyst (Fig. 26B). *Telson*, longer than in other species of the genus, sub-equal in length to the sixth abdominal somite; twice as long as broad at its base; lateral margins nearly straight, converging to the narrow apex, armed along the distal third of their length with a regularly graduated row of eleven small spines which become progressively longer distally; apex narrowly rounded, armed with a pair of very long straight spines (which are one-fourth of the length of the telson) flanking three long plumose setae (Fig. 26B, C).

Length of immature male, 6 mm.

REMARKS. This new species closely resembles *G. philippinensis* in the shape of the telson, the number and arrangement of the spines arming it and in the proportions and shape of the antennules and antennae. In *G. philippinensis* the outer margin of the scale ends in a strong thorn, but in many species a thorn in this position does not appear until the animals are fully grown, and its absence in *G. megalops* may be merely due to immaturity.

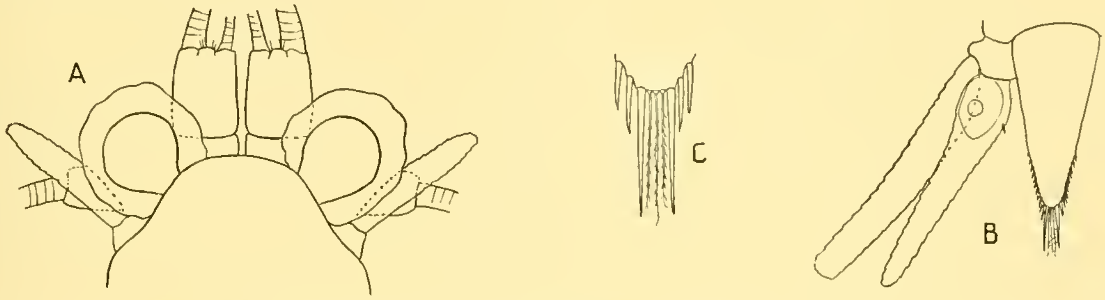

Fig. 26. *Gibberythrops megalops* sp.n. A, anterior end of immature male in dorsal view, × 28; B, telson and left uropod, × 28; C, apex of telson (enlarged).

G. megalops can at once be distinguished from the other species of the genus by the well-developed broad rostral plate, which is produced forward to cover the bases of the eyes and the whole of the first segments of the antennular peduncles, by the presence of a slender spine in the inner margin of the endopod of the uropod, by the relatively greater length of the telson, the length of the apical spines and by the presence of three long plumose setae between them. The most remarkable feature of the specimen is the peculiar form of the eyes but, as this may not be normal, I have relied upon other features for the identification of the species and trust that further specimens may come to light so that the true nature of these organs may be ascertained.

DISTRIBUTION. Atlantic Ocean, to the west of Cape Town.

Genus Meterythrops S. I. Smith, 1879

1879 *Meterythrops* S. I. Smith, p. 93.
1879 *Parerythrops* (pars) G. O. Sars, p. 98.

REMARKS. This genus very closely resembles *Parerythrops* in the general form of the antennules, antennae, eyes, mouth-parts and telson, but differs in the form of the first pleopods of the male. In *Parerythrops* these appendages are rudimentary as in the female, but in *Meterythrops* they are as in *Erythrops*, well-developed, biramous, with the exopod normal and multiarticulate and the endopod reduced to a single segment.

Meterythrops picta Holt and Tattersall, 1905

1905 *Meterythrops picta* Holt and Tattersall, p. 116, figs.
1906*a* *Meterythrops picta*, Holt and Tattersall, p. 23.
1911*b* *Meterythrops picta*, Tattersall, p. 28.
1951 *Meterythrops picta*, Tattersall and Tattersall, p. 113, figs.

OCCURRENCE:

St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 2 juv. ♂♂, 6·4–7 mm., 1 ♀, 10 mm.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 1 imm. ♂, 9·2 mm., and 2 fragments.
St. 100. 2. x. 26 (night). West of Cape Town, 475(–0) m., 1 ♂, 8·5 mm.
St. 100B. 3/4. x. 26 (night). Off Cape Town, 1000–900 m., 2 imm. ♂♂, 8·0–8·8 mm., 2 ♀♀, 10·4 and 6·4 mm., 1 juv.
St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 2 ♂♂, 6·5–7·4 mm., 3 ♀♀, 6·4–11 mm.

St. 267. 23. vii. 27 (night). West of Angra Pequena, 550–450(–0) m., 4 juv. ♀♀, 4·2–6 mm.; (second tube) 1 imm. ♀, 6 mm.

St. 407. 12. vi. 30 (day). South-west of Cape Town, 950–800 m., 1 ♀, 13·4 mm.

St. 700. 18. v. 21 (day). North-east of Cape Verde Is., 2025–0 m., 1 ♀, 9·2 mm.

St. 1569. 12. iv. 35 (night). South-east of Durban, 1200–500 m., 2 ♀♀, 11·8 mm. and 13·6 mm.

St. 1604. 29. x. 35 (night). South-east of St Helena, 620–500 m., 1 juv. ♂, 7·5 mm.

St. 1606. 31. x. 35 (night). West of Angra Pequena, 600–500 m., 4 ♀♀, 7·2–10·8 mm. and fragments.

St. 1761. 3. v. 36 (day). South of Madagascar and east of East London, 1800–650 m., 1 ♂, 6·4 mm.

DISTRIBUTION. This species is a bathypelagic form widely distributed in the temperate and northern waters of the Atlantic. It has been recorded on many occasions from northern European waters and once from the West Atlantic off Long Island, U.S.A. (Tattersall, 1951). It has been recorded from South African waters, west of Cape Town (Zimmer, 1914; Illig, 1930), and seven of the stations at which it was taken by 'Discovery' and 'Discovery II' are in the same area. The other five stations are all in or near South African waters, three off the west coast and two in the Indian Ocean to the east of Cape Colony.

Genus **Katerythrops** Holt and Tattersall, 1905

1905 *Katerythrops* Holt and Tattersall, p. 117.

REMARKS. This genus is characterized by the inflation of the cephalic region of the carapace; by the short rostral projection which covers only the bases of the eyes; by the long, relatively robust antennular peduncles; by the extremely small antennal scale, which is narrower and usually shorter than the peduncle and with the apex very little, if at all, longer than the tooth terminating the outer margin; by the presence of a well-marked ocular papilla on the eyestalk; by the very long sixth abdominal somite which is longer than the fourth and fifth somites together; by the very long uropods and the triangular telson with unarmed lateral margins and narrow apex armed with two pairs of spines. A pair of median setae or bristles may or may not be present.

Three species have, up to the present, been referred to this genus, *K. oceanae* Holt and Tattersall, *K. parva* Zimmer, and *K. tattersalli* Illig. I am now able to add a fourth species to the genus, *K. resimora*.

In *K. parva* and *K. tattersalli* the telson is very short and is shaped like an equilateral triangle with the lateral margins almost straight and converging to a very narrow apex. In *K. oceanae* and the new species the telson is pear-shaped with the lateral margins very convex proximally, but straight in the middle region of its length and slightly concave distally so that the distal third of the telson is very narrow and elongate. *K. resimora* closely resembles *K. oceanae* in the form, proportions and shape of the antennules and antennae, but may be distinguished from *oceanae* by the very large, well-developed eyes in which the cornea is considerably wider than the eyestalks and by the more produced rostral plate with its characteristic upturned margins. A further difference may be seen in the armature of the apex of the telson. In *K. oceanae* the outer pair of spines is very slightly, if at all, shorter than the inner pair, but in *K. resimora* the outer spines measure less than a third of the length of the inner pair.

Katerythrops oceanae Holt and Tattersall, 1905

1905 *Katerythrops oceanae* Holt and Tattersall, p. 117, pl. XX, figs. 1–6.

1906*a* *Katerythrops oceanae*, Holt and Tattersall, p. 24.

1906*a* *Katerythrops dactylops* Illig, p. 198, fig. 5A–B.

1911*b* *Katerythrops oceanae*, Tattersall, p. 30.

1930 *Katerythrops oceanae*, Illig, p. 432, figs. 55, 56.

1951 *Katerythrops oceanae*, Tattersall and Tattersall, p. 214, fig. 47A–F.

OCCURRENCE:

St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 3 ♂♂, 6·8–8·4 mm.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 1 adult ♂, 8·4 mm., 1 juv. ♂, 1 juv. ♀, fragments.
St. 100D. 2. x. 26 (day). West of Cape Town, 675–625 m., 1 ♀, 6 mm.
St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 2 ♀♀, 9·6 mm.
St. 267. 23. vii. 27 (night). West of Orange River estuary, 550–450(–0) m., 1 juv. ♂, 4·4 mm.
St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 adult ♂, 6·8 mm.
St. 714. 30. x. 31 (night). Atlantic, east of Montevideo, 246–0 m., 1 ♂ imm., 7·5 mm.
St. 1555. 29. iii. 35 (night). South of South Africa, 1000–0 m., 1 imm. ♀, 5 mm.
St. 1575. 24. iv. 35 (night). Between Madagascar and Portuguese East Africa, 800–0 m., 1 juv., 2·5 mm.
St. 1739. 17. iv. 36 (day). West of Perth, Western Australia, 3000–2000(–0) m., 1 ♀, 6·2 mm.
St. 1753. 27. iv. 36 (day). North-west of New Amsterdam, South Indian Ocean, 2900–1400 m., 1 ♀, not fully mature, 6·8 mm.
St. WS 976. 6. iii. 50 (day). 200 miles west of Walvis Bay, South Africa, 1000–750 m., 1 small juv., 2·5 mm.

REMARKS. The carapace in this species is very thin and membranous and the specimens are not in good condition. As a result the anterior region of the carapace, which is normally inflated, has become crushed and distorted in some cases and does not present the characteristic appearance of the types but seems more produced anteriorly. The only other difference shown by these specimens is in the length of the antennal scale. In young specimens the scale is extremely small, but may become proportionally longer in some animals, until it may overreach its own peduncle. I have found among the specimens in the Discovery collection that the scale varies in length, being either shorter than the antennal peduncle or longer by one-fifth of its length. In every case the scale is very delicate and narrow and has the bowed shape described in the type. I do not find that this increase in length is always correlated with the size of the animal and this bears out the observation of Holt and Tattersall (1906*a*, p. 24) that the scale in an adult male of 8 mm. had the same proportions as that shown by the immature type specimens.

The cornea of the eyes even in preserved specimens is a clear orange yellow and the ocular papilla is well developed. On the label for station 87 there is the following note on colour: 'Cornea of eyes orange. Large dorsal black patch on anterior part of carapace. Last three abdominal somites blackish —otherwise colourless in two specimens. In one specimen pinkish red pigment on anterior 1 and 2 (somites) and all thoracic legs.'

The form of the first pleopod of the male and of the telson is most consistent throughout.

DISTRIBUTION. This species is a bathypelagic and mesopelagic form, widely distributed in the North and South Atlantic and in the Indian Oceans. The type was taken off the south-west coast of Ireland and the species has since been recorded from the Azores and Canaries (Hansen), West Atlantic (as *K. dactylops*) (Illig), South Africa (as *K. dactylops*) (Zimmer), Bahamas and Bermudas (Tattersall) and the mouth of the Congo and New Amsterdam (Illig). Seven of the ten stations at which it was taken by the ships of the 'Discovery' Investigations are from the South Atlantic, three in the Indian Ocean, one north-west of New Amsterdam, one west of Perth, Australia, and one from between Portuguese East Africa and Madagascar.

Katerythrops resimora sp.n.

(Fig. 27A–J)

OCCURRENCE:

St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 1 adult ♂ with posterior part of pleon missing; 2 ♀♀, adult, 9·8 and 10·2 mm. TYPES.

DESCRIPTION. *General form* moderately robust. *Carapace* inflated anterior to the cervical sulcus, but not so markedly as in *K. oceanae. Rostral plate* with the anterior margin almost straight and turned upward at right-angles to the plane of the carapace; the lateral margins are also bent upward, so that in dorsal view the rostrum appears to be truncate with the lateral margins straight and meeting the anterior margin in an obtuse angle on each side (Fig. 27A). *Antennular peduncle* short and robust, distal margin of first segment produced at the outer angle; third segment larger than the first and second together; hirsute lobe of the male particularly large with extremely long and dense setae (Fig. 27B). *Antennal scale* small, slender, arcuate, only very slightly longer than the peduncle; apex equal in length to the thorn terminating the outer margin; *peduncle* nearly twice as wide as the scale and reaching to the middle of the third segment of the antennular peduncle. The scale normally lies obliquely, crossing inward over the penduncle which is directed outward in the normal way; no spine on the outer distal angle of the sympod (Fig. 27, C). *Eyes* well developed with normal functioning ocelli,

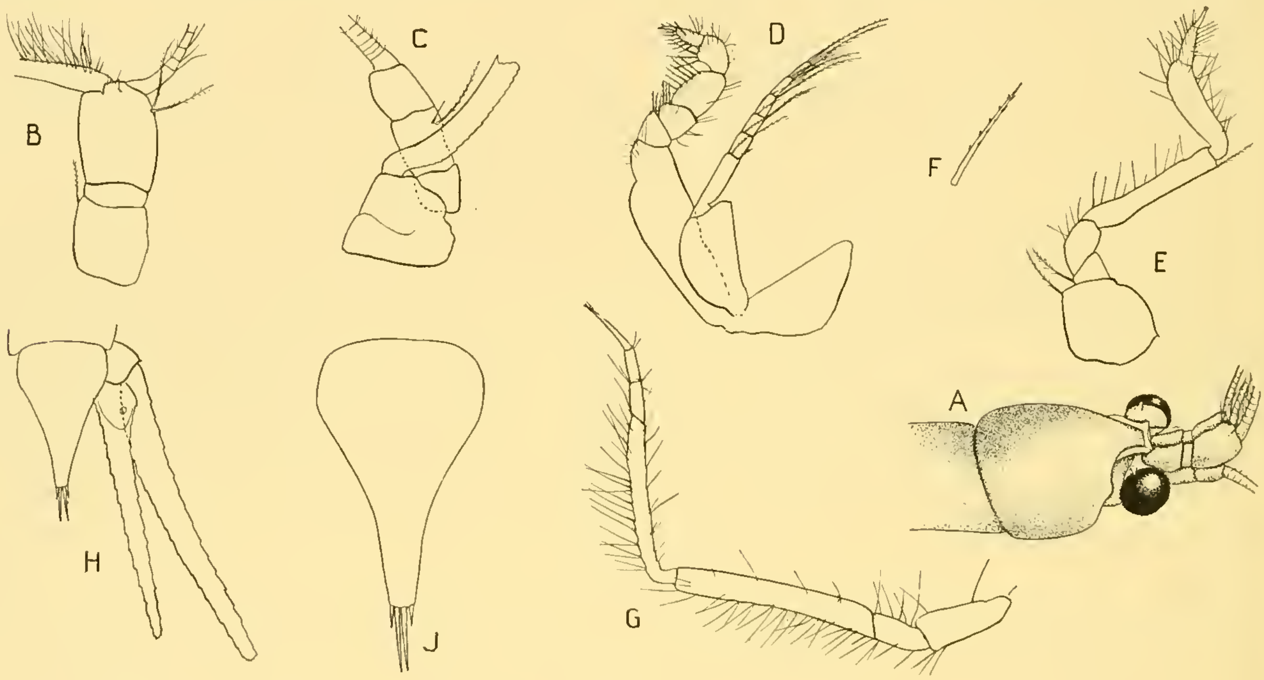

Fig. 27. *Katerythrops resimora* sp.n. A, anterior end of female in dorso-lateral view, × 12; B, left antennule, × 20; C, left antenna, × 20; D, first thoracic appendage with epipod, × 20; E, endopod of second thoracic appendage, × 20; F, enlarged spine from first thoracic endopod; G, endopod of third thoracic appendage, × 20; H, telson and right uropod of female, × 20; J, telson of male, × 30.

globular and not flattened dorso-ventrally, set widely apart with the wide straight anterior margin of the rostral plate between them; well-developed ocular papilla present on the dorsal surface of the eyestalk. This papilla is relatively larger in the male specimen than in the females; *pigment* in preserved specimens, a clear golden brown (Fig. 27A). *Labrum* large, with rounded anterior margin. *First and second thoracic appendages* similar to those of *Erythrops*. First pair more robust and almost as long as the second. Both pairs armed with strong spines which are regularly and strongly spinulose (Fig. 27D, E, F). *Third to the eighth thoracic appendages* long and slender; carpus nearly twice as long as the two-segmented propodus; dactylus fused with the nail to form a very long, slender claw. The thoracic endopods in the type species, *K. oceanae*, are longer and more slender than in this species (Fig. 27G). *Pleopods of the female* rudimentary, in the form of simple setose plates; *pleopods of the male*, well developed, biramous and normal except for the first pair in which the endopod is reduced to a single segment. *Uropods* long and slender; exopod bowed outward, twice as long as the telson; endopod slightly shorter, tapering; no spines on the inner margin (Fig. 27H). *Telson* small, narrowly triangular; equal in length to the last abdominal somite; lateral margins concave, naked, converging to the very narrow apex; *apex* armed with two pairs of spines; inner pair very long, one-fourth as long as the telson; outer pair half as long as the inner; no median plumose setae (Fig. 27 H, J). *Marsupium* composed of two pairs of brood lamellae.

Length of larger female, 10·2 mm. The male specimen is broken, but I think that it would have been larger than the females.

REMARKS. This species very closely resembles *K. oceanae* especially as regards the antennae and the tail fan, but may be distinguished from it by the larger eyes in which the cornea is wider than the eyestalk; by the straight upturned edges of the rostral plate, the less inflated carapace and by the shorter and less slender endopods of the thoracic appendages.

DISTRIBUTION. Known only from the west of Table Bay, South Africa.

Genus Heteroerythrops gen.n.

DIAGNOSIS. *Carapace* inflated anterior to the cervical sulcus; anterior margin very short, produced into a bluntly rounded right-angled rostrum leaving the whole of the eyes exposed. *Antennular peduncle* long and robust; outer distal angle of first segment not produced; articulation between second and third segments very oblique. *Antennal scale* very small and narrow with rounded apex; no spine at distal end of naked portion of outer margin; *antennal peduncle* long and robust. *Eyes* large and globular; not dorso-ventrally compressed; set widely apart; no ocular papilla. First thoracic endopod robust with a long narrow lobe from the second segment. Second thoracic appendage as in *Erythrops*. *Uropods* very long with the endopod nearly as long as the exopod. *Telson* very short, triangular, lateral margins straight and unarmed; apex very narrow and armed with one or two pairs of spines.

Heteroerythrops purpura gen.n., sp.n.

(Fig. 28 A–H)

OCCURRENCE:

St. 1606. 31. x. 35 (night). West of Angra Pequena, 600–500 m., 1 adult ♀, 6·2 mm. TYPE.

DESCRIPTION. *Carapace* relatively large and considerably inflated anterior to the cervical sulcus. *Rostral plate* short with lateral margins nearly straight, converging to the bluntly rounded apex; antero-lateral angles slightly produced and rounded; posterior margin straight and transverse except for a median semicircular emargination, which leaves the last two segments exposed in dorsal view (Fig. 28 A). *Antennular peduncle* with the first and third segments sub-equal in length; distal margin of first segment transverse and not produced at its outer angle; posterior margin of third segment very oblique so that the outer margin of the second segment is very much longer than the inner (Fig. 28 A, B). *Antennal peduncle* shorter than the antennular peduncle; first and second segments relatively broad; third segment more slender and nearly twice as long as the second; *scale* very small and narrow, slightly shorter than the peduncle; apex rounded; proximal two-thirds of outer margin naked and not ending in a thorn or spine; distal third and inner margin armed with long plumose setae; no distal suture; no spine on outer distal angle of sympod (Fig. 28 C). *Eyes* large and globular; not flattened dorso-ventrally; set very widely apart and extending well beyond the lateral margins of the carapace. There is a distinct swelling at the base of the eyestalk, but I am unable to say whether this is natural or due to distortion. I am unable to find any ocular papilla. Colour note in bottle, 'eyes brilliant golden'. *Mandibles: palp* unusually large, extending forward beyond the distal margin of the second segment of the antennular peduncle; second segment very broad with outer margin very convex; third segment long and narrow with parallel sides (Fig. 28 A, D). *Maxilla* similar to *Erythrops*. The exopod is armed with a number of unusually strong, very plumose setae in which the 'plumes' are so long and thick that each seta has the form of a thick brush (Fig. 28 E). *First thoracic endopod* robust; armed along its outer margin with very strong barbed spines; lobe from second segment long and narrow, armed distally with a group of long plumose setae. This lobe is continued backwards as a flat ridge fused with the segment and armed along its outer edge with 9–10 very long plumose setae; no lobes from third and fourth segments; one very strong plumose seta similar to those on the exopod of the maxilla at the outer distal angle of the second, third and fourth segments (Fig. 28F). *Third to the eighth thoracic appendages.* All the endopods of these appendages are missing. *Pleopods of the female* reduced to very small plates. *Uropods* unusually long with the exopod almost three times as long as the

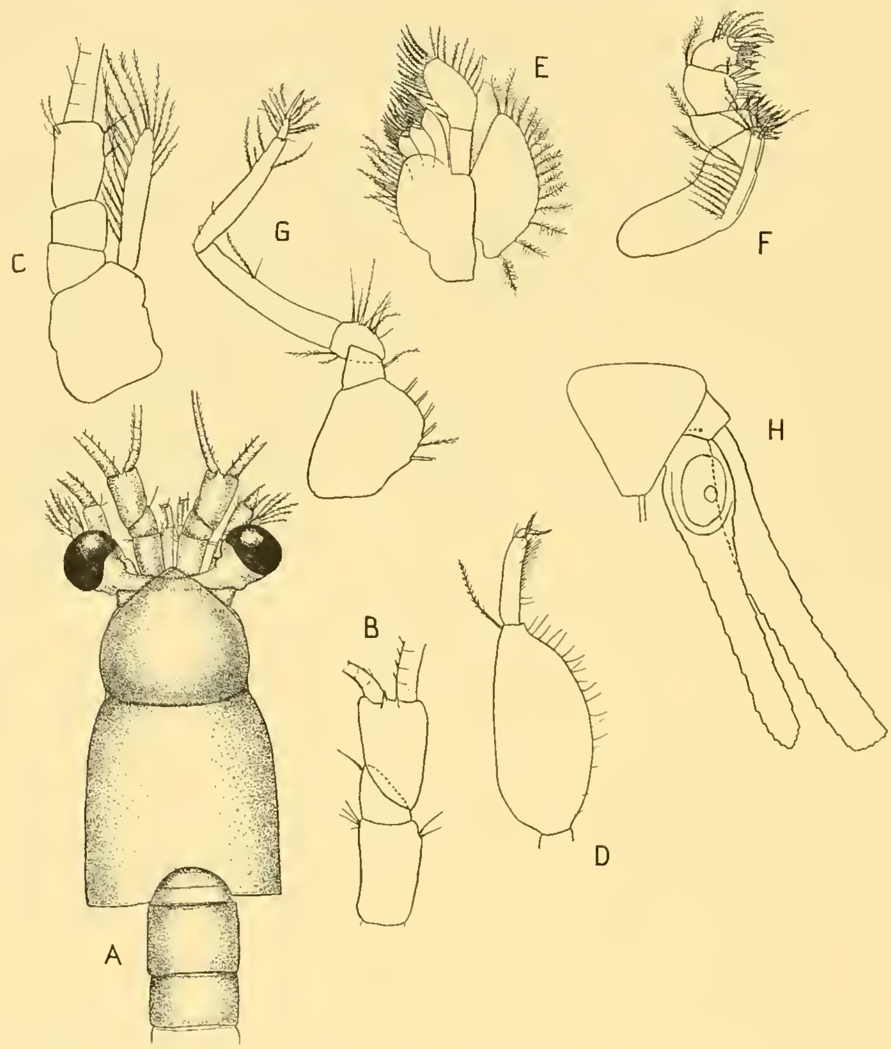

Fig. 28. *Heteroerythrops purpura* gen.n., sp.n. A, anterior end of adult female in dorsal view, × 18; B, antennular peduncle of adult female, × 36; C, right antenna, × 36; D, mandibular palp, × 36; E, maxilla, × 36; F, endopod of first thoracic appendage, × 36; G, endopod of second thoracic appendage, × 36; H, telson and right uropod, × 36.

telson; apex truncate and rather broad; endopod almost as long as the exopod. I can find no spines among the setae on the inner margin (Fig. 28H). *Telson* small, triangular, with the lateral margins sub-equal in length to the width at the base; slightly more than half as long as the last abdominal somite; no spines on the lateral margins; apex narrowly truncate. Only the proximal portion of one spine is present and the posterior margin of the apex is damaged, so that I am unable to ascertain how many spines were originally borne there. I am inclined to think that there were only two spines; if there had been more, the inner ones must have been much more slender than the only base which is still attached. It may be that there were two plumose setae (Fig. 28H)

Length of female with large, well-developed marsupium, 6·2 mm.

Colour. There is a note in the bottle which reads, 'deep purple in colour with brilliant golden eyes'.

REMARKS. This species strongly resembles *Katerythrops oceanae* Holt and Tattersall in the general form of the anterior end, the inflation of the carapace anterior to the cervical sulcus, the shape of the short rostral plate, the spacing of the widely separated eyes and the very small narrow antennal scale with a relatively robust antennal peduncle. It may, however, be distinguished from this species as follows: (1) by the absence of a tooth or spine on the outer margin of the antennal scale, (2) by the absence of an ocular papilla and by the shape of the eye, (3) by the form of the telson. In *Katerythrops* the eye is ovoid with its widest part half-way along the stalk; the cornea is small and there is a well-developed ocular papilla on the dorsal surface of the eyestalk. In *Katerythrops* the telson is triangular and considerably longer than broad at its base with the lateral margins more or less concave. The apex is narrowly truncate and armed with two pairs of spines. In the Discovery specimen the telson is an equilateral triangle with the lateral margins straight and converging to a very narrow apex. In shape it recalls the telson of *Erythrops.*

In the absence of male specimens and owing to the damaged condition of this specimen, I am unable to gauge the true taxonomic position of this new genus. It is certainly very closely related to both *Erythrops* and *Katerythrops.*

DISTRIBUTION. The type specimen was taken in a closing net in a vertical haul from 600 m. to 500 m. off the west of Angra Pequena.

Genus Erythrops G. O. Sars, 1869

1863 *Nematopus* G. O. Sars, p. 233.
1869 *Erythrops* G. O. Sars, p. 325.

Erythrops africana sp.n.

(Fig. 29A–K)

OCCURRENCE:

St. 277. 7. viii. 27 (night). Off Cape Lopez, West Africa, 63(–0) m., 10 ♂♂, 4·4–4·6 mm., 19 ♀♀ with brood sacs, 3·8–4·6 mm., 22 juv. and ♀♀ without brood sacs, 3·2–4·2 mm. TYPES.

DESCRIPTION. *Carapace* produced anteriorly into a short, pointed rostrum which only just covers the bases of the eyestalks; emarginate posteriorly, leaving the last two thoracic somites exposed in dorsal view. *Sternal processes.* In the middle of the sternum of each thoracic somite in the male there is a peculiar club-shaped, spiny process similar to that found in *E. serrata* (G. O. Sars), the only difference being that it is relatively larger and the spines arming the distal end are considerably longer and more irregularly placed. In *E. serrata* similar processes occur in immature females as well as in the males but, although a number of young females in the present material have no oostegites, none of them has sternal processes. The specimens are not in good condition and it may be that these females are in fact adult but have lost their oostegites. In Fig. 29A I have dissected away the bases of some of the thoracic appendages, in order to show these sternal processes of the male *in situ* (Fig. 29A, C). *Antennular peduncle* showing marked sexual dimorphism; twice as stout in the male as in the female; third segment of the male swollen especially dorsally, and with the outer distal angle considerably produced; in the female the outer distal angle of the second segment also is produced and tipped with two or three setae. I have figured, to the same scale, the right antennules of a male and a female of the same size, so that the very marked difference between them may be appreciated (Fig. 29D, E). *Antenna.* Peduncle slightly shorter than the antennular peduncle; third segment the longest; *scale* slightly arcuate; outer margin entire, terminating in a strong tooth which is equal in length to the small apex; scale very narrow, eight times as long as broad; extending beyond the antennular peduncle by nearly one-fourth of its length; no distal articulation; one large and one small spine on the outer distal margin of the sympod (Fig. 29A, B, F). *Eyes* large; set widely apart; cornea reniform; flattened dorso-ventrally; no papilla on the eyestalk (Fig. 29B). *Thoracic appendages.* In all the specimens the third to the eighth thoracic endopods are broken off, but there were a number of them loose in the tube. I have figured the largest of these but cannot say from which pair it came. These endopods have the same general form as in the other species of the genus and, if the largest loose endopod is the eighth, it would extend to the anterior margin of the sixth abdominal somite. There is a minute spine on the outer distal angle of the first segment of the exopod (Fig. 29G). *Pleopods* of the female rudimentary;

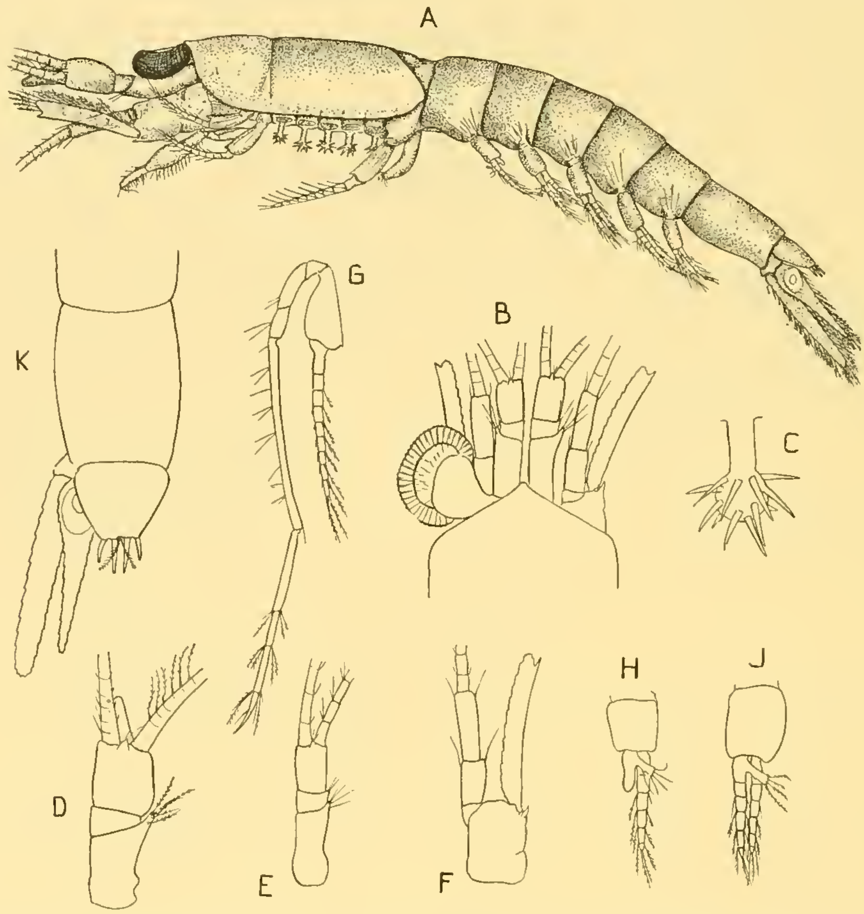

Fig. 29. *Erythrops africana* sp.n. A, adult male in lateral view with thoracic appendages removed to expose sternal processes, × 20; B, anterior end of female in dorsal view, × 34; C, sternal process of male (much enlarged); D, right antennule of male, × 34; E, right antennule of female, × 34; F, right antenna, × 34; G, thoracic appendage, × 34; H, first pleopod of male, × 34; J, fourth pleopod of male, × 34; K, telson and left uropod, × 34.

of the male normal and biramous, with well-developed lobes from the basal segments of the endopods; in the first pair the endopod is reduced to a single segment which is slightly inflated distally and bears a well-developed lobe at its base (Fig. 29H, J). *Uropods* more than twice as long as the short telson; endopod tapering, shorter than the exopod; no serrulations on the inner margin and no spines in the neighbourhood of the statocyst (Fig. 29K). *Telson* of the usual type found in the genus; lateral margins straight, converging to the broad truncate apex; inner pair of apical spines slightly longer than outer (Fig. 29K).

Length. Largest male, 4·6 mm.; largest female, 4·6 mm.

REMARKS. This species very closely resembles *E. serrata* (G. O. Sars), but can be distinguished from it by the relatively narrower antennal scale and the absence of serrations along its outer margin; by the longer spines on the sternal processes; by the absence of serrulations beneath the setae of the inner margin of the endopod of the uropod and by its smaller size. Adults of *E. serrata* measure 11 mm. while females of *E. africana* of less than 4·2 mm. have well-developed brood sacs. A large number of females of the same size have no brood lamellae, but the material is in bad condition and they have probably been lost as have the thoracic endopods.

DISTRIBUTION. Off Cape Lopez, just south of the equator, West Africa. *E. africana* is the first species of the genus to be recorded from the Atlantic south of the equator, the only other species from the southern hemisphere being *E. yongei* Tattersall, from the Great Barrier Reef, Queensland.

Genus Echinomysis Illig, 1905

1905 *Echinomysis* Illig, p. 151.

Echinomysis chuni Illig, 1905

1905 *Echinomysis chuni* Illig, p. 151, figs.
1912 *Echinomysis chuni*, Illig, pp. 129–38, 4 coloured plates.
1930 *Echinomysis chuni*, Illig, p. 453, figs. 104–23.
1939 *Echinomysis chuni*, Tattersall, p. 244.

OCCURRENCE:

St. 673. 25. iv. 31 (night). West of Tristan da Cunha, 340–0 m., 2 juv.
St. 1587. 3. v. 35 (night). South-east of Ras Hafun, 450–0 m., 1 ♀, 10 mm.

REMARKS. The single female specimen agrees very closely with Illig's description and figures in all respects, except that the spines arming the carapace appear to be relatively longer than in his specimens.

DISTRIBUTION. This species was taken at eight stations by the 'Tiefsee' Expedition, one in the Gulf of Guinea near Lagos and seven in the Indian Ocean—one off Sumatra, three off Ceylon, one off the Amirante Islands, one south-east of Ras Hafun and one in the Gulf of Aden. W. M. Tattersall (1939, p. 244) recorded a single female from the central Arabian Sea. The Discovery capture at station 673 extends its known geographical range considerably to the southward.

Genus Longithorax Illig, 1906

Longithorax capensis Zimmer, 1914

(Fig. 30A–F)

1914 *Longithorax capensis* Zimmer, p. 392, pl. XXIV, figs. 20–4.
1930 *Longithorax capensis*, Illig, p. 428.
1943 *Longithorax capensis*, Nouvel, p. 75, figs. 119–122.

OCCURRENCE:

St. 78. 12. vi. 26 (day). North-west of Tristan da Cunha, 1000(–0) m., 1 ♀, 10·2 mm.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 1 ♂, 10 mm., 1 juv. ♂, 3 ♀♀, 8·2–8·4 mm.
St. 100. 2. x. 26 (day). West of Table Bay, 475(–0) m., 1 ♂, 9 mm., 1 ♀, 9·8 mm.
St. 100C. 2. x. 26 (day). West of Table Bay, 450–550 m., 1 ♂, 10 mm.
St. 254. 21. vi. 27 (night). Midway between Tristan da Cunha and Cape Town, 200(–0) m., 1 ♀, 8·8 mm.
St. 258. 25. vi. 27 (night). West of Cape of Good Hope, 450–320 m., 1 ♀, 8·2 mm.
St. 259. 26. vi. 27 (night). West of Cape of Good Hope, 450–370(–0) m., 1 juv. ♂, 7 mm., 2 ♀♀, 1 adult 9·6 mm., 1 juv. 8 mm.
St. 266. 21. vii. 27 (night). West of Orange River estuary, 200(–0) m., 1 imm. ♂, 7·4 mm.
St. 844. 8. iv. 32 (night). South of Cape Town, 155–0 m., 7 ♂♂, 12 ♀♀, 4 juv., largest 10·0 mm.
St. 1374. 24. v. 34 (night). East of St John's, Natal, 230–0 m., 1 adult ♀, 9·4 mm.
St. 1586. 2. v. 35 (night). North-west of Seychelles, 550–0 m., 1 ♀ in two pieces.

REMARKS. This species was instituted by Zimmer for two specimens taken in a vertical haul (3000–0) m. off the west of the Cape of Good Hope. The types consisted of an adult ♂ of 9 mm. and an immature female. Specimens of the same size in the Discovery material agree so closely with Zimmer's description and figures, that I have no hesitation in referring them to his species. The only difference I can find is in the largest specimens of the Discovery material, where the anterior margin of the carapace extends farther forward than in Zimmer's figure and partially covers the bases of the eyestalks. In Fig. 30 I have copied some of Zimmer's figures and placed them beside corresponding figures of an adult female from station 254. A comparison shows not only how closely they resemble one another, but also the slight difference which I have mentioned. In his description Zimmer noted a single blunt spine on the inner margin of the endopod of the uropod at the distal end of the statocyst, but did not figure it. I have found this spine to be present in all my specimens, but it is by no means easy to see unless the appendage is dissected, for it is blunt and lies on the ventral side of the endopod a little way in from the margin, barely projecting at all (Fig. 30B). The finger-like process on the inner margin of the eye is very small in younger animals, but in adults of both sexes it lengthens and curves outward in front of the cornea (Fig. 30A).

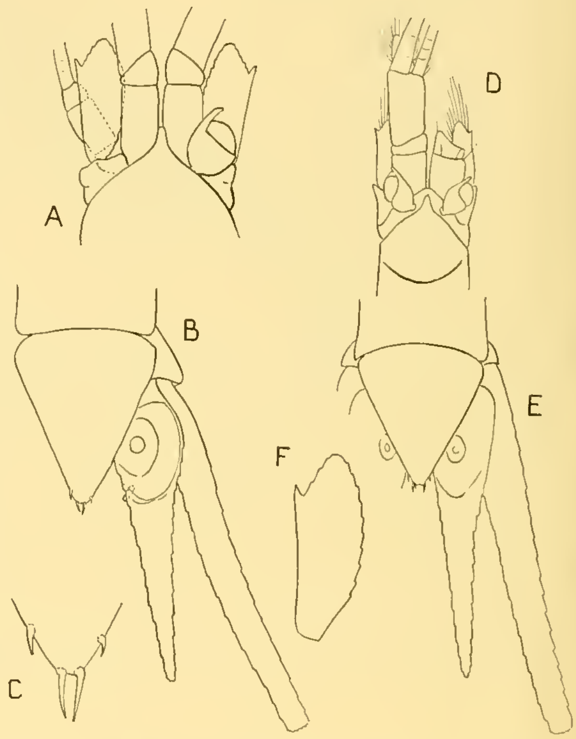

Fig. 30. *Longithorax capensis* Zimmer (A–C for comparison with Zimmer's figures D–F). A, anterior end of female in dorsal view; B, telson and right uropod of female in dorsal view; C, distal end of telson (enlarged); D, anterior end of male (after Zimmer); E, telson and right uropod of male (after Zimmer); F, left antennal scale (after Zimmer).

Nouvel (1943, p. 75) doubtfully referred a damaged female specimen captured off the Azores in a vertical haul, 2500–0 m., to this species. He pointed out that the rostral plate formed a more obtuse angle than in Zimmer's types and that the rostrum was less marked. He also noted that the scale was somewhat narrower than in *L. capensis* and that the spine on the outer margin was more acute.

In his review of the Mysidacea of the United States National Museum, written just before his death in 1943, my husband (Tattersall, 1951, p. 120) referred a number of specimens captured off the Bermudas to *L. capensis*. He had not seen Nouvel's 1943 publication and stated that the species had only once been recorded. He pointed out that his specimens agreed very closely with the types, but that the rostral plate had straight sides set at about an angle of 120°, with the apex bluntly rounded and not produced. I made figures of the telson and one uropod and of the antenna, but not of the anterior end.

In reviewing the whole of the records, I am of the opinion that we have here two distinct species, one the original *L. capensis* from the South Atlantic and the other from the Azores and Bermudas. I suggest for the second species the name *L. nouveli* after Professor Nouvel who first published its description.

This new species differs from *L. capensis* as follows:

(1) *Rostrum.* The anterior margins of the rostral plate are straight, converging to an obtuse angle and not produced forward between the eyes as a bluntly rounded rostrum as in *L. capensis.*

(2) *Antennal scale* relatively more slender. In the types and in the Discovery specimens of *L. capensis* the ratio of the length to the greatest breadth is 2·7:1 whereas in *L. nouveli* it is slightly more than 3:1. The spine marking the distal end of the naked outer margin is more slender and acute in *L. nouveli* than in *capensis*.

(3) *Uropod*. Nouvel definitely stated that the endopod of the uropod was unarmed; Tattersall did not mention this point, but in *L. capensis* there is a spine near the statocyst (Fig. 30 B).

(4) *Size*. Nouvel's specimen of 9·8 mm. was quite immature with very small oostegites. Tattersall's specimens of 6–9 mm. from the surface and a male of 10 mm. from deeper water were all immature, and adult females measured 13 mm. Zimmer's adult male type of *L. capensis* was only 9 mm. and in the Discovery material, males of 9–10 mm. and females of 8·2–8·6 mm. are quite adult, the latter with very large oostegites.

The form of the telson is not exactly similar in Nouvel's and Tattersall's specimens, but this may be due to two things. First, the telson from which I made the figure for Tattersall's report had been dissected off and mounted and was therefore flattened, so that it is wider than it would appear *in situ*. Professor Nouvel has told me that, having but a single specimen, he made his figure without dissecting the telson off and the lateral margins, being foreshortened, appeared less convex. The apex was damaged in his specimen so that he was not able to show its armature.

Tattersall stated that all his specimens of both sexes had a tuft of long setae at the base of the outer flagellum of the antennule. Nouvel did not mention this point, but his specimen was badly damaged and they may have been broken off. I can find no trace of any such tufts in my material.

Distribution. The types of *L. capensis* were taken in a vertical haul from 1000–0 m. in daylight. The only other record of the species was by Illig—also in a vertical haul from a great depth to the surface by daylight—off the east of the Cape Verde Is. The Discovery collection indicates that it is widely distributed in the waters of the South Atlantic, from the coasts of Africa to Tristan da Cunha. Six of the ten hauls in which it was taken were oblique and taken at night, two of them from a depth of 200 m. to the surface, one from 230 m. to the surface, one from 450–0 m., one from 550–0 m. and one in a closing net from 550–450 m. The remaining four hauls were also oblique and were taken in daylight. Two were taken from 1000(–0) m. and one from 475(–0) m. where the nets failed to close, and one in a closing net between 550 m. and 450 m.

It is evident that the species is not such a deep-water form as has been supposed and it must be regarded as a definitely mesoplanktonic species.

Genus Euchaetomera G. O. Sars, 1884

1884 *Euchaetomera* G. O. Sars, p. 42.
1896 *Brutomysis* Chun, p. 179.
1906*b* *Mastigophthalmus* Illig, p. 227.
1910 *Euchaetomera* Hansen, p. 65.

Euchaetomera typica G. O. Sars, 1884

1884 *Euchaetomera typica* G. O. Sars, p. 42; 1885, p. 211, figs.
1896 *Brutomysis vogtii* Chun, p. 179, figs.
1906*a* *Euchaetomera limbata* Illig, p. 203, fig.
1914 *Euchaetomera typica*, Zimmer, p. 393.
1918 *Euchaetomera sennae* Colosi, p. 7; 1920, p. 239, figs.
1930 *Euchaetomera typica*, Illig, p. 434, figs.
1923 *Euchaetomera typica*, Tattersall, p. 283; 1939, p. 243.

Occurrence:

St. 29° 27′ N., 15° 07′ W. 16. x. 25. From the stomach of *Naucrates ductor* 900–0 m., 1 ♀ with empty brood sac, 8 mm.
St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 2 ♀♀, 10 mm. and 8 mm., larger breeding.
St. 89. 28. vi. 26 (day). West of Cape Town, 1000(–0) m., 1 ♂, 7 mm., 1 imm.
St. 252. 20. vi. 27 (night). Midway between Cape Town and Gough I., 135 m., 1 imm. ♂, 3 breeding ♀♀, largest 11·5 mm.
St. 256. 23. v. 27 (day). West of Cape Town, 1100–850(–0) m., 1 juv. ♂, 5 mm., 1 juv. ♀, 4·5 mm.
St. 257. 24. vi. 27 (night). West of Cape Town, 250(–0) m., 1 ♂, 2 ♀♀, all juv.
St. 266. 21. vii. 27 (night). Off West coast of South Africa, 200(–0) m., 1 ♀, 8 mm.
St. 282. 12. viii. 27 (night). West of Cape Lopez, West Africa, 300(–0) m., 1 ♀, 8 mm., not fully adult.
St. 286. 17. viii. 27 (night). Midway between Cape Lopez and Ascension I., 125(–0) m., 1 ♀, 9 mm., 1 juv. ♀.
St. 295. 25. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 imm. ♀.
St. 673. 25. iv. 31 (night). Mid-Atlantic, east of Tristan da Cunha, 340–0 m., 1 ♂, 8 mm.
St. 674. 25. iv. 31 (night). West of Tristan da Cunha, 280–0 m., 1 juv. ♂, 5 mm., 1 juv. ♀, 4·5 mm.
St. 676. 26. iv. 31 (night). North-west of Tristan da Cunha, 290–0 m., 1 imm. ♂, 6·5 mm.
St. 692. 9. v. 31 (night). Mid-Atlantic, equatorial zone, 350–0 m., 1 ♀, 8 mm., with large empty brood sac, 1 juv.
St. 693. 10. v. 31 (day). Mid-Atlantic, equatorial zone, 250–0 m., 2 ♀♀, with large empty brood sacs, larger 8·5 mm.
St. 694. 10. v. 31 (day). Mid-Atlantic, equatorial zone, 210–0 m., 2 ♀♀, larger 8 mm.
St. 698. 13. v. 31 (night). South-west of Cape Verde Is., 470–0 m., 1 juv. ♀.
St. 699. 14. v. 31 (night). West of Cape Verde Is., 370–0 m., 1 ♀, 7 mm.
St. 701. 16. x. 31 (night). Off Cape Verde Is., 242–0 m., 1 juv. ♀.
St. 1377. 4. viii. 34 (night). South Atlantic, south-west of Cape Town, 100–0 m., 1 imm. ♀, 8 mm.
St. 1578. 26. iv. 35 (night). Midway between Cape Delgado and north of Madagascar, 500–0 m., 1 adult ♀, 8·5 mm., 1 juv. ♀.
St. 1596. 21. x. 35 (night). Gulf of Guinea, 450–310 m., 1 adult ♀, with empty brood sac, 8 mm.
St. 1602. 27. x. 35 (night). West of south-west Africa, 175–0 m., 1 ♀, 8 mm.
St. 1747. 23. iv. 36 (day). South Indian Ocean midway between Durban and Perth, Western Australia, 400–0 m., 1 ♀ with large empty brood sac, 10 mm.
St. 2685. 22. vi. 50 (night). West of Cocos Is., Indian Ocean, 250–100 m., 1 juv.
St WS 977. 6/7. iii. 50 (night). Nearly 200 miles west of Walvis Bay, 500–250 m., 1 juv. 3 mm.
St. WS 978. 7. iii. 50 (day). 150 miles west of Walvis Bay, 100–50 m., 1 imm. ♂, 5·6 mm.

Distribution. *E. typica* has a wide distribution in the tropical and sub-tropical waters of the southern hemisphere in the Atlantic, Indian and Pacific Oceans and has been recorded from near the Bermudas in the northern hemisphere. It has usually been taken in oblique hauls from relatively shallow depths to the surface. It was collected in twenty-five hauls by 'Discovery' and 'Discovery II' and in two vertical hauls by 'William Scoresby' from between 1000 m. and 135 m. to the surface. The greatest depth at which it was taken in a closing net was 450–510 m. and the least was 100–50 m. It is not a gregarious form, usually only one or two specimens were captured in a haul and the greatest number taken together in the Discovery collection was four at station 252.

Euchaetomera tenuis G. O. Sars, 1883

1883 *Euchaetomera tenuis* G. O. Sars, p. 43; 1885*a*, p. 214, figs.
1905 *Euchaetomera fowleri* Holt and Tattersall, pp. 123 and 144, figs.
1909 *Euchaetomera tenuis*, Tattersall, p. 130.
1910 *Euchaetomera tenuis*, Hansen, p. 66, figs; 1912, p. 201.
1914 *Euchaetomera tenuis*, Zimmer, p. 394.
1930 *Euchaetomera tenuis*, Illig, p. 448.
1951 *Euchaetomera tenuis*, Tattersall and Tattersall, p. 275, figs.

OCCURRENCE:

St. 89. 28. vi. 26 (day). West of the Cape of Good Hope, 1000(–0) m., 1 ♀, 7 mm.
St. 100. 3. x. 26 (day). Off south-west Africa, two hauls: (i) 310–260 m. 1 ♂, 7 mm., 5 ♀♀, 7·5–8 mm. (some ovig.), 4 juv.; (ii) 2500(–0) m., 4. x. 26 (day), 2 adult ♀♀, larger 9 mm.
St. 256. 23. vi. 27 (day). West of Cape of Good Hope, 1100–850(–0) m., 2 juv. ♀♀.
St. 258. 25. vi. 27 (night). West of the Cape of Good Hope, 450–320 m., 2 ♀♀, 8·5 mm.
St. 267. 23. vii. 27 (night). North-west of Angra Pequena, 550–450(–0) m., 2 ♂♂, 8–8·5 mm., 1 juv. ♂.
St. 282. 12. viii. 27 (night). West of Cape Lopez, 300(–0) m., 5 juv., 4–4·5 mm.
St. 295. 25. viii. 27 (day). West of Sierra Leone, 2700–2500(–0) m., 1 juv. ♀.
St. 673. 25. iv. 31 (night). West of Tristan da Cunha, 340–0 m., 2 ♀♀, 1 juv. ♂.
St. 695. 11. v. 31 (night). Mid-Atlantic, just north of equator, 370–0 m., 1 juv. ♀, 5 mm.
St. 697. 12. v. 31 (night). Mid-Atlantic, just north of equator, 460–0 m., 1 ♀, 8 mm.
St. 702. 17. x. 31 (night). West of Sierra Leone, 236–0 m., 1 juv. ♂, 5·5 mm.
St. 1568. 11. iv. 25 (night). South-east of Durban, 1400–0 m., 1 juv. ♂, 1 juv. ♀, fragments.
St. 1581. 28. iv. 35 (night). East of Zanzibar, 600–0 m., 1 juv. ♀.
St. 1586. 2. v. 35 (night). North of Madagascar, 550–0 m., 1 juv. ♀.
St. WS 977. 6/7. iii. 50 (night). Nearly 250 miles west of Walvis Bay, 250–100 m., 2 juv., 2·5–3 mm. (Benguela Current Survey).

REMARKS. The species would appear to be by no means a gregarious form for usually only one or two specimens have been found in a haul. The largest number taken in a haul was at station 100 in a closing net fishing between 260–310 m., when ten specimens were caught.

DISTRIBUTION. *E. tenuis* is a mesoplanktonic species with a world-wide distribution in the tropical and sub-tropical waters of the globe. It has been recorded on several occasions from the South Pacific and Indian Oceans and from Atlantic waters, extending eastward from the coast of Florida to the west coast of Ireland in the northern hemisphere, and off the coasts of South Africa in the South Atlantic. It has also been recorded from the Mediterranean on a number of occasions.

The species has previously usually been taken in vertical hauls, often from considerable depths to the surface, so that it is not possible to say from the earlier records at which depths the animals were actually living. 'Discovery', working with closing nets, took adult breeding females at station 100, at 260–310 m., and station 258, at 320–450 m. The shallowest depth at which it was taken in the present collection was at station 702 in an oblique haul from 236 m. to the surface. The species has only once been recorded actually at the surface, when the type was captured by 'Challenger' in the South Pacific, off the coast of Chili. Although it occurred on a few occasions with *E. typica*, it appears to tend to occupy somewhat deeper water than that species.

Euchaetomera zurstrasseni (Illig) 1906

1906*a* *Mastigophthalmus zurstrasseni* Illig, pp. 203–5, figs.
1913 *Euchaetomera pulchra* Hansen, p. 15, figs.
1914 *Euchaetomera zurstrasseni*, Zimmer, p. 394.
1930 *Euchaetomera zurstrasseni*, Illig, pp. 437–44, figs.

OCCURRENCE:

St. 100C. 4. x. 26 (day). West of Table Bay, 2500–2000 m., 1 ♂, 7 mm. Almost black.
St. 120. 22. xi. 26 (day). North-west of Bouvet I., 360–340(–0) m., 1 ♀, 10 mm.
St. 254. 21. vi. 27 (night). West of Cape of Good Hope, 200(–0) m., 2 juv., 4 mm.
St. 259. 26. vi. 27 (night). West of Cape of Good Hope, 450–370(–0) m., 1 ♂, 7 mm. damaged.
St. 267. 23. vii. 27 (night). West of Orange River estuary, 550–450(–0) m., 4 juv. ♀♀, 1 juv. ♂, 5 mm., 11 very small juv. 2·5–4 mm.
St. 461D. 22. x. 30 (night). South-west of Bouvet I., 490–385 m., 1 ♂, 6 mm.

St. 563. 1. i. 31 (day). Bellingshausen Sea, 450–180 m., 1 ♂, 8·5 mm.
St. 590. 14. i. 31 (day). West of Graham Land, 1400–1150 m., 1 ♂, 9 mm.
St. 591. 14. i. 31 (day). Bellingshausen Sea, 360–122 m., 1 juv. ♂, 3·5 mm.
St. 592. 15. i. 31 (day). Bellingshausen Sea, 350–124 m., 1 ♀, 9 mm., with large empty brood-sac.
St. 594. 15. i. 31 (day). North-west of Graham Land, 435–165 m., 1 ♀, 9·5 mm.
St. 663. 5. iv. 31 (day). East-north-east of South Georgia, 500–250 m., 1 very small juv.
St. 666. 17. iv. 31 (day). North-east of South Georgia, 750–500 m., 1 ♀, 8 mm.
St. 668. 19. iv. 31 (day). North of South Georgia: (i) 750–500 m., 1 ♂, 8 mm., 1 ♀, 5·5 mm.; (ii) 1500–0 m., 1 ♂, 7·2 mm.
St. 673. 25. iv. 31 (night). West of Tristan da Cunha, 500–250 m., 2 ♀♀, 6·5 and 4·2 mm.
St. 946. 3. ix. 32 (night). South of Chatham Is., 270–120 m., 1 small juv.
St. 971. 25. ix. 32 (night). North of Bellingshausen Sea, 340–120 m., 1 ♂, 8 mm.
St. 1517. 14. ii. 35 (night). East of Weddell Sea, 420–230 m., 1 ♀, 8 mm., 2 small juv.
St. 1539. 25. ii. 35 (night). Ice Edge, off Enderby Land, 350–230 m., 1 ♀, 8·5 mm.
St. 1558. 1. iv. 35 (night). North-west of Prince Edward Is., 1300–0 m., 1 ♀, 7·5 mm.
St. 1838. 12. x. 36 (day). West-north-west of South Sandwich Is., 750–250 m., 1 ♀, 7 mm.
St. 1915. 2. xii. 36 (day). Scotia Sea, 550–350 m., 1 ♂, 8 mm., 1 ♂, 9·5 mm., 1 juv. ♀, 6 mm.
St. 2550. 23. i. 39 (night). 67° 27·8′ S., 06° 35·3′ E., 430–230 m. 1 imm. ♂, 8·2 mm., 3 ♀♀, 7–9·2 mm., 5 juv.
St. WS 30. 19. xii. 26 (night). Off South Georgia, 250–100 m., 1 imm. ♀, 6·8 mm.
St. WS 173. 6/7. iii. 28 (night). East of South Georgia, 500–250 m., 1 ♀, 7·5 mm. empty brood-sacs.
St. WS 552. 3. ii. 31 (day). Off South Georgia, 250–200 m., 2 ♀♀, 10 and 8 mm., with large empty brood-sacs.
St. WS 976. 6. iii. 50 (day). Nearly 200 miles west of Walvis Bay, 250–100 m., 1 juv. 3 mm.

REMARKS. This species appears to be rather less fragile than either of the two preceding ones. Most of the specimens are in good condition and retain their thoracic appendages. There is a colour note in the tube from station 590 as follows: 'Transparent. Red dots on sides of abdomen and distal leg joints. Upper side of eyes with patch of silvery grey.'

There is some considerable variation in the length of the spines arming the body and telson, but the shape and form of the antennal scale, the proportions of the telson and uropods and the disposition of the spines arming the carapace and abdominal somites are so uniform that I have no hesitation in referring the specimens to *E. zurstrasseni*.

DISTRIBUTION. This species was first recorded from the Indian Ocean west of the Chagos Islands, when the type specimen was captured in a vertical haul from 2500 m. to the surface (Illig, 1906*a*). Hansen (1913) recorded it from south of Prince Edward Island and Zimmer (1914) from the Falkland Islands—both records from vertical hauls to the surface. Illig (1930) recorded it from the south-east and east of Bouvet Island and from between the Chagos Islands and the Seychelles, again in vertical hauls with open nets from 2500 m. and less to the surface.

In the Discovery collection the species has been taken in closing nets at no fewer than twenty stations and, though it once occurred in a net fishing between 2500 m. and 2000 m. at station 100 C, in all the others it was taken between 750 m. and 100 m., the greatest number being taken between 300 m. and 500 m.

The Discovery collection considerably enlarges its known geographical range and proves this species to be widely distributed far south in the Antarctic Ocean where it was taken at eleven stations.

It also occurred at fifteen stations in the South Atlantic Ocean and at one in the South Pacific. Up to the present it has not been recorded from the northern hemisphere.

Euchaetomera glyphidophthalmica Illig, 1906

1906*a* *Euchaetomera glyphidophthalmica* Illig, pp. 201–2, text-fig. 9.
1914 *Euchaetomera glyphidophthalmica*, Zimmer, p. 394, pl. xxiv, fig. 25.
1915*b* *Euchaetomera glyphidophthalmica*, Zimmer, p. 318. (Doubtfully.)
1929 *Euchaetomera glyphidophthalmica*, Colosi, p. 417.
1930 *Euchaetomera glyphidophthalmica*, Illig, pp. 445–6, text-figs. 84–7.
1939 *Euchaetomera glyphidophthalmica*, Tattersall, p. 243.

Occurrence:

St. 266. 21. vii. 27 (night). West of Orange River estuary, 200(–0) m., 1 ♂, 8·5 mm., 1 ♀, 8·5 mm., 3 small juv., 3–4·2 mm.
St. 276. 5. viii. 27 (night). South of Cape Lopez, 150(–0) m., 1 ♀, 8·8 mm.
St. 695. 11. v. 31 (night). Mid-Atlantic, north of equator, 370–0 m., 1 ♂, 1 ♀, 8 mm.
St. 701. 16. x. 31 (night). Near Cape Verde Is., 242–0 m., 2 ♀♀, 7 mm., both imm.

Remarks. This species is characterized by the very large lateral areas of ocelli in the eyes and by the small area of colourless facets between this area and the terminal area of ocelli. In large animals the two areas are only separated from each other by a depression. I have found it extremely difficult to decide whether to refer some of the specimens from the Discovery material to *E. glyphidophthalmica*, to *E. oculata*, or to *E. intermedia*, for so many of the specific characters have no set boundaries, and individuals may show certain characters of one species and at the same time characters of the others. Even those characters which they do show are often intermediate between those given by the authors for the identification of the species. Unless numbers of new species are to be founded, considerable latitude must be allowed in the characters which are accepted for the existing species. This I have done and I have referred to *E. glyphidophthalmica* those specimens in which (1) the lateral areas of ocelli in the eyes are very much larger than the terminal ones and are separated from the terminal areas by a very narrow colourless area; (2) in which the rostrum is small and acutely pointed and (3) in which the lateral margins of the telson are unarmed, the posterior margin truncate, armed at its outer angles with a small spine on each side and with two long median plumose setae. The one really outstanding character lies in the nature of the eyes, but I have found it difficult to decide in some cases whether the characters I have mentioned are definite enough to admit the individual to this or to that species, so much do they grade one into another.

Distribution. This species was first described from off the Canary Isles. It has since been recorded again from the same area, from the Gulf of Guinea and from west of Angra Pequena (Illig, 1930), and from the Gulf of Aden (Tattersall, 1939). Zimmer (1915*b*) and Colosi (1929) doubtfully referred specimens from the Gulf of Naples to this species, but I think that these specimens were in all probability *E. intermedia*. W. M. Tattersall (1943) recorded one immature male from east of the Windward Isles taken at 50 m.

All the specimens in the Discovery collection were taken in the South Atlantic, two off the west coast of South Africa and the other two in mid-Atlantic a little north of the equator.

This species does not appear to inhabit such deep waters as *E. tenuis* and *E. typica*. There are no records from closing nets but, except in one case, all the known specimens have been taken in vertical or oblique hauls from comparatively shallow depths.

Euchaetomera oculata Hansen, 1910

1910 *Euchaetomera oculata* Hansen, p. 66, pl. x, fig. 4*a–e*.
1911*a* *Euchaetomera oculata*, Tattersall, p. 125; 1923, p. 284.
1930 *Euchaetomera oculata*, Illig, pp. 447–8, text-figs. 88–92.
1939 *Euchaetomera oculata*, Tattersall, p. 243.

OCCURRENCE:

St. 1568. 11. iv. 35 (night). South-east of Durban, 1400–0 m., 1 juv. ♀, 5·4 mm.

REMARKS. It is with some hesitation that I refer this specimen to *E. oculata*, for the characters it possesses are not entirely as described for the type. The lateral areas of ocelli in the eyes are larger than the terminal ones, but are not so swollen as in *E. glyphidophthalmica* and the colourless area between them and the terminal area is quite wide. The antennal scale is the same length as the peduncles of the antennules and antennae, and the lateral margins of the telson are straight, but the posterior margin of the telson is not narrow. The specimen is not adult and I feel that perhaps it might be *E. intermedia*.

DISTRIBUTION. This species has been recorded on a number of occasions from the Indian Ocean (Tattersall, 1911*a*, 1939; Illig, 1930; Coifmann, 1936). The type specimen was taken near New Guinea and Tattersall (1923) recorded the species from off New Zealand.

Euchaetomera intermedia Nouvel, 1942

1942*c* *Euchaetomera intermedia*, Nouvel p. 9, text-figs. 21–3.

OCCURRENCE:

St. 87. 25. vi. 26 (day). West of Cape Town, 1000(–0) m., 5 ♀♀, 8–9 mm.
St. 254. 21. vi. 27 (night). West of Cape of Good Hope, 200(–0) m., 1 ♂, 6·5 mm.
St. 256. 23. vi. 27 (day). West of Cape Town, 1100–850(–0) m., 1 ♂, 6 mm., 1 ♀, 5 mm.
St. 257. 24. vi. 27 (night). West of Cape Town, 250(–0) m., 1 ♀, 6·5 mm.
St. 259. 26. vi. 27 (night). West of Cape Town, 450–370(–0) m., 1 ♀, 7·2 mm.
St. 267. 23. vii. 27 (night). North-west of Angra Pequena, 550–450(–0) m., 2 ♀♀, 7 mm.
St. 268. 25. vii. 27 (night). West of Cape Frio, South Africa, 150–100(–0) m., 2 ♂♂, 7 mm. and 6·5 mm.
St. 673. 24/25. iv. 31 (night). West of Tristan da Cunha, 340–0 m., 2 ♀♀, larger 8 mm., 1 juv.
St. 674. 25. iv. 31 (night). West of Tristan da Cunha, 280–0 m., 3 ♀♀, 6–6·5 mm., 3 small juv.
St. 698. 13. v. 31 (night). South-west of Cape Verde Is., 470–0 m., 1 ♂, 7 mm. (doubtfully).
St. 700. 18. v. 31 (day). North-east of Cape Verde Is., 2025–0 m., 1 juv.
St. 704. 19. x. 31 (night). South of Cape Verde Is., 231–0 m., 1 juv., 5·5 mm.
St. 714. 30. x. 31 (night). East of Monte Video, 246–0 m., 3 ♀♀, 7–8·5 mm.
St. 717. 2. xi. 31 (night). North of Falkland Is., 212–0 m., 1 juv.
St. 1571. 21. iv. 35 (night). South-west of Madagascar, 500–0 m., 1 ♀, 8·5 mm.
St. WS 976. 6. iii. 50 (day). Nearly 200 miles west of Walvis Bay, South Africa, 100–50 m., 1 ♀, 6·8 mm., not adult (Benguela Current Survey).
St. WS 978. 7. iii. 50 (day). 150 miles west of Walvis Bay, South Africa, 100–50 m., 1 ovig. ♀, 8 mm., 1 juv.

REMARKS. *E. intermedia* closely resembles *E. oculata* in its general form. It is slender and long and evidently very brittle, for there is not a single undamaged specimen in the whole collection. In particular the eyes break off very easily and in their absence correct identification is difficult. Nouvel (1942*c*, p. 9) stated that the antennal scale surpassed the antennular peduncle by the full length of its apex and that the antennal peduncle was a little shorter than the antennular peduncle. His type was not fully adult and I have found exactly the conditions he described in the smaller immature animals in the Discovery collection. In fully grown, sexually mature specimens the peduncles of the first and second antennae, and the thorn terminating the naked outer margin of the scale, are all the same length and I ascribe the shortness of the antennal peduncle of Nouvel's type to its immaturity.

Illig (1930, p. 448) stated definitely that in *E. oculata* the antennal scale is generally shorter than the antennular and antennal peduncles, that it may rarely be equal to them in length, *but that it never overreaches them.* Other differences between the two species are variable, and I have therefore used the relative length of the scale for the identification of the specimens which I have here referred to *E. intermedia.* In every case the whole of the apex of the scale extends beyond the distal margins of the subequal antennae and this is the case in juveniles also. The species may be also recognized by the eyes, which are longer and more slender than in *E. glyphidophthalmica*, with the outer margins nearly straight and the lateral areas of ocelli larger than the terminal ones but not swollen. There is quite a wide region of colourless, imperfectly developed facets between the two areas of ocelli. I have found the width of the posterior margin of the telson too variable to make a good specific guide, but in every case the length of the telson is less than its width at its base.

The rostrum in *E. intermedia* is very short and acute though not so sharply pointed as in *E. glyphidophthalmica*, while in *E. oculata* it is produced into a small, distally rounded projection.

DISTRIBUTION. This species was originally recorded from the west of the Canary Isles. Zimmer (1915*b*) recorded an immature specimen of *E. glyphidophthalmica* from the Gulf of Naples, but he noted that the eyes were more slender and that the two areas of ocelli in the eyes were separated by a wider region of colourless facets than in the type of that species. This description coincides so exactly with *E. intermedia* that I suggest that he was in fact dealing with this species. If I am correct in my supposition, its geographical range would include the Mediterranean.

It was taken at fifteen stations by 'Discovery', 'Discovery II' and 'William Scoresby' from off the south and south-west coasts of South Africa in the south to the Cape Verde Islands in the north, and also off Montevideo. It was also taken in the Indian Ocean, south of Madagascar.

It is interesting to note that twelve of the Discovery hauls were taken at night. It is not a particularly deep-water form, but as in each case it was taken in oblique hauls to the surface, it is not possible to say exactly at which depth the animals were living. Most of the captures were made in nets fishing from less than 500 m. to the surface and the least depth was at station 268, 100–150(–0) m. when the net failed to close.

Genus Euchaetomeropsis Tattersall, 1909

1909 *Euchaetomeropsis* Tattersall, W. M., p. 130.

REMARKS. This genus agrees with the genus *Euchaetomera* in all respects, save in the form of the antennal scale. In *Euchaetomera* the outer margin of the scale is naked and may or may not end in a thorn, but in *Euchaetomeropsis* it is setose all round. In the only species, at present referred to the genus, the scale is narrowly lanceolate in shape with a narrowly rounded apex. In both genera there is a small distal suture.

Euchaetomeropsis merolepis (Illig), 1908

1903 *Euchaetomera tenuis* (pars) Lo Bianco, p. 191.
1908 *Euchaetomera merolepis* Illig, p. 550.
1909 *Euchaetomeropsis merolepis* Tattersall, pp. 130–2.
1914 *Euchaetomeropsis merolepis*, Zimmer, p. 395.
1929 *Euchaetomeropsis merolepis*, Colosi, p. 417.
1930 *Euchaetomeropsis merolepis*, Illig, pp. 450–2, text-figs. 97–103.

OCCURRENCE:

St. 250. 17. vi. 27 (night). East of Tristan da Cunha, 300(–0) m., 4 imm. ♂♂, 6–6·5 mm.; 1 adult ♀, 8 mm., 4 imm. ♀♀, 4–5 mm., 4 very small juv.

St. 257. 24. vi. 27 (night). West of Cape of Good Hope, 250(–0) m., 3 juv. 3–5 mm.

St. 266. 21. vii. 27 (night). West of Orange River estuary, 200(–0) m., 1 ♂, 7 mm., 1 juv., 5 mm.; 4 juv. ♀♀, 4·5–5·5 mm.

St. 267. 23. vii. 27 (night). North-west of Angra Pequena, 550–450(–0) m., 1 imm. ♂, 4·5 mm.

REMARKS. These specimens do not differ in any essential from the published descriptions of the species, except that the uropods are proportionally longer in comparison with the telson. Illig (1930, p. 452) says that the endopod of the uropod is three times as long as the telson and that the exopod is slightly longer. I find in the largest of my specimens that the endopod of the uropod is fully four times as long as the telson.

None of my specimens is fully mature and all are badly damaged. Only one or two possess any thoracic appendages and only a few have any eyes. It is evidently a very fragile form and I think that this fragility is responsible for the difference of opinion, which has arisen among workers, as to whether the median setae on the telson are plumose or not. Only in two specimens of this collection are there any complete setae on the telson—one on each animal. When closely examined with a high power both these proved to be very sparsely and delicately plumose. I think that in all probability they are normally plumose, but that the fragility, which is evident in the rest of the body, extends also to the armature of the setae, so that where they appear to be non-plumose they have in fact been stripped bare of their armature.

Illig, in his description of the type, stated that there were five thorns on the inner margin of the endopod of the uropod. Zimmer (1914, p. 395) recorded that he could find no trace of these in his specimens and I could find none in any of my specimens either.

DISTRIBUTION. This is one of the few species of mysids which are represented in the fauna of both the northern and the southern hemispheres. It was first recorded from the Mediterranean by Lo Bianco as *Euchaetomera tenuis* and was later found in the same area from depths of 900–2500 m. and 100–800 m. (Tattersall, 1909; Colosi, 1929). Illig's types were collected in the Indian Ocean and he recorded (1930) the species again from four stations in the Indian Ocean in vertical hauls from 600 m. and 3000 m. In the Atlantic it has been recorded from equatorial waters and from the Gulf of Guinea in vertical hauls over great depths; there have also been a number of records from deep water in the South Atlantic. W. M. Tattersall (1943) recorded it from the East Pacific west of San Francisco from 100 m.

It is evidently a somewhat bathypelagic form, but as previously it has always been recorded from vertical hauls with open nets, it is not possible to say at what depths it normally lives. The three hauls in which it appears in the Discovery collection were all taken at much shallower depths than earlier records and in each case the net failed to close. These three hauls were taken at night and it may well be that these animals, in common with so many other species of mysids, carry out an upward migration during the hours of darkness.

Genus Caesaromysis Ortmann, 1893

1893 *Caesaromysis* Ortmann, p. 22.

This genus was instituted by Ortmann for a new species, *C. hispida*, for specimens taken in equatorial waters in mid-Atlantic. He defined the genus as possessing the following characters:

(1) Very long thorn-like rostral projection.

(2) Very plump body armed profusely with very long, strong thorns.

(3) Eyes large, with two areas of ocelli and long slender stalks.

(4) Antennal scale small, styliform and not leaf-like.

(5) The seven posterior pairs of thoracic appendages almost equal in length with three-segmented propodus and well developed dactylus.

(6) Exopods of first thoracic appendages lacking.

(7) Female pleopods rudimentary, those of male all well developed and normal.

(8) Telson small, egg-shaped, apex truncate.

(9) Endopods of uropods shorter than exopods. Statocyst well developed.

Ortmann in his description of the species recorded that the uropods were twice as long as the telson.

Stebbing (1905, p. 114) recorded the species from 190 fm. about 47 miles off Cape Town and Zimmer (1914, p. 397) recorded specimens taken by the German South-Polar Expedition, 1901–3. He discussed the close affinity of this genus to *Echinomysis* Illig and pointed out that the essential differences between them lay in the form of the antennal scale and of the exopods of the first thoracic appendages. In *Echinomysis* both these organs, though small, are well developed and normal. Ortmann had stated that there was no trace of an exopod on the first thoracic appendage in *Caesaromysis*, but Zimmer discovered that a quite readily recognizable vestige was present as well as a large well developed epipod (Fig. 31 C).

The exopod and endopod of the thoracic appendages in the Mysidacea arise from the third segment of the sympod, i.e. the basis, and the epipod, when present, arises from the second segment of the sympod, the coxa. In *Caesaromysis* the basis of the first thoracic appendage has become fused with the body-wall along the greater part of its anterior margin, while the coxa has become so closely fused with it and with the body-wall as to be indistinguishable. A considerable lengthening of the body has taken place in the region of the first and second thoracic somites and, as a result, the attached basis of the first thoracic appendage has also become lengthened. That portion bearing the endopod has remained closely associated with the mouth parts, while the portion bearing the exopod and the coxa with its epipod has become widely separated from it and remains attached to the body-wall just in front of the second thoracic appendage. If one places the animal on its side and gently lifts the carapace one can see the whole peculiar structure of the appendage clearly. The tiny finger-like vestige of the exopod projects downward from the body in its normal position, while the large basin-shaped epipod extends backward under the carapace covering the bases of the succeeding thoracic appendages. A well-marked ridge, which is really the median portion of the basis of the first thoracic appendage, can be clearly seen running forward to the proximal end of the endopod immediately behind the mouth.

In *Echinomysis* the exopod of the first thoracic appendage is normal and is borne in the normal position beside the endopod.

Considerable sexual differences occur in *Caesaromysis* and, whereas in the females and in immature specimens the antennal scale is reduced to a simple papilla-like vestige, in adult males it is well developed and similar to the scale in *Echinomysis*.

Zimmer and Illig showed that considerable sexual differences exist in the proportions of the uropods and in their length, relative to that of the telson. Their investigations were restricted by the lack of fully adult males and as a result they could only indicate the tendency to sexual differentiation. The beautifully preserved material of the Discovery collections contains adults of both sexes and I have been able to figure those parts of the male which are of special interest. I am now able to draw up an amended definition of the genus in the light of our present knowledge:

(1) Cephalothorax broad and flattened dorso-ventrally; abdomen short and relatively small.

(2) Rostrum produced anteriorly into a very long powerful spine, lateral margins armed with long spines.

(3) Carapace and abdomen richly adorned with strong spines.

(4) Eyes large, with a large distal area of ocelli and a smaller lateral area; eyestalks very long and slender, running transversely across the body to beyond the lateral margins of the carapace and then bending forward in a right-angle; finger-like process present on the inner side of the eye, larger in the male than in the female.

(5) Antennal scale in the male small, armed with long plumose setae around the apex and distal portions of lateral margins; in the female, small and reduced to a small styliform process tipped with a single short bristle.

(6) Exopod of first thoracic appendage vestigial, situated just in front of the second thoracic appendage; endopod normal, situated immediately behind the maxilla. Well-developed epipod present.

(7) Telson small, entire, armed with a varying number of spines and no median plumose setae.

(8) Uropods of adult male nearly three times as long as the telson with the exopod considerably longer than the endopod; in females and juveniles, uropods shorter, either with rami sub-equal or with the endopod longer than the exopod.

Caesaromysis hispida Ortmann, 1893

(Fig. 31 A–G)

1893 *Caesaromysis hispida* Ortmann, pp. 22, 24, fig.
1905 *Caesaromysis hispida*, Stebbing, p. 114.
1910 *Caesaromysis hispida*, Stebbing, p. 403.
1914 *Caesaromysis hispida*, Zimmer, p. 397, figs.
1930 *Caesaromysis hispida*, Illig, p. 465, text-figs.

Occurrence:

St. 6° 55′ N., 15° 54′ W. 2. xi. 25. West of Monrovia, Liberia, 800–0 m., 1 ♀, 7·5 mm.
St. 78. 12. vi. 26 (day). Mid-Atlantic between Cape Town and Monte Video, 1000(–0) m., 1 juv. ♀.
St. 81. 18. vi. 26 (day). Mid-Atlantic, west of Cape Town, 650(–0) m., 2 ♀♀, 7·2 mm. with large empty brood pouches.
St. 89. 28. vi. 26 (day). Off Cape Town, 1000(–0) m., 3 small juv.
St. 100. West of Table Bay. Three hauls: (i) 3. x. 26 (day), 310–260 m., whole sample, 2 adult ♂♂, 7 mm., 3 juv. ♀♀, 5 mm.; (ii) (day), 2500–2000 m., 2 juv., 3·5 and 4 mm.; (iii) (day), 2500(–0) m., 1 adult ♂, 6·5 mm.
St. 256. 23. vi. 27 (night). Atlantic, west of Cape Town, 1100–850(–0) m., 1 ovig. ♀, 8 mm.
St. 267. 23. vii. 27 (night). West of Walvis Bay, 550–450(–0) m., 2 ♀♀, 5·5 mm., 1 juv.
St. 282. 12. viii. 27 (night). West of Cape Lopez, 300(–0) m., 3 juv., 2–2·5 mm.
St. 673. 25. iv. 31 (night). East of Tristan da Cunha, 1000–750 m., 1 adult ♀, 8·2 mm.
St. 692. 9. v. 31 (night). Mid-Atlantic near equator, 350–0 m., 2 ♂♂, 6·5 mm., 2 ovig. ♀♀, 7–8 mm., 2 juv. ♀♀, 4 mm.
St. 695. 11. v. 31 (night). South of Cape Verde Is., 370–0 m., 1 ♀, 6·5 mm.
St. 697. 12. v. 31 (night). South of Cape Verde Is., 460–0 m., 1 ♀, 6 mm., 1 ♀ juv.
St. 699. 14. v. 31. West of Cape Verde Is. Two hauls: (i) (night) 370–0 m., 2 small juv.; (ii) (day), 250–0 m. 2 adult ♂♂, 6·5–7 mm., 2 ♀♀, 6·8 mm. The male specimens are very good and it is from them that I have made the accompanying figures.
St. 706. 21. x. 31 (night). North-east of Pernambuco, 354–0 m., 1 juv. ♂.
St. 1585. 2. v. 35 (night). North of Madagascar, 500–0 m., fragments of ♂ which I somewhat doubtfully refer to this species.
St. WS 977. 6/7. iii. 50 (night). North-west of Walvis Bay, South Africa (Benguela Current Survey), 500–250 m., 2 ♂♂, 4·4–4·8 mm., 1 juv., 1 ♀, 5·6 mm.

Remarks. Ortmann's original figures were taken from a male of 9 mm. Neither Zimmer nor Illig had an adult male in his material and the figures which they give are all taken from female specimens.

Both these workers realized that there were considerable sexual differences present in this species. Zimmer (1914, p. 398) says that the antennal scale is variable in its size, that it is smaller in females than in males of the same size and that it varies also in comparison with the spine at the outer distal margin of the sympod. From the Discovery material I am able to trace the gradual development and increase in size of the antennal scale in growing males. In the young of both sexes the scale appears in the form of a small papilla, shorter than the spine arising from the sympod at its base and armed only with a minute bristle at its apex. In fully adult females the scale appears very much as figured by Ortmann (1893, pl. 1, fig. 8*c*), as a small styliform outgrowth tipped with two bristles. The largest males in the Discovery collection have a small well-developed scale of the normal leaf-like form, extending almost to the distal margin of the second segment of the peduncle and armed around the apex with 7–9 long plumose setae (Fig. 31 A). The proportions of the abdomen and tail-fan show very marked changes as growth proceeds. In young forms the abdomen is very short and is bent forward beneath the flattened cephalothorax so that, with the very large eyes and the laterally spread thoracic appendages, the animals look rather like megalopa larvae. As growth proceeds, the abdomen tends to become straightened out and longer, but the most noteworthy change takes place in the uropods. In small animals they are short and very little longer than the telson with the exopods shorter than the endopods. Gradually the uropods lengthen and the rami become more equal in length until in adult females they are fully twice as long as the telson with the rami of equal length. In fully grown males, the uropods are nearly three times as long as the telson and the exopods are markedly longer than the endopods.

Considerable variation occurs in the armature of the telson, but this does not appear to bear the same direct relation to size as do the other variable characters. Though the general tendency with growth is towards an increase in the number of spines arming the apex and distal portion of the lateral margins, quite large specimens may have no more spines than small ones. Usually there are three spines on the apex and just one smaller spine on one of the lateral margins (Fig. 31 G). The statocyst is very large in young animals, but does not increase in size with the growth of the endopods, so that a feature which is very noticeable in juveniles is no longer apparent in adults.

The male pleopods are particularly robust and project beyond the lateral margins of the abdominal somites, so that the abdomen appears much more robust than it actually is. I have not seen a male with the abdomen flexed under the body as is so regularly the case in the female and the outstretched pleon with the longer uropods and the spreading pleopods give the males (Fig. 31 G) a vastly different appearance from females of the same length. The marsupial pouch is surprisingly large in ovigerous females and extends backward almost to the telson, thus further increasing the difference in general form between the two sexes.

The first thoracic appendage is essentially as figured by Zimmer (1914, pl. XXIV, fig. 30) in the general form of the appendage, but I found in my larger male specimens that the vestige of the exopod is longer and is tipped with one or two short bristles (Fig. 31 C). Zimmer did not figure an endite on the basis at the point of origin of the endopod, but there is a well-developed one in my specimens. The spines at the apex of the dactylus and the nail are armed along one side with long spinules (Fig. 31 D).

In the endopods of the third to the eighth thoracic appendages the carpus is considerably longer than the propodus and is divided from it by an oblique articulation. The propodus is secondarily divided into two almost equal sub-segments. The genital organ on the eighth thoracic appendage is barrel-shaped and armed distally with a strong bristle (Fig. 31 E, F).

One further point of sexual difference can be seen in the finger-like outgrowth from the inner side of the eyestalk. In the female this is very small and difficult to see, but in large males it is much longer and extends almost to the distal margin of the cornea (Fig. 31, A).

Colosi (1920, p. 240) instituted a new genus and species, *Caesaromysides liguriae*, for a very small male specimen taken off Valparaiso. His description and figures so closely resemble young males of *Caesaromysis hispida* that I very strongly suspect that he was dealing with a young specimen of this species. The principal distinguishing feature of Colosi's new genus is the complete absence of an

Fig. 31. *Caesaromysis hispida* Ortmann. A, anterior end of adult male in dorsal view, × 16; B, maxilla, × 24; C, first thoracic appendage of adult male with rudimentary epipod and exopod, × 24 (*exo* = exopod, *epi* = epipod, end. = endite); D, distal end of first thoracic endopod; E, endopod of fourth thoracic appendage, × 20; F, eighth thoracic appendage of adult male, × 20; G, telson and uropods of adult male, × 16.

exopod on the first thoracic appendage, but I have found that the vestige of this organ is extremely small and difficult to find in small specimens of *C. hispida* and I think that it is probable that it was overlooked by Colosi. For the present I feel that *Caesaromysides liguriae* can only be accepted with reserve.

In the tube from station 81 there is a note on colour: 'Eyes fawn brown with longitudinal splashes of milk white—a touch of red on mouth parts, on fifth legs at junction of exopod and endopod, and a few red chromatophores on incubatory lamellae—otherwise quite transparent.'

DISTRIBUTION. This species is widely distributed in the warmer waters of the Atlantic and has once been taken in the Indian Ocean. It was recorded from five stations in equatorial waters in mid-Atlantic (Ortmann, 1893); from off the west of Cape Town (Stebbing, 1905); Gulf of Guinea, west of Cape Town, west of Cape Verde Islands (Zimmer, 1914); Gulf of Guinea, Atlantic, west of Angra Pequena and north-west of Cape Town, east of Maldives (Indian Ocean) (Illig, 1930).

In the Discovery collections, it occurred at fourteen stations in the Atlantic, between 14° N. and 38° S. Fragments of a male from station 1585, to the north of Madagascar, probably belong to this species, for the form of the spines and the shape and size of the antennal scale are as in *Caesaromysis hispida*, but the telson has more spines on the lateral margins than I have seen in this species. In the absence of the thoracic endopods and part of the thorax, I am unable to say whether there was a normal exopod on the first thoracic appendage. It may be a specimen of *Echinomysis chuni*, a species which has been recorded from these waters.

Except for one record by Ortmann, in which he states that a closing net fishing between 200 and 400 m. was used, the species, apart from the Discovery material, has always been taken in vertical or oblique hauls from depths of 3000 m. to the surface. It has never been taken at the surface. During the Discovery investigations, it was captured on a number of occasions in closing nets and we are now able to say with more precision at what depths the animals were living. It appeared in two hauls taken at station 100 C in closing nets fishing at 260–310 m. and at 2500–2000 m. and was also taken in a closing net at station 673 fishing at 1000–750 m. It would therefore appear to be usually a deep-water form. The shallowest water in which it was taken was at station 282, 230(–0) m.

Caesaromysis hispida has never been taken in large numbers, rarely more than one or two at a time and is obviously not a gregarious form.

Genus Arachnomysis Chun, 1887

Arachnomysis leuckartii Chun, 1887

1887 *Arachnomysis leuckartii* Chun, p. 33, figs.
1896 *Arachnomysis leuckartii*, Chun, p. 169, figs.
1905 *Arachnomysis leuckartii*, Thiele, p. 445, figs.
1911*b* *Arachnomysis leuckartii*, Tattersall, p. 56.
1914 *Arachnomysis leuckartii*, Zimmer, p. 399.
1930 *Arachnomysis leuckartii*, Illig, p. 469, text-figs.
1951 *Arachnomysis leuckartii*, Tattersall and Tattersall, p. 282, figs. 68–9.

OCCURRENCE:

St. 270. 27. vii. 27 (night). West of Benguela, 200(–0) m., 1 ♀, 7 mm.
St. 282. 12. viii. 27 (night). Gulf of Guinea, 300(–0) m., 1 very small juv.
St. 290. 24. viii. 27 (dawn). West of Sierra Leone, 100(–0) m., 1 imm. ♀, 6 mm.
St. 694. 10. v. 31 (night). Mid-Atlantic, south-south-west of Cape Verde Is., 210(–0) m., 1 ♀, 6·8 mm. with very small brood pouch.
St. 699. 14. v. 31 (night). West of Cape Verde Is., 250–0 m., 1 small juv. ♀.
St. WS 986. 10. iii. 50 (day). West of Spencer Bay, South-west Africa, 50–0 m., 1 adult ♀, 5·6 mm. (Benguela Current Survey).

DISTRIBUTION. This species was for many years thought to be confined to the Mediterranean, where it had been recorded on many occasions from deep water (1050–2000 m.). Later it was recorded from the East Atlantic slope off the south-west of Ireland. Illig (1930, p. 469) recorded it from the Gulf of Guinea (2000 m.); west of Angra Pequena (500 m.); South Atlantic and west of Chagos Islands (2000 m.); Seychelles (1500 m.); west of Arimante Islands (2000 m.); east of Ras Hafun (1500 m.).

The specimens in the Discovery collection were captured in much shallower water than has hitherto been recorded for the species, the deepest being at station 282 where it was found in a haul from 300 m. to the surface. At station 290 it was taken at dawn in a haul from only 100 m. During the Benguela Current Survey an adult female was taken in the morning in a haul of only 50 m. to the surface. It is significant that nearly all the specimens were taken at night or very early dawn and it may well be that these animals, in common with so many other mysids, frequent deeper waters by day and carry out vertical upward migrations during the hours of darkness.

The Discovery records do not add to its known geographical range.

Arachnomysis megalops Zimmer, 1914

1914 *Arachnomysis megalops* Zimmer, p. 401, pl. 25, figs. 35.
1930 *Arachnomysis megalops*, Illig, p. 470.

Occurrence:

St. 252. 20. vi. 27 (night). Midway between Cape Town and Gough I., 135 m., 2 ♂♂, 8·5 mm.
St. 267. 23. vii. 27 (night). Off Walvis Bay, South Africa, 550–450(–0) m., 4 ♂♂, not adult; 3 ♀♀ with large empty brood pouches, largest 8 mm., 4 small juv.
St. 268. 25. vii. 27 (night). West of Cape Frio, 150–100(–0) m., 1 imm. ♂, 7·5 mm., 2 small juv.
St. 282. 12. viii. 27 (night). Gulf of Guinea, 300(–0) m., 1 ovig. ♀, 7·8 mm.
St. 674. 25. iv. 31 (night). West of Tristan da Cunha, 280–0 m., 2 ♀♀, 8–9·5 mm.
St. 692. 9. v. 31 (night). Mid-Atlantic just north of equator, 350–0 m., 1 ♂, 5 mm., 1 ♀, 4·5 mm., both juv.
St. 694. 10. v. 31 (night). Mid-Atlantic, south-south-west of Cape Verde Is., 210–0 m., 1 ♀, with very small brood pouch, 6·8 mm.
St. 697. 12. v. 31 (night). South-west of Cape Verde Is., 460–0 m., 1 ♀, 6·5 mm.
St. 699. 14. v. 31 (night). West of Cape Verde Is., 370–0 m., 1 ♀, 6·4 mm.
St. 704. 19. x. 31 (night). South of Cape Verde Is., 231–0 m., 1 juv. ♀.
St. 706. 21. x. 31 (night). North-east of Pernambuco, 354–0 m., 1 juv. ♀.

Remarks. This species can be distinguished from *A. leuckartii* Chun by the large balloon-like eyes, which are almost as wide as they are long, and by the larger number of facets in the cornea. In *A. leuckartii* there are from ten to fourteen facets across the largest diameter, but in this species there are from eighteen to twenty-five. Zimmer figured the anterior end of his type specimen and showed only four spinous processes on the anterior margin of the carapace, arranged two on either side of the median line. I have not found this arrangement in any of the Discovery specimens. Although the length of the spines may vary, there is always one in the median line and at least two on each side of it. However, in all other respects these specimens agree so closely with the published descriptions of *A. megalops*, that I have no hesitation in referring them to this species.

Distribution. Zimmer's types were taken in vertical hauls from 3000–0 m. in the Gulf of Guinea and west of St Paul de Loanda. Illig (1930) recorded three females from vertical hauls from 3000–2000–0 m. one off the south-west of Sierra Leone and two from the Gulf of Guinea. The Discovery material proves it to be widely distributed in the South Atlantic. All previous records were from vertical hauls ranging through a considerable column of water, so that it was not possible to say at which level the animals were actually living. It is now evident from the captures made by 'Discovery' and 'Discovery II' that they are not confined to the deeper levels. Eight of the nine hauls in which the species occurred were taken obliquely from 354–200 m. to the surface; the net failed to close at one station, 267, at a depth of 500 m. All the hauls were taken at night and it may be possible that this species, as well as *A. leuckartii*, carries out upward migrations during hours of darkness and may be found in deeper water during the day.

Tribe *LEPTOMYSINI*

Genus Mysidetes Holt and Tattersall, 1906

1885*a* ? *Mysidopsis* G. O. Sars, p. 202.
1905 *Mysideis* (pars) Holt and Tattersall, p. 127.
1906 *Mysidetes* Holt and Tattersall, *a*, p. 39; *b*, p. 10.
1906*a* *Metamysidella* Illig, p. 210.
1908 *Mysidetes*, Tattersall, p. 32.

REMARKS. G. O. Sars (1885*a*, p. 202) formed a new species for a very damaged female specimen collected by 'Challenger' off Australia and doubtfully referred it to the genus *Mysidopsis* as *M. incisa*. From the form of the telson and the endopods of the uropods it is probable that this specimen should be referred to the genus *Mysidetes*, but in the absence of males it is impossible to be quite certain on this point.

Illig (1906*a*, p. 210) founded a new genus and species, *Metamysidella kerguelensis*, for specimens collected by the 'Tiefsee-Expedition', 1898–9. He did not mention the form of the male pleopods nor the male genital organ, but there is no doubt that his species must be referred to the genus *Mysidetes*, which had been founded earlier in the same year by Holt and Tattersall (1906*a*, p. 39) for specimens collected in the Antarctic.

These authors considered that the rudimentary form of the pleopods in both sexes was sufficiently distinctive a character to warrant the institution of a new subfamily which they named Mysidetinae. This suggestion has not been adopted by subsequent workers and the genus *Mysidetes* remains in the tribe Leptomysini of the subfamily Mysinae.

The genus *Mysidetes* can be distinguished from all other genera of the tribe *Leptomysini* by the rudimentary form of the male pleopods, and by the larger number of sub-segments into which the carpo-propodus of the third to the eighth thoracic endopods is divided. In this respect the genus resembles the genus *Pseudomysis*, but in that genus the male pleopods are normal and not reduced.

One of the most remarkable features of *Mysidetes* is the very long, forwardly directed, tubular genital organ of the male, which in some species, notably *M. kerguelensis* (Illig), is enormously elongate and may extend beyond the anterior margin of the antennular peduncle. Similar long tubular male genital organs are found in two other genera of mysids, *Heteromysis* and *Mysidella*, although these belong to widely separated tribes and subfamilies. It may be difficult to distinguish females of these genera, but males may be recognized by the form of the first and third thoracic endopods. In *Mysidetes* the endopods of both these appendages are normal and not swollen or modified; in *Heteromysis* the carpo-propodus of the third thoracic endopod is unsegmented and very swollen with the dactylus bending over to form a strong sub-chela, while in *Mysidella* the endopod of the first thoracic appendage has the propodus very swollen and armed with strong spines.

Six species, five of which are from Antarctic waters, have been referred to this genus, but the Discovery material is so rich that, in addition to adding some details to already known species, I have been obliged to found no fewer than six new species. There is considerable individual variation in the members of the species of *Mysidetes* and much evidence that growth changes take place after maturity has been reached. It may be that later workers will consider that in some cases further divisions should be made within the new species here described. I have tried to find clear and definite specific characters for these new species and have in no case relied upon a single specimen.

All the five species previously recorded from Antarctic waters, except *M. hanseni* Zimmer, are represented in this collection. The new species, which I have named *M. microps*, resembles Zimmer's description of *M. hanseni* in some respects, principally in the small size of the eyes with the cornea terminally situated and not extending laterally over the eyestalks, and also in the shape and proportions of the rostral plate. There are, however, one or two outstanding differences. The peduncles of the first and second antennae are of equal length in *M. microps* and I have not found any specimens among the Discovery material in which this is not the case. In *M. hanseni*, on the other hand, the antennular peduncle is much longer than the antennal peduncle which extends only to the distal margin of its second segment. Zimmer stated definitely that the inner margin of the endopods of the uropods was armed with setae only, whereas in *M. microps* there is an uneven row of fine spines among the setae. Furthermore, though in both species the cleft of the telson is shallow and widely open, the armature of the lateral margins of the telson is very different.

In his second description of *M. kerguelensis*, Illig (1930, p. 472) mentioned that the male genital organ was very long, and gave a figure in which it extended forward beyond the region of the mouth. I have found specimens in the Discovery material in which the genital organ reaches far beyond the distal end of the antennular peduncle, but in other characters the specimens conform so closely to Illig's description that I have no hesitation in referring them to his species. The genital organ increases with the growth of the animals in some species and may show great variation though in other respects the males appear to be sexually mature, with dense hirsute brushes on the antennules. The actual length of the organ is so variable that I do not consider that this character can safely be used for the separation of species.

Mysidetes posthon Holt and Tattersall, 1906

1906*a* *Mysidetes posthon* Holt and Tattersall, p. 10.
1908 *Mysidetes posthon*, Tattersall, p. 33, pl. VII, figs.
1923 *Mysidetes posthon*, Tattersall, p. 287.

OCCURRENCE:

St. 39. 25. iii. 26 (day). Cumberland Bay, 235–179 m., over 50 adults, largest 15·4 mm., some ♀♀ ovigerous, 10 juv.
St. 42. 1. iv. 26 (day). Cumberland Bay, 204–120 m., 1 ♂, 12 mm., 2 adult ♀♀, 16 mm.; fragments.
St. 45. 6. iv. 26 (day). Off South Georgia, 270–238 m., 14 adult ♂♂, largest 15·6 mm.; 7 adult ♀♀, largest 16 mm., few juv.
St. 123. 15. xii. 26 (day). Off South Georgia, 230–250 m., over 100, largest 17·2 mm.
St. 142. 30. xii. 26 (day). East Cumberland Bay, 88–273 m., 1 adult ♂, 18·4 mm., 1 imm. ♂, 15 mm.; 5 imm. ♀♀, 15 mm.; many juv. up to 10 mm.
St. 143. 30. xii. 26 (day). Cumberland Bay, 273 m., 12 juv., largest 10 mm.
St. 144. 5. i. 27 (day). Cumberland Bay, 155–178 m., 3 juv., largest 11 mm.
St. 148. 9. i. 27 (day). Off South Georgia, 132–148 m., 3 ♂♂, largest 14·4 mm.; 2 ♀♀, 14 mm.
St. 152. 17. i. 27 (day). Off South Georgia, 245 m., 1 adult ♀, 17·2 mm., 1 imm. ♀, 14·2 mm.
St. 154. 18. i. 27 (day). Off South Georgia, 60–160 m., 13 adult ♂♂, 17·2–17 mm., 5 adult ♀♀, largest 17 mm., 14 juv.
St. 156. 20. i. 27 (day). Off South Georgia, 200–236 m., 3 juv.
St. 167. 20. ii. 27 (day). Off Signy Island, South Orkneys, 244–344 m., 12 ♂♂, largest 20 mm., 17 ♀♀, largest 22 mm. (those of 17 mm., quite imm.), 12 juv.
St. 181. 12. iii. 27 (day). Palmer Archipelago, 160–335 m., 4 ♂♂ (largest 21 mm., adult), 6 ♀♀, 18–22 mm.; none fully adult; 3 juv.
St. 182. 14. iii. 27 (day). Palmer Archipelago, 278–500 m., 1 ♂, 17 mm., 2 ♀♀, 18 mm., all imm.
St. 187. 18. iii. 27 (day). Palmer Archipelago, 259 m., 1 adult ♀, 27 mm., with very small eighth thoracic endopod.
St. 190. 24. iii. 27 (day). Palmer Archipelago. Two hauls: (i) 93–126 m., 3 ♂♂, 19–21 mm.; (ii) 315 m., 1 adult ♂, 22 mm. 1 imm. ♀, 20 mm.
St. 363. 26. ii. 30 (day). South Sandwich Is., 329–278 m., 1 ♂, 18·5 mm., 2 fragments.
St. 368. 8. iii. 30 (day). South Sandwich Is., 653 m., 1 adult ♂, 22 mm.

St. 1652. 23. i. 36 (day). Bay of Whales, 567 m., 1 imm. ♀, 16·8 mm.
St. 1660. 27. i. 36 (day). Bay of Whales, 351 m., 1 adult ♀, 25 mm.
St. 1872. 12. xi. 36 (day). Scotia Sea, 247 m., 1 imm. ♂, 11·4 mm.
St. 1955. 29. i. 37 (day). South Shetlands, 440–410 m., 5 ♂♂, 4 ♀♀, largest 22 m., adult.
St. 1957. 3. xii. 37 (day). South Shetlands, 785–810 m., 2 ♂♂, 19 mm., 1 ♀, 18 mm. Colour note 'Crimson, eyes golden'.
St. WS 219. 3. vi. 28 (day). North of Falkland Is., 116–114 m., 1 ♂, 14·4 mm.
St. WS 229. 1. vii. 28 (day). North-east of Falkland Is., 210–271 m., 2 ♂♂, larger 17 mm. adult; 58 juv. up to 14 mm.
St. WS 239. 15. vii. 28 (night). West of Falkland Is., 196–193 mm., 1 ♂, 16 mm.

REMARKS. The specimens which I have here referred to *M. posthon* show considerable individual variation, but these are too inconsistent to admit of the grouping of the animals into separate species. As is the case in many other species, specimens from the southern, colder waters are much larger than those captured farther north and attain sexual maturity at a much larger size. Females of 15–16 mm. taken at station 45 off South Georgia have large, fully developed oostegites, while specimens of over 18 mm. from the Bay of Whales are quite immature with small oostegites only just beginning to develop.

There is considerable variation in the size of the eyes and in the amount of uptilting of the lateral margins of the small rostral plate. It may be that the specimens, which I have referred to *M. posthon*, represent in fact more than one species, but no two specimens appear to be absolutely alike and I think it better for the present to regard the differences as examples of individual variation.

DISTRIBUTION. *M. posthon* has a circumpolar distribution and has been taken, often in considerable numbers, by all the principal South Polar and Antarctic Expeditions. The most northerly latitude at which it has been taken is from near Kerguelen Island at 'about 49° S.' (Illig, 1930, p. 488) and the most southerly from the Bay of Whales, 75° 56·2′ S. in the Discovery collection. It would appear to be gregarious in its habits, especially when young.

Mysidetes kerguelensis (Illig), 1906

1906*a* *Metamysidella kerguelensis* Illig, p. 210, figs.
1930 *Mysidetes kerguelensis* (Illig), p. 472, text-figs.

OCCURRENCE:

St. MS 68. 2. iii. 26 (day). East Cumberland Bay, 220–247 m., 14 adult ♂♂, largest 8·4 mm., 3 adult ♀♀ (2 with large full brood sacs), 8·6 mm., 23 juv. ♂♂, 16 juv. ♀♀, 6 very small juv.
St. 39. 25. iii. 26 (day). East Cumberland Bay, 179–235 m., 3 adult ♂♂, largest 8·2 mm., 2 juv. ♂♂, 6 mm., 1 adult ♀, 8·4 mm.
St. 142. 30. xii. 26 (day). East Cumberland Bay, 88–273 m., 2 imm. ♂♂, 6·4–7·6 mm., 1 adult ♀, 8·4 mm., 2 juv.

REMARKS. The Discovery specimens agree very closely with Illig's description and figures, but appear to be adult at a smaller size than his types. The most remarkable feature of this species is the enormous development of the male genital organ. In the immature specimen of 6·4 mm. from station 142 it extends as far forward as the mouth, but in all the males of over 8 mm. it stretches forward quite considerably beyond the distal margin of the antennular peduncle. In the specimen of 8·2 mm. from station 39 the genital organ measures just over 5 mm.

The specimens which were taken at station MS 68 are all very dark in colour, but those from the other stations are opaque and quite colourless and have no pigment in the eyes. This gives them a peculiar dead appearance and makes the animals easy to pick out when sorting.

DISTRIBUTION. The types were taken off Kerguelen Island and there have been no other records until the present one from Cumberland Bay, South Georgia.

Mysidetes crassa Hansen, 1913

(Fig. 33 H)

1913 *Mysidetes crassa* Hansen, p. 18, figs. pl. II, 3*a–g*; pl. III, 1*a–c*.

OCCURRENCE:

St. 51. 4. v. 26 (day). East Falkland Is., 105–115 m., 1 adult ♂, 10 mm.

St. 371. 14. iii. 30 (day). South Sandwich Is., 99–161 m., 2 ♀♀ with well developed oostegites, 3 badly damaged (doubtful).

St. WS 213. 30. v. 28 (day). North of Falkland Is., 249–239 m., 1 adult ♀, 9·8 mm.

St. WS 226. 10. vi. 28 (day). North-west of Falkland Is., 144–152 m., 1 adult ♀, 10 mm., and 1 small juv. (damaged).

St. WS 773. 31. x. 31 (day). Patagonian Shelf, north of Falkland Is, 291–298 m., 1 ♂, broken in two pieces.

REMARKS. This species was founded by Hansen on a single immature female, which was captured by the Swedish Antarctic Expedition (1901–3) off the Falkland Islands at a depth of 40 m. It has not been recorded since. I am now able to add a few details to Hansen's description because the Discovery collection contains adults of both sexes.

The general form, proportions and shape of the rostrum, antennae and appendages of these specimens agree very closely with the type. The shape and proportions of the uropods and telson also are typical, but I find certain differences in the armature of these organs, which I ascribe to the immaturity of Hansen's specimen. In the type only the distal half of the lateral margins of the telson is armed with nine spines, each increasing regularly in size towards the apical lobes. These are armed with an outer strong long spine and an inner shorter one. Only the proximal half of the cleft is armed with small teeth, the distal half being naked. I give (Fig. 33 H) a figure of the posterior end of the adult female from station 226. In it, the lateral margins of the telson are armed near the base with three minute spines. These are followed by a small unarmed gap and then by a close row of 17–19 stronger spines, which increase regularly in size towards the apex. Closer examination reveals that in many of the spaces between these spines, there is a single minute spine, especially in the proximal half of the spine row. Each apical lobe is armed with a long strong spine flanked by two, almost equal, shorter spines on its inner side. The cleft is armed throughout the whole of its length with a close row of even, fine teeth. The inner margin of the endopod of the uropod is armed with a close row of regularly graduated spines, which are very slender and relatively long distally, extending almost to the apex (Fig. 33 H). Hansen did not mention any armature on the endopods of the uropods in his description nor did he show any in his figure. These spines in the Discovery specimens are very slender and difficult to see, but it seems unlikely that Hansen would have overlooked them had they been present in the specimen he examined.

Tattersall (1923, p. 287) recorded that in juvenile specimens of *M. posthon* the lateral margins of the telson are armed with a few spines at the base followed by an unarmed portion and then with a close row of spines which extend to the apex. In older animals the unarmed gap in the armature disappears, so that there is an unbroken row of close spines from the base of the telson to the apical lobes. Smaller spines appear between the older larger ones and in adults the typical arrangement in series has been established.

I suggest that the same development may occur in *M. crassa*. Although the specimen which I have figured is apparently sexually mature, it may well be that growth continues after sexual maturity has been reached. Larger animals may be found in which there is no gap at all in the armature of the lateral margins and in which the slight tendency to an arrangement of the lateral spines in series has proceeded further and in which spines have developed along the whole of the margins of the apical cleft.

The only objection to this suggestion is that Hansen's specimen measured 9 mm. and 'the marsupial lamellae were scarcely half-developed'. In the Discovery collection an apparently adult female with large, well-developed lamellae measured only 9·8 mm. and this increase in size is small to be associated with such considerable changes in the armature of the tail fan. However, it is possible that Hansen's specimen did have spines arming the inner margin of the endopod of the uropod. As the whole form of these specimens, the shape and proportions of the anterior end of the body and appendages, and of the tail fan agree closely with Hansen's description of *M. crassa* and, furthermore, they come from the same locality, I feel justified in referring them to that species.

The male genital organ in the largest male is not unusually long and extends forward only to the region of the third thoracic somite.

Distribution. The species is only known from the north and west of the Falkland Is. and, apart from the Discovery material, has not been recorded since it was first discovered. Its occurrence round the South Sandwich Islands, if my diagnosis is correct, considerably extends its range to the southward.

Mysidetes brachylepis Tattersall, 1923

1923 *Mysidetes brachylepis* Tattersall, p. 288, figs.

Occurrence:

St. 148. 9. i. 27 (day). Off South Georgia, 132–148 m. 1 ♂, 17 mm., not fully adult.
St. 172. 26. ii. 27 (day). Off Deception I., South Shetlands, 525 m., 1 adult ♂, 20 mm.
St. WS 212. 30. v. 28 (day). North of Falkland Is., 242–249 m., 1 imm. ♀, 13·8 mm.

Remarks. This species was founded on a single adult female captured by 'Terra Nova' at the mouth of McMurdo Sound in 457 m. The Discovery specimens conform closely to the type. The genital organ differs considerably in the two male specimens at my disposal. In the larger specimen of 20 mm., the antennular brushes are very well developed and the genital organs are long, running forward parallel to one another in the mid-ventral line as far as the level of the third thoracic somite, then diverging and curving outward to beyond the level of the mouth. They are not swollen distally, but bear the usual single seta at the apex. In the smaller male of 17 mm. the antennular brushes are not so densely hirsute and the genital organs are much shorter, extending forward only as far as the level of the fifth thoracic somite. There is no distal curve, but their distal ends are expanded and spatulate. In all other respects this specimen agrees so closely with the others and with the type, that I am sure that it belongs to the same species, but I am unable to say whether the differences which I have mentioned are due to age or are traumatic. The armature of the telson and uropods conforms exactly to the type except in one detail. The single large spine arming each apical lobe in the Discovery specimens is flanked on its inner side by a smaller spine, about half as long as the large spine, but this is not present in the type. These spines are fragile and the two are only present in two apical lobes among my specimens, though the indentations marking their point of origin can be seen. Tattersall mentioned that his specimen was much mutilated; possibly it had two spines at each apex, but the inner one had been lost.

Distribution. The type was taken in the Ross Sea area and the Discovery captures indicate a wide, possibly circumpolar, range for this species.

Mysidetes microps sp.n.

(Fig. 32 A–J)

Occurrence:

St. 39. 25. iii. 26 (day). East Cumberland Bay, South Georgia, 179–235 m., 1 imm. ♂, 12·8 mm.
St. 45. 6. iv. 26 (day). Mouth of Cumberland Bay, 238–270 m., 5 ♂♂, 9 ♀♀.

St. 123. 15. xii. 26 (day). Mouth of Cumberland Bay, 230–250 m., 54 ♂♂, largest 16·2 mm., 70 ♀♀, largest 16·4mm.

St. 140. 23. xii. 26 (day). Cumberland Bay, 122–136 m., 4 badly damaged.

St. 142. 30. xii. 26 (day). East Cumberland Bay, 88–273 m., 32 ♂♂, 20 ♀♀, 19 juv.

St. 144. 5. i. 27 (day). Off South Georgia, 155–178 m., fragments.

St. 148. 9. i. 27 (day). Off Cape Saunders, South Georgia, 132–148 m., 5 adult ♀♀, 16·2 mm.

St. 154. 18. i. 27 (day). Off South Georgia, 60–160 m., 50 ♂♂, 54 ♀♀, largest 17 mm., over 200 juv. Types.

St. 190. 24. iii. 27 (day). Palmer Archipelago, 93–126 m., fragments (doubtful).

St. WS 219. 3. vi. 28 (day). North of Falkland Is., 116–114 m., 1 ♂ (doubtful).

St. MS 20. 9. iv. 25 (day). East Cumberland Bay, 200–160 m., 1 imm. ♀, 11·2 mm.

St. MS 27. 29. iv. 25 (day). East Cumberland Bay, 160–120 m., 2 ♂♂, larger 14 mm., 1 adult ♀, 14 mm., 1 juv.

St. MS 68. 2. iii. 26 (day). Cumberland Bay, 220–247 m., 70, all imm.

St. MS 71. 9. iii. 26 (day). East Cumberland Bay, 110–60 m., large numbers of fragments.

Description. *Carapace* very short anteriorly, with the short acutely pointed rostral plate produced forward between the widely diverging eyes (Fig. 32A); lateral margins of rostrum markedly concave and more or less uptilted. In many specimens the anterior portion of the rostrum is bent downward between the eyes and in dorsal view appears to be blunter and shorter than it really is. *Antennal peduncle* unusually long, extending slightly beyond the distal margin of the antennular peduncle; *scale* small and narrowly oval, five times as long as broad; upper dorsal spine on the sympod at the base of the scale short and thick and rather blunt, ventral spine long and sharp (Fig. 32A, B). *Eyes* small, set widely apart and diverging, eyestalk rather long, cornea not wider than eyestalk and occupying the distal end of the organ, not extending along the outer lateral margin of eyestalk (Fig. 32A). Pigment pale yellow to gold, very rarely dark in preserved specimens. *Mandibles* strong with well-developed *lacinia mobilis* and unusually strong spine row; palp slender (Fig. 32C). *First and second thoracic appendages* somewhat long and slender (Fig. 32D, E). *Endopods of remaining thoracic appendages* with the carpo-propodus composed of seven (occasionally eight) sub-segments. In some specimens the eighth has only six sub-segments; nail well developed (Fig. 32F). *Male genital organ* robust and somewhat thickened distally, extending forward to the first thoracic somite in largest specimens. *Pleopods* rather unusually long for the genus (Fig. 32G). *Uropods*, endopods extending only slightly beyond the apex of telson; inner margin armed with 16–17 fine, irregularly spaced spines extending along the distal three-fourths of the margin, smaller and more crowded proximally (Fig. 32H). *Telson* more than twice as long as broad at the base; lateral margins armed at the base with 5–6 strong spines succeeded by 4–5 widely spaced very tiny spines, which are absent in smaller animals, and then by a close row of spines arranged in series. The long spines of this series may be very long and slender and the small spines in the spaces between them are particularly small and not graduated; *cleft* shallow and widely open, one-twelfth of the length of the telson in depth; armed with about 13–14 small even teeth on each side (Fig. 32J).

Length of adults of both sexes, 17 mm., but females of 13 mm. may have very large oostegites and one of 13 mm. from station 42 was ovigerous.

Remarks. *M. microps* can at once be recognized by the small golden eyes with the cornea small and confined to the distal end of the organ. In this respect it differs sharply from nearly all the other species of the genus in which the eyes are large and the cornea extends over the lateral portion of the organ almost to its base. The shallow, widely open cleft of the telson also affords a ready means of recognizing the species.

Distribution. All the certain captures of this species were made in or off the mouth of Cumberland Bay, South Georgia. All were taken during hours of daylight during the southern summer, in depths of 60–273 m.

I very doubtfully refer to this species some fragments from station 190 in the Bismarck Strait, Palmer Archipelago, and a single immature male from station WS 219. In these specimens the cleft of the telson is typical, but the details of the anterior end do not conform with the types.

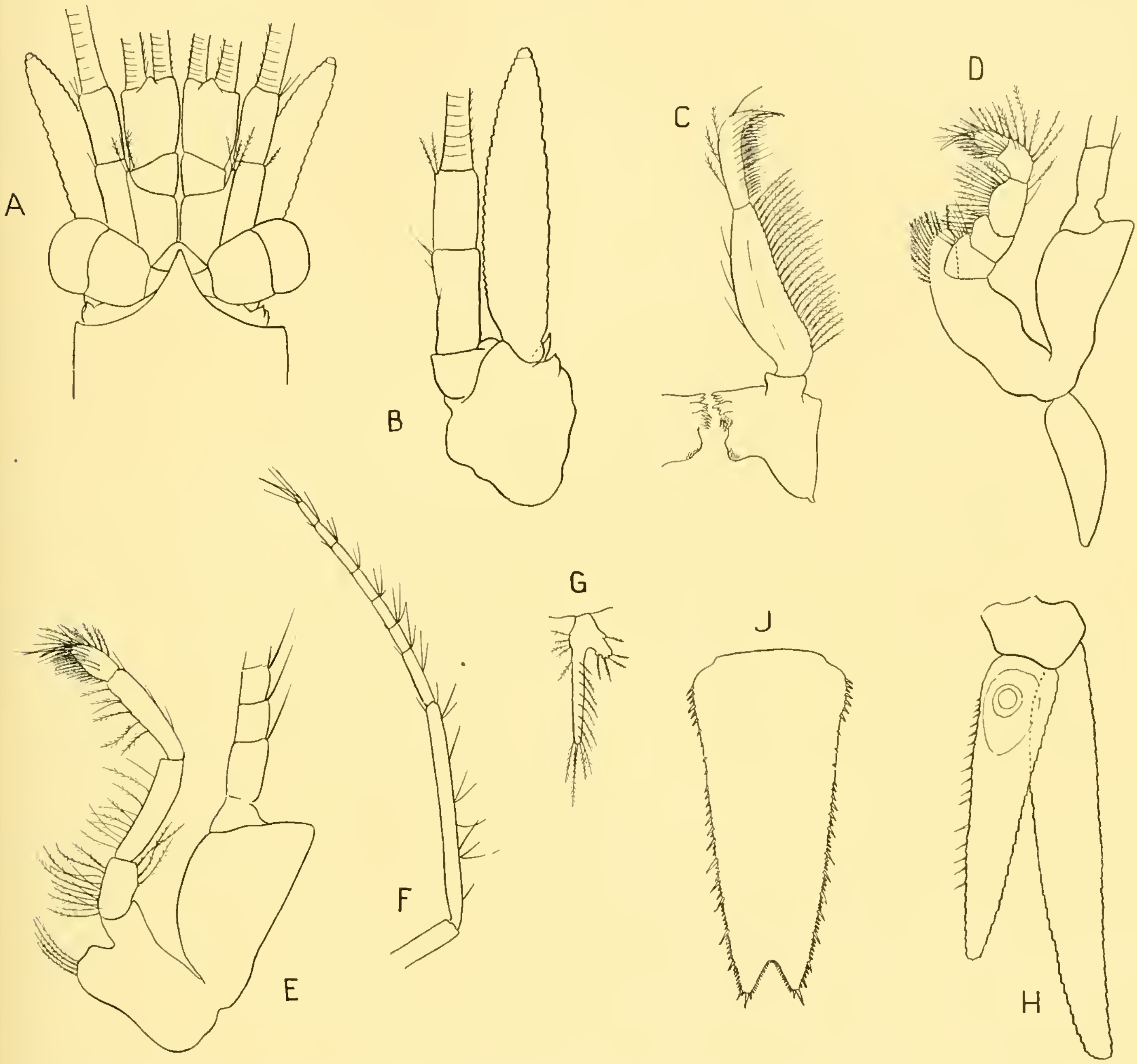

Fig. 32. *Mysidetes microps* sp.n. A, anterior end of adult female in dorsal view, × 16; B, right antenna, × 20; C, mandibles with left mandibular palp in ventral view, × 20; D, first thoracic appendage, × 20; E, second thoracic appendage, × 20; F, distal end of endopod of seventh thoracic appendage, × 20; G, fifth pleopod of male, × 20; H, right uropod, × 20; J, telson, × 20.

Mysidetes macrops sp.n.

(Fig. 33 A–G)

Occurrence:

St. 142. 30. xii. 26 (day). East Cumberland Bay, South Georgia, 88–273 m., 2 ♂♂, 7 ♀♀, largest 15·8 mm., 1 small juv.

St. WS 212. 30. v. 28 (day). North of Falkland Is., 242–249 m., 8 ♂♂, 16 ♀♀, nearly all imm., 12–14 mm.; few adults, 15 mm.

St. WS 213. 30. v. 28 (day). North of Falkland Is., 249–239 m., 3 ♂♂, 4 ♀♀, largest 13·2, all imm.

St. WS 227. 12. vi. 28 (dawn). Off Falkland Is., 320–298 m., 5 ♂♂, largest 16·6 mm., 4 ♀♀, imm., 13 mm.; 8 juv.

St. WS 229. 1. vii. 28 (day). North-east of Falkland Is., 210–271 m., 2 adult ♂♂, 15–16 mm., 61 juv.

St. WS 233. 5. vii. 28 (day). North of Falkland Is., 185–175 m., 2 ♀♀, 15 mm., adult, 1 juv.

St. WS 234. 5. vii. 28 (night). North of Falkland Is., 195–207 m., 4 ♂♂, 8 ♀♀, largest 14 mm., all imm.

St. WS 236. 6. vii. 28 (dusk to night). North of Falkland Is., 272–300 m. Two tubes: (i) 5 ♂♂, 15·6–15·8 mm., 1 ♀ (imm.), 14 mm., 1 small juv.; (ii) 10 ♂♂, 17 ♀♀ (some ovigerous), 15·8–16 mm., fragments.

St. WS 244. 18. vii. 28 (day). West of Falkland Is., 253–247 m., 2 ♂♂, 2 ♀♀, largest adult 15·6 mm.

St. WS 245. 18. vii. 28 (night). South-west of Falkland Is., 304–290 m., 11 ♀♀ and large number of fragments in bad condition.

St. WS 772. 30. x. 31 (day). North of Falkland Is., 309–163 m., 92, nearly all adult, largest 16·0 mm. TYPES.

St. WS 818. 17. i. 32 (day). West-south-west of Falkland Is., 272–278 m., 9 adult ♂♂, largest 16 mm., 14 adult ♀♀ (3 ovigerous), 15–16 mm., 5 juv.

St. WS 839. 5. ii. 31 (dusk to night). South-west of Falkland Is., 503–534 m., 81, largest 16 mm., many adult.

St. WS 871. 1. iv. 32 (day). South-west of Falkland Is., 336–342 m., 1 adult ♂, 16 mm., 1 imm. ♂, 14 mm., 1 adult ♀, 16·0 mm., fragments.

St. MS 68. 2. iii. 26 (day). Cumberland Bay, South Georgia, 220–247 m., 6 ♂♂, 1 ♀, largest 14 mm., 5 small juv., fragments.

DESCRIPTION. *Carapace* very short anteriorly, leaving the whole of the eyes completely uncovered; rostral plate with very short pointed apex (Fig. 33 A). *Antennular peduncle* moderately robust, with the process from the outer distal corner of the first segment longer than the outer margin of the second segment (Fig. 33 B). *Antennal scale* small, only slightly longer than the antennular peduncle; outer margin nearly straight, inner margin convex; *peduncle* small and slender, less than two-thirds as long as the scale. The two spines on the outer distal angle of the sympod at the base of the scale are of equal size and unusually long (Fig. 33 A, C). *Eyes* very large, extending laterally beyond the carapace, with the cornea extending over nearly all the outer margins of the eyestalks (Fig. 33 A). *Mandible* with the second segment of the 'palp' only very slightly expanded (Fig. 33 D). *Thoracic endopods* slender with the carpo-propodus composed of 9–10 sub-segments. Genital appendage in the male curving outward distally and extending to the mouth region (Fig. 33 E). *Uropods* with the endopods short, only slightly longer than the telson; armed along the inner margins with a close row of long, slender spines from the region of the statocyst (where they are shorter) to within one-third of the length to the apex; distal third of margins armed with 4–5 evenly spaced spines with the last one quite near the apex (Fig. 33 F). *Telson*, lateral margins naked at the base; armed from the level of the statocyst with a close row of spines which increase somewhat in size distally and may have one, rarely two, very small spines in the spaces between the larger ones. These small spines may easily be overlooked and in young individuals there are very few, especially at the distal end of the series; *apical lobes* rounded, armed with one long spine, flanked on its inner side with two shorter equal spines; *cleft* more than one-fourth of the telson in depth, armed on each side with about seventeen teeth (Fig. 33 G).

Length 16 mm. but females may be adult at less than 15 mm.

REMARKS. This species closely resembles *M. posthon*, which also has very large eyes, but may be distinguished by the shorter antennal scale with its straight outer margin, the short uropods with the very close row of spines arming the inner margin of the endopod and the distal spaced spines extending nearly to the apex, by the relatively shorter telson with its deep cleft and, particularly, by the armature of its lateral margins. In *M. posthon* the intervals between the larger spines of the telson are much longer, especially at the distal end of the series and are occupied with 5–9 small spines, but in *M. macrops* the larger spines are closer together and there are never more than two small spines in a space. Very large eyes are also found in *M. patagonica* and *M. anomala*, but in these species the armature of the telson is too distinctive for them to be confused with *M. macrops*.

DISTRIBUTION. This species has been taken at thirteen stations around the Falkland Islands and at two in Cumberland Bay, South Georgia. It would appear to be quite abundant in suitable localities.

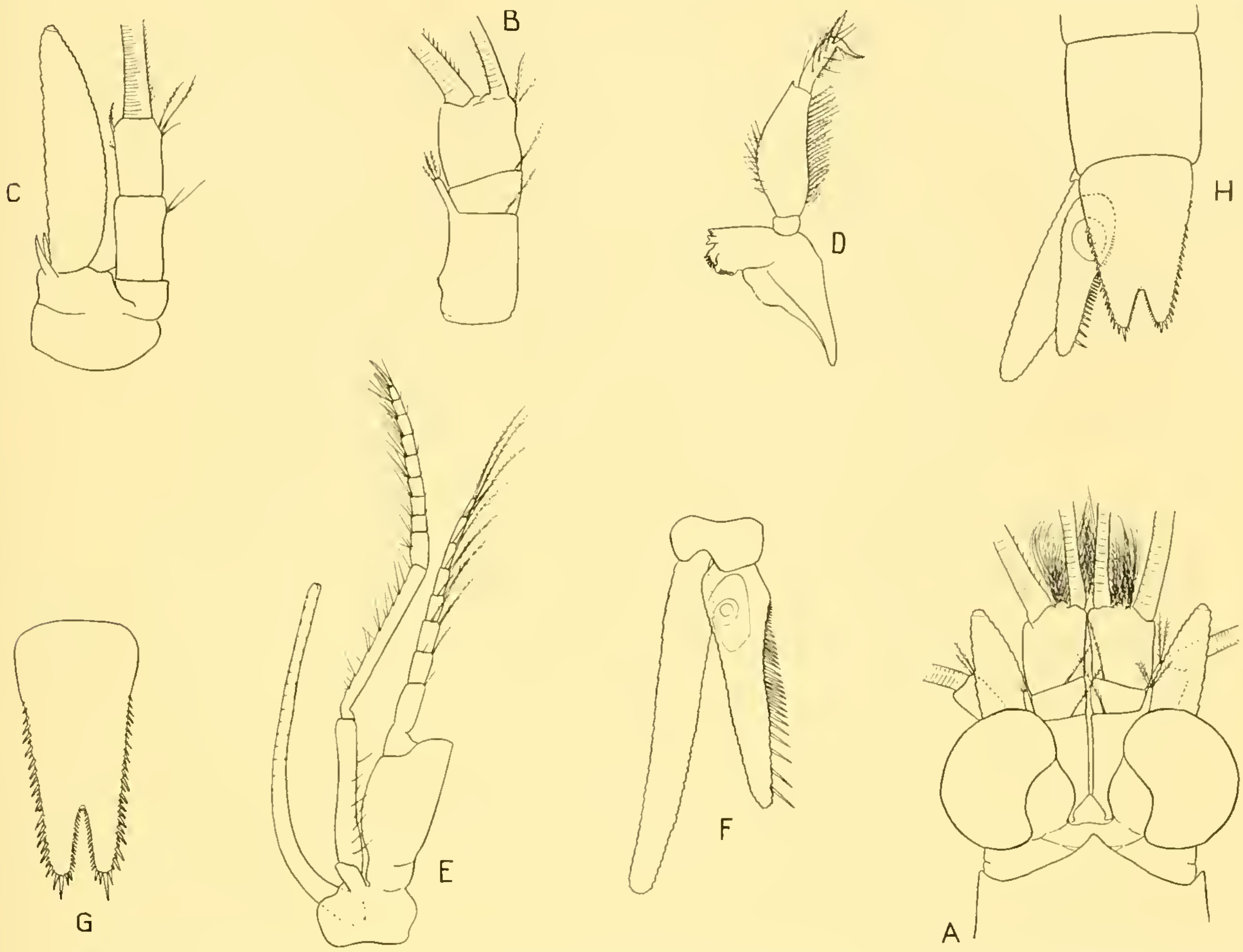

Fig. 33. *Mysidetes macrops* sp.n. (A–G). A, anterior end of male in dorsal view, × 12; B, left antennular peduncle, × 16, C, left antenna, × 16; D, mandible, × 16; E, eighth thoracic appendage of male, × 12; F, left uropod, × 16; G, telson of female, × 16.

Mysidetes crassa Hansen. H, telson and left uropod, × 16.

Mysidetes intermedia sp.n.

(Fig. 34, A–L)

OCCURRENCE:

St. 51. 4. v. 26 (day). East Falkland I., 105–115 m., 1 imm. ♂, 13·6 mm.

St. WS 243. 17. vii. 28 (dusk to dark). West of Falkland Is., 144–141 m., 1 imm. specimen, badly damaged.

St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 2 ♂♂, 14·8 mm., 1 ♀, 13·8 mm., with large empty brood sac.

St. WS 758. 12. x. 31 (night). North of Falkland Is., 94–0 m., 23 ♂♂, 10 ♀♀, largest 13·4 mm., not quite adult, many fragments. TYPES.

St. WS 784. 5. xii. 31 (day). North of Falkland Is., 170–164 m., 1 juv. (doubtful).

St. WS 801. 22. xii. 31 (day). North of Falkland Is., 165–165 m., 3 ♂♂, largest 14·4 mm. adult, 1 juv.

REMARKS. *M. intermedia* shows many characters which are intermediate between those of *M. macrops* and *M. microps*. In general form, the proportions of the antennae, the uropods and the

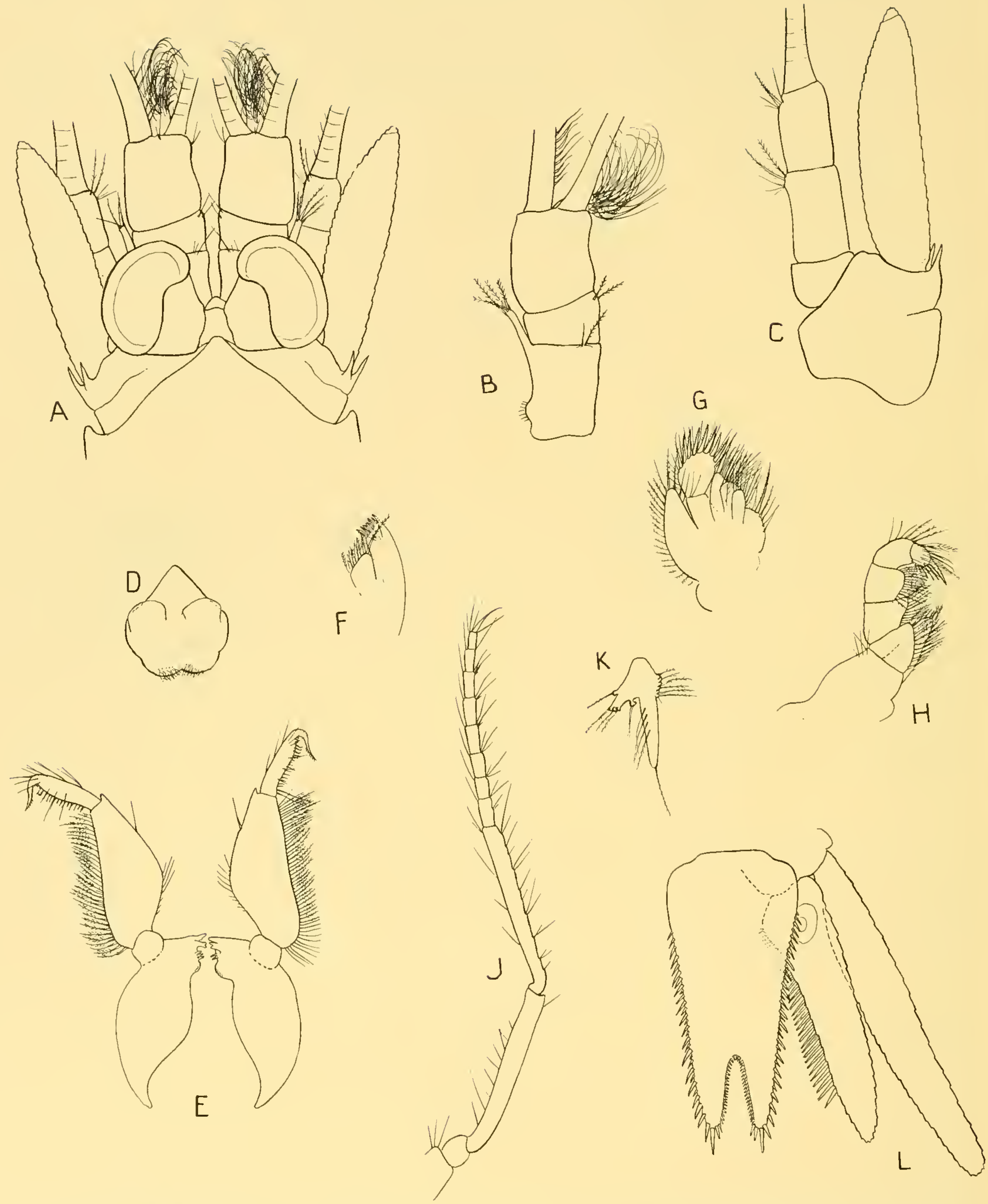

Fig. 34. *Mysidetes intermedia* sp.n. A, anterior end of male in dorsal view; B, left antennule of male; C, right antenna; D, labrum; E, mandibles; F, maxillule; G, maxilla; H, endopod of first thoracic appendage; J, endopod of seventh thoracic appendage; K, fourth pleopod of male; L, telson and right uropod. All × 25.

telson, it very closely resembles *M. macrops*, but differs in the rather longer rostral plate, the slightly longer antennal peduncle, the absence of spines on the distal third of the inner margin of the endopod of the uropod and, especially, in the smaller eyes. These are set rather close together and are turned outward so that, though the cornea really occupies only the distal part of the organ, as it does in *M. microps*, it appears to extend laterally as in *M. macrops*. The eyes are larger than in *M. microps* and the cornea is wider than the eyestalk, but the eyes do not extend laterally as far as the margins of the carapace, and in dorsal view they do not cover the antennal scale (Fig. 34A).

M. intermedia may be distinguished from *M. microps* at once by the shorter eyestalks, the larger cornea, the armature of the endopods of the uropods, the larger, more regular spines arming the lateral margins of the telson and, particularly, by the deep, narrow cleft of the telson (Fig. 34A, L).

The 'palp' of the maxilla is expanded and is almost as long as broad, and the labrum is more pointed anteriorly than in either of the other two species (Fig. 34D, G).

DISTRIBUTION. This species has been taken at four stations off the Falkland Islands and at one in the Strait of Magellan.

Mysidetes patagonica sp.n.

(Fig. 35A–E)

OCCURRENCE:

St. WS 210. 29. v. 28 (day). North of Falkland Is., 161 m., 1 adult ♂, 20 mm.
St. WS 214. 31. v. 28 (day). North of Falkland Is., 208–219 m., 1 ♂, 16 mm., 2 juv. ♂♂, 2 juv. ♀♀.
St. WS 215. 31. v. 28 (dusk to night). North of Falkland Is., 219–146 m., fragments.
St. WS 233. 5. vii. 28 (day). North of Falkland Is., 185–175 m., 1 adult ♂, 19 mm.
St. WS 234. 5. vii. 28 (night). North of Falkland Is., 195–207 m., 1 adult ♀, 16·4 mm.
St. WS 236. 6. vii. 28 (dusk to night). North-east of Falkland Is., 272–300 m., 1 adult ♀, 21 mm.
St. WS 239. 15. vii. 28 (night). North-west of Falkland Is., 196–193 m., 4 ♂♂, 8 ♀♀, largest 17 mm., 12 juv. (1 ♀ of 16 mm. ovigerous).
St. WS 244. 18. vii. 28 (day). West of Falkland Is., 253–247 m., 14 ♂♂, 25 ♀♀, largest of both sexes 20 mm., fragments. TYPES.
St. WS 583. 2. v. 31 (day). Magellan Strait, 14–78 m., 1 ovig. ♀, 17 mm.
St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 1 adult ♂, 16 mm.
St. WS 758. 12. x. 31 (night). North of Falkland Is., 112(–0) m., 2 ♂♂, larger 17 mm.

DESCRIPTION. *Carapace* very short anteriorly; rostral plate acutely pointed with its apex reaching the anterior margin of the eye-bases (Fig. 35A). *Antennular peduncles* relatively short and slender; process from distal outer angle of first segment longer than the outer margin of second segment. *Antennal scale* slender, more than six times as long as broad, somewhat bowed, with outer margin concave and inner margin convex; extending for about one-third of its length beyond the antennular peduncle; *peduncle* short, less than two-thirds as long as the scale (Fig. 35A, B). *Thoracic appendages* with large, well-developed exopods; endopods of third to eighth pairs relatively short and slender with the carpo-propodus composed of 9–10 sub-segments. Genital appendage of the male thick and much shorter than is usual in the genus (Fig. 35C). *Uropods* long and slender, exopod twice as long as the telson and bowed outward; endopod armed along inner margin with a close regular row of about 30–32 very strong spines, extending from the statocyst to within one-fourth of the length from the apex (Fig. 35D). *Telson* short and broad, somewhat shorter than the sixth abdominal somite and less than twice as long as broad at the base; cleft to nearly one-third of its length; proximal fourth of lateral margins naked, the remaining three-fourths armed with a close row of 30–33 strong spines, which increase in size towards the apex and are not arranged in series of larger spines with smaller ones in the spaces between them; apical lobes broad and bluntly rounded, armed with five large spines, of which the outermost two form the natural culmination of the row of strong lateral spines and the inner three are progressively shorter towards the cleft. *Cleft* very deep and widely rounded at its base; armed on each side with 20–21 regular teeth (Fig. 35E).

Length of adults of both sexes, 20 mm., though animals may be sexually mature at a length of 16 mm.

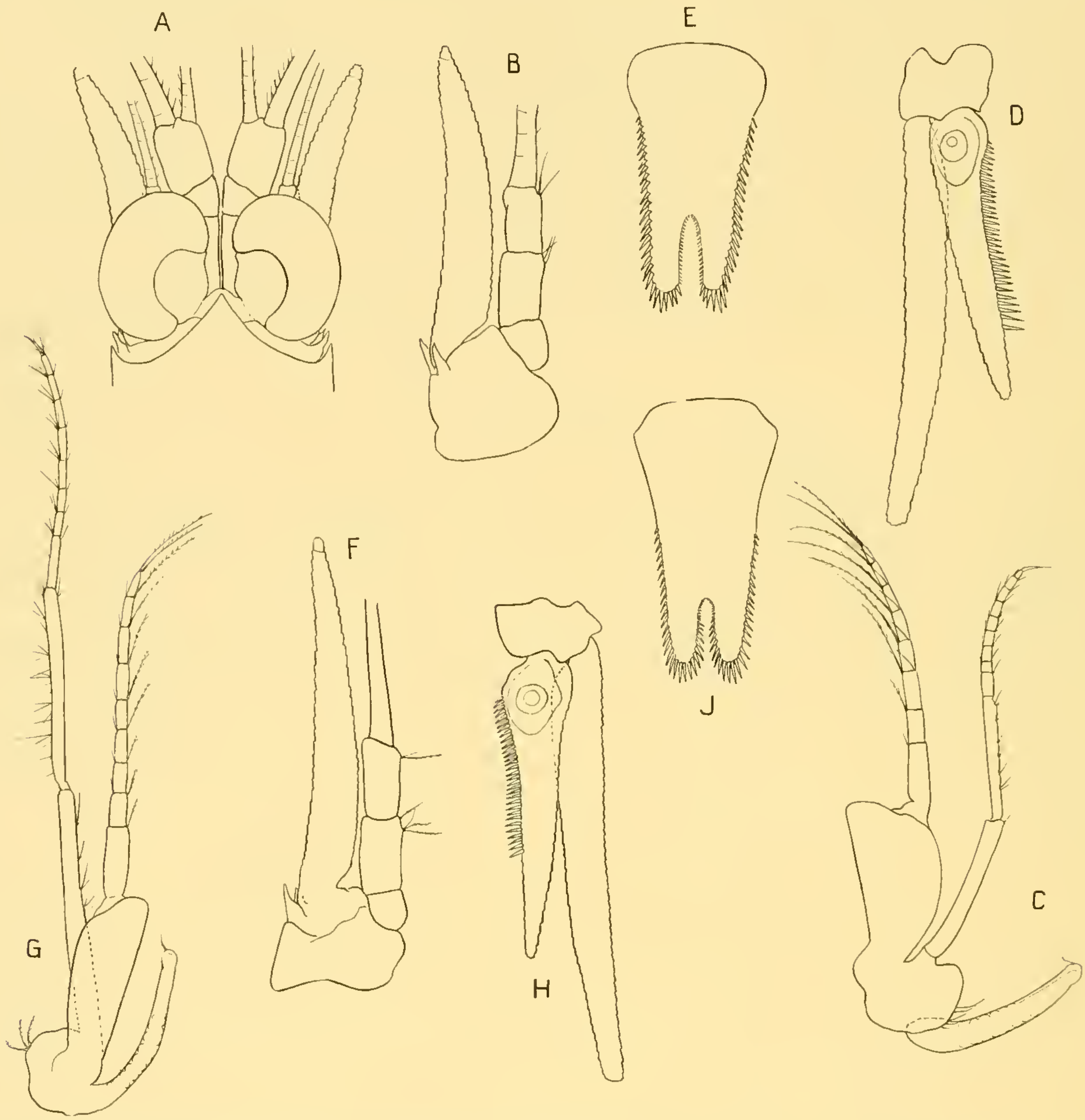

Fig. 35. *Mysidetes patagonica* sp.n. (A–E). A, anterior end of female in dorsal view, × 12; B, left antenna, × 16; C, eighth thoracic appendage of adult male, × 12; D, left uropod, × 16; E, telson, × 16.

Mysidetes anomala sp.n. (F–J). F, left antenna of male; G, eighth thoracic appendage of male of 20 mm.; H, right uropod of female; J, telson of female. All × 14.

Remarks. This species can readily be recognized by the slender, outwardly curved antennal scale, the large eyes, the long slender uropods and, especially, by the strong, regular spines arming the telson. Males can also be distinguished by the unusually short thick genital appendage. The specimen, from which Fig. 34C was made, had a large dense brush of setae on the antennule and appeared to be adult, and I do not think that the shortness of the genital organ is due to immaturity.

Distribution. This species was taken at twelve stations on the Patagonian Shelf to the north and west of the Falkland Islands and at two stations in the Strait of Magellan.

Mysidetes anomala sp.n.

(Fig. 35 F–J)

OCCURRENCE:

St. WS 748. 16. ix. 31 (night). Magellan Strait, 300(–0) m., 5 ♂♂, largest 20 mm., 2 ♀♀, larger 19·8 mm., fragments. TYPES.

St. WS 749. 18. ix. 31 (day). Magellan Strait, 40(–0) m., posterior end of large female.

REMARKS. This species so closely resembles *M. patagonica* that it will suffice to point out the differences whereby they may be distinguished.

General form. M. anomala is rather more slender with a longer tail-fan. *Rostrum* in both species is acutely pointed, but in *M. anomala* its lateral margins are uptilted as they are in *M. posthon.*

Antennular peduncle. The process from the outer distal angle of the first segment is shorter than in *M. patagonica* and in only one specimen did it extend to the distal margin of the second segment.

Antenna. The scale is considerably longer and more tapering than in *M. patagonica* (cf. Fig. 35 B and F) and the dorsal spine of the sympod is larger than the ventral.

Thoracic endopods longer and more slender. In Fig. 34 C and G I have figured on the same scale the eighth thoracic appendage of an adult male of the same size of both species. Both specimens appeared to be fully adult with dense setose brushes on the antennules.

Uropods. Though very alike in form and armature, the uropods in *M. anomala* are half as long again as in specimens of the same size of *M. patagonica* and the exopod is more bowed. It should be noted that the magnification of Fig. 35 D is greater than that of Fig. 35 H.

Telson shorter than the sixth abdominal somite. *Cleft* relatively less deep than in *M. patagonica*, being less than one-fourth of the total length of the telson, though the very long apical spines give the appearance of greater depth. The armature of the apical lobes is the most striking character of this species and is unlike that of any other species of the genus as yet known. The specimens appear to be fully adult, but the lateral margins of the telson are unarmed on the proximal half of their length. The spines arming the distal half are very large and strong, forming a regularly graduated series increasing in size to the large apical spines, and extending round the broadly rounded apical lobes into the cleft for fully two-thirds of its depth. The remaining third of the margin of the cleft is armed on each side with 9–10 very small teeth (Fig. 35 J).

Length of largest male, 20 mm.; female, 19·8 mm.

DISTRIBUTION. The species has been taken at two stations only, both in the Strait of Magellan.

Mysidetes dimorpha sp.n.

(Fig. 36 A–J)

OCCURRENCE:

St. 45. 6. iv. 26 (day). South Georgia, 238–270 m., fragments.

St. 140. 23. xii. 26 (day). South Georgia, 122–136 m., fragments.

St. 190. 24. iii. 27 (day). Palmer Archipelago, 93–126 m., fragments (doubtfully).

St. MS 19. 9. iv. 25 (day). East Cumberland Bay, South Georgia, 120–80 m., fragments of imm. male.

St. MS 23. 12. iv. 25 (day). East Cumberland Bay, 220–160 m., 1 adult ♀, 14 mm., fragments.

St. MS 62. 19. i. 26 (day). Wilson Harbour, South Georgia, 31 m., 1 ♂, 4 ♀♀, all imm., largest 12 mm., fragments.

St. MS 63. 24. ii. 26 (day). East Cumberland Bay, 23 m., 1 adult ♂, 1 juv. ♂, 7 adult ♀♀, largest 14 mm., 2 juv. ♀♀. ♀ TYPES.

St. MS 65. 28. ii. 26 (day). East Cumberland Bay, 39 m., 28 juv., largest 10 mm.

St. MS 66. 28. ii. 26 (day). East Cumberland Bay, 18 m., 3 adult ♂♂, 13·2–13·6 mm., 67 juv., largest 10 mm. ♂ TYPES.

St. MS 67. 28. ii. 26 (day). East Cumberland Bay, 38 m., 1 juv., 9 mm.

St. MS 68. 2. iii. 26 (day). East Cumberland Bay, 220–247 m., 3 juv.

St. MS 74. 17. iii. 26 (day). East Cumberland Bay, 22–40 m., 1 adult ♀, 14 mm., 34 juv., largest 10·2 mm.

Description. *Carapace* very short anteriorly with lateral margins of the short rostrum meeting in a bluntly rounded right angle, not covering even the base of the eyestalks (Fig. 36A). *Antennular peduncle* showing marked sexual dimorphism. In the female the peduncle is slender; the projection from the outer distal angle of the first segment is nearly twice as long as the outer margin of the second segment; third segment armed with five very long plumose setae along its inner margin and with a group of 4–5 even longer setae on the inner distal angle. The plumes on these setae are particularly

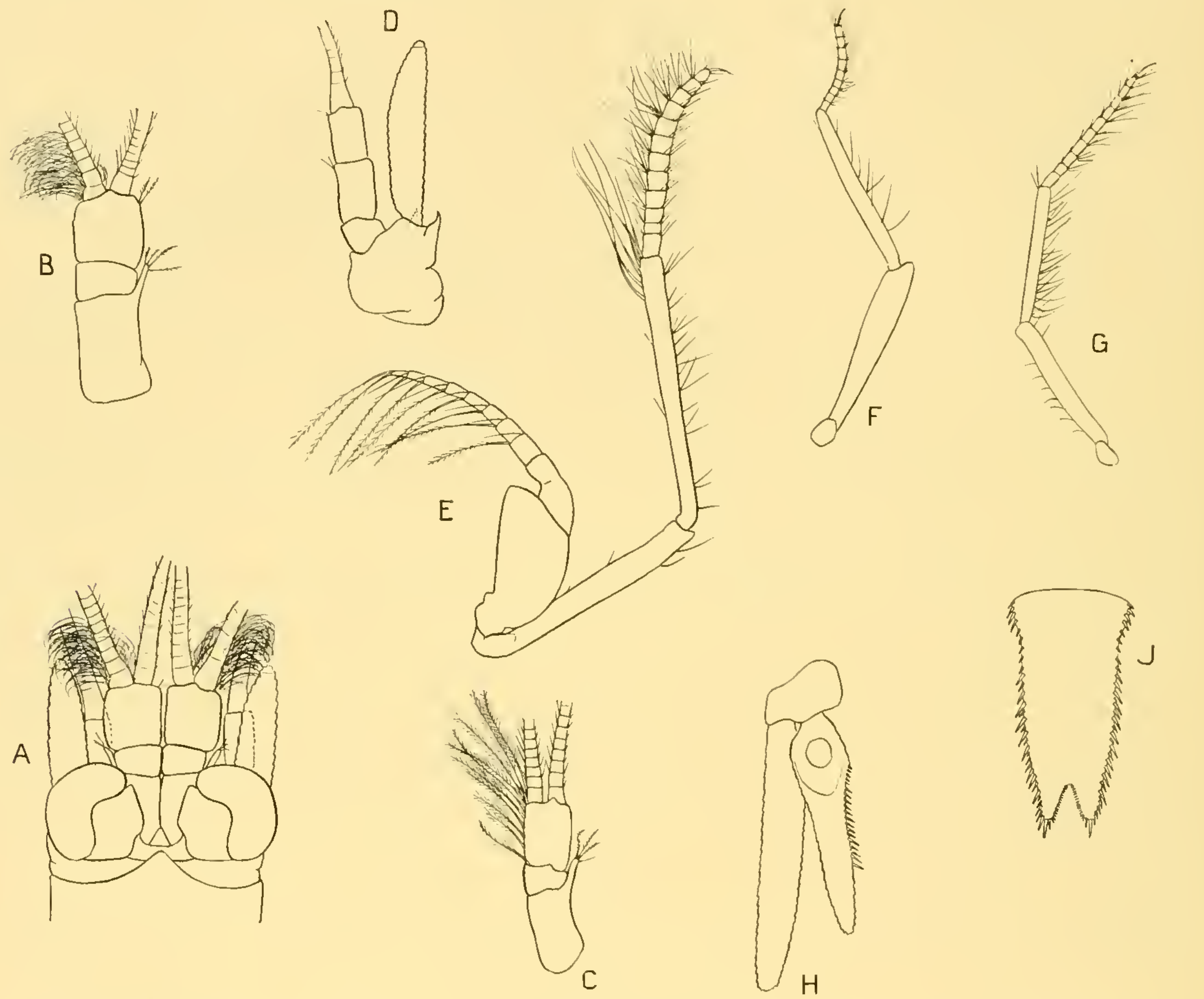

Fig. 36. *Mysidetes dimorpha* sp.n. A, anterior end of male in dorsal view, × 16; B, right antennular peduncle of male, × 18; C, right antennular peduncle of female, × 18; D, right antenna, × 16; E, seventh thoracic appendage of male, × 16; F, endopod of eighth thoracic appendage of male, × 16; G, endopod of seventh thoracic appendage of female, × 16; H, left uropod, × 16; J, telson, × 16.

long and conspicuous. Peduncle in the male more robust and the projection from the first segment relatively shorter than in the female; in immature males there are a few plumose setae on the inner margin of the third segment, but they are smaller than in the female and I can find none in adult males with well-developed antennular brushes (Fig. 36B, C). *Antennal scale* small and narrow, extending for about one-sixth of its length beyond the antennular peduncle; nearly six times as long as broad; *peduncle* two-thirds as long and equal in breadth to the scale; dorsal spine on the outer distal margin of the sympod longer than the ventral spine, broad at its base and then markedly concave on its inner margin and acutely pointed. This spine has the same shape in all the specimens I have examined (Fig. 36A, D). *Eyes* moderately large, dorso-ventrally compressed, set well apart, cornea kidney-shaped and laterally directed; pigment black (Fig. 36A). *Mandibles* with no spine or acute point at the outer distal angle of the second segment of the mandibular palp. *Thoracic appendages.* The endopods of the third to the eighth thoracic appendages are not unusually long in the female, but become progressively longer from the third to the seventh pairs. That of the eighth pair is a little shorter than the seventh. The carpo-propodus is composed of 9–10 sub-segments (Fig. 36G). In the male the thoracic endopods are larger than in the female and the seventh pair is very much enlarged, especially the carpo-propodus. This is composed in adult males of twelve sub-segments, which are very swollen and profusely armed with long setae. The distal portion of the outer margin of the merus is armed with 7–8 extremely long setae (Fig. 36E). The eighth thoracic endopods are much smaller than the seventh; the ischium is somewhat swollen distally, the merus has no long setae and the carpo-propodus is small and curved so that it looks deformed. I have found this peculiar curvature in all the males I have examined (Fig. 36F, G). *Genital appendage* slender, extending forward as far as the second thoracic somite. *Uropods* small; endopod only slightly longer than the telson; inner margin armed with about twenty spines from the distal end of the statocyst to within one-third of the distance from the apex; the proximal five spines of the row are very small (Fig. 36H). *Telson* small, middle region of the lateral margins convex; lateral margins armed throughout with a close row of spines, which are relatively rather large and only in the middle region of the margins show a tendency to arrangement in series of larger spines with smaller ones in the spaces between them; *cleft* widely open and shallow, armed with about twenty teeth on each margin (Fig. 36J).

Length of largest male which appears to be adult, 13·6 mm.; adult female, 14 mm.

REMARKS. It is very easy to recognize adult males of this species by the enlarged seventh thoracic endopods with swollen, hirsute sub-segments of the carpo-propodus and by the small, distorted-looking distal end of the eighth thoracic endopods. Young males and all females can be distinguished by the very short rostral plate, by the armature of the third segment of the antennular peduncle, by the widely spaced eyes with their black pigment, by the small, slender antennal scale, by the small uropods and by the shape and armature of the telson with its open, somewhat shallow cleft. The differences shown by the males are so marked, that at first I thought that they represented another species, but in young immature males the antennular peduncle does not differ markedly from that of the female and the endopods of the seventh and eighth thoracic appendages are not so much modified, although even in quite small males, the eighth are much smaller than the seventh. The material from several of the stations is in bad condition and I only tentatively refer the damaged specimens from station 190 to *M. dimorpha.*

DISTRIBUTION. All the stations at which *M. dimorpha* was taken are situated around South Georgia, most of them from East Cumberland Bay, with the exception of the very doubtful record from station 190 in the Palmer Archipelago. Numerous immature specimens were taken in water of 18–40 m., but only a few specimens and fragments occurred in depths of over 100 m.

Genus Mysidopsis G. O. Sars, 1864

1864 *Mysidopsis* G. O. Sars, p. 249.
1912 *Paramysidopsis* Zimmer, p. 4.
1918 *Mysidopsis*, Zimmer, p. 17.

REMARKS. This genus is characterized by the presence of only six segments in the endopod of the first thoracic appendage, due to the fusion of the third and fourth segments. The telson is variable. In most of the species it is short and linguiform, with the lateral margins markedly convex near the base and narrowing slightly to a broadly rounded or narrowly truncate apex. In one or two species there is a tendency to a slight emargination at the apex, and in one species, *M. angusta* G. O. Sars, there is a small unarmed notch or cleft. The lateral margins are armed throughout with a varying number of spines, very rarely more than thirty in number, and not arranged in series. There are no median setae.

Of the thirteen species at present included in the genus *Mysidopsis*, only four have been recorded from southern waters, *M. schultzei* (Zimmer), *M. similis* (Zimmer), and *M. major* (Zimmer), all from shallow, coastal waters near Angra Pequena on the west coast of South Africa, and *M. acuta* Hansen from near the Falkland Islands. I am now able to add two new species, *M. camelina* and *M. falklandica*, to the genus *Mysidopsis*.

Mysidopsis schultzei (Zimmer), 1912

(Fig. 37A–J)

1912 *Paramysidopsis schultzei* Zimmer, p. 5, figs.

OCCURRENCE:

St. 90. 10. vii. 26 (day). False Bay, Cape Town, 10–12 m., 36 ♂♂, largest 9·8 mm., 16 ♀♀, largest 10 mm. (ovig.), 6 juv. ♂♂, 12 juv. ♀♀.

St. 91. 8. ix. 26 (day). False Bay, Cape Town, 5–0 m., 1 ♂, 9 mm.

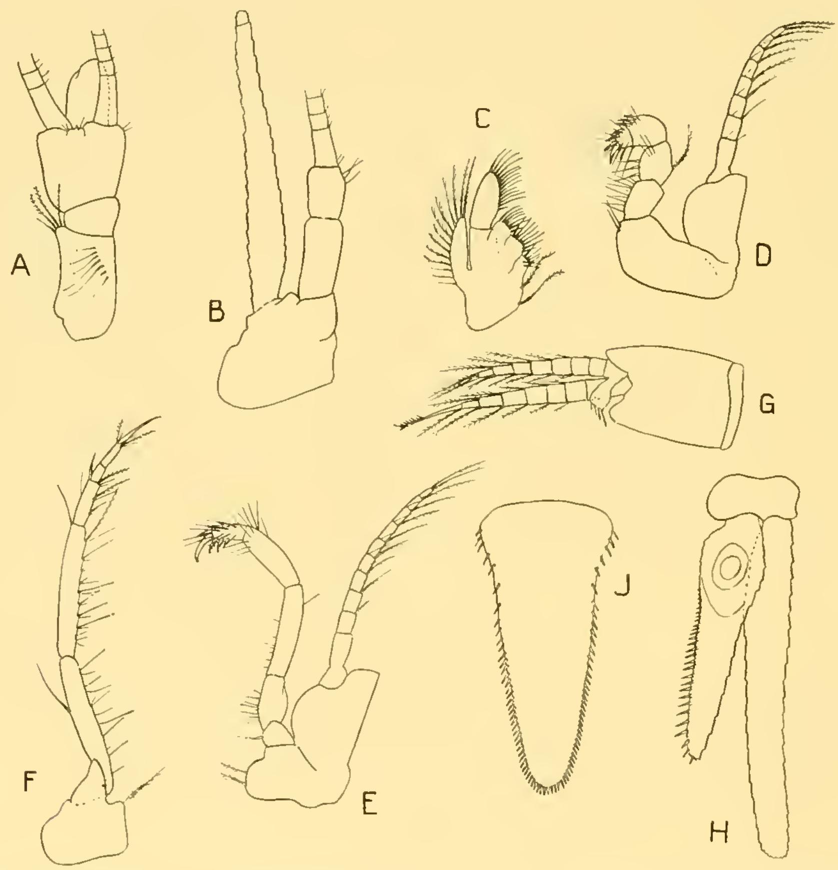

Fig. 37. *Mysidopsis schultzei* (Zimmer). A, antennular peduncle of adult male, ×24; B, antenna, ×24; C, maxilla, ×36; D, first thoracic appendage, ×24; E, second thoracic appendage, ×24; F, endopod of third thoracic appendage, ×24; G, fourth pleopod of male, ×24; H, right uropod, ×24; J, telson, ×24.

REMARKS. This species was founded by Zimmer for specimens taken in shallow water among seaweed in Luderitz Bay near Angra Pequena. The animals were captured in quite considerable numbers together with two other new species, *M. similis* (Zimmer) and *M. major* (Zimmer). I have nothing to add to Zimmer's description of the species but, since his figures are rather small and the Discovery records are the first since he founded it, I give figures showing its salient features. Zimmer recorded that in his material the males considerably outnumbered the females, and it is interesting to note that in the captures made by 'Discovery', there are more than twice as many adult males as females. Among the juvenile specimens there are more females than males, but there is not enough evidence to show whether this has any significance or whether the females are less viable than the males.

DISTRIBUTION. *M. schultzei* has hitherto only been known from near Angra Pequena and the present records considerably extend its known geographical range to the southward.

Mysidopsis similis (Zimmer) 1912

(Fig. 38A–J)

1912 *Paramysidopsis similis* Zimmer, p. 6, pl. 11, figs. 28–36.

OCCURRENCE:

St. 90. 10. vii. 26 (day). False Bay, Cape Town, 10–12 m., 4 ♂♂, largest 10 mm., 2 ♀♀, larger 8·6 mm., with large brood sac.

St. 91. 8. ix. 26 (day). False Bay, Cape Town, 35 m., 1 ♂, 7 mm., 1 juv. ♀.

REMARKS. The types of this species were captured with those of the preceding species in shallow water near Angra Pequena.[1]

The specimens in the Discovery material agree closely with Zimmer's figures and I find that, even in the largest specimens, the spine row on the inner margin of the endopod of the uropod does not extend as far as half the total length of the endopod (Fig. 38H). Zimmer's figures are very small and I give drawings of the most characteristic appendages of this species (Fig. 38A–H).

DISTRIBUTION. Besides the original record of this species from near Angra Pequena, I have recorded it from shallow water in Saldanha Bay north of Cape Town and from Knysna Lagoon on the south coast of South Africa. The two stations at which it was taken by 'Discovery' lie within its known geographical range, but its occurrence in 35 m. at station 91 is from considerably deeper water than any other record.

Mysidopsis major (Zimmer), 1912

1912 *Paramysidopsis major* Zimmer, p. 7, pl. 11, figs. 37–49.

OCCURRENCE:

St. 90. 10. vii. 26 (day). False Bay, Cape Town, 10–12 m., 11 ♂♂, not adult, largest 11·8 mm., 3 ♀♀, largest 12 mm., ovigerous, 4 juv. ♂♂, 4 juv. ♀♀.

REMARKS. These specimens agree so closely with the description and figures given by Zimmer that I have nothing to add. The species can readily be distinguished from *M. schultzei* and *M. similis*, with which it appears normally to live, by the broader, more rounded apex of the telson, by the very long, acutely pointed rostrum and by the form of the spines arming the inner margin of the endopod of the uropod. In *M. schultzei* these spines are much larger than in the other two species and much more spaced, especially towards the distal end of the endopod, and they extend right to the apex.

[1] While examining a small collection of mysids from estuarine waters of South Africa (O. S. Tattersall, 1952, p. 177), I described and figured certain specimens from Langebaan Bay, to the north of Cape Town and from Knysna Lagoon on the south coast of South Africa, referring them to a new species which I named *Leptomysis tattersalli* in memory of my late husband. I then thought that the endopod of the first thoracic appendage was composed of the normal number of sub-segments and that therefore the specimens must belong to the genus *Leptomysis*. Since examining the Discovery material, I have re-examined these specimens and find that, in the endopods of the first thoracic appendages, the third and fourth segments are fused and that they therefore belong to the genus *Mysidopsis* (Fig. 38D). They agree closely with Zimmer's description and figures of *M. similis*, except that the endopods of the uropods are longer than the telson and the row of spines arming their inner margins is longer, extending almost to the level of the apex of the telson. I consider that they should be referred to *M. similis* and I withdraw *L. tattersalli* as a synonym of that species.

In *M. similis* the spines are much more dense, small in the region of the statocyst, but increase in size distally. The spine row appears to be variable in length, but usually extends only from the distal portion of the statocyst to about half way along the endopod. In *M. major* the spine row is composed of very small spines which are of equal size throughout, extremely dense and extend from the distal region of the statocyst to about seven-eighths of the total length of the endopod.

DISTRIBUTION. Identical with that of *M. similis*, except that it has only been taken in shallow water.

Fig. 38. *Mysidopsis similis* (Zimmer). A, right antennular peduncle of adult male; B, right antenna; C, maxilla; D, first thoracic appendage without epipod; E, endopod of second thoracic appendage; F, endopod of sixth thoracic appendage; G, fourth pleopod of male; H, endopod of right uropod; J, telson. All × 36.

Mysidopsis acuta Hansen, 1913

(Fig. 39A–H)

1913 *Mysidopsis acuta* Hansen, p. 16, figs.
1921 *Mysidopsis acuta*, Hansen, p. 3.

OCCURRENCE:

St. 49. 3. v. 26 (night). Off Cape Bougainville, East Falkland I., 0–5 m., 2 adult ♂♂, 10·5 mm.
St. 51. 4. v. 26 (day). East Falkland I., 105–115 m., 1 ♂, 11 mm., 2 ♀♀, 10·8 mm.
St. 56. 16. v. 26 (day). East Falkland I., 10½–16 m., 1 juv. ♀, 4·8 mm.
St. 123. 15. xii. 26 (day). Off mouth of Cumberland Bay, South Georgia, 230–250 m., 3 ovig. ♀♀, largest 12·6 mm., 10 imm. ♀♀.

St. 980. 15. x. 32 (night). Between Falkland Is. and South America, 104–0 m., 1 adult ♂, 22 juv. (In the juvenile specimens the eyes appear to be very red.)

St. WS 211. 29. v. 28 (day). North of Falkland Is., 161–174 m., 1 imm. ♀.

St. WS 219. 3. vi. 28 (day). North-east of estuary of River Desire, South America, 116–114 m., 96 juv. (In very bad condition.)

St. WS 220. 3. vi. 28 (dusk to dark). East of estuary of River Desire, 108–104 m., 4 adult ♂♂, 9 breeding ♀♀, 30 juv.

St. WS 222. 8. vi. 28 (day). South-west of estuary of River Desire, 100–106 m., 3 small juv.

St. WS 226. 10. vi. 28 (day). North-west of Falkland Is., 144–152 m., 4 ♂♂, 11·5 mm., 2 juv. ♂♂, 2 adult ♀♀ (1 ovig.), 9 juv. ♀♀.

St. WS 233. 5. vii. 28 (day). North of Falkland Is., 185–175 m., 1 adult ♀.

St. WS 243. 17. vii. 28 (dusk to dark). West of Falkland Is., 144–141 m., 2 adult ♂♂, 2 adult ♀♀, largest 12 mm., 2 juv. ♂♂, fragments.

St. WS 758. 12. x. 31 (night). North of Falkland Is., 94–0 m., 6 adult ♂♂, 11 breeding ♀♀, largest 12·4 mm.

St. WS 767. 19. x. 31 (night). East of Gulf of St George, South America, 98(–0) m., 3 ♂♂, 5 ♀♀, 4 juv.

St. WS 781. 6. xi. 31 (day). North of Falkland Is., 148 m., 2 adult ♀♀.

St. WS 782. 4. xii. 31 (day). North of Falkland Is., haul A, 141–146 m., 1 ovig. ♀.

St. WS 786. 7. xii. 31 (day). East of Santa Cruz, South America, 134–119 m., 1 adult ♂, 3 adult ♀♀, largest 9·5 mm.

St. WS 787. 7. xii. 31 (day). East of Port St Julian, South America, 106–110 m., 3 adult ♂♂, 15 ♀♀ (some ovig.), fragments.

St. WS 798. 20. xii. 31 (day). South-east of Gulf of St George, 49–66 m., 5 adult ♀♀, 2 juv. ♀♀.

St. WS 801. 22. xii. 31 (day). North of Falkland Is., 165–165 m., 6 adult ♂♂, 15 ♀♀, breeding, fragments.

St. WS 802. 5. i. 32 (day). North of Falkland Is., 2 hauls: (i) haul A, 128–132 m., 5 adult ♂♂, 5 adult ♀♀, 1 juv.; (ii) haul B, 132–139 m., 8 ♂♂, 12 ♀♀, breeding, largest 11·6 mm., 3 juv. ♀♀.

St. WS 806. 7. i. 32 (day). North-west of Falkland Is., 130–123 m., 13 adult ♂♂, 19 adult ♀♀, some ovig., largest 10·8 mm., many fragments.

St. WS 809. 8. i. 32 (day). Off Cape S. Francisco de Paula, South America, 108–104 m., 6 adult ♂♂, 8 adult ♀♀, 4 juv. ♀♀, 1 juv. ♂.

St. WS 816. 14. i. 32 (day). West of Falkland Is., 150–150 m., 2 adult ♂♂, 11 adult ♀♀, breeding, fragments.

St. WS 837. 3. ii. 32 (day). Off eastern end of Strait of Magellan, 102–102 m., 2 adult ♂♂, 1 juv. ♂, 6 adult ♀♀ (3 ovig.), 1 juv. ♀.

REMARKS. Up to the present this species has been known only from the types—two poorly preserved immature males taken in 1902 off the Falkland Isles—and from three specimens captured by the Tierra del Fuego Expedition in April 1896.

The present specimens agree so closely with Hansen's figures and description (1913, p. 16) that I have no hesitation in referring them to his species. There is, however, one striking feature which Hansen did not mention. In all the specimens I have examined in the Discovery material, the inner margins of the endopods of the uropods are armed from the region of the statocyst to within a short distance of the apex with an extremely close row of regular spines, which are smaller proximally and increase evenly in size distally. These spines are present in quite small immature specimens as well as in the adults, and it is most surprising that so meticulous a worker as Hansen could have overlooked them. I have not had an opportunity of examining the type specimens, but in view of the very close agreement in all other respects of my specimens with the published description of *M. acuta*, I venture to suggest that the presence of these spines is a regular character of the species (Fig. 39H).

Although Hansen had an adult male in the Tierra del Fuego material he did not describe or figure the male pleopods. I am now able to record that in the fourth pair the exopod, as in other species of the genus, is modified being longer and stouter than the endopod and bearing at its tip a single strong barbed non-plumose seta (Fig. 39G).

M. acuta may readily be recognized by the acutely pointed apex of the antennal scale (Fig. 39A) and by the long linguiform telson, which is fully twice as long as the breadth at the base (Fig. 39H).

Hansen figures the telson with the lateral margins convex at about one-third of the distance from the base, but in all Discovery specimens they are almost straight, converging evenly to the rounded apex. They are armed throughout their entire length with 24–27 small regular spines and the apex is armed with one pair of long slender spines, which are set somewhat apart leaving a characteristic gap in the median line (Fig. 39H). The rostrum, which is not mentioned by Hansen, is pointed and short, extending only to half the length of the first segment of the antennular peduncle (Fig. 39A). I have figured the maxilla, one mandible with palp, and the first three thoracic endopods, in order to show how closely they resemble Hansen's figures (Fig. 39B–F).

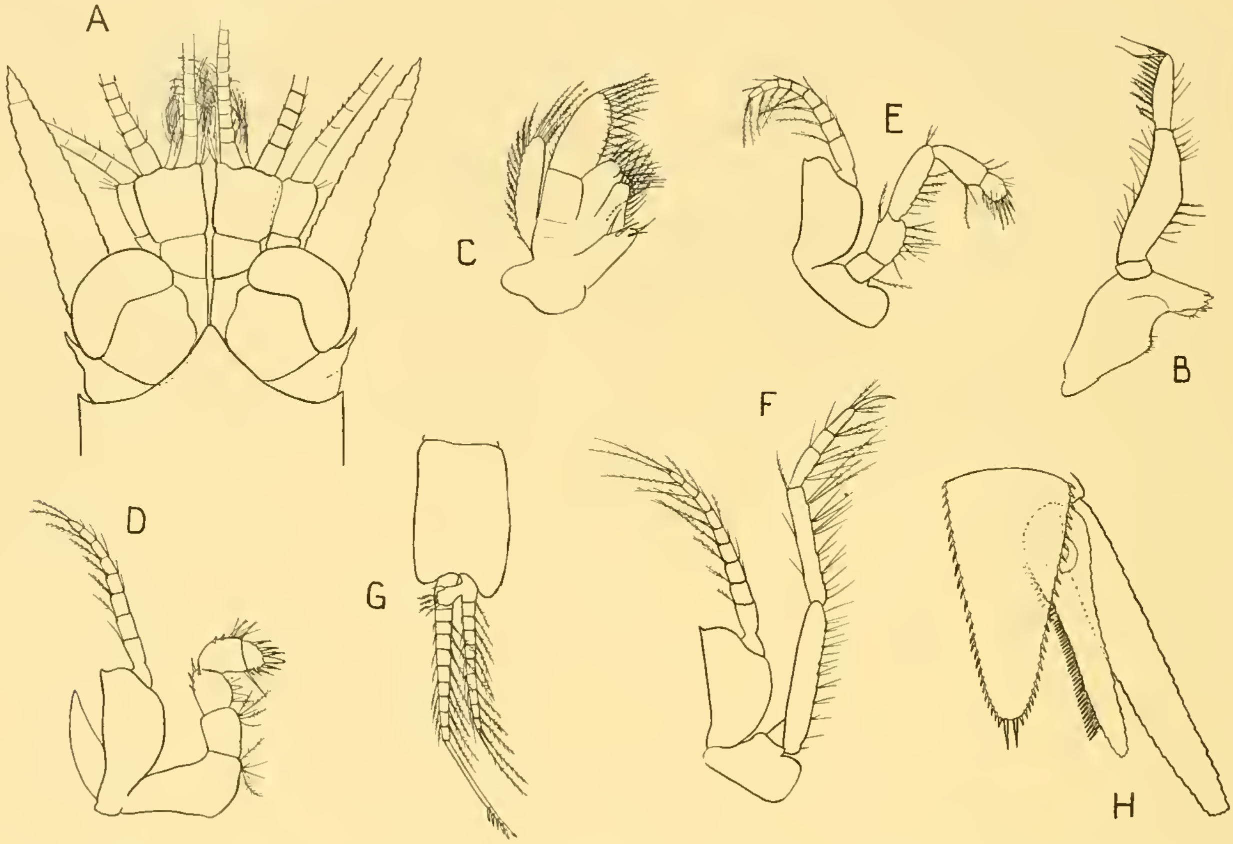

Fig. 39. *Mysidopsis acuta* Hansen. A, anterior end of adult male in dorsal view, ×20; B, mandible, ×20; C, maxilla, ×45; D, first thoracic appendage with epipod, ×25; E, second thoracic appendage, ×20; F, third thoracic appendage, ×20; G, fourth pleopod of male, ×20; H, telson and right uropod, ×20.

Distribution. The types of this species were taken in 16 m. in Berkeley Sound, Falkland Isles and it has since been taken on two occasions off Tierra del Fuego in 6–10 fm. (Hansen, 1921, p. 3). The present records do not appreciably extend its known geographical range, but most of the captures were made at greater depths. The deepest water in which it was taken by 'Discovery' was at station 123 at a depth of 230–250 m.

Mysidopsis camelina sp.n.

(Fig. 40A–N)

Occurrence:

St. 90. 10. vii. 26 (day). Simon's Town, False Bay, South Africa, 10–12 m., 1 adult ♀, 6·2 mm., large empty brood sac.

St. 406. 5. vi. 30 (day). Simon's Town, False Bay, South Africa, 29 m., 1 ovig. ♀, 6·2 mm. Type.

Description. *General form* small and robust; sigmoid in lateral view. *Carapace* small, with two strong protuberances like two humps in the mid-dorsal line, posterior to the cervical sulcus. The two humps are close together and the anterior one considerably larger than the other; *rostrum* short and triangular with the lateral margins uptilted, so that in dorsal view it appears to be narrower than it really is; lateral margins of carapace short and emarginate, leaving the whole of the bases of the thoracic appendages uncovered in lateral view; antero-lateral angles bluntly pointed; postero-lateral angles considerably produced (Fig. 40 A). *Pleon* comparatively robust, especially at its anterior end; first somite with the tergum very swollen and produced backward into a broad, rounded saddle, which covers half of the dorsal surface of the second somite; the second somite and, to a less extent the third, also produced backward in the mid-dorsal line over the succeeding somite; last three abdominal somites progressively more slender, the sixth being less than half as thick as the first (Fig. 40 A). *Antennular peduncle* small and short; first segment longer than the second and third together; outer margin concave; distal margin very oblique, the outer distal angle acutely pointed but not produced as it is in *Erythrops* (Fig. 40 B, C). *Antennal peduncle* equal in length to the antennular peduncle; second segment the longest; *scale* oval, short and broad; slightly longer than the peduncle; outer margin nearly straight; small distal suture present, cutting off the bluntly rounded apex (Fig. 40 B); short strong spine on outer distal angle of the sympod (Fig. 40 D). *Eyes* large and globular, with only a slight tendency to dorso-ventral flattening; very minute ocular papilla present on the eyestalk near the cornea (Fig. 40 A). *Mandibles:* palp with the proximal portion of the outer margin produced into a wide triangle, armed at its apex with a strong blunt spine, with a similar smaller spine half-way along its distal margin; distal half of segment narrower with nearly parallel sides; its distal margin produced on the ventral side into a blunt point and armed at each angle with a blunt spine; third segment long and narrow and armed along its inner margin with about thirteen strong, rather short spines alternating with an equal number of smaller spines; spine at the apex considerably larger than the others. As I have only two specimens of this interesting new species, I have only dissected one mandible. It does not appear to be damaged, but I am unable to make out any molar process or clear spine row though there seems to be a *lacinia mobilis.* I give a figure of this appendage as it appears and trust that further captures of the species may throw more light on its true structure (Fig. 40 E). *Maxillule* and *maxilla* as described for the genus. The latter has a well-developed slender exopod and the distal segment of the 'palp' is not expanded (Fig. 40 F, G). *First thoracic endopod* composed of six segments as described for the genus (Fig. 40 H). *Second thoracic endopod* robust and comparatively large, with a well-marked expansion from the basis; distal portion of the tarsus armed with a number of specialized setae, which are unusually long and have the distal half very slender and armed with very fine hairs, instead of the close row of regular spines which adorn the proximal half (Fig. 40 K). *Remaining thoracic appendages* with well-developed exopods and short endopods. The tarsus is composed of three segments. Without dissection and staining, it is not possible to tell whether these represent a separate carpus and propodus with a small dactylus, or whether the carpus and propodus are really fused and secondarily divided; nail strong and well-developed (Fig. 40 L). *Pleopods of the female* in the form of rudimentary flat plates, which become progressively larger on the posterior somites (Fig. 40 A). *Uropods* very broad and short; endopod extending very slightly beyond the apex of the telson; armed on the inner margin, near the statocyst, with a graduated row of five spines, which increase regularly in size distally; exopod only two and a half times as long as broad and only slightly longer than the endopod (Fig. 40 M). *Telson* linguiform; slightly longer than the sixth abdominal somite; hollowed from above into the shape of a trowel; lateral margins nearly straight, converging slightly to the bluntly rounded apex; armed with 9–10 small spines arranged more or less regularly from the base to the apex; *apex* armed with two pairs of short, stout spines, the inner pair of which is nearly twice as large as the outer; no median setae (Fig. 40 N).

Length of ovigerous female, 6·2 mm.

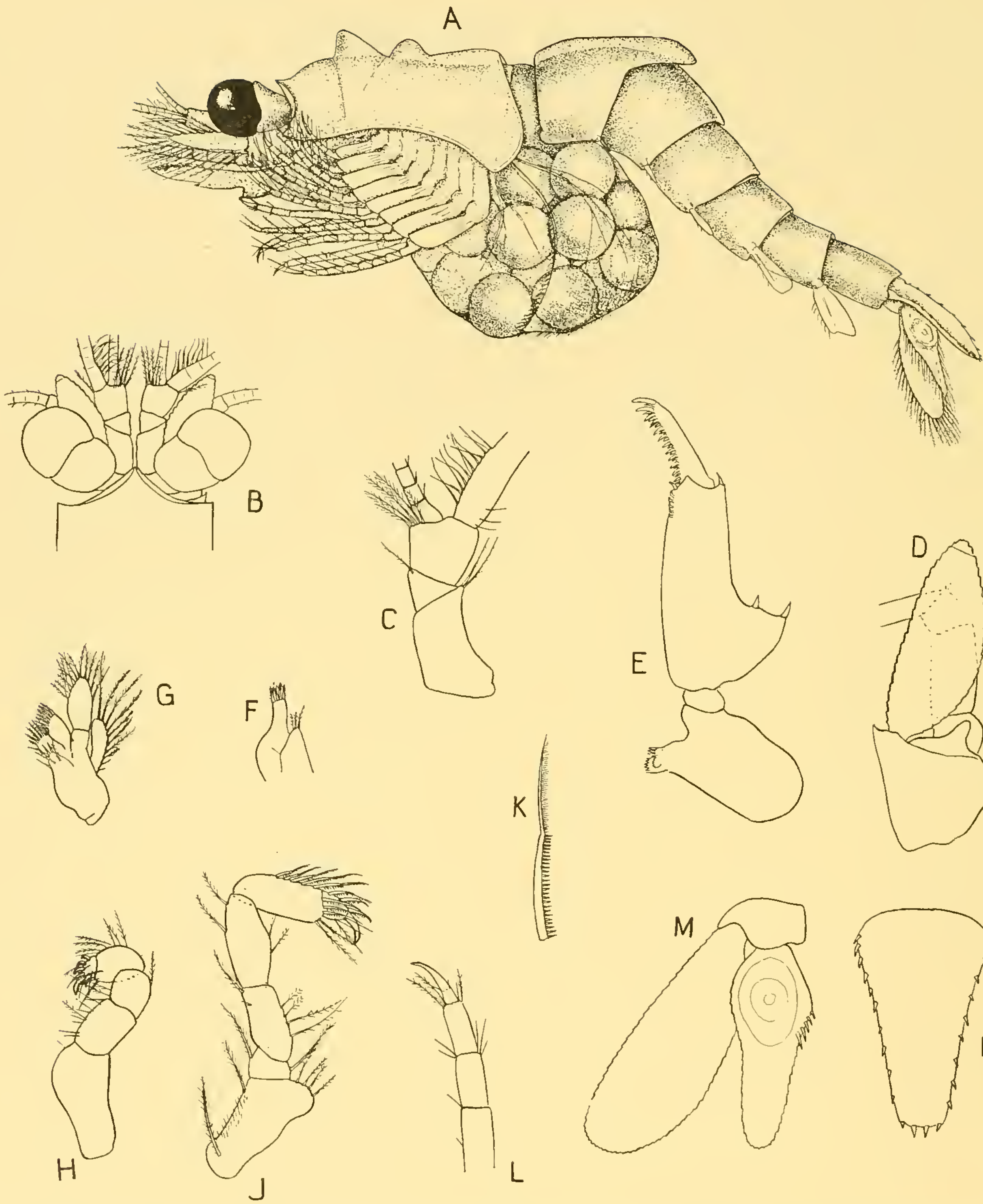

Fig. 40. *Mysidopsis camelina* sp.n. A, adult female in lateral view, × 20; B, anterior end of female in dorsal view, × 20; C, right antennular peduncle of female, × 43; D, left antenna, × 43; E, left mandible from ventral side, × 43; F, maxillule, × 43; G, maxilla, × 43; H, endopod of first thoracic appendage, × 43; J, endopod of second thoracic appendage, × 43; K, modified seta from second thoracic endopod (enlarged); L, distal end of fourth thoracic endopod, × 43; M, left uropod, × 43; N, telson, × 43.

REMARKS. In general appearance this species closely resembles *M. gibbosa* G. O. Sars from European and Mediterranean waters, which is characterized by the presence of two 'humps' on the carapace and a marked sigmoid shape in lateral view. The form of the antennae, eyes, rostrum and tail-fan is very similar in the two species, but they may readily be distinguished by the much larger unequal protuberances on the carapace, by the less marked sigmoid shape of *M. camelina*, and particularly by the peculiar development of the first abdominal somite in this new species. In *M. gibbosa* the first abdominal somite is larger and more robust than the succeeding somites, but there is no prolongation of its posterior margin. The marsupium in *M. camelina* is unusually large and I can count no fewer than twenty-three large eggs in the type specimen. It may be that the robust abdomen and the peculiar strengthening of the first abdominal somite are correlated with the strain of supporting such a relatively enormous load; the males may not show a similar modification. The form of the mandibular palp is quite different from anything previously described in the genus, and had the other appendages shown differences instead of close similarities, I should have felt inclined to found a new genus for this remarkable new species.

DISTRIBUTION. The species has been taken on two occasions only, both from the same locality, in somewhat shallow water near Simon's Town, False Bay, near Cape Town, South Africa.

Genus Leptomysis G. O. Sars, 1869

1869 *Leptomysis* G. O. Sars.

REMARKS. This genus can be distinguished from the genus *Mysidopsis*, which it very closely resembles, by the form of the endopod of the first thoracic appendage, by the shape of the apex of the telson and by the armature of the fourth pleopod of the male. In *Mysidopsis*, the third and fourth segments of the first thoracic endopod are fused with no trace of a dividing suture, but in *Leptomysis* the two segments are articulated in the usual way. In *Mysidopsis*, the exopods of the fourth pair of pleopods in the male are longer than the endopods and the distal segment is terminated by a single strong straight spinous seta. The setae on the other segments are of the normal slender plumose form. In *Leptomysis* the setae of the distal three segments of the exopod of the fourth pair of male pleopods are modified by being longer and slightly more plumose than those arming the other segments, and the distal segment is terminated by a pair of long setae. In both genera this exopod is longer than the endopod.

At one time, it was laid down as a generic character of *Mysidopsis* that the lateral margins of the telson were armed with only a few more or less widely spaced spines, and this formed a useful distinction from the species of the genus *Leptomysis*. Owing to the addition of *M. acuta* and *M. similis* to the genus *Mysidopsis*, this definition has had to be modified, for in both these species there is a large number of spines on the lateral margins of the telson. However, these spines are of equal size or are graduated regularly, increasing in size distally, whereas in *Leptomysis*, the lateral margins of the telson are armed with a very large number of spines, which are usually arranged in series of larger spines with small spines in the spaces between them. The apex of the telson in *Mysidopsis* is (except in *M. similis*) broader and less pointed than in *Leptomysis*, showing in some species either a median emargination or a small unarmed cleft, whereas in all the known species of *Leptomysis* it is evenly and more narrowly rounded.

Only three species of *Leptomysis* are represented in the Discovery collection: *L. apiops* G. O. Sars, *L. capensis* Illig and *L. megalops* Zimmer.

Leptomysis apiops G. O. Sars, 1877

1877 *Leptomysis apiops* G. O. Sars, p. 51.
1915*b* *Leptomysis apiops*, Zimmer, p. 319, fig. 9.
1915*c* *Leptomysis apiops*, Zimmer, p. 167, fig. 19.
1941 *Leptomysis apiops*, Băcesco, p. 25.

Occurrence:

St. 274. 4. viii. 27 (day). Off St Paul de Loanda, 65–64 m., 1 adult ♂, 7 mm., 1 ovig. ♀, 7 mm.
St. 277. 7. viii. 27 (night). South-west of Cape Lopez, 63(–0) m., 8 ♂♂, all imm., largest 5·5 mm., 58 ♀♀, nearly all ovigerous, largest 7 mm. but many breeding at 5·8 mm.
St. 279. 10. viii. 27 (day). Off Cape Lopez, 58–67 m., 2 ♂♂, adult, 7·5 mm.

Remarks. These specimens agree closely with the published descriptions and figures of *Leptomysis apiops*, except as regards the size at which they attain maturity and, in the females only, in the relative lengths of the median spinules and large apical spines of the telson.

In his description of the types Sars did not comment on any peculiarity of the eyes, but Zimmer (1915*b*, p. 319, fig. 9), examining specimens taken near to the same locality as the types, noted that a group of facets in the outer proximal region of the cornea were enlarged and elongated, giving the eye a peculiar distorted appearance. Later workers have confirmed this observation and the Discovery specimens have eyes exactly as figured by Zimmer.

Sars gave the length of adults from the Mediterranean as 11 mm., but in the Discovery material, males are fully adult at 7 mm., while many females of 5·8–6 mm. are carrying advanced embryos. It is quite common for animals from warmer waters to attain sexual maturity at a smaller size than those in cooler localities. Although the Discovery specimens are smaller, they were taken in equatorial waters and I have no hesitation in referring them to *L. apiops*, but the variations, which I find in the relative proportions of the spinules and spines arming the apex of the telson, especially in the females, have caused me much misgiving. The inner pair of apical spines in Sars's figure of the types are from one-fifth to one-sixth of the length of the telson, but in my specimens they are fully one-third of the telson in length, in juveniles and adults of both sexes. The length of the median spinules increases with the age of the animal, being relatively small in young specimens. In adult males, the apex of the telson is almost exactly as shown by Sars (1877, p. 18, fig. 9), with the median spinules less than half as long as the long inner pair of apical spines, and the outer pair of apical spines only a little longer than the spinules. In the females, however, the median spinules are much longer and may be more than three-quarters of the length of the inner pair of apical spines. The distal lateral spines increase regularly in size towards the apex of the telson, forming an evenly graduated series culminating in the outer apical spines, which are almost equal in length to the inner pair. Thus in the females the contour of the apex is more evenly rounded than in the males and the inner pair of apical spines does not project markedly. These females are, in fact, similar to the single damaged females from the Indian Ocean which Zimmer (1915*c*, p. 167, fig. 19) referred doubtfully to *L. apiops*.

In all other respects the Discovery specimens agree so closely with the descriptions of *L. apiops* that, in spite of this sexual dimorphism, I feel that they must be referred to that species. I consider that Zimmer's specimen from the Indian Ocean should also be referred to *L. apiops*.

Distribution. Apart from the specimen mentioned above, and two questionable records from the English Channel,[1] this species has never before been recorded outside the Mediterranean. Sars's types were taken near Naples, and the species has been recorded by Băcesco (1941, p. 25) from the

[1] Pubs. Circs. 48, 1909 and Pubs. Circs. 70, 1916.

south of France, at Banyuls and off Cannes. If we accept the Discovery specimens as belonging to *L. apiops*, it would appear that the species has a wide distribution in shallow coastal waters of temperate and tropical latitudes.

Leptomysis capensis Illig, 1906

1906*a* *Leptomysis capensis* Illig, p. 206, fig. 13A–D.
1930 *Leptomysis capensis*, Illig, p. 474, figs. 149–51.

OCCURRENCE:

St. 279. 10. viii. 27 (day). Off Cape Lopez, 58–67 m., 1 adult ♂, 7·6 mm.
St. 406. 5. vi. 30 (day). Off Cape Peninsula, 29 m., 1 ♂, 8·4 mm.
St. 421. 31. viii. 30 (day). South of Cape Town, 77–0 m., 5 ♂♂, 3 ♀♀, largest 6 mm., all imm.
St. 424. 4. ix. 30 (night). Off Port Elizabeth, 59–0 m., 1 ♀, 8 mm.
St. 443. 23. ix. 30 (night). South-west of Port Elizabeth, 49–0 m., 8 ♂♂, largest 8·4 mm., 20 ♀♀, largest 8·4 mm., 2 juv.
St. 444. 24. ix. 30 (night). South of Cape Peninsula, 80–0 m., 1 adult ♀, 8·6 mm.

REMARKS. The only previous record of this species is of the types from near Cape Agulhas, South Africa, and from south of Cape Town. Illig's specimens were all very small, the largest being only 5 mm. in length. He states that one of the most outstanding characters of the species is the peculiar shape of the eyes, in which the stalks are very thick and barrel-shaped and are wider than the cornea. He does not record whether his specimens were adult, but by comparison with the Discovery material, I believe that they were all juvenile and I attribute the form of the eye to their immaturity. Eyes of the shape figured by Illig (1930, fig. 149) are frequently found in juvenile mysids. Most of the present specimens are fully mature, measuring 8–8·6 mm., but the few juveniles agree very closely with Illig's figures.

In the adults the eyes are of a different shape, resembling those of *L. megalops*. They are very large, with the cornea occupying considerably more than half the whole organ, the eyestalk small proximally and widest next the cornea.

The outstanding character of the species is the dense covering of fine short bristles over the whole integument, which makes it possible to recognize specimens immediately and forms the most ready means of distinguishing them from *L. megalops*, which they so closely resemble in all other respects.

DISTRIBUTION. Except for the one record of this species from near Cape Lopez at station 279, it has only been taken off the south coast of South Africa. I think it is probable that it may occur in coastal waters along the west of South Africa as far north as Cape Lopez.

Leptomysis megalops Zimmer, 1915

1915*b* *Leptomysis megalops* Zimmer, p. 320, figs.
1929 *Leptomysis megalops*, Colosi, p. 422, fig.
1941 *Leptomysis megalops*, Băcesco, p. 25.

OCCURRENCE:

St. 274. 4. viii. 27 (day). Off St Paul de Loanda, 65–64 m., 1 adult ♂, 7·2 mm., 2 imm. ♀♀, 6·8 mm.
St. 277. 7. viii. 27 (night). South-west of Cape Lopez, 63(–0) m., 5 adult ♂♂, largest 8·4 mm., 4 adult ♀♀, 8·2 mm., 7 juv.
St. 444. 24. ix. 30 (night). Off the Cape of Good Hope, 80–0 m., 4 ♂♂, largest 11 mm., 3 ♀♀, largest 10·2 mm.
St. 844. 8. iv. 33 (night). Off Cape of Good Hope, 155–0 m., 7 ♂♂, largest 11 mm., 12 ♀♀, 10·2 mm., 2 juv. ♂♂.
St. WS 998. 13. iii. 50 (day). West of Orange River estuary. Two hauls: (i) 100–50 m., 1 badly damaged juv.; (ii) 175–100 m., 3 juv. ♀♀, largest 5·6 mm., 4 very small juv.
St. WS 1000. 13. iii. 50 (night). West of Orange River estuary, 100–50 m., 1 ♂, 8·4 mm., 3 ♀♀, largest 8·8 mm., 8 juv.

REMARKS. The Discovery specimens agree so closely with the description and figures given by Zimmer for *L. megalops* that, although this species has never before been recorded outside the Mediterranean, I have no hesitation in referring them to it. The very large eyes, the long slender scale, the smooth integument and the form and armature of the uropods and telson make the species readily recognizable. It may be distinguished from *L. capensis*, which it closely resembles, by the absence of dense bristles on the integument and by the somewhat longer apex of the antennal scale.

In Zimmer's figures the rostrum is more acutely pointed than in the Discovery specimens. I find, however, that the lateral margins of the rostrum are uptilted, so that in dorsal view the apex appears narrower and more acutely pointed than it actually is. When flattened out, the margins meet in a rounded angle of about 90°.

DISTRIBUTION. Up to the present *L. megalops* has been recorded on three occasions, all from the Mediterranean. The types were taken near Naples and it has been recorded from the same locality by Colosi (1929). It has been recorded from two stations off the south of France near Cannes (Băcesco, 1941, p. 25).

The Discovery records extend along the west coast of Central and South Africa from Cape Lopez, just south of the Equator, to the Cape of Good Hope, and I think that the species probably occurs in coastal waters, along the coasts of Africa, from the Straits of Gibraltar to the equator.

Genus Afromysis Zimmer, 1916

1916 *Afromysis* Zimmer, p. 62.

REMARKS. This genus closely resembles the genus *Bathymysis* Tattersall but may be distinguished from it by its well-developed, normal eyes; by the presence of only two segments in the propodus of the thoracic endopods and by the presence of a pair of long plumose setae at the base of the cleft of the telson. Three species have now been referred to this genus—the type species, *A. hansoni* Zimmer, *A. macropsis* Tattersall and *A. australiensis* Tattersall. Only the type species is represented in the Discovery collection.

Afromysis hansoni Zimmer, 1916

1916 *Afromysis hansoni* Zimmer, p. 63, text-figs. 2–8.

LOCALITIES:

Walvis Bay. 12. ix. 26. From stomach of *Trigla capensis* taken at a depth of 4·57 m., 1 adult ♂, 10·4 mm., 1 imm. ♂, fragments.

St. 280. 10. viii. 27 (night). Off Cape Lopez, 84–0 m., 1 adult ♀, 8·5 mm.

REMARKS. I have nothing to add to the very full description given by Zimmer, except that the spines arming the inner margin of the endopod of the uropod in my specimens are stouter and blunter and do not show such inequality in size as described and figured by Zimmer for the type. The Discovery specimens appear to be adult at a much smaller size than the type, which was 13 mm. in length.

DISTRIBUTION. One of the two captures of this species was made in precisely the same conditions as that of the type specimens, from the stomach of *Trigla capensis* taken in Walvis Bay, South Africa. The other record is from near Cape Lopez, just south of the equator and is therefore much farther north; this is the only recorded capture of a free swimming specimen.

Genus Mysis Latreille, 1803

1803 *Mysis* Latreille, p. 282.
1830 *Megalophthalmus* Leach, p. 176.
1882*a* *Onychomysis* Czerniavsky, p. 138 (pars); 1887, p. 79.
1902 *Michtheimysis* Norman, p. 477.

REMARKS. The genus *Mysis* was instituted by Latreille with *M. oculata* (Fabricius) as the type because the generic name, *Cancer*, to which it had been referred by Fabricius was preoccupied.

Only eight species have previously been referred to the genus and none of these is represented in the southern hemisphere. I am now able to record a species belonging to the genus *Mysis* from waters of the southern hemisphere. Unfortunately the specimens are not adult and there are no males, but they differ sufficiently from all the known species to justify the formation of a new one, *Mysis australe*.

Mysis australe sp.n.

(Fig. 41 A–H)

OCCURRENCE:

St. 326. 2. ii. 30 (night). South Georgia, 50–0 m., 2 imm. ♀♀, 14·5 mm. TYPES.
St. 327. 2. ii. 30 (day). West of South Georgia, 50–0 m., 1 imm. ♀, 14·2 mm.

DESCRIPTION. *General form* slender and graceful. *Carapace* very short anteriorly, anterior margin produced into a small acutely pointed rostrum, which leaves the whole of the eyes exposed in dorsal view (Fig. 41 A). *Antennular peduncle* slender, first segment equal in length to the second and third together (Fig. 41 A). *Antennal scale* long and very narrow, apex acutely pointed, eight times as long as broad at its widest part; no distal suture; *peduncle* very small; only one-fourth of the length of the scale and half as wide; very strong spine at the outer distal angle of the sympod and another on the ventral surface in the middle of its distal margin. Both these spines are long and acutely pointed (Fig. 41 A). *Mandibles* with the third segment of the palp rather broader than in other species of the genus (Fig. 41 B). *Maxilla* as shown in Fig. 41 C. *First thoracic endopod* small with the gnathobasic lobe on the second segment large and well developed, that on the third segment much smaller and only extending half-way along the fourth segment; only a faint indication of a lobe on the fourth segment (Fig. 41 D). *Second thoracic* appendage moderately long and slender, with the second segment only slightly expanded on its inner margin (Fig. 41 E). *Third to the eighth thoracic appendages* with the carpo-propodus composed of 6–7 sub-segments; nail long and particularly slender (Fig. 41 F). The distal outer angle of the large proximal segment of the exopods of all the thoracic appendages produced into a short acute process. *Uropods* slender with the endopods slightly shorter than the long telson; armed along the inner margin with a close irregular row of slender spines, which show a definite tendency to an arrangement into series of larger spines with smaller ones in the spaces between them. These larger spines increase in size towards the apex of the endopod, and in all three specimens there is a particularly long slender spine right at the apex (Fig. 41 G). *Telson* very long and narrow, almost three times as long as broad at the base; width at the level of the base of the cleft about three-fifths of that at the base; lateral margins almost straight and armed throughout their length with about twenty-eight somewhat irregular spines, which in places show a tendency to an arrangement into series. It may well be that in fully adult specimens this arrangement into series becomes more pronounced. There are five spines on the lateral margins distal to the base of the cleft and there is one larger spine on each apical lobe; cleft deep and narrow with its margins convex distally; armed throughout with a close row of regular teeth; no median setae (Fig. 41 H).

Length of immature females with very small brood lamellae, 14·2–14·6 mm.

Remarks. *M. australe* very closely resembles *M. mixta* Lilljeborg, a species well known from Scandinavian waters and from the coasts of Iceland and Greenland, and common along the east coast of North America, from the shores of Canada in the north to Woods Hole in the south. It may be distinguished from this species by the acutely pointed rostrum, the reduced gnathobasic lobes on the

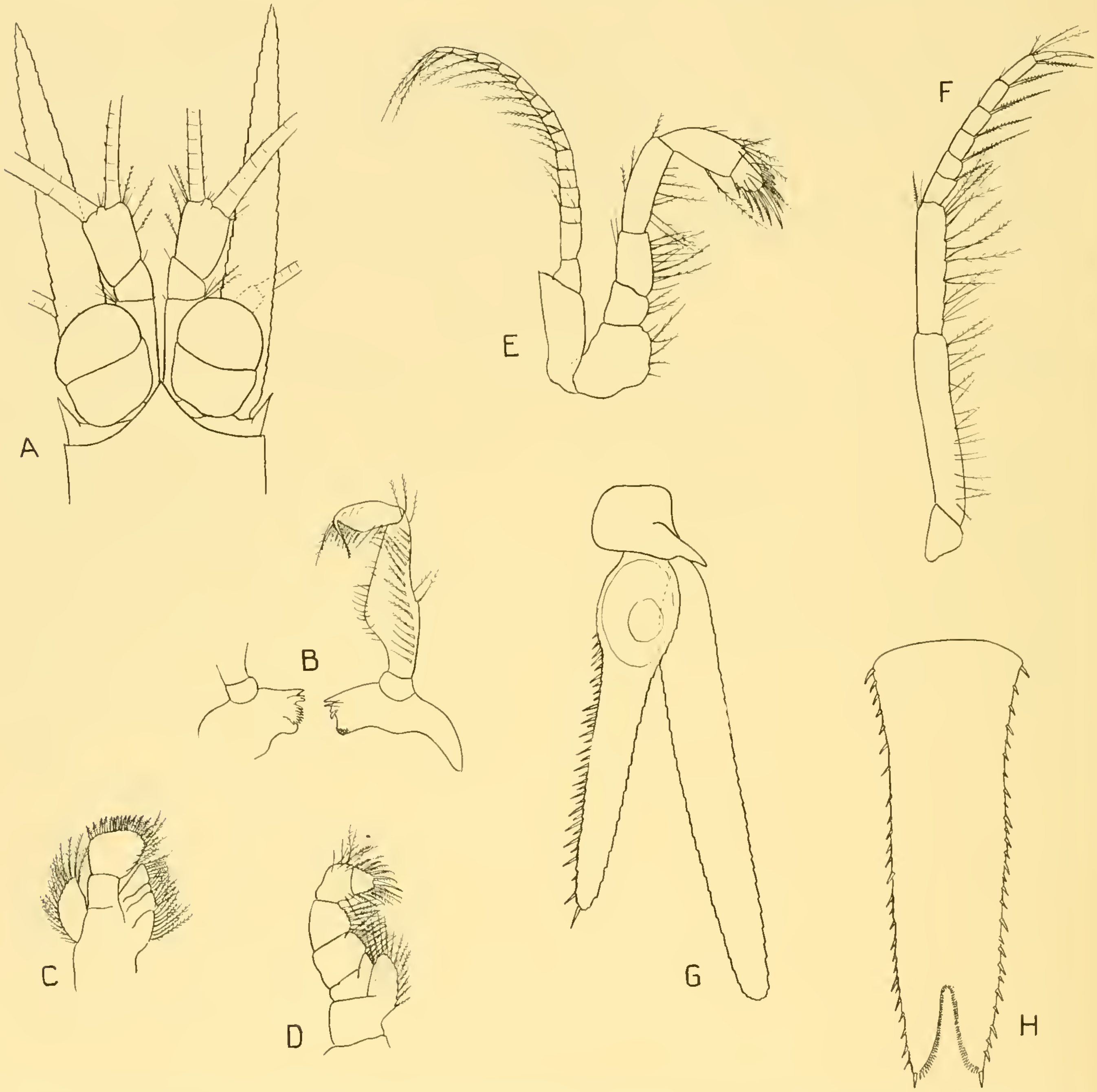

Fig. 41. *Mysis australe* sp.n. A, anterior end of immature female in dorsal view, × 20; B, mandibles, × 25; C, maxilla, × 25; D, endopod of first thoracic appendage, × 25; E, second thoracic appendage, × 25; F, endopod of fifth thoracic appendage, × 25; G, right uropod, × 25; H, telson, × 25.

third segment of the endopod of the third thoracic appendage, and by the virtual absence of the lobe on the fourth segment, by the fewer sub-segments of the carpo-propodus of the third to the eighth thoracic endopods and, mostly, by the armature of the uropods and telson. In *M. mixta* the endopod of the uropod is a little longer than the telson and is armed along only the proximal three-quarters of its length with a row of 13–15 practically equal spines. The larger number of spines extending right to the apex of the endopod in *M. australe* and their arrangement into weak series is quite distinctive and cannot be attributed to the immaturity of the specimens. In other species of mysids, it is found that, when spines are arranged in series of larger spines with smaller ones in the spaces between them, the condition tends to become more pronounced with age. The telson in *M. mixta* is relatively shorter and broader than in *M. australe* and the spines arming the lateral margins are larger and more regular in size and spacing.

This is the first species of the genus to be described from the waters of the southern hemisphere. Unfortunately there are no male specimens available and until the male pleopods are seen it is not possible to say whether the secondary sexual modification in the fourth pair is the same as that shown in other species of the genus.

DISTRIBUTION. The present specimens were taken at two stations to the west of South Georgia in vertical hauls of 50–0 m.

Genus Neomysis Czerniavsky, 1882

1882*b* *Heteromysis* Czerniavsky, **2**, p. 33.
1882–3*b*, *c* *Neomysis* Czerniavsky, **2**, p. 23; **3**, p. 81.

REMARKS. In his revision of the tribe Mysini, Zimmer (1915*a*, p. 214) amalgamated the genera *Neomysis* Czerniavsky and *Acanthomysis* Czerniavsky, as he considered that the only difference between them, the acutely pointed, unsegmented antennal scale in *Neomysis* and the two-segmented scale with rounded apex in *Acanthomysis*, was not of sufficient generic significance to warrant the existence of both genera. Tattersall (1932, p. 317) suggested that since a considerable number of species had been referred to the two genera, it might be convenient to retain them both, as the shape of the antennal scale forms an easy means of dividing them into two groups. Ii (1936, p. 579) agreed with this suggestion and restored the genus *Acanthomysis*.

Tattersall (1951, p. 180) drew attention to the fact that, in all the species of *Neomysis* which he had examined, with the exception of *N. spinosa* Nakazawa, breeding females possessed a median finger-like sternal process on each of the last two or three thoracic somites. He had not examined specimens of *N. monticellii* Colosi, *N. patagona* Zimmer and *N. meridionalis* Colosi and he thought that, if these species were found to possess sternal processes also, their presence might form a useful generic character, since no such processes have been recorded from any species of *Acanthomysis*. Unfortunately there are no female specimens of *Neomysis monticellii* in the Discovery collection and I am unable to ascertain whether there are sternal processes in the females of this species, but in the abundant captures of *N. patagona* I have been able to examine females in all stages of development. In no case could I find any sternal processes in this species.

The marsupium is composed of two pairs of brood lamellae, which are borne on the last two pairs of thoracic appendages in females. In addition there is, in most species of the genus, a rudimentary brood lamella in the form of a small knob, armed with a group of extremely long non-plumose setae on the bases of the sixth abdominal appendages. Similar rudimentary oostegites have been recorded in some species of *Acanthomysis* and it is probable that they occur in other species of both genera but have not been noticed.

Neomysis patagona Zimmer, 1907

(Fig. 42 A–K)

1907 *Neomysis patagona* Zimmer, pp. 1–5, figs. 1–17.
1913 *Neomysis patagona*, Hansen, p. 21, figs.
1921 *Neomysis patagona*, Hansen, p. 5.
1951 *Neomysis patagona*, W. M. Tattersall, p. 180.

OCCURRENCE:

St. WS 89. 7. iv. 27 (day). Half-way between Falkland Is. and Staten I., 23–21 m., 2 adult ♀♀, 19 mm., 3 juv. ♂♂, 1 juv. ♀.

St. WS 749. 18. ix. 31 (day). Magellan Strait, 40(–0) m., 77 ♂♂, largest 18 mm., 138 ♀♀, 10 ovig., largest 19·5 mm., 405 juv.

St. WS 834. 2. ii. 32 (day). Off north-east coast of Tierra del Fuego, 27–38 m., 4 adult ♂♂, largest 24 mm., 18 adult ♀♀, largest 19·5 mm.

REMARKS. Hansen (1913, p. 21) referred an immature female from Port Albemarle, Falkland Isles, to this species, although in some respects it did not agree with Zimmer's description and figures of the types. I find in the large number of specimens, which I here refer to *N. patagona*, some characters which agree with Zimmer's description and figures and some which more closely agree with Hansen's. The outstanding characters of this species are the broad rostral plate with a median incision, the long, very narrow telson with its lateral margins armed with a large number of equal spines, and the long exopod of the uropods in which the distal five or six plumose setae of the outer margin have become replaced by strong, finely plumose articulated spines (Fig. 42J). Coifmann (1937, p. 13) added another character, which I have been able to verify in all the specimens which I have examined, namely: the distal plumose seta on the outer margin of the antennal scale has become modified into a strong spine which, as far as I can see, is not plumed (Fig. 42C). The specimens in the Discovery collection all possess these specific characters and the differences which they show in the proportions of the various parts I attribute to individual variation.

The rostrum resembles Hansen's figure more closely than that of Zimmer. It is clearly divided by a definite incision into two lobes and the appearance of a median cleft is heightened by a thickening of the tissues in the middle line (Fig. 42A). The antennal scale is nine times as long as broad and in shape agrees very closely with Zimmer's description. Hansen's specimen had a more slender scale especially in its distal half. The eyes are more robust and are more covered by the rostral plate than in Hansen's specimen and agree more closely with Zimmer's figure. The maxilla is almost precisely as figured by Hansen with the lobes from the second, third and fourth segments much more developed than in Zimmer's figure and the outer setiferous lobe relatively smaller (Fig. 42E). The numbers of sub-segments in the carpo-propodus of the third to the eighth thoracic endopods show some variation, but in almost all the specimens I have examined they are greater than described by Zimmer. He gave the number as eight in the third pair of appendages and nine in the last. I have found that there are usually ten in the anterior appendages and there may be as many as twelve in the last pair. On the base of the sixth thoracic endopods in the females there is a small rudimentary oostegite similar to that figured by me for *Mysis stenolepis* (in W. M. Tattersall, 1951, p. 173). Similar structures have been noticed in a number of species of *Neomysis* and *Acanthomysis* and it is quite probable that they occur in many other species, but have not been noticed by workers (Fig. 42H). The endopods of the uropods are shorter than the long telson, and my specimens differ from previous descriptions in having usually three (rarely two) graduated spines on the ventral surface of the distal end of the statocyst. Zimmer stated that there was only one spine in this position. The distal five or six setae of the outer margin of the exopod are replaced by strong spines which are very finely plumose (Fig. 42J). The telson is rather longer and narrower than in either Zimmer's or Hansen's descriptions, the spines arming the lateral margins are fewer and not so densely crowded towards the apex (Fig. 42K).

DISTRIBUTION. *Neomysis patagona* has only been recorded from waters south of Patagonia and in the Strait of Magellan, and the Discovery records do not extend its known geographical range. From the large number of specimens taken at station WS 749 it is evidently a gregarious form, although it has usually been taken only in small numbers.

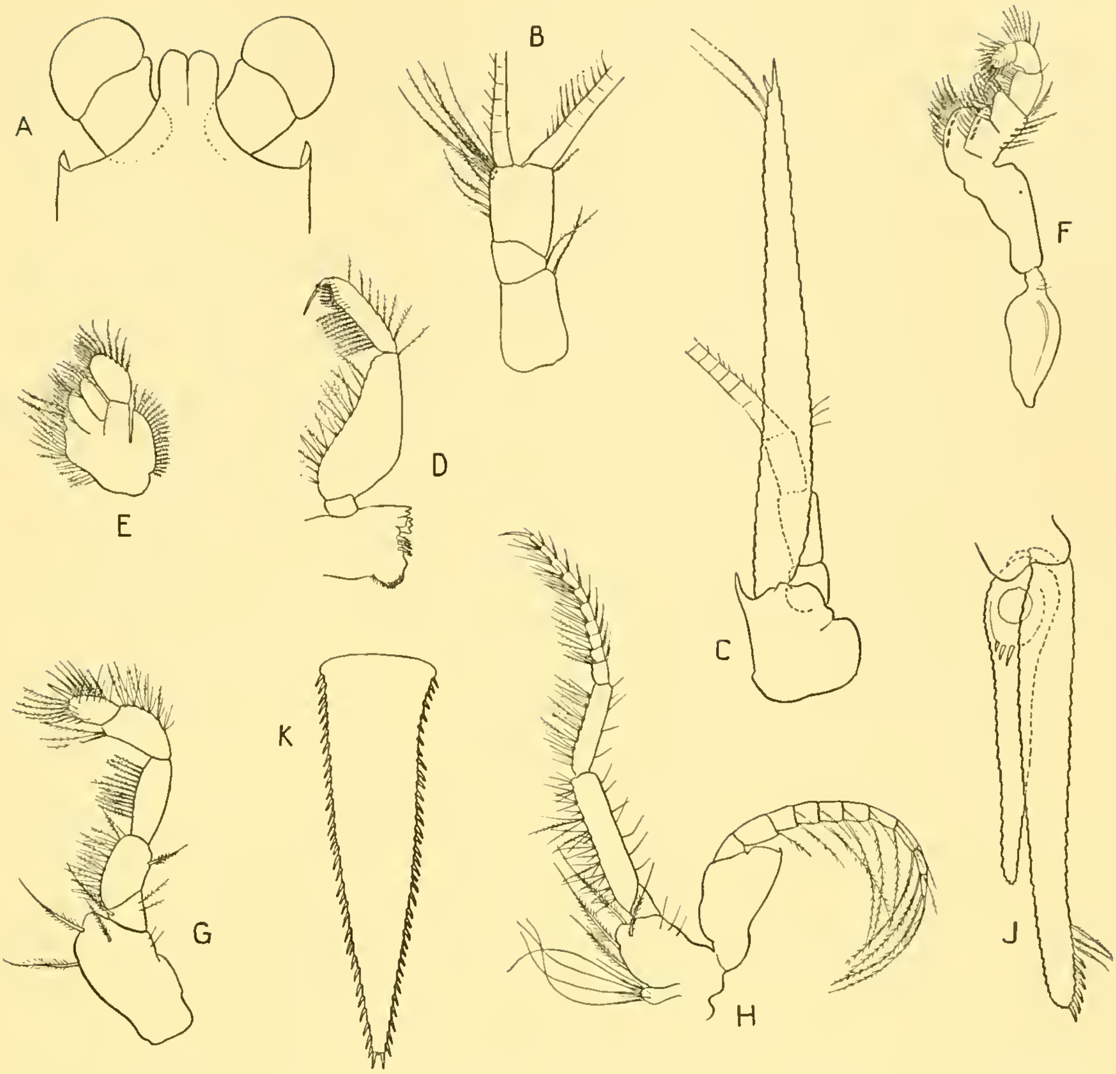

Fig. 42. *Neomysis patagona* Zimmer. A, anterior end of carapace and eyes in dorsal view, × 16; B, antennular peduncle, × 16; C, left antenna, × 16; D, mandible, × 20; E, maxilla, × 20; F, endopod of first thoracic appendage with epipod, × 20; G, endopod of second thoracic appendage, × 20; H, sixth thoracic appendage of female, × 16; J, right uropod, × 16; K, telson, × 16.

Neomysis monticellii Colosi, 1924

(Figs. 43 A, 44 A–C)

1924 *Neomysis monticellii* Colosi, p. 6, figs. 7–9.

OCCURRENCE:

St. WS 798. 20. xii. 36 (day). Off mouth of River Desire, South Patagonia, 49–66 m., 3 ♂♂, largest, 10·4 mm.

REMARKS. I am unable to find any record of this species apart from the somewhat meagre original description by Colosi (1924, p. 6). He gives figures of the telson and the fourth pleopod of the male only, but from these figures and his description I have no doubt that the three specimens taken at station WS 798 belong to this species. I am able to supplement the published description and to give such figures as are possible without dissection.

The rostral plate is very short and does not cover any part of the eyes; the narrowly rounded acute apex bends downward between the bases of the attachment of the eyestalks; the antero-lateral angles of the carapace produced and rounded (Fig. 43 A). Antennal scale shorter than in most species of

Neomysis; extending for only one-fifth of its length beyond the antennular peduncle. Colosi stated that there was a distinct distal articulation present, but I am unable to find one in any of my specimens. The antennal peduncle is relatively large and extends almost to the distal end of the antennular peduncle (Fig. 43A). There are only one or two thoracic endopods left attached in these specimens. They are very slender and fragile with the carpo-propodus composed of 10–11 sub-segments. There is no spine nor acute angle on the outer distal margin of the first segment of the exopods of the thoracic appendages. The exopod of the fourth pleopod of the male is four times as long as the endopod (which is as usually found in the genus), and extends beyond the apex of the telson (Fig. 44B, C). The uropods are exactly as described by Colosi, except that he stated that there is only one spine on the ventral side of the endopod at the distal end of the statocyst. I find in all my specimens that there are two spines in this position—a large median spine and a smaller one close beside it on the outer side (Fig. 44A). The telson in my specimens is relatively somewhat shorter than as figured by Colosi, but the armature is the same. It is more than half as long again as the sixth abdominal somite (Fig. 44A).

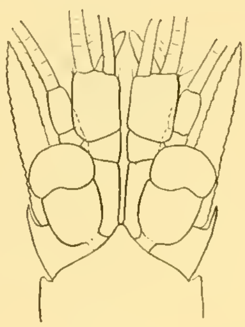

Fig. 43.

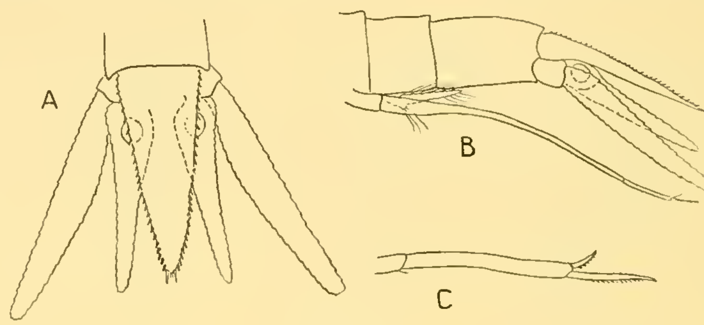

Fig. 44.

Fig. 43. *Neomysis monticellii* Colosi. Anterior end of adult male in dorsal view, × 14.

Fig. 44. *Neomysis monticellii* Colosi. A, telson and uropods of adult male, × 14; B, posterior end of adult male in lateral view, × 14; C, distal end of fourth pleopod of male, × 44.

Colosi gave the length of his specimens as 9 mm. but the largest male in the Discovery collection measures over 10 mm. It is apparently fully mature with the lobe from the antennule very densely covered with setae.

Distribution. The types of this species were taken in the Strait of Magellan, but there is no record of the depth at which they were living. The Discovery record is from quite close to the coast, north of the eastern end of the Straits in water 49–66 m. in depth.

Genus Antarctomysis Coutière, 1906

1906 *Antarctomysis* Coutière, p. 1.

Remarks. Coutière (1906, p. 1) founded this genus for those forms which, while resembling the genus *Mysis* in the form of the antennal scale and the telson, differed markedly in the form of the male pleopods. I have tried to find some definite generic characters, which apply to both sexes, whereby the genus may be distinguished, but have failed to do so. It is unfortunate that the one constant generic distinguishing character should apply to one sex only, but it is so definite that there can be no doubt as to the validity of the genus.

The principal characters of the genus are as follows: antennal scale long and narrow in shape, setose all round; apex sharply pointed; distal segment of the 'palp' of the maxilla expanded distally; carpo-propodus of the endopods of the third to the eighth thoracic appendages multi-articulate; inner margin of the endopod of the uropod armed with a row of spines; pleopods of the female reduced to simple unsegmented plates; in the male the first and second pairs rudimentary as in the female; third pair well developed, biramous, multi-articulate; fourth pair biramous with the endopod normal, multi-articulate; exopod extremely long, multi-articulate and armed distally with long modified setae; fifth pair well developed, biramous and multi-articulate. Telson long and narrow with the lateral margins nearly straight and armed with many small spines; apex deeply cleft, the margins of the cleft armed with a regular row of closely set, very small teeth.

Only two species have, up to the present, been referred to this genus, *A. maxima* (Hansen, in MS.) Holt and Tattersall and *A. ohlini* Hansen. The genus has always been regarded as purely Antarctic, but the capture of four, nearly adult specimens at station 274 off St Paul de Loanda, Angola, West Africa in a latitude of only 8° 40′ S. is most astonishing. I have carefully examined hauls from stations between the Falkland Islands and Africa, and along the west coast of Africa, but have found no trace of either of the species of this genus. Neither species has been recorded from the northern hemisphere.

The genera most closely allied to *Antarctomysis* are *Mysis*, *Hemimysis* and *Arthromysis* and, since the real differences between them lie in the form of the male pleopods, it is most difficult to decide to which genus female specimens should be referred. In all four genera the first and second pairs of pleopods in the male are reduced to simple unsegmented plates as in the female. In all of them also the third pair are biramous, but only in *Antarctomysis* are both rami normal and multiarticulate. In *Mysis* and *Arthromysis* the exopod is normal but the endopod is unsegmented and reduced to a simple plate. In *Hemimysis* both rami are very small, the exopod reduced to a small knob and the endopod, at most, two-segmented. In all four genera the exopod of the fourth pair is extremely long and armed distally with long modified setae, but in *Antarctomysis* alone the endopod is normal and multi-articulate. In *Mysis* and *Arthromysis* the endopod is reduced to a simple unsegmented plate and in *Hemimysis* it is very small and obscurely two-segmented. The fifth pair of pleopods is well developed and normal in *Hemimysis*, *Arthromysis* and *Antarctomysis*, but in *Mysis* it is reduced to a single plate which is usually unsegmented, but may be two-segmented. *Antarctomysis* can be distinguished from *Arthromysis* by the absence of two long plumose setae at the base of the cleft of the telson; from *Hemimysis*, by the form of the antennal scale. In *Antarctomysis* this is setose all round, but in *Hemimysis* the outer margin is unarmed distally, with no tooth or spine marking the distal end of the naked portion. In one species, however, *H. serrata* Băcesco (1938, p. 425), the outer margin of the antennal scale is armed with spines instead of setae.

It is fortunate that both the species of the genus *Antarctomysis* are abundant and gregarious in habit, so that males are usually available and the form of their pleopods leaves no doubt as to the genus to which specimens belong.

Antarctomysis maxima (Hansen in MS.) (Holt and Tattersall), 1906

1906*b* *Mysis maxima* (Hansen in MS.) Holt and Tattersall, p. 11.
1906 *Antarctomysis maxima* Coutière, pp. 1–10.
1908 *Antarctomysis maxima*, Hansen, p. 13, figs.
1908 *Antarctomysis maxima*, Tattersall, p. 36, fig.; 1913, p. 872; 1918, p. 12; 1923, p. 301.
1913 *Antarctomysis maxima*, Hansen, p. 19.
1915*a* *Antarctomysis maxima*, Zimmer, p. 203, figs.
1935 *Antarctomysis maxima*, Hardy and Gunther, p. 201, fig.

OCCURRENCE:

St. MS 20. 9. iv. 25 (day). Cumberland Bay, South Georgia, 40–0 m., 1 ♀, 15 mm.
St. MS 22. 9. iv. 25 (day). Cumberland Bay, 40–0 m., 2 ♀♀, juv.
St. MS 26. 15. iv. 25 (day). Cumberland Bay, 10 m., 1 small juv. ♀.

St. MS 27. 29. iv. 25 (day). Cumberland Bay, 160–120 m., 1 ♂, 5 ♀♀, all juv.
St. MS 32. 1. v. 25 (day). Cumberland Bay, 40 m., 1 ♂, 39 mm., 1 imm. ♀, 16 mm.
St. MS 68. 2. iii. 26 (day). Cumberland Bay, 220–247 m., 1 juv. ♂, 13 mm., 1 small juv. ♀.
St. MS 71. 9. iii. 26 (day). Cumberland Bay, 110–60 m., 2 ♂♂, 6 ♀♀, 30–33 mm., 1 juv.
St. 31. 17. iii. 26 (night). Off Cumberland Bay, 90(–0) m., 10 ♂♂, 28–35 mm., 27 imm. ♀♀, several hundreds of small young, both sexes.
St. 32. 17. iii. 26 (night). Off Cumberland Bay, 90(–0) m., 3 small juv.
St. 39. 25. iii. 26 (day). East Cumberland Bay, 179–235 m., 4 ♂♂, 35–45 mm., 8 ♀♀, 32–41 mm., 1 juv.
St. 41 D–E. 28. iii. 26 (night, ship anchored). 100–50 m., 3 ♂♂, 31–42 mm., 1 juv. ♂, 3 juv. ♀♀.
St. 42. 1. iv. 26 (day). Cumberland Bay, 120–204 m., hundreds of both sexes, some breeding, 50 juv. up to 20 mm.
St. 45. 6. iv. 26 (day). Off Cumberland Bay, 238–270 m., 3 ♂♂, 42 mm., 1 ovig. ♀, 45 mm., with well-developed eggs, 81 juv.
St. 123. 15. xii. 26 (day). South Georgia, 230–250 m., 10 ♂♂, up to 40 mm., 20 imm. ♀♀, 26 very small juv.
St. 134. 21. xii. 26 (day). South Georgia, 123 m., 1 ♂, 32·5 mm.
St. 140. 23. xii. 26 (day). South Georgia, 122–136 m., 2 ♂♂, 2 ♀♀, all juv.
St. 143. 30. xii. 26 (day). South Georgia, 273 m., 14 juv., largest 11 mm.
St. 144. 5. i. 27 (day). South Georgia, 155–178 m., 1 ♂, 30 mm., 7 ♀♀, largest 27 mm., all imm., 7 small juv.
St. 148. 9. i. 27 (day). South Georgia, 132–148 m., 1 ♂, 38 mm., 2 ♀♀, largest 47 mm., 2 small juv. ♂♂, 6 juv. ♀♀.
St. 149. 10. i. 27 (day). South Georgia, 200–234 m., about 50 juv.
St. 154. 18. i. 27 (day). South Georgia, 60–160 m., 10 ♂♂, 19 ♀♀, largest 25 mm., all imm.
St. 156. 20. i. 27 (day). Off South Georgia, 200–236 m., 1 ♂, 30 mm., 1 ♀, 33 mm.
St. 162. 17. ii. 27 (day). Off Signy I., South Orkneys, 320 m., 1 ♂, 40 mm. (the exopod of the 4th pleopod extends 3 mm. beyond the apex of the telson), 4 adult ♀♀, 42–48 mm., 3 juv. ♀♀.
St. 164. 18. ii. 27 (day). South Orkneys, 24–36 m., 2 imm. ♂♂, 29 mm. and 30 mm.
St. 167. 20. ii. 27 (day). South Orkneys, 244–344 m., several hundreds adults and young, largest 50 mm.
St. 170. 23. ii. 27 (day). Off Clarence I., South Shetlands, 342 m., 1 ♀ with advanced embryos, 53 mm.
St. 181. 12. iii. 27 (day). Schollaert Channel, Palmer Archipelago, 160–335 m., 2 ♂♂, larger 56 mm., with 4th pleopod 20 mm. in length, 4 ♀♀, 55 mm., 2nd haul, 2 ♂♂, 76·5 mm. and 77 mm.
St. 187. 8. iii. 27 (day). Palmer Archipelago, 259 m., 1 ♂, 39 mm., 2 ♀♀, 39–41 mm.
St. 190. 24. iii. 27 (day). Palmer Archipelago. Three hauls: 43 m., 3 ♀♀, 45–48 mm., 2 juv.; 93–126 m., fragments; 315 m., 2 ♂♂, 38 mm., 1 ovig. ♀, 35 mm.
St. 208. 7. iv. 27 (day). South Shetlands, 800(–0) m., 1 small juv.
St. 274. 4. viii. 27 (day). Off St Paul de Loanda, Angola, 65–64 m., 2 ♂♂, 2 ♀♀, largest 27 mm., all imm.
St. 326. 2. ii. 30 (night). West of South Georgia. Two hauls: 100–50 m., 12 juv., 10–15 mm.; 200–100 m., 18 juv., largest 17 mm.
St. 327. 2. ii. 30 (day). Off South Georgia, 200–100 m., 19 juv., largest 24 mm.
St. 331. 2. ii. 30 (day). Off South Georgia, 100–50 m., 7 juv., largest 14 mm.
St. 338. 5. ii. 30 (day). Off South Georgia, 225–100 m., 2 ♂♂, 37 and 39 mm.
St. 339. 5. ii. 30 (day). Off South Georgia. Two hauls: 100–50 m., 1 ♂, 39 mm., 4 juv. ♀♀; 250–100 m., 1 ♂, 33 mm., 2 ♀♀, 29 mm., all juv.
St. 340. 5. ii. 30 (night). South Georgia, 100–50 m., 2 juv. 12–14 mm.
St. 341. 5/6. ii. 30 (night). South Georgia. Three hauls: 50–0 m., 1 ♂, 28 mm., 1 ♀, 32 mm., 6 juv.; 100–50 m., 1 ♂, 35 mm., 1 ♀, 35 mm.; 230–100 m., 1 ♂, 35·5 mm., 1 ♀, 29 mm., 1 juv.
St. 348. 8. ii. 30 (day). South Georgia, 90–50 m., 18 small juv.
St. 349. 8. ii. 30 (night). South Georgia, 100–50 m., 1 ♂, 32 mm., 11 juv., largest 15 mm.
St. 366. 6. iii. 30 (day). South Sandwich Is., 322–155 m., 5 ♂♂, 15 ♀♀, largest 34 mm. all imm.
St. 371. 14. iii. 30 (day). South Sandwich Is., 99–161 m., 40 juv., largest 35 mm.
St. 517. 26. xi. 30 (night). South Georgia, 102–0 m., 25 juv., largest 21 mm.
St. 518. 27. xi. 30 (night). South Georgia, 90–0 m., 14 juv., 9–11 mm.
St. 1644. 16. i. 36 (day). Bay of Whales, Ross Sea, 626 m., 1 ♀, juv. 35 mm.
St. 1652. 23. i. 36 (day). Bay of Whales, 567 m., 1 ovig. ♀, 54 mm.
St. 1660. 27. i. 36 (day). Bay of Whales, 351 m., 3 juv. and fragments.
St. 1866. 9. xi. 36 (day). Scotia Sea, 380–200 m., 3 ♂♂, 45·5 mm., 4 ♀♀, 42–45 mm.

St. 1872. 12. xi. 36 (day). Scotia Sea, 247 m., 1 juv., 11 mm.

St. 1873. 13. xi. 36 (day). Scotia Sea, 210–180 m., 3 ♂♂, 42 mm., 11 ovig. ♀♀, largest 50 mm., 1 ♀, 46 mm., imm., 2 juv.

St. 1952. 11. i. 37 (day). South Shetlands, 367–383 m., 1 ♀, 51 mm.

St. 1955. 29. i. 37 (day). South Shetlands, 440–410 m., 1 ♀, 44 mm. with large empty brood sac, 1 juv. ♀.

St. WS 25. 17. xii. 26 (night). South Georgia, 18–27 m., 6 ♂♂, 9 ♀♀, largest 30 mm., 13 juv.

St. WS 27. 19. xii. 26 (day). Off South Georgia, 107 m., 71 juv., largest 17 mm.

St. WS 28. 19. xii. 26 (day). Off South Georgia. Two hauls: 80 m., 4 ♂♂, 1 ♀, all juv.; 145–100 m., 2 ♂♂, 30 mm., 12 juv. ♂♂, 6 juv. ♀♀, 17–20 mm.

St. WS 29. 19. xii. 26 (day). Off South Georgia, 50–0 m., 1 imm. ♀, 23 mm.

St. WS 30. 19/20. xii. 26 (night). South Georgia. Two hauls: 100–50 m., 4 juv., 17–19 mm.; 250–100 m., 1 ♀, 30 mm., not mature, 12 juv., 18–20 mm.

St. WS 31. 20. xii. 26 (day). South Georgia, 53 m., 1 ♂, 31 mm. not mature.

St. WS 32. 21. xii. 26 (day). South Georgia, 225 m., 13 ♂♂, 18 ♀♀, largest 30 mm., all juv.

St. WS 33. 21. xii. 26 (day). South Georgia, 130 m. (bottom), many hundreds 25–30 mm. all imm.; ♀♀ greatly outnumber ♂♂.

St. WS 35. 21/22. xii. 26 (night). South Georgia, 51 m., 1 juv. ♂.

St. WS 37. 22. xii. 26 (day). South Georgia, 300–250 m., 3 juv., 11 mm.

St. WS 40. 7. i. 27 (day). South Georgia. Two hauls: 100–50 m., 5 juv.; 175–100 m., 1 ♀, 39 mm., with large empty brood sac, 1 juv.

St. WS 41. 7. i. 27 (day). South Georgia, 146 m., 36 imm., largest 30 mm., 21 juv.

St. WS 42. 7. i. 27 (dusk to dark). South Georgia. Three hauls: 99 m., 2 ♂♂, 30 mm.; 170–100 m. many hundreds of both sexes, breeding, largest 45 mm., 9 very small juv.; 198 m. bottom (night), 3 ♂♂, 4 ♀♀, 30–35 mm., 5 juv.

St. WS 43. 7/8. i. 27 (night). South Georgia. Four hauls: 0–5 m., 3 juv., largest 10 mm.; 70 m., 20 ♂♂, 30–41 mm., 6 ♀♀, 30–36 mm., several hundreds of small juv., largest 11 mm.; 50–0 m., 3 ♂♂, largest 30 mm., imm.; 141 m., about 200 juv., 12–25 mm.

St. WS 44. 8. i. 27 (day). South Georgia, no depth on label, 2 adult ♂♂, 42 mm., 1 ♀, 32 mm.

St. WS 45. 8. i. 27 (day). South Georgia. Four hauls: 51 m., over 100 juv., 20–30 mm.; 102 m., several hundreds, largest 30 mm., all imm.; 100–50 m., 1 ♂, 3 ♀♀, largest 31 mm., imm.; 175–100 m., 1 adult ♀, 35 mm., 1 juv. ♀, 25 mm., 4 small juv., 11 mm.

St. WS 46. 9. i. 27 (night). South Georgia. Five hauls: 50–0 m., 1 juv., 23 mm.; 171–50 m., 1 juv., 15 mm.; 100–50 m., 3 ♂♂, 18 mm., 5 small juv.; 73 m., 4 ♀♀, 36–37 mm., several hundred juv., largest 11·5 mm.; 146 m., 4 ♂♂, 4 ♀♀, 20–23 mm., 3 small juv., 10 mm.

St. WS 47. 9. i. 27 (night). South Georgia. Six hauls: 0–5 m., 1 ♂, 7 ♀♀, largest 35·5 mm.; 63 m., several hundreds, mostly imm. A few ♀♀ with large empty brood sacs; 126 m., many adults, 30–50 mm. Females of 32–34 mm. adult; several hundreds immature, largest 28 mm.; 50–0 m., 1 adult ♀, 36 mm., 1 juv. ♀, 24 mm.; 100–50 m., 15 ♂♂, 20–33 mm., 2 juv. ♀♀, 30 mm., 23 juv., 10–12 mm.; 150–100 m., 6 ♂♂, 27–30 mm., 5 ♀♀, 27–31 mm., 23 juv., 11–12 mm.

St. WS 48. 9. i. 27 (day). South Georgia. Four hauls: 96 m., 2 adult ♂♂, 33 juv., largest 11·5 mm.; 192 m., over 100 adults, 32–41 mm., 147 juv.; 50–0 m., 1 ♂, 27 mm.; 224–100 m., 1 ♂, 33 mm., 11 juv. ♂♂, 20–28 mm., 28 juv. ♀♀, 11–27 mm.

St. WS 49. 9. i. 27 (day). South Georgia. Four hauls: 69 m., over 100, largest 41 mm.; 137 m., several hundred adults, largest 38 mm.; 100–50 m., 7 ♂♂, 25–32 mm., 2 ♀♀, 12–28 mm.; 225–100 m., 10 juv. ♂♂, 20–28 mm., 1 adult ♀, 40 mm., 55 juv., 12–20 mm.

St. WS 50. 9. i. 27 (day). South Georgia. Four hauls: 71 m., 6 ♂♂, 6 ♀♀, 22–23 mm., all imm.; 142 m., 11 juv., 27–30 m., 12 juv., 8–10 mm.; 50–0 m., 1 ♂, 32 mm., 1 juv., 10·5 mm.; 225–100 m., 5 small juv.

St. WS 51. 9. i. 27 (day). South Georgia. Five hauls: 64 m., 131 juv., 7–10 mm.; 119 m., many hundreds in two definite sizes, 11–12 mm. and 20–23 mm.; 128 m., several hundreds, all immature, largest 30 mm., a few adults of 36 mm.; 100–50 m., 10 ♂♂, 17–32 mm., 21 juv., 5–10 mm.; 210–100 m., 2 ♂♂, 4 ♀♀, 20–28 mm., 24 small juv., 8–10 mm

St. WS 52. 10. i. 27 (day). South Georgia. Two hauls: 100 m., 1 adult ♂; 180–100 m., 1 juv. ♀, 20 mm.

St. WS 62. 19. i. 27 (day). South Georgia, 26–83 m., many hundreds imm.

St. WS 144. 19. ii. 28 (day). Off South Georgia, 270–100 m., 4 small juv.

St. WS 177. 7. iii. 28 (day). Off South Georgia, 97–0 m., 1 juv.

St. WS 237. 7. vii. 28 (day). North of Falkland Is., 150–256 m., 11 juv.

REMARKS. This is one of the most common species of mysid to be found in Antarctic waters. It was taken by the National Antarctic Expedition in 78° 25′ S., 165° 39′ E. in 56 fm. It has been recorded by the French, Swedish and Belgian Antarctic Expeditions. In the present collection it was taken in 114 hauls (at 78 separate stations), frequently in considerable numbers. Sixty of these stations were situated around the coasts of South Georgia, one to the north of the Falkland Islands, two off the South Sandwich Is., two off the South Orkneys, one between the South Orkneys and South Shetlands, three off the South Shetlands, three in the Palmer Archipelago, two in the Scotia Sea, three in the Bay of Whales and one, very surprisingly, off St Paul de Loanda off the west of Africa in latitude 8° S. This is the only record north of the 46th parallel.

A. maxima was not taken in large numbers in depths of less than 50 m. or of more than 275 m.—most of the hauls which yielded a large number of specimens being taken between 75 m. and 150 m. In a few cases, specimens were taken in nets which had been fishing at 400 m., but these had failed to close and the animals may have entered the net as it was being hauled to the surface.

Hansen (1913, p. 20) recorded *A. maxima* from waters around South Georgia in May and June. The latest date in the year upon which it was taken by 'Discovery' was 7 April at station 208 in the South Shetlands, while 'William Scoresby' did not take it later than 7 March at station WS 177 off South Georgia. It was taken at the Marine Biological Station, South Georgia, on four occasions in March and once on 1 May at station MS 32 in East Cumberland Bay, South Georgia. An analysis of the dates in the present collection is given below.

This species has always been regarded as a purely Antarctic form, but there is some evidence in this collection to indicate that this may be true for the warmer months of the year only. The specimens captured in November included some large adults which were breeding but, although hauls had been taken at all depths earlier in the Antarctic spring in the same localities in which *A. maxima* abounds later in the year, none were taken. Since it certainly must take some weeks for individuals to grow and become sexually mature and to produce eggs, it would appear that these November adults had been living elsewhere and that migration to the Antarctic occurs during the warmer months of the year. If this is the case it might explain the occurrence of four juvenile specimens at station 274 in August, but it is strange that no records have been made from any intermediate localities.

A. maxima attains sexual maturity at a much smaller size in warmer waters than in waters at the southern limit of its range. Specimens of less than 35 mm. in length, from station 42 off Cumberland Bay, South Georgia, were mature and breeding, while at station 1644 in the Bay of Whales a specimen of this length was quite immature with very small oostegites. A breeding female from station 1652 in the Bay of Whales measured 54 mm. The largest specimens in the collection were two males from station 181 in the Schollaert Channel, Palmer Archipelago measuring 76·5 mm. and 77 mm. respectively. These are the largest specimens of the species which have been recorded.

Analysis of dates

Month	No. of stations where *A. maxima* was collected	Hauls containing over 50 specimens	Over 100
November	3	—	—
December	13	3	—
January	27	3	13
February	13	—	1
March	13	—	1
April	1	—	—
May	1	—	—

Antarctomysis ohlini Hansen, 1908

1908 *Antarctomysis* sp. Tattersall, p. 36, figs.
1908 *Antarctomysis ohlini* Hansen, p. 13; 1913, p. 20, figs.
1923 *Antarctomysis ohlini*, Tattersall, p. 300.
1930 *Antarctomysis ohlini*, Rustad, p. 21.

OCCURRENCE:

St. 39. 25. iii. 26 (day). East Cumberland Bay, South Georgia. 179–235 m., 21 ♂♂, largest 51 mm., 8 ♂♂, juv., 26 ♀♀, largest 54 mm. (breeding), 10 ♀♀, juv.
St. 41 E. 28. iii. 26 (night). South Georgia. 100–50 m., 1 adult ♀, 43 mm. (damaged).
St. 42. 1. iv. 26 (day). Cumberland Bay. Two hauls: (*a*) N7-T, 120–204 m., 7 ♂♂, largest 54 mm., 2 ♂♂ juv., 16 ♀♀, largest 51 mm., 1 ♀, juv. (parasitized). (*b*) Net N4-T, 120–204 m.; many juv., a few adults, largest 40 mm.
St. 45. 6. iv. 26 (day). South Georgia. 238–270 m., 2 ♀♀, largest 45 mm.
St. 123. 15. xii. 26 (day). Cumberland Bay. 230–250 m., 13 ♂♂, largest 52 mm., 12 ♀♀ breeding, largest 52 mm. One specimen of 33 mm. with advanced embryos in the marsupium, 3 ♀♀, juv.
St. 142. 30. xii. 26 (day). Cumberland Bay. 88–273 m., 29 ♂♂, 45–52 mm., 5 ♂♂, juv., 12 ♀♀, 45–51 mm., 23 ♀♀, juv., largest 11·5 mm.
St. 154. 18. i. 27 (day). South Georgia. Two hauls: (*a*) Net N4-T, 60–160 m. 6 ♂♂, largest 30 mm., 15 ♀♀, largest 29 mm., all juv.; (*b*) Net NCS-T, 60–160 m. 3 ♂♂, 50–52 mm., 1 ♀, 44 mm., 21 ♀♀, juv.
St. 205. 6. iv. 27 (day). South Shetlands, no depth on label, 1 ♀, 14 mm. juv.
St. 208. 7. iv. 27 (day). South Shetlands. 800(–0) m., 1 ♂, 15 mm., 3 ♀♀, 14·5 mm., all juv.
St. 376. 11. iv. 30 (day). South Shetlands. 750–500 m., 1 juv. ♀.
St. WS 32. 21. xii. 26 (day). South Georgia. 225 m., 1 ♂, 44 mm.
St. MS 68. 2. iii. 26 (day). East Cumberland Bay. 220–247 m., 2 ♂♂, 50 mm., 1 ♀, 46 mm.

REMARKS. This species can be distinguished from *A. maxima* by the form of the eyes and by the slope of the anterior lateral margins of the carapace. In *A. ohlini* the corneal elements occupy only the distal end of the eye, so that the eyes look essentially forward, while in *A. maxima* they extend over a large part of the outer margin of the eye as well and so look forward, outward and downward. The anterior lateral portions of the margin of the carapace are oblique and the antero-lateral angles lie well behind the insertion of the eyestalks, but in *A. maxima* these margins are vertical in lateral view and the antero-lateral angles lie just below the insertion of the eyestalks.

A. ohlini was taken at nine stations round South Georgia and at three near the South Shetlands.

Tattersall (1923, p. 300) has noted that this species, like *A. maxima*, grows to a much larger size in more southerly, colder waters. Hansen recorded adult females of 50 mm. and males of 52·5 mm. from lat. 54° S., but Tattersall found in his material from the Ross Sea that a female of 52 mm. was quite immature, while an ovigerous female measured 71 mm. Rustad (1930, p. 21) recorded an ovigerous female of 47 mm. from South Georgia.

The Discovery material does not add greatly to our knowledge on this subject, for all the specimens taken from the South Shetlands were juvenile and all the others came from around South Georgia. At station 123 (in December) in Cumberland Bay, a female with advanced embryos in the brood pouch measured only 33 mm., while the largest specimen in the collection was an ovigerous female of 54 mm. from station 39 (in March) also in Cumberland Bay. It is evident that there is great variation in the size at which this species can breed in these waters.

The following note on the colour of these specimens is given on the label from station 208: 'Whitish and transparent. Stomach deep purplish brown. Mouth parts and endopods of all the legs a rich madder-red. A row of red chromatophores on under side of abdomen. Eyes black. Largest specimen tinged with red throughout.'

DISTRIBUTION. Prevously recorded by the National Antarctic Expedition and the Norwegian Antarctic Expedition from South Georgia and by the 'Terra Nova' Expedition from the Ross Sea.

This species was taken in company with *A. maxima* at nine out of the twelve stations at which it occurred. The greatest depth at which it was taken was 750–500 m. at station 376 in the South Shetlands and the least depth was 60–160 m. at station 154 off Cumberland Bay. It only occurred once in a night haul, at station 41 E off South Georgia.

Genus Arthromysis Colosi, 1924

1924 *Arthromysis* Colosi, p. 3.

REMARKS. Cunningham (1871, p. 497) instituted a new species, *Macromysis magellanica*, for a few specimens taken at the eastern end of the Strait of Magellan in January 1867. He gave a brief description of this species, stating that it resembled a species then known as *Macromysis gracilis* Dana (= *Mysidium gracilis* (Dana)) in general form, shape of the anterior end, and in having a deeply cleft telson, but he gave no figures.

Zimmer (1915*b*, p. 170) recorded very briefly a single damaged specimen taken in the Strait of Magellan in 1892. He believed that this specimen represented a new species of the genus *Antarctomysis* Coutière, 1906, but felt that it was too damaged to allow him to institute a species for it. He recorded that the main point of distinction between it and the known species of *Antarctomysis* was the great length and slenderness of the eyes.

Colosi (1924, p. 3) founded a new genus and species, *Arthromysis chierchiae*, for a single adult female taken in the Strait of Magellan in 1882. He gave a fairly full description of it and figured the anterior end, the telson and the distal end of an endopod of one of the thoracic limbs.

Among the material collected by 'William Scoresby', I am fortunate in finding a number of beautifully preserved adults of both sexes of this interesting species, taken at stations WS 89, off Tierra del Fuego and WS 749, in the Strait of Magellan. From an examination of these specimens I have no doubt at all that the species described by Cunningham, Zimmer and Colosi are synonymous. I am now able for the first time to examine and to figure the male pleopods. From their form there is no doubt that these specimens cannot be included in the genus *Antarctomysis*. I therefore accept Colosi's genus *Arthromysis* for them, but the specific name *chierchiae* must give place to the earlier name of *magellanica*.

The definition of the genus *Arthromysis* can now be given more fully: Anterior margin of *carapace* a smoothly rounded semicircle; *antennal scale* long, setose all round, lanceolate, with narrowly rounded apex, small distal suture. *Eyes* extremely long and narrow. *Mandibular palp* long and robust, second segment long and narrow with parallel sides; third segment much narrower and half as long as the second. *Endopods of the third to the seventh thoracic appendages* with the carpo-propodus subdivided into a large number of segments; that of the eighth divided into about half as many sub-segments; no nail. *Pleopods of the female* reduced to simple unsegmented plates; *of the male*, *first* and *second pairs* almost exactly like the corresponding pairs of the female; *third pair*, small, biramous, with normal exopod; endopod reduced to a simple unsegmented plate; *fourth pair* biramous with the exopod extremely long, multiarticulate, distal segments armed with very long modified setae; endopod reduced to a simple unsegmented plate; *fifth pair* large, biramous, both rami normal, multi-articulate and natatory; exopod slightly longer than endopod. *Uropods* with exopod considerably longer than endopod; inner margin of endopod armed with a row of spines. *Telson* broadly oblong; deeply cleft; lateral margins armed with a continuous row of almost equal spines not arranged in series; pair of long, plumose setae at base of cleft.

This genus agrees with the genus *Antarctomysis* in many of its characters, but may be distinguished from it by the simple unsegmented endopods of the third and fourth male pleopods; by the very long slender eyes; by the narrow second segment of the mandibular palp; by the very large number of sub-segments of the carpo-propodus of the third to the seventh thoracic endopods and by the presence of a pair of very long plumose setae at the base of the cleft of the telson.

Arthromysis magellanica (Cunningham), 1871
(Fig. 45 A–D; 46 A–P)

1871 *Macromysis magellanica* Cunningham, p. 497.
1915*b* *Antarctomysis* sp. Zimmer, p. 170.
1924 *Arthromysis chierchiae* Colosi, p. 3, figs.

Occurrence:

St. WS 89. 7. iv. 27 (day). Midway between the Falkland Is. and Tierra del Fuego, 23–21 m., 64 ♂♂, 59 ♀♀, 28–31 mm., many breeding.

St. WS 749. 18. ix. 31 (day). Strait of Magellan, 40(–0) m., 21 adult ♂♂, 14 ♀♀ (5 ovig.), 22–31 mm., 9 juv. ♂♂, fragments.

Description. *General form* long and slender. *Carapace* short posteriorly, leaving the whole of the last two and part of the sixth thoracic somites exposed in dorsal view; anterior margin semicircular with, in a few large specimens only, a hint of an angle in the median line; antero-lateral angles produced into very acute spine-like processes (Fig. 45 A, B); carapace very shallow laterally with the margin anterior to the cervical sulcus sinuous (Fig. 45 B); posterior margin transverse with only a very slight emargination in the median region; postero-lateral angles rounded. *Abdomen* strong and muscular; anterior five somites sub-equal; sixth nearly twice as long as the fifth (Fig. 45 B). *Antennular peduncle* long and slender especially in the female; second segment the shortest, third segment expanded at its distal end (Figs. 45 A and 46 A); *scale* long and slender, more than twice as long as the antennular peduncle; small distal suture present (Figs. 45 A and 46 B). *Mandibular palp* slender, with second segment not expanded (Fig. 46 C). *Maxillule*, *maxilla*, *first* and *second thoracic appendages* as shown in Fig. 46 D–G. *Third to the eighth thoracic appendages* with the endopods not particularly long; carpo-propodus with 24–26 sub-segments in the third to seventh endopods and with ten in the eighth. Male genital organ very large, barrel-shaped with a well-marked lobe at its distal end (Fig. 45 D). Marsupium composed of three pairs of brood lamellae, those on the sixth thoracic appendages very small. *Pleopods* of the female rudimentary, in the form of unsegmented plates, which become progressively longer on the posterior somites (Fig. 45 B). *Pleopods* of the male; *first* and *second pairs* as in the female (Fig. 46 H, J); *third pair* with unsegmented endopod (Fig. 46 K); *fourth pair* with simple unsegmented endopod; exopod extremely long, extending backward beyond the apex of the telson, composed of ten segments marked off by very obscure articulations; penultimate segment very short, armed with one strong, long seta, which is armed along its outer margin with a regular row of small spines; distal segment long and slender, armed distally with two unequal spinous setae and a simple seta (Fig. 46 L); *fifth pair* large, normal, with the exopod slightly longer than the endopod (Fig. 46 M). *Uropods*, very long and slender, exopod more than half as long again as the endopod, which is armed along the inner margin with 17–19 spines among the setae (Fig. 46 N). *Telson* broad and oblong, lateral margins nearly parallel, armed throughout their whole length with 25–26 evenly spaced spines; distal spine long and placed very close to the small apical spine which is less than half its length (in some specimens this long spine appears to be borne on the apex but in the majority of the animals it is definitely situated on the lateral margin); *cleft* about one-sixth of the length of the telson, its margins very convex distally, no proximal dilation, armed with a very dense row of small even teeth; pair of long plumose setae borne at base of cleft. There is a very conspicuous large chromatophore in the median line of the telson about two-thirds of its length from the base (Fig. 46P).

Length. Largest female, 31 mm.; largest male, 30 mm.

DISTRIBUTION. All the records of this species are from the Strait of Magellan with the exception of station WS 749, half-way between Tierra del Fuego and the Falkland Islands.

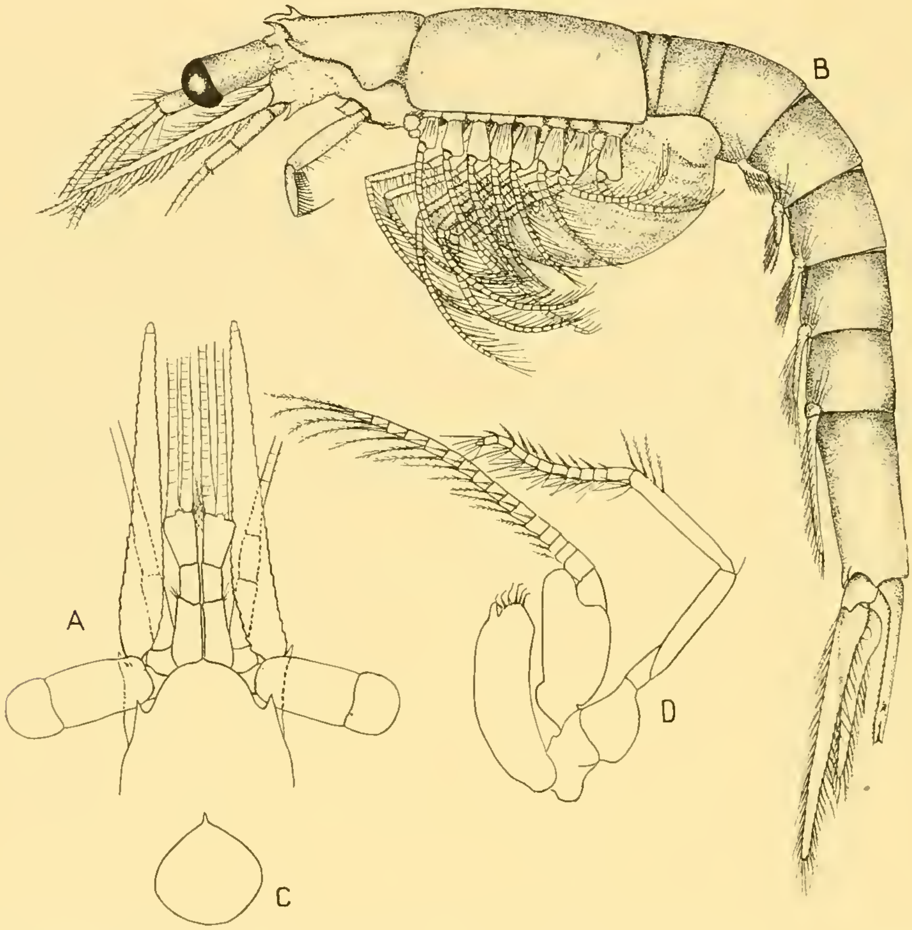

Fig. 45. *Arthromysis magellanica* (Cunningham). A, anterior end of adult female in dorsal view, ×9; B, adult female in lateral view, ×6; C, labrum; D, eighth thoracic appendage of adult male, ×14.

REMARKS. In all essential characters this species conforms to the definition laid down by Hansen for the tribe *Mysini*, but it possesses one character, which has not before been recorded for this tribe—the presence of long plumose setae at the base of the cleft of the telson. These setae are characteristic of the tribe *Erythropini* and occur in one or two genera of the tribe *Leptomysini*. Since all the other characters of the genus *Arthromysis* are definitely those of the tribe *Mysini*, the presence of these conspicuous setae, in conjunction with the very large number of sub-segments in the tarsus of the thoracic endopods, simplifies the identification of both sexes of the species. The only species with which the females might be confused is *Tenagomysis tenuipes*, in which there may be as many as 14 sub-segments in the tarsus of the third to seventh thoracic endopods and in which the presence of plumose setae arming the base of the cleft of the telson is a generic character. *A. magellanica* may be distinguished from this species by the very long, slender eyes and by the semicircular shape of the anterior margin of the carapace.

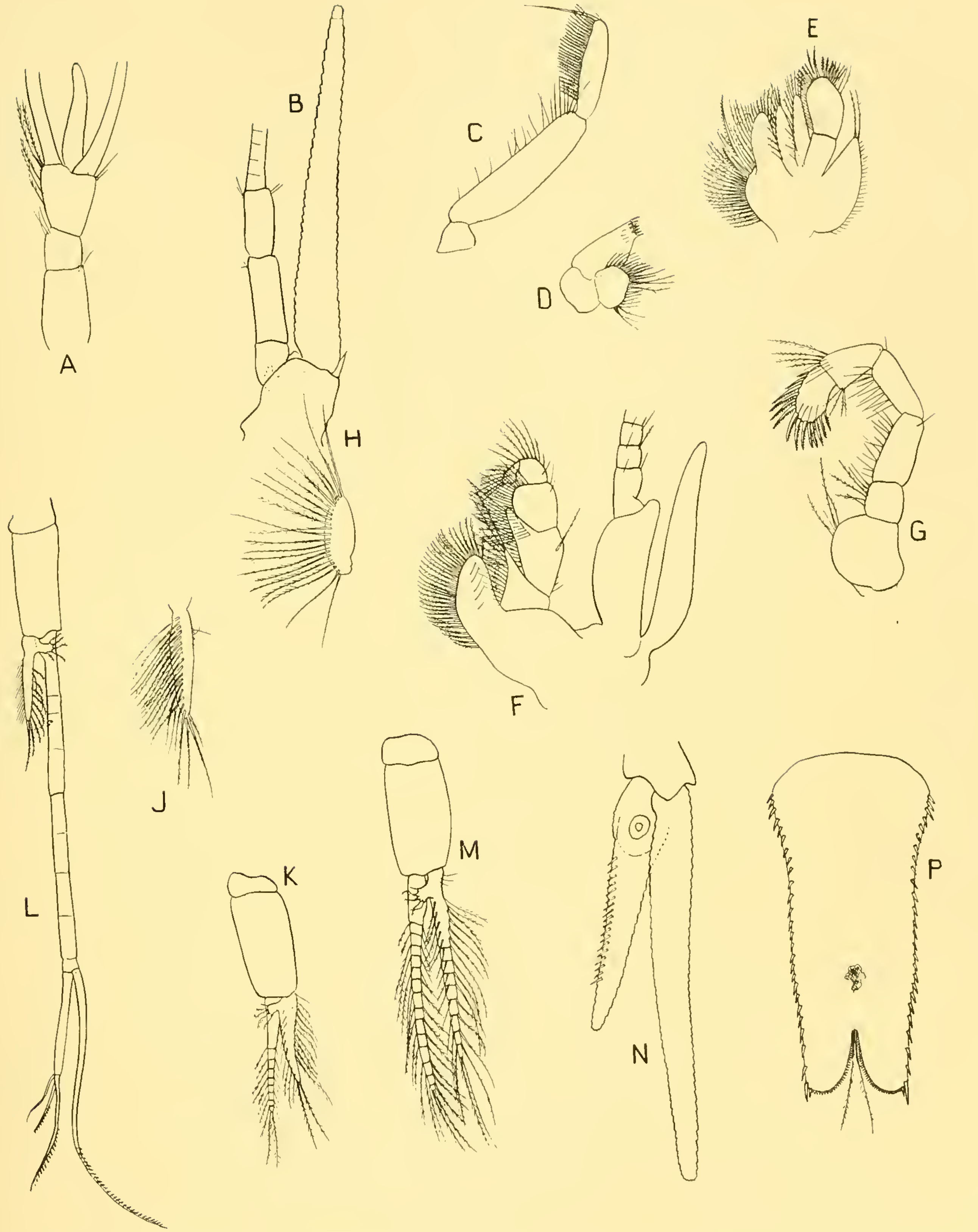

Fig. 46. *Arthromysis magellanica* (Cunningham). A, antennular peduncle of adult male, × 18; B, right antenna, × 18; C, mandibular palp, × 21; D, maxillule, × 25; E, maxilla, × 25; F, first thoracic appendage with epipod; × 21; G, endopod of second thoracic appendage, × 21; H, first pleopod of male, × 18; J, second pleopod of male, × 18; K, third pleopod of male, × 18; L, fourth pleopod of male, × 18; M, fifth pleopod of male, × 18; N, right uropod, × 18; P, telson, × 21.

REPORT ON THE MYSIDACEA COLLECTED DURING A SURVEY OF THE BENGUELA CURRENT BY R.R.S. 'WILLIAM SCORESBY', 4–14 MARCH 1950

During the course of a first survey of the Benguela Current by 'William Scoresby' in March 1950, mysids were captured at twelve stations off the west coast of South Africa, from west of the Orange River estuary to the latitude of Walvis Bay. Surprisingly few specimens were taken, apart from a haul containing over 450 specimens of the gregarious *Gastrosaccus sanctus* at station WS 1002. In spite of the few numbers, the collection has proved to be very rich, ten genera being represented and sixteen species, one of which is new to science. In addition there were a few specimens, which may represent other genera and species, but they were either too young or too damaged to be identified. I have been particularly struck by the large proportion of very small specimens, in many cases measuring only 2 mm. or 3 mm. and some so small that they must only just have been liberated from the brood pouch. This must be due in part to the type of gear used, and especially to the meticulous care of Dr T. J. Hart, who dealt with the hauls and sorted the catch.

Full details of the stations and the names of the species captured at each are given at the end of the list of 'William Scoresby' stations.

Eucopia grimaldii Nouvel, 1942

Occurrence:

St. WS 986. 10. iii. 50 (day). 1000–750 m., 1 very small juv.

Distribution. Within the known geographical range of this species.

Boreomysis rostrata Illig, 1906

Occurrence:

St. WS 976. 6. iii. 50 (day). 750–500 m., 1 small juv., 3 mm.
St. WS 977. 6/7. iii. 50 (night). 750–500 m., 1 juv. ♂.
St. WS 978. 7. iii. 50 (day). 750–500 m., 3 ♀♀, 9·4–12 mm.
St. WS 986. 10. iii. 50 (day). 50–0 m., 1 adult ♂, 14·5 mm.

Distribution. Within the known range for the species.

Boreomysis microps G. O. Sars, 1884

Occurrence:

St. WS 996. 12. iii. 50 (day). 1000–750 m., 1 imm. ♀, in two pieces, estimated length 10 mm.

Distribution. Within the known range for the species.

Boreomysis insolita sp.n.

Occurrence:

St. WS 979. 7. iii. 50 (night). 100–50 m., 1 adult ♀, 8·2 mm., 3 imm. ♀♀.
St. WS 987. 10. iii. 50 (day). Two hauls: 50–0 m., 1 adult ♂, 9 mm., 1 imm. ♂, 7·6 mm., 1 imm. ♀, 7·3 mm., 3 juv.; 250–100 m., 3 adult ♂♂, 8·2 mm., 3 imm. ♂♂, 4 adult ♀♀, 8·4 mm., 3 imm. ♀♀, 4 juv., 10 small larvae. Types.

Distribution. West and south-south-west of Walvis Bay.

Gastrosaccus sanctus (van Beneden), 1861

Occurrence:

St. WS 1000. 13. iii. 50 (night). 100–50 m., 1 very small juv.
St. WS 1002. 14. iii. 50 (night). 50–0 m., 20 adult ♂♂, 24 adult ♀♀ (ovig.), largest 9 mm., over 350 juv., 3–7 mm.

Distribution. West of Orange River estuary, shallow water. This is considerably farther south than previous records although one specimen was taken off South Georgia by R.R.S. 'Discovery' at station 149.

Anchialina typica (Kröyer), 1861

Occurrence:

St. WS 1000. 13. iii. 50 (night). Three hauls: 50–0 m., 5 juv., largest 3·4 mm.; 100–50 m., 4 juv., largest 3·2 mm.; 150–0 m., 1 adult ♂, 7·2 mm.

Distribution. This species is widely distributed in equatorial and tropical waters of the world. The present record is the most southerly to be made in the southern hemisphere.

Dactylamblyops hodgsoni Holt and Tattersall, 1906

Occurrence:

St. WS 976. 6. iii. 50 (day). 1000–750 m., 1 badly damaged juv. ♂, 6 mm.

Distribution. This species has never before been recorded so far north. All previous records are from deep water in the Antarctic or Southern Oceans.

Meterythrops sp., S. I. Smith 1879

Occurrence:

St. WS 978. 7. iii. 50 (day). 500–250 m., 1 badly damaged juv., 3·4 mm.

Distribution. 150 miles west of Walvis Bay.

Katerythrops oceanae Holt and Tattersall, 1905

Occurrence:

St. WS 976. 6. iii. 50 (day). 1000–750 m., 1 small juv. 2·5 mm.

Distribution. Within the known range of the species.

Euchaetomera typica G. O. Sars, 1884

Occurrence:

St. WS 977. 6/7. iii. 50 (night). 500–250 m., 1 juv., 3 mm.
St. WS 978. 7. iii. 50 (day). 100–50 m., 1 juv. ♂, 5·6 mm.

Distribution. Within the known range of the species.

Euchaetomera tenuis G. O. Sars, 1883

Occurrence:

St. WS 977. 6/7. iii. 50 (night). 250–100 m., 2 juv., 2·5 and 3 mm.

Distribution. Within the known range of the species.

Euchaetomera intermedia Nouvel, 1942

Occurrence:

St. WS 976. 6. iii. 50 (day). 100–50 m., 1 juv. ♀, 6·8 mm.

Distribution. Within the known range of the species.

Euchaetomera zurstrasseni (Illig), 1906

Occurrence:

St. WS 976. 6. iii. 50 (day). 250–100 m., 1 juv., 3 mm.

Distribution. This species has been recorded on many occasions from the Antarctic and the Southern Atlantic. Except for one record from waters to the west of Cape Town it has never been taken in the Atlantic north of South Georgia. The present record from the west of Walvis Bay is the most northerly in the Atlantic Ocean.

Euchaetomera larvae too young to identify, station WS 997.

Caesaromysis hispida Ortmann, 1893

OCCURRENCE:

St. WS 977. 6/7. iii. 50 (night). 500–250 m., 2 adult ♂♂, 4·6–4·8 mm., 1 ♀, 5·6 mm., 1 juv., 3·6 mm.

DISTRIBUTION. Within the known range of the species.

Arachnomysis leuckartii Chun, 1887

OCCURRENCE:

St. WS 986. 10. iii. 50 (day). 50–0 m., 1 adult ♀, 5·6 mm.

DISTRIBUTION. Within the known range of the species.

Leptomysis megalops Zimmer, 1915

OCCURRENCE:

St. WS 998. 13. iii. 50 (day). Two hauls: 100–50 m., 1 badly damaged juv.; 175–100 m., 3 ♀♀, 4–5·6 mm., 4 very small juv.

St. WS 1000. 13. iii. 50 (night). 100–50 m., 1 ♂, 8·4 mm., 3 ♀♀, largest 8·8 mm., 8 small juv.

St. WS 1001. 13/14. iii. 50 (night). 50–0 m., 2 very small *Leptomysis* larvae ? *megalops*.

DISTRIBUTION. Within the known range of the species.

REMARKS. Only two of the species recorded above show any marked deviation from previous records of their distribution. Both *Dactylambylops hodgsoni* and *Euchaetomera zurstrasseni* are Antarctic forms or from very far south in the South Atlantic. Their capture off the west coast of South Africa is considerably farther north in the Atlantic than any previous records of them, although *E. zurstrasseni* was originally taken in the Indian Ocean to the west of Chagos Islands.

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INDEX OF SPECIES

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THE DISTRIBUTION OF THE STANDING CROP OF ZOOPLANKTON IN THE SOUTHERN OCEAN

By

P. FOXTON

CONTENTS

THE DISTRIBUTION OF THE STANDING CROP OF ZOOPLANKTON IN THE SOUTHERN OCEAN

By P. Foxton

(Figs. 1–19)

INTRODUCTION

In recent years much attention has been paid to the productivity and organic resources of the seas, but there are formidable difficulties in the technique of quantitative sampling of the oceanic fauna and flora, and little is known of the relative fertility of the oceans at different times and places. Investigations on fertility are largely concerned with the primary production of phytoplankton (i.e. the amount of organic matter synthesized in a given time), but take account not only of the rate of production and consumption of both phytoplankton and zooplankton, but also of variations in the 'standing crop', i.e. the amount or density of the plankton at a given place at the time of sampling. The standing crop (which represents the amount of food available for consumers of the plankton) can be taken as an indication of fertility only with certain reservations, of which the most important is that a fertile region may yet have a small standing crop if a high rate of consumption keeps pace with a high rate of production.

The present paper, which is part of an investigation of the distribution and abundance of the southern oceanic fauna, deals with the standing crop of zooplankton, and it depends on measurements of the volume of plankton samples. These samples are all from one standard net, and in so far as no single net can equally sample all planktonic animals from the most minute to the largest and most active, it is an arbitrary part of the plankton fauna which is being measured. But it is a net which does sample animals through a considerable range of sizes, the samples are comparable with one another, and this paper is concerned with relative and not absolute quantities.

Work on this aspect of oceanography was initiated by Hensen and his co-workers on the 'Plankton Expedition'. They developed methods which have formed the basis of plankton research ever since, but as with nearly all deep-sea expeditions the observations, though distributed over wide oceanic areas, were not repeated at different times of year and therefore do not take account of seasonal variations. (The main conclusions of this and other investigations in relation to plankton production are briefly summarized in historical sequence by Dakin & Colefax, 1940.)

Perhaps the most valuable body of data collected hitherto is that of the 'Meteor' Expedition (Hentschel, 1936) which covered the central and southern Atlantic on fourteen latitudinal profiles, during which 310 stations were worked. Even so, the observations were rather widely dispersed, especially in the southern part of the area investigated, and (of necessity) they did not cover seasonal variations. This applies also to the results of the 'Dana' Expeditions (Jespersen, 1923, 1935), which cover a great geographical range mainly in sub-tropic and tropic latitudes, and to those of the 'Carnegie' (Graham, 1941; Wilson, 1942), which cruised in both Pacific and Atlantic waters.

Inshore waters in most parts of the world have been well surveyed, and among the many works on production and standing crop are those of Bigelow & Sears (1939), Clarke (1940), Redfield (1941) and Riley (1941) in America; Gundersen (1951) in Norway; Sheard (1949) in Australia; Huntsman (1919) in Canada; and Delsman (1939) in the Java Sea. Most of these studies, however, are not directly applicable to the present work because they refer to local areas and for the most part do not extend to the true oceanic fauna and flora. There are relatively few data from oceanic areas, and apart from the observations to be considered here there are in the Southern Ocean only a few 'Meteor' stations and the material collected on the B.A.N.Z.A.R. Expedition and described by Sheard (1947).

From other regions there are the results of the few expeditions already mentioned, which, although limited, have allowed something to be known of conditions in the open ocean. The 'Meteor' observations, for example, have enabled Hentschel to make valuable distinctions between regions of rich and poor plankton in the Atlantic Ocean.

In the warmer latitudes it may be that there are no very great seasonal variations in the standing crop. Nevertheless, when observations are made only at one time of year there can be no certainty that the amount measured is much indication of the amounts which may be present at other times of year. Indeed, it seems hardly possible to make true quantitative comparisons of fertility over large areas without data suitably spread in time as well as in space. It is felt that the material collected by the 'Discovery II' in the Southern Ocean allows for a new step forward because it has been taken from almost all parts of a large oceanic area—the Southern Ocean—at almost all times of year. Measurement of the volumes of samples is no doubt a crude method, but it allows many samples to be dealt with quickly and it gives an approximate estimate of the standing crop which is at least significant for large-scale or persistent differences. Furthermore, measurements from the Southern Ocean can be used to some extent as a basis for comparison of the standing crop with that of other oceanic regions.

Probably no other oceanic region is richer in life than the Antarctic, an area far greater than any other of comparable fertility. It is hoped that even a rough comparison of the abundance of plankton in different parts of the Southern Ocean, an account of the variations which take place, and an indication of the standing crop in the Antarctic compared with other regions, will contribute to what is known of the fertility of the oceans as a whole.

The features to be measured and compared are (*a*) the seasonal vertical movements between superimposed water masses, and seasonal variations in the amount of plankton, (*b*) the standing crop in different latitudes, and (*c*) the standing crop in different longitudes and faunistic areas.

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MATERIAL

This paper is based on material collected with the 'Discovery' pattern 70 cm vertical closing net (N 70 V), the construction and operation of which is described in detail in Kemp, Hardy & Mackintosh (1929, pp. 183 and 199). The net provides a standard series of hauls which, by virtue of a constant speed of hauling and an accurate knowledge of the depth of closure, are more reliable for quantitative purposes than samples from horizontally or obliquely towed nets (Mackintosh, 1937, p. 371). The N 70 V is closed on the Nansen principle by means of a throttling rope, and Barnes (1949) maintains that significant losses occur in the catches taken by this method. It is felt, however, that the conditions which he describes do not fulfil the actual working conditions of the N70V both with regard to the method and speed of hauling and to the length of water column sampled. (The net is hauled vertically at a speed of 1 m. per sec. over a davit incorporating a spring accumulator, and the shortest closing haul is from 100 to 50 m.) As Østvedt (1955) points out, such losses, if they do occur, will only be of significance if the plankton is very unevenly distributed in depth or if the haul is a short one, i.e. 100–50 m.

Nets of the dimensions given in Kemp, Hardy & Mackintosh (1929) have been used on the ships of the Discovery Committee from 1927 until 1939. On the first post-war commissions of the R.R.S. 'Discovery II' (1950–51) and the R.R.S. 'William Scoresby' (1950) the nets were inadvertently made to slightly different measurements, and there can be little doubt that, although the same grades of silk were used, the filtering capacity of this net differed from its pre-war counterpart. In view of this discrepancy preliminary comparative tests have been made which consisted of duplicate hauls with nets of both dimensions. As a result of four paired hauls at each of six stations in the North Atlantic and Mediterranean (i.e. 48 volume measurements), it has been found that there is a fairly consistent difference, the pre-war net giving about one and a half times the catch (by volume) of the post-war net. A factor of $\frac{3}{2}$ has therefore been applied to the volume measurements of 203 samples from the 33 post-war stations used in this work. This factor must be considered as provisional, since future tests may allow the differences in filtering capacity and catching power to be more accurately gauged.

It should be noted that even if uncorrected results are used they in no way alter the principal conclusions drawn from the data, but it was deemed better to use a provisional correction rather than to ignore the difference.

At most stations there are samples from the following six routine depth intervals between the surface and 1000 m: 50–0 m., 100–50 m., 250–100 m., 500–250 m., 750–500 m., and 1000–750 m. Occasionally a deeper haul from 1500 to 1000 m. was worked, and at eight of the stations taken into account in this paper (1675, 1677–1682 and 1684) the normal shallow haul was done in two stages of 50–25 m. and 25–0 m. Here these volumes have been combined to represent a haul from 50 to 0 m.

Hydrological data are available for each station at all depths sampled by the nets, so that it is possible to view the standing crop of plankton in relation to the sea temperature and other variables and to the distribution and movements of the main water masses of the Southern Ocean. (For full details of the hydrology of the area reference should be made to Deacon, 1933, 1937; Clowes, 1938; and for a brief account Mackintosh, 1937, p. 373.)

The positions of stations from which the volumes of samples have been measured are given in tables 11*a–f* in the appendix, and it is necessary to explain the basis on which these stations have been selected from the much greater number available in the Discovery collections. For various reasons the work of the 'Discovery II' was more concentrated in some areas and times of year than in others, and for the present work it is not necessary to make use of all of them, since the labour of measuring all the samples would be out of proportion to the objects in view. I have, however, measured 2185 samples from 366 stations, chosen so as to cover seasonal variations of the standing crop of zooplankton in as many different regions of the Southern Ocean as possible. Certain meridional lines of stations, which have been repeated in different months, are particulary suitable for this purpose. They cover a period from December 1933 to November 1934 plus October 1932 in the meridian of 80° W; April 1938 to March 1939 plus September 1936 in 0°; and April 1938 to March 1939 plus June 1936 in 20° E. The nine lines of stations in both 0° and 20° E cover all the seasons in the south-east Atlantic sector of the Antarctic and sub-Antarctic zones, and the six lines in 80° W (south-east Pacific) cover more than half the year.

From the work of Deacon (1937), Clowes (1938) and Mackintosh & Herdman (1940) it is clear that the physical and chemical features of the environment are disposed in relatively uniform zones all round the Southern Ocean, and Baker (1954) has shown that the distribution of the species of Antarctic plankton are correspondingly continuous in a circumpolar direction. It may be expected, therefore, that the seasonal cycle and latitudinal succession observed in even one transverse (meridional) section are broadly representative of the whole of the Antarctic and sub-Antarctic zones.

It is desirable to check this, however, in so far as the available data will allow. Repeated lines of stations of the kind worked in 80° W, 0° and 20° E, are not available from other parts of the Southern Ocean, but there are other lines running approximately north and south which can be used at least to show whether or not the vertical and meridional distribution of plankton is similar at a given time of year to that found in 80° W, 0° and 20° E. I have grouped together the following stations and for convenience will refer to them as the lines in 20° W (804–817 and 1990–2004), 110° E (877–887, 1720–1735 and 2152–2168) and 160° E (912–928, 1675–1684 and 2201–2209). These lines of observations cover two or three different months in each particular area, but from different years. Experience in 80° W, 0° and 20° E (see p. 205), however, has shown that year to year differences in a given area are less than the month to month variations.

All these lines of stations run approximately in a north-south direction, in which there is the greatest change in normal hydrological conditions. I have made use of stations selected from circumpolar cruises (845–875, 2213–2310 and 2838–2881), to ascertain whether or not, in comparable months, there is any great variation in standing crop from east to west, in which direction there is least hydrological change. This material also provides additional observations for the study of seasonal and regional variations.

Although this work is concerned principally with variations in the standing crop of zooplankton in the Southern Ocean it seemed worth while to extend the observations as far north as possible to gain some comparison with conditions in sub-tropic and tropic oceanic waters. For this reason I have included a line of stations across the Indian Ocean in 32° S (1736–1766), and a line of stations running north from 30° S nearly to the equator, in the meridian of 90° E (2886–2895).

In the initial planning of the work at sea complications due to diurnal migration were mitigated by working full stations at a fixed time of day (20.00 hrs., ship's time) whenever practicable, but in this paper some series of data including both day and night hauls have had to be considered. The relevant diagrams and text (p. 209) show that their comparability is unaffected by diurnal movements of the plankton.

METHODS

Before describing the method of volume measurement used in this work it is worth while to consider briefly the methods used by other workers.

Measurement of the volume of a sample as a rough estimate of relative plankton concentration was one of the earliest techniques used in the quantitative approach to plankton, and in papers by Schütt (1892) and Hensen (1895) two methods, usually termed the settlement and displacement methods, were described.

The settlement method, in which the volume is obtained by allowing the sample to settle in a graduated cylinder, has been used with success by many workers including Huntsman (1919), Hardy (1928) and Gunther (1936). The settlement volume, however, includes the volume of the liquid in the interstices between the organisms which, since this varies with their shape and compactness, makes the method very inaccurate (Hardy & Gunther, 1935, p. 27; Sheard, 1947, p. 10) and particularly unsuitable for measuring the volumes of small samples containing but a few differently shaped organisms. It is also not suitable for use at sea where steady conditions, necessary for settlement, are unusual. A variation of the method was, however, used at sea by Jespersen (1923, 1935) in his extensive studies in the Atlantic and Mediterranean, the samples being allowed to drain and settle in a graduated sieve from which the volume could be read directly. This method, however, is only suitable for large samples.

The displacement method consists essentially of filtering off the plankton on to a piece of filter paper (Sheard, 1947) or silk (Apstein, 1909; Moore, 1949) and adding it to a known volume of water. The difference in measurements gives the volume of the plankton. Many workers have used this technique, including Leavitt (1935), Bigelow & Sears (1939), Clarke (1940), Redfield (1941), Sheard (1947), Moore (1949) and Gundersen (1951). By some, notably Apstein (1909), Jacobsen & Paulsen (1912), Ussachev (1939), Berardi (1953), Ealey (1953) and Frolander (1954), the method has been elaborated by the design of special apparatus, some of which allow very small volumes to be measured.

It will be realized that neither the settlement nor the displacement method measures the absolute volume of the plankton since, in both, the moisture contained between the individual animals is included in the final volume. In the latter method, however, this error is reduced to a minimum (see p. 198), and much smaller samples, as are caught with vertical closing nets, can be measured with some accuracy. Furthermore, the displacement method is relatively quick and admirably suited to use at sea where some of the samples in the 1950–51 commission of R.R.S. 'Discovery II' were measured.

All volumes used in this work were measured by this method, the particular procedure used being as follows:

The preserved sample, after the large animals had been picked out (see p. 199), was poured into a brass funnel, the stem of which, measuring $1\frac{1}{4}$ in. diameter, was closed at its lower end by a disk of fine silk held in position by a rubber band. The use of N 50 silk, which has 200 meshes compared with 74 meshes per linear inch of N 70 silk, ensured that even the smallest organisms in the sample were retained on the disk.

Most of the liquid was allowed to drain off, the process being accelerated by placing the disk on a pad of blotting paper, great care being taken not to injure the plankton by complete drying out. The disk and plankton were then removed from the funnel and placed, care being taken not to enclose air bubbles, into a measured volume of water contained in a graduated cylinder, and the increase in volume noted. The difference in measurements minus the volume of the silk disk (0·1 cc.) gave the volume of the plankton. By measuring the volume of plankton and filter disk together, one ensures that the plankton is not damaged, as it might be by the alternative method of scraping the animals off the silk into the measured volume of water.

The size of the measuring cylinder had naturally to be suited to the size of sample, but in most cases a 25 c.c. cylinder graduated in 0·2 c.c. was used, and the volumes were measured to the nearest 0·1 c.c.

After measurement, the sample was completely washed off the silk and replaced in 10 per cent neutral formalin. The importance of not losing any of the sample need not be emphasized, and the washing of the silk was repeated a number of times, the time taken being much longer than that for the actual volume measurement. Finally, by a very brief and rough inspection a note was made of the dominant animal in the sample and any other features.

It will be obvious from the foregoing account that the inherent limitation to the accuracy of the method is the amount of liquid retained by the plankton after drainage. Samples from 70 cm. vertical closing nets, however, are on the whole small—much smaller than samples from towed nets—and, as Jacobsen & Paulsen (1912) found, for small samples this error is very small. This is also shown by the results, given in Table 1, of ten repeated measurements on samples from St. 2414. The variations in the measurements that occur at each depth in no way detract from the main conclusions to be drawn from this particular set of data, namely, that the bulk of the plankton is concentrated below 250 m., the upper 100 m. being relatively poor in plankton (see Fig. 2).

Table 1. *The results of ten repeated measurements (in cc.) of the volumes of samples from St. 2414*

	50–0 m.	100–50 m.	250–100 m.	500–250 m.	750–500 m.	1000–750 m.
1	0·2	0·4	0·7	1·6	2·5	3·1
2	0·3	0·4	0·6	1·6	2·6	3·1
3	0·2	0·4	0·7	1·3	2·5	3·2
4	0·2	0·5	0·7	1·3	2·3	3·2
5	0·2	0·4	0·5	1·3	2·3	2·7
6	0·2	0·4	0·6	1·3	2·3	2·9
7	0·2	0·4	0·6	1·4	2·2	2·8
8	0·3	0·4	0·6	1·3	2·1	2·9
9	0·2	0·3	0·6	1·4	2·3	2·7
10	0·2	0·4	0·6	1·4	2·2	3·0
Sum	2·2	4·0	6·2	13·9	23·3	29·6
Mean	0·22	0·40	0·62	1·39	2·33	2·96

The rather crude method of 'drying' the plankton on blotting paper is thus a convenient method of reducing such errors to a minimum. While the basic method of measurement remained the same throughout this work the procedure outlined above had to be variously modified when dealing with many Antarctic spring and summer shallow samples containing phytoplankton. This paper is concerned only with the variations in the standing crop of zooplankton, so that it was necessary to separate the animals from the phytoplankton and measure their volume separately. No standard treatment was possible, since among such samples there was every gradation from those rich in zooplankton and poor in phytoplankton to those in which phytoplankton predominated. Where there was only a trace of phytoplankton no attempt was made to separate it from the zooplankton, since it was considered that the amount was so small as to be immeasurable by the displacement method. Other samples, though rich in phytoplankton, contained only a few relatively large animals which could easily be picked out for separate measurement of their volume. The most difficult samples to deal with were those rich in phytoplankton and both adult and larval zooplankton organisms. To pick out the animals would be a lengthy and difficult task, and it is doubtful whether the result would be commensurate with the effort. The method adopted for a sample of this kind was to dilute it with water and pour it into a large glass funnel having its stem closed by a large-bore glass tap. The zooplankton, by virtue of its faster rate of settlement, collects at the bottom of the funnel, from which it can be run off via the tap, and measured by the standard method, after which it is preserved again with the phytoplankton. This method has the same disadvantage as the method of picking out the animals, namely, that some of the smaller forms remain in the phytoplankton and are not measured. It was considered, however, that as these are such small forms, the inaccuracy due to their omission from the final volume would not be great enough to influence any conclusions drawn from the result, the main thing being to get the best possible measure of the zooplankton volume alone rather than to measure the sample as a whole and thereby to introduce a considerable error due to inclusion of the phytoplankton. A few samples (23) defied all attempts to separate the animals, and these were not measured. Shallow hauls rich in phytoplankton are noted in Tables 11 *a–f* in the Appendix

As well as removing phytoplankton, it has also been my procedure to pick out any large animals from samples before measuring the volume.

As Mackintosh (1937, p. 371) has pointed out, the N70V samples only the smaller and medium-sized constituents of the plankton, and thus copepods, chaetognaths, small euphausiids and small amphipods numerically form the bulk of the catch. Often, however, comparatively large inactive animals are caught, such as siphonophores, medusae and salps, which if they were included would increase the volume disproportionately in relation to the number of animals present. For instance, the 500–250 m. samples from Sts. 2379 and 806 had volumes of 0·4 and 3·2 cc. respectively. The sample from St. 2379, however, contained two siphonophore nectophores having a combined volume of 2·8 cc., and it is obvious that if this volume were included to bring the total to 3·2 cc. any comparison between the stations would be most misleading. Salps in some cases would influence the volumes to

Table 2. *The number of samples from which particular groups of organisms were removed and the numbers expressed as a percentage of the whole*

Organisms removed	Siphonophora	Tunicata	Medusae	Fish	*Gelatinous fragments	Phytoplankton	Amphipoda	Pteropoda	Polychaeta	Ctenophora	Euphausiidae	Unidentified crustacea	Cephalopoda	Ostracoda	Pelagonemertes
No. of samples	264	203	177	145	88	83	70	42	28	20	17	17	11	8	2
As % total no. samples	12·1	9·3	8·1	6·6	4·0	3·3	3·2	1·9	1·3	0·9	0·8	0·8	0·5	0·4	0·1

* Includes mainly salp tests and siphonophore fragments.

an even greater extent, since they are animals that occur in swarms and are hence sometimes caught in extremely large numbers. At St. 2585, for instance, in the 50–0 m. haul there were 625 salps having a combined volume of 169·0 cc., and these must obviously be omitted. In addition to these inactive forms there are occasional active swimming animals, such as fish, large euphausiids (e.g. krill above 20 mm. in length) and large amphipods, which are caught by the N70V. These animals I have regarded as atypical of N70 catches and have picked them out. Table 2 gives the number of samples, expressed as a percentage of the total number, from which animals of a particular group and phytoplankton were extracted before the volume was measured. It is seen that by far the greater percentage picked out were animals of a gelatinous nature, the more active animals being relatively rare. (It should be noted that this table does not give the numbers of animals but only the number of samples from which they had been previously extracted.)

In view of the particular types of organism removed from the sample before measurement, the volumes adopted in this work may be taken to represent the variations in that part of the total standing crop of plankton composed mainly of copepods, chaetognaths and small euphausiids (which includes krill larvae). The importance of individual species volumetrically is not known. It would obviously depend upon the number and size (i.e. stage of maturity) in each sample and would vary from station to station, depth to depth and month to month. Such variations, however, are only of importance when considering the interrelationships of species, while in this case only gross changes in the bulk of zooplankton are being examined.

SEASONAL VARIATION IN THE VERTICAL DISTRIBUTION OF THE STANDING CROP OF ZOOPLANKTON

DESCRIPTION OF THE OBSERVATIONS

It has been shown by Mackintosh (1937) that one of the most marked features of the plankton cycle in Antarctic waters is that some of the most common species, including *Rhincalanus gigas*, *Calanus acutus* and *Eukrohnia hamata*, accomplish marked seasonal vertical migrations by which they maintain themselves within the limits of their environment. They drift northwards during the summer when they are concentrated both day and night in the Antarctic surface layer and southward during the winter when the greater number have moved into the warm deep current.

Although a knowledge of the relative numbers of animals caught at each depth illustrates this seasonal migration it gives little indication of its effect on the vertical distribution of the standing crop of plankton. As the volume of a sample is a function of the size of the organisms just as much as it is of the number present, it does not necessarily follow that because there has been a numerical increase there will be a rise in volume (i.e. the total mass) of the plankton. In this section, however, it will be shown that in the Antarctic and to a lesser extent sub-Antarctic zones there is a winter increase in the concentration of standing crop of zooplankton in the deeper waters comparable to the numerical increase described by Mackintosh.

Probably the best way of representing the results is to use block diagrams in which the area of a block at a particular depth (or, more precisely, in the limited column of water through which the net has been fished) is proportional to the volume of the sample taken from that depth. The results from the repeated lines in 0°, 20° E and 80° W, together with the observations in 20° W, 110° E, 160° E and 90° E, have been plotted in this fashion in Figs. 1–6. The vertical scale represents depth in metres and the horizontal scale latitude, with south to the right of the page. Stations are plotted according to their latitude except where large volumes or the proximity of stations makes this impossible. The approximate latitudes of the Antarctic convergence (A.C.) and, where possible, the sub-tropical convergence (S.T.C.) as determined from the continuous thermograph records of surface temperature, are also shown. Stations which occurred during daylight hours are indicated by a '○'. Gaps occur in the observations where samples were not available, or where the presence of phytoplankton made it impossible to measure the volume of the sample (see p. 198).

In plotting the volumes allowance has been made for the different duration of hauls at certain depths by making the width of each block equivalent to the volume of plankton for each 50 m. of the haul. For example, the width of a 50–0 m. haul is equivalent to the total volume of the sample, while the width of a 500–250 m. block is equivalent to one-fifth the volume of the sample since the haul was five times longer than the shallower haul. Width thus represents concentration per 50 m. haul (i.e. local density of plankton), and area the volume of the catch from that depth interval.

In drawing conclusions from these diagrams it should be remembered that the disposition of the water layers in the Antarctic is such that the 50–0 and 100–50 m. hauls sample the Antarctic surface layer, the 250–100 m. hauls sample partly the Antarctic surface layer and partly the warm deep layer, while the deeper hauls sample the warm deep layer exclusively. In the sub-Antarctic conditions are more complicated and no such simple distinction can be drawn. Only constant or large-scale variations are being considered, and the minor irregularities, which are usually evident from station to station, must be ignored.

The meridian of 0°, 1938–39 *season* (Fig. 1)

The April line of stations started much farther south than those in the following months and all stations were in Antarctic water. From the diagram it is apparent that while most of the standing crop of plankton was concentrated in the top 50 m. of the Antarctic surface water large volumes occurred in hauls below 250 m. at the two northernmost stations.

There were no observations in May and July, but in June (winter) the shallow hauls were relatively poor in plankton compared with those in April. The concentration of plankton in the deeper hauls, however, had increased, particularly at Antarctic and southern sub-Antarctic stations.

In August the volumes of catches at all levels were poorer than those of the previous month, but the bulk of the plankton was below 250 m. in the warm deep current, except at Sts. 2389 and 2391 where the hauls from 50 m. to the surface had large volumes consisting mainly of small euphausiids and copepods.

In September (late winter) the standing crop was still concentrated in deep water, and samples from the 750–500 m. hauls consistently gave the largest volumes. As in August there are small concentrations in the northern Antarctic surface water.

The October (spring) results show that there was a rise in the vertical distribution of the bulk of the plankton, which was concentrated above 250 m. at sub-Antarctic and Antarctic stations. This apparent upward migration of plankton seems to have proceeded further at St. 2463 which was just south of the Antarctic convergence.

In December the concentration of plankton had increased in the top 100 m. at the three southernmost stations, although at one of them (St. 2496) there was a large volume at the 500–250 m. level due to the presence of many *Rhincalanus gigas* in the sample. At two of the other sub-Antarctic stations the plankton did not appear to be concentrated above the 250–100 m. level.

In January the observations extended farther south than in the previous months owing to the recession of the ice edge. The vertical distribution was similar to that in December with the bulk of the plankton concentrated in the top 100 m. in Antarctic surface water. St. 2535 just south of the Antarctic convergence had large volumes at nearly all depths, but at the other Antarctic stations the volumes were on the whole less than in the previous month. In sub-Antarctic waters the largest concentrations were also between 100 m. and the surface compared with 250–100 m. in December.

In late February and early March the Antarctic surface layer appeared to be poor in plankton except in the region of the convergence, at St. 2586. The volumes at the sub-Antarctic stations were similar to those in the previous month.

The meridian of 20° E, 1938–39 *season* (Fig. 2)

In April the volumes of samples from Antarctic stations were not as great as those in 0°. The vertical distribution of the plankton, however, was basically the same, with the largest concentrations in the Antarctic surface layer but with large volumes also in the warm deep current. The sub-Antarctic surface waters appeared to be poor in plankton, while the volumes of the deeper hauls, particularly at St. 2348, suggest that the largest concentrations were deeper than in the Antarctic.

In July both sub-Antarctic and Antarctic surface waters were poor in plankton except at St. 2374. The volume of plankton in the deeper hauls down to 1000 m., however, had increased.

In August the concentration of surface plankton had decreased still further except for the 50–0 m. haul at St. 2412, which contained many small euphausiids. The bulk of the plankton, as in 0°, is concentrated in the warm deep layer, and in the Antarctic the largest volumes occurred at the 1000–750 and 750–500 m. levels as compared with the 500–250 m. level in July.

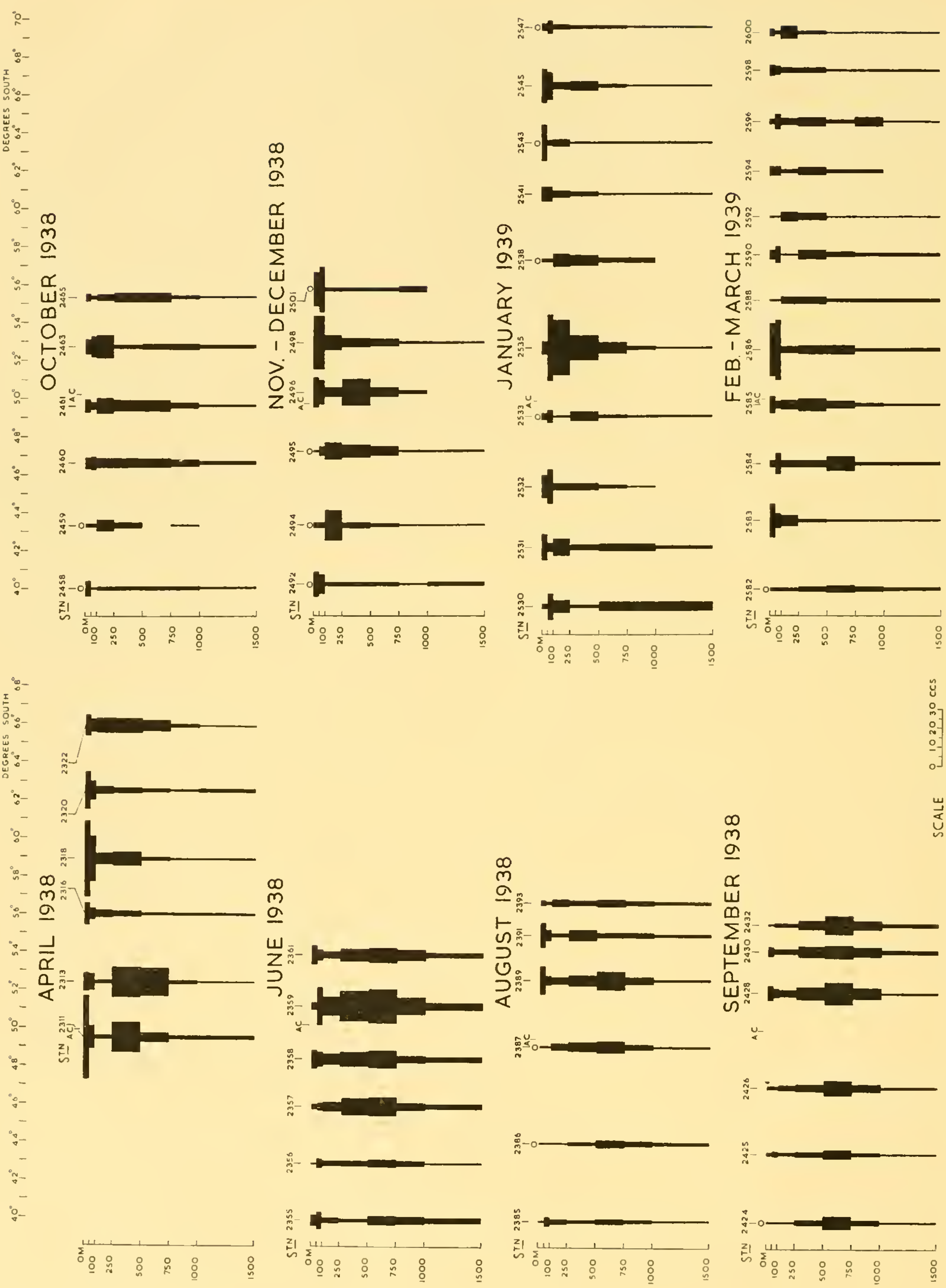

Fig. 1. Vertical distribution of the standing crop of zooplankton in o°. (The following contractions are used in Figs. 1–6: A.C. = Antarctic convergence; S.T.C. = sub-tropical convergence; T.C. = tropical convergence.)

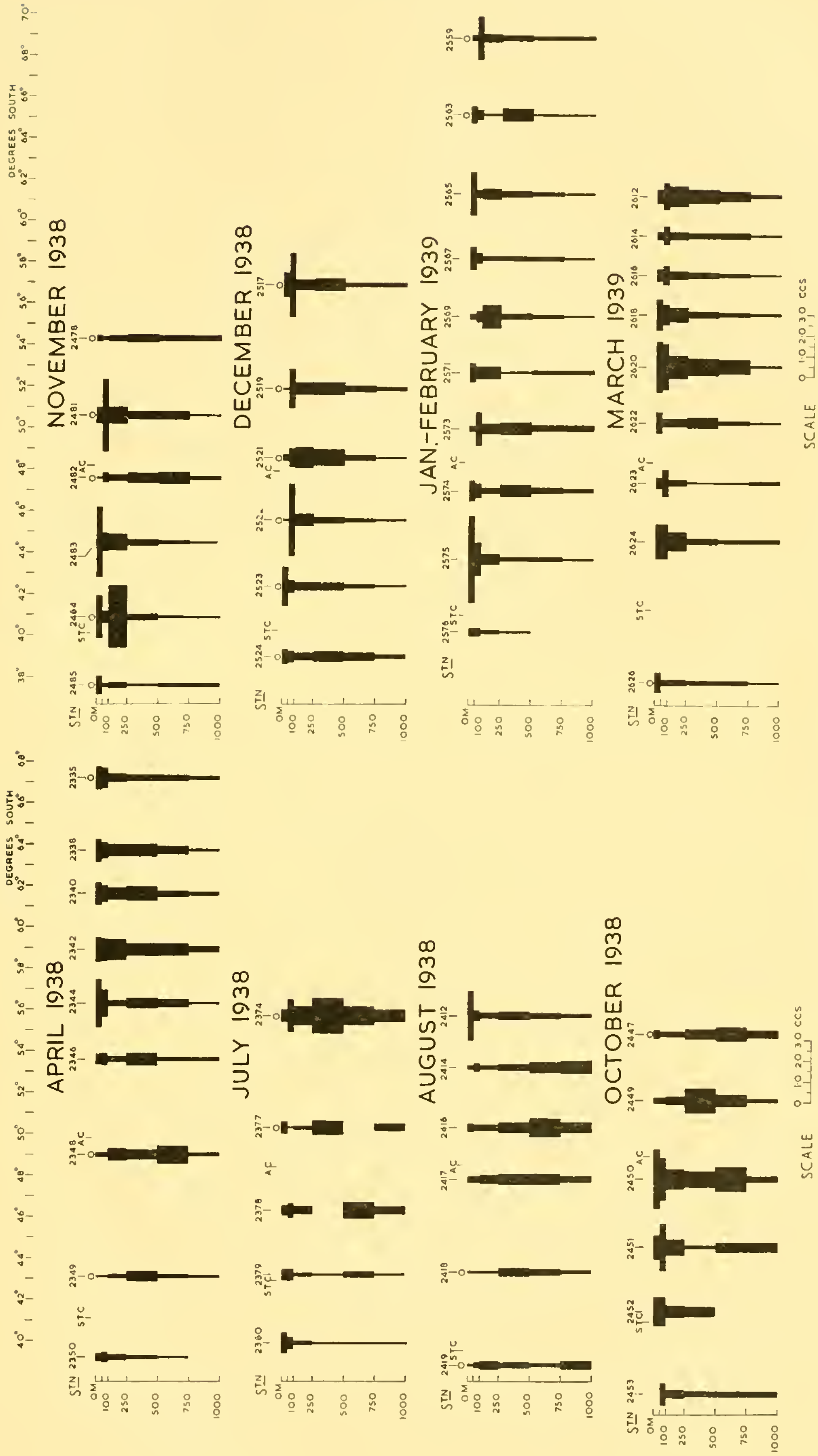

Fig. 2. Vertical distribution of the standing crop of zooplankton in 20° E.

There were no observations in September, but in October, as in 0°, there was a marked increase in the volumes at all stations, particularly in the sub-Antarctic region where there was a large concentration of plankton in the surface layer. At the Antarctic stations there was no indication of this, and the highest concentrations were in deep water though at a shallower level than they were in August.

In November most of the plankton appeared to be between 100 and 0 m. except for the exceptionally large 250–100 m. haul of 8·9 cc., due to a large number of small euphausians, at St. 2484. In the sub-Antarctic the plankton appeared to be concentrated nearer the surface (i.e. between 50 and 0 m.) than in the Antarctic, which contrasts with the vertical distribution in 0° where the reverse was the case.

In December at all stations except St. 2521 the bulk of the plankton was above 100 m. On the whole the 100–50 m. level had the highest concentration in both sub-Antarctic and Antarctic regions.

In late January and early February the standing crop of plankton was similar in vertical distribution to that in December when there was very little plankton below 250 m.

In March large concentrations in the surface layer were still evident, but at St. 2620 there was a marked increase in the volume of the deeper hauls.

The meridian of 80° W, 1933–34 *season* (Fig. 3)

Although the observations in 80° W do not present such a complete series as do those in 0° and 20° E they are of particular interest because an analysis of the same samples has formed the basis of a paper by Mackintosh (1937) which described the seasonal circulation of the macroplankton of the area. It is thus possible, in this case only, to compare the volume of a particular haul with its animal composition, and brief reference will be made to these results in the description of the volume measurements that follows.

In December 1933 the results show that the standing crop of plankton was concentrated in the sub-Antarctic and the northernmost Antarctic surface waters. The volumes at three stations, 1222, 1221 and 1220, suggest that in the southern part of the Antarctic region the plankton was still concentrated in deeper water (between 750 and 500 m.). The distribution of the volumes shows there to be a greater quantity of plankton in the sub-Antarctic than in the Antarctic zone, which is the same as the distribution of the total numbers of organisms (Mackintosh, 1937, p. 380).

In March 1934 the concentration of plankton in the surface waters had increased, and as Mackintosh (*ibid*) observed for the total numbers, the largest volumes were nearer the surface than in December. The two Antarctic stations nearest the ice edge were relatively poor in surface plankton, as in the previous month, although there is evidence that at these and the stations just north of the convergence the plankton was concentrated in deep water. The September results are rather unsatisfactory owing to the loss of part of the samples at some depths, and the volumes of these samples, which are shown in brackets in Table 11*c*, are thus minimal values. In spite of this, however, it is obvious that the surface layer in the sub-Antarctic and the Antarctic zones was very poor in plankton except at St. 1421, while the largest concentrations were at the 750–500 m. level.

In October there is definite indication that in the sub-Antarctic zone the plankton was concentrated at the 250–100 m. level. This was true also of the two northernmost Antarctic stations, in particular St. 1447. At Sts. 1449 and 1450, however, the plankton had not risen above 250 m. It is interesting to note that Mackintosh (*ibid*) observed that in this month the 250–100 m. horizon provided the greatest number of organisms.

In November there was still much plankton between 250 and 100 m., but at the Antarctic stations the 250–100 m. level was the richest.

The monthly results in 80° W compare well with those for similar months in 0° and 20° E. In each meridian the greatest concentrations of zooplankton were in the surface water during summer and autumn and in deeper water during winter. The 80° W September volumes were less at all depths than those in the other meridians, and it may be either that in winter this area is generally poorer in zooplankton or that the bulk of the plankton moves into water deeper than the range of the nets. As in other areas the October observations show a reconcentration of plankton at the shallower depths, though not quite at the high level of the greatest concentrations of November and December.

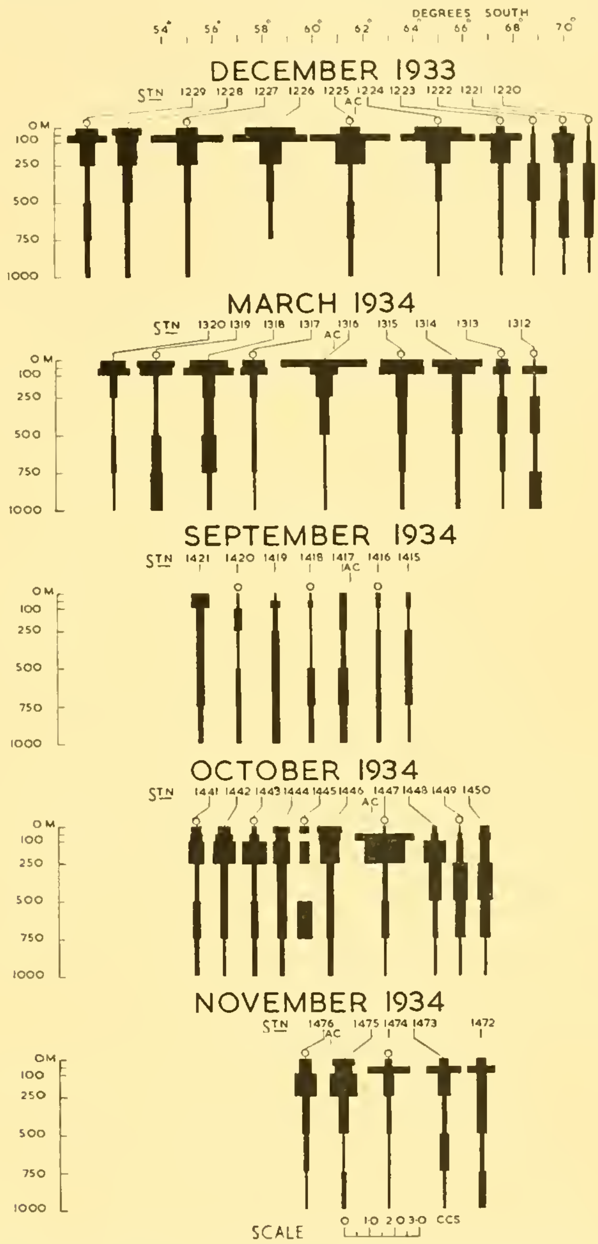

Fig. 3. Vertical distribution of the standing crop of zooplankton in 80° W.

Observations in 0°, 20° E *and* 80° W *in other years* (Fig. 4)

The observations in 0°, 20° E and 80° W present a more or less complete series extending over a 12-month period from which it has been possible to gain some idea of the vertical distribution of the standing crop in any one month. Conditions, however, may not be the same in different years, particularly in Antarctic regions where the presence or absence of pack ice can influence the biology of the whole area. In order to see what year to year differences are likely to occur, observations in these same meridians but from different years are plotted in Fig. 4. There are results for September 1936 in 0°, June 1936 in 20° E and October 1932 in 80° W.

The results in September 1936 compared with those in September 1938 (Fig. 1) show the distribution of the plankton to be essentially the same. In 1936 the shallower hauls gave higher volumes than in 1938, especially at sub-Antarctic stations. Antarctic St. 1813 showed a particularly large volume at 50–0 m., but over 50 per cent of this was due to thirteen amphipods, and if they were omitted the volume would be similar to that at St. 1812, and both would be similar to the 1938 Sts. 2428 and 2430. In both years the deeper hauls at Antarctic stations gave large volumes, while those in sub-Antarctic waters were larger in 1938.

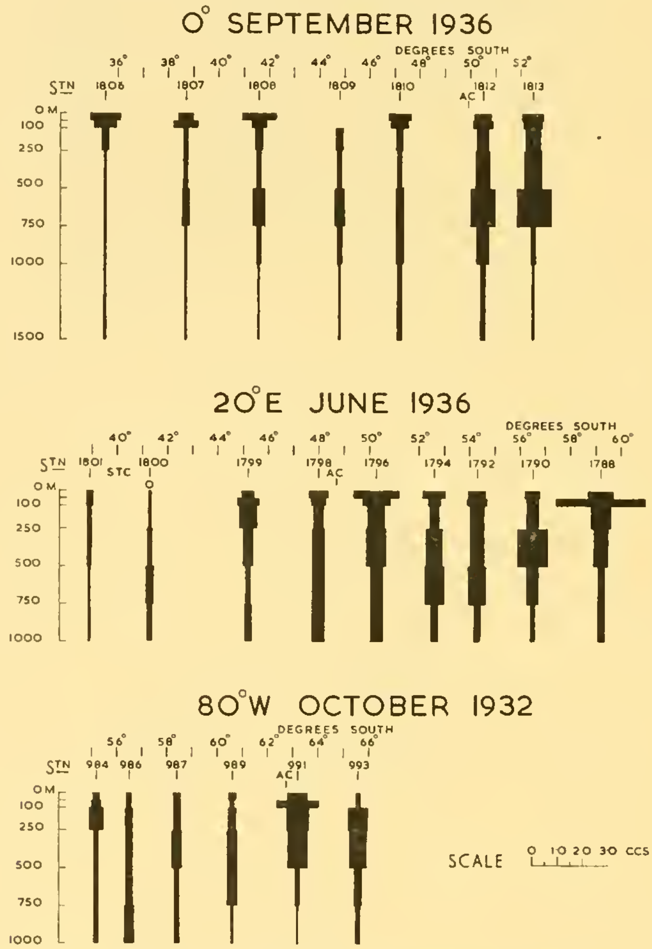

Fig. 4. Vertical distribution of the standing crop of zooplankton during September 1936 in 0°; June 1936 in 20° E; and October 1932 in 80° W.

In 20° E there are no June observations in 1938, but the 1936 series shows the presence of deep concentrations of plankton at a level intermediate between that in April and July 1938 (Fig. 2); and similarly the surface volumes were on the whole not as large as those in April but greater than those in July. The results for 1936 thus appear to fit reasonably well into the general picture presented by the 1938–39 series.

The October results for 1932 and 1934 (fig. 3) in 80° W, compare very well and show the same essential features, particularly at stations in approximately the same latitude (i.e. Sts. 984 and 1441, 991 and 1447), although the 1934 sub-Antarctic hauls were greater than those in 1932. In both years the plankton was concentrated deeper, the farther south the station.

From these three diagrams it would seem that differences from year to year are not, in these instances at least, outstanding, and if the 1932 October data had been used in the 1933–34 80° W series it would not have affected the general conclusions for that meridian. This is of some importance, because the lack of data has made it necessary to select the monthly series of stations in other regions, from different years, in an attempt to show that the vertical movement of the plankton is a general phenomenon in the whole of the sub-Antarctic and Antarctic regions and is not just peculiar to 80° W, 0° or 20° E. As previously mentioned (p. 196), the number of observations in other areas is very small, but they are sufficient to allow for a comparison with observations from 80°, 0° and 20° in similar months.

Observations in other areas (Fig. 5)

20° W. The observations in 20° W were not extended into sub-Antarctic waters, but they are of particular interest because they sampled an area of the Southern Ocean greatly influenced by the Weddell Drift. This current of surface water originating in the Weddell Sea has been found to play an important part in the biology of *Euphausia superba*, an animal in which it is immensely rich (Marr, personal communication). Except in its young stages this animal is too large and active to be caught regularly by the N70V, so that the volumes from stations in this region represent the standing crop of zooplankton other than the older krill.

The January 1932 volumes were similar to those from other regions, and showed a rather irregular vertical distribution of plankton but with the bulk concentrated in the top 100 m. of water at most stations. The March 1937 volumes seem typical of that month in other areas, with very large concentrations of plankton in the Antarctic surface water.

110° E. These stations cover an area south of Australia from Fremantle, and they sample subtropic, sub-Antarctic and Antarctic waters. The May 1932 results indicated late autumnal conditions, with larger hauls below 250 m., particularly at stations just north and south of the Antarctic convergence, while the northernmost sub-Antarctic and the southernmost Antarctic stations show large shallow hauls. On the whole the conditions were not so advanced as in June in other areas.

March-April 1936 and January 1938 compare well with the same months in other areas.

160° E. The stations cover an area south of New Zealand. In June 1932 the volumes were small at all depths, with some indication of greater concentration in deeper water at St. 919 in the Antarctic. The volumes in February 1936 and January 1938 were typical of summer months in other regions, with most of the plankton concentrated in the surface waters. Of particular note are the exceptionally large 50–0 and 100–50 m. catches in February.

These rather fragmentary observations in the region of 20° W, 110° E and 160° E are not sufficient to give a seasonal picture of the variations of standing crop in each particular area, but when compared with results from 0°, 20° E and 80° W, they do show that in comparable months the general pattern of vertical distribution throughout those regions of the Southern Ocean which have been examined is the same.

The meridian of 90° E, 1951 (Fig. 6)

The Indian Ocean results are considered separately because they are the only available meridional line of observations in tropical waters, and while a seasonal comparison is impossible they are yet of special interest in relation to the sub-Antarctic and Antarctic data.

The volume measurements (corrected for difference in net dimension (see p. 195)) show that the bulk of the plankton was in the upper 100 m. of water at all stations. There appeared to be little difference between the catches at sub-tropical and tropical stations, but compared to October volumes in sub-Antarctic and Antarctic waters the volumes of hauls at all depths were small. Of particular note is the uniformity of the results—the vertical distribution of the plankton and the catch at each depth being about the same from station to station.

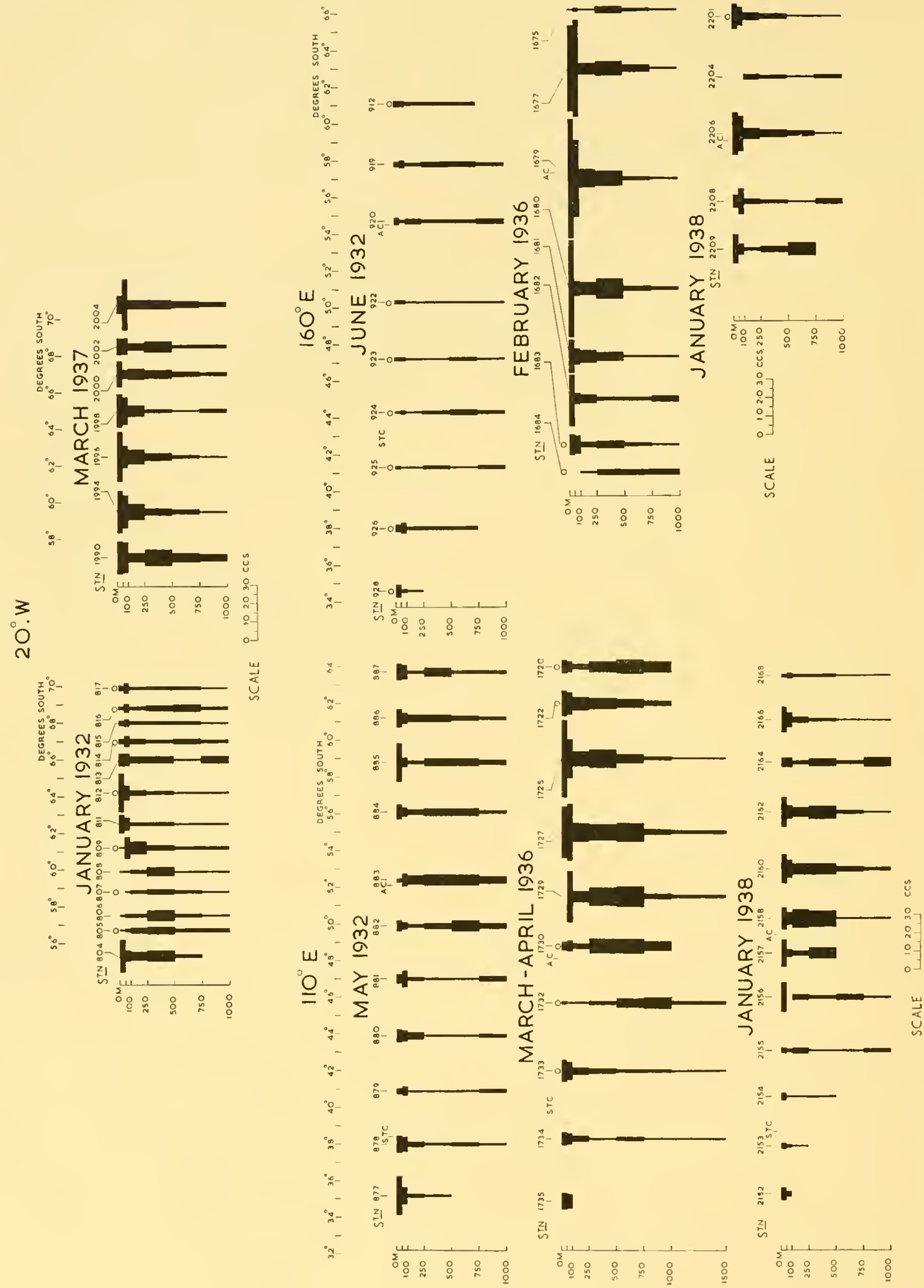

Fig. 5. Vertical distribution of the standing crop of zooplankton during 2 months near the meridian of 20° W, and during 3 months near the meridians of 110° W and 160° W.

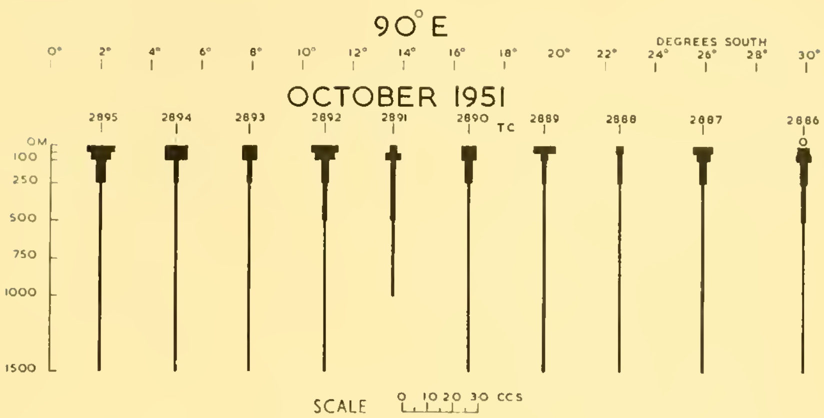

Fig. 6. Vertical distribution of the standing crop of zooplankton during October 1951, in 90° E.

AVERAGE MONTHLY VARIATIONS IN THE SUB-ANTARCTIC AND ANTARCTIC

Consideration of the individual lines of observations shows that it is reasonable to assume that in any one month the vertical distribution of the standing crop of zooplankton throughout the Southern Ocean will, on the whole, be the same. It is thus possible, by grouping observations from all areas according to month, to gain a general idea of the variations that take place in the quantity of sub-Antarctic and Antarctic zooplankton from month to month in an average year. Table 3 gives the mean monthly volume of plankton per 50 m. haul, together with the number of observations, at all depths down to 1000 m. in the sub-Antarctic and Antarctic zones. Results for the 1500–1000 m. horizon are not given owing to the inadequacy of the data; nor, for the same reason, can mean values be assessed from the few observations in sub-tropical waters. Fig. 7 is based on the data given in Table 3, and as in the previous diagrams, concentration of plankton is equivalent to width, and quantity to area of the block at each depth interval.

It should be pointed out that in this and all subsequent diagrams involving average values, it has been necessary to use observations from day and night stations, and possible variations in the vertical distribution of the plankton due to the effects of diurnal migration have been ignored. This seemed justifiable, at least in the case of sub-Antarctic and Antarctic data, because the results from those lines in which day and night stations occur, particularly those in 80° W, show no large or constant differences in the relative vertical distribution of the quantities of plankton caught.

This is not surprising since it has been shown (Mackintosh, 1937) that the three commonest organisms sampled by the N70V at least in 80° W, *Rhincalanus gigas*, *Eukrohnia hamata* and *Calanus acutus*, accomplish no diurnal but only seasonal migrations. Moreover, these species in adult form are relatively large, whereas the most common species showing diurnal variation in its vertical distribution, *Pleuromamma robusta*, is a copepod of small individual size. Hardy & Gunther (1935) also found *Calanus simillimus* and *Metridia gerlachii* to be diurnal migrants, but they are also small. Of the larger forms the euphausiids *Euphausia triacantha*, *E. vallentini* and *E. frigida* are known to be influenced by daylight (Hardy & Gunther, 1935; Mackintosh, 1937), but as adults they are all relatively uncommon in N70V net hauls. Obviously the importance of such animals volumetrically, and hence their relative importance as components in the total standing crop of plankton, is very variable, being influenced by many factors, including latitude, longitude, stage in life history, etc. As far as can be seen from the limited data available, however, diurnal variation seems to play only a minor part in directing the gross vertical distribution of the plankton, at least in sub-Antarctic and Antarctic plankton. In the tropics and sub-tropics diurnal variations are probably more important, as was found by King & Demond (1953) in the Central Pacific where shallow night hauls gave consistently larger volumes than the day ones. In this respect it is interesting to note that the variations due to time of day did not mask the major variations, which were latitudinal.

Table 3. *The monthly variation in the mean concentration (i.e. volume per 50 m. of haul) at six depth intervals in the sub-Antarctic and Antarctic. Numbers of observations are given in brackets*

Zone	Depth (m.)	January	February	March	April	May	June
Sub-Antarctic	50–0	0·94 (10)	2·42 (18)	1·84 (8)	0·60 (5)	0·72 (10)	0·34 (8)
	100–50	0·79 (9)	0·96 (18)	1·63 (8)	0·52 (5)	0·58 (11)	0·34 (8)
	250–100	0·36 (10)	0·54 (18)	0·48 (9)	0·31 (5)	0·23 (11)	0·23 (8)
	500–250	0·29 (10)	0·41 (18)	0·34 (9)	0·25 (5)	0·25 (11)	0·27 (7)
	750–500	0·32 (8)	0·34 (18)	0·33 (9)	0·37 (5)	0·26 (10)	0·29 (7)
	1000–750	0·25 (7)	0·22 (17)	0·27 (9)	0·24 (5)	0·21 (11)	0·26 (7)
Antarctic	50–0	0·89 (31)	1·73 (14)	1·93 (32)	2·12 (25)	1·00 (5)	0·63 (12)
	100–50	0·77 (32)	1·45 (16)	1·37 (38)	1·12 (25)	0·62 (5)	0·69 (12)
	250–100	0·47 (33)	0·44 (18)	0·54 (38)	0·47 (27)	0·32 (5)	0·36 (12)
	500–250	0·39 (33)	0·46 (19)	0·54 (37)	0·59 (29)	0·44 (5)	0·44 (12)
	750–500	0·19 (33)	0·25 (19)	0·41 (36)	0·49 (28)	0·39 (5)	0·46 (12)
	1000–750	0·15 (32)	0·15 (18)	0·24 (37)	0·22 (28)	0·28 (5)	0·29 (10)
Zone	**Depth (m.)**	**July**	**August**	**September**	**October**	**November**	**December**
Sub-Antarctic	50–0	0·47 (9)	0·37 (6)	0·55 (11)	0·71 (17)	1·28 (6)	0·99 (8)
	100–50	0·52 (9)	0·68 (6)	0·46 (12)	0·71 (16)	0·63 (6)	2·03 (8)
	250–100	0·27 (9)	0·31 (6)	0·26 (13)	0·60 (17)	1·13 (6)	0·75 (7)
	500–250	0·38 (8)	0·35 (6)	0·22 (13)	0·37 (16)	0·32 (6)	0·35 (7)
	750–500	0·59 (9)	0·45 (6)	0·38 (14)	0·41 (15)	0·26 (6)	0·26 (8)
	1000–750	0·38 (8)	0·25 (6)	0·20 (13)	0·23 (15)	0·13 (6)	0·15 (7)
Antarctic	50–0	0·49 (9)	0·75 (11)	0·54 (8)	0·37 (10)	0·52 (6)	0·96 (11)
	100–50	0·67 (9)	0·41 (11)	0·43 (8)	0·72 (10)	1·43 (6)	1·65 (11)
	250–100	0·37 (9)	0·32 (11)	0·30 (8)	0·72 (10)	0·59 (6)	0·59 (11)
	500–250	0·70 (9)	0·48 (11)	0·51 (8)	0·58 (10)	0·32 (6)	0·53 (11)
	750–500	0·77 (8)	0·58 (10)	0·94 (6)	0·39 (10)	0·26 (6)	0·29 (11)
	1000–750	0·52 (8)	0·32 (9)	0·41 (6)	0·19 (10)	0·19 (6)	0·14 (11)

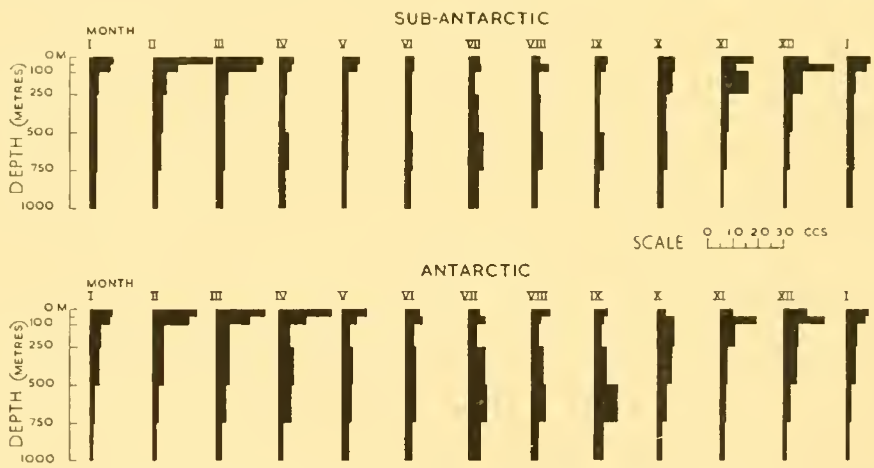

Fig. 7. Monthly mean vertical distribution of the standing crop in the sub-Antarctic and Antarctic. The number of observations and the mean concentration of plankton at each depth are given in Table 3.

Fig. 7 illustrates very clearly the seasonal variations that occur in the vertical distribution of the standing crop of plankton. In the winter months of July and August, and the early spring month of September, the bulk of the plankton is concentrated below 250 m., particularly in the Antarctic zone.

With the development of spring and then summer, the level of greatest concentration gets nearer the surface. In the Antarctic it is between 250 and 100 m. in October, and between 100 and 50 m. in November and January; and by late summer and autumn it lies between 50 m. and the surface. A similar sequence of vertical movement is also evident in the sub-Antarctic, although the winter concentration in deep water does not appear to be so marked as that in the Antarctic.

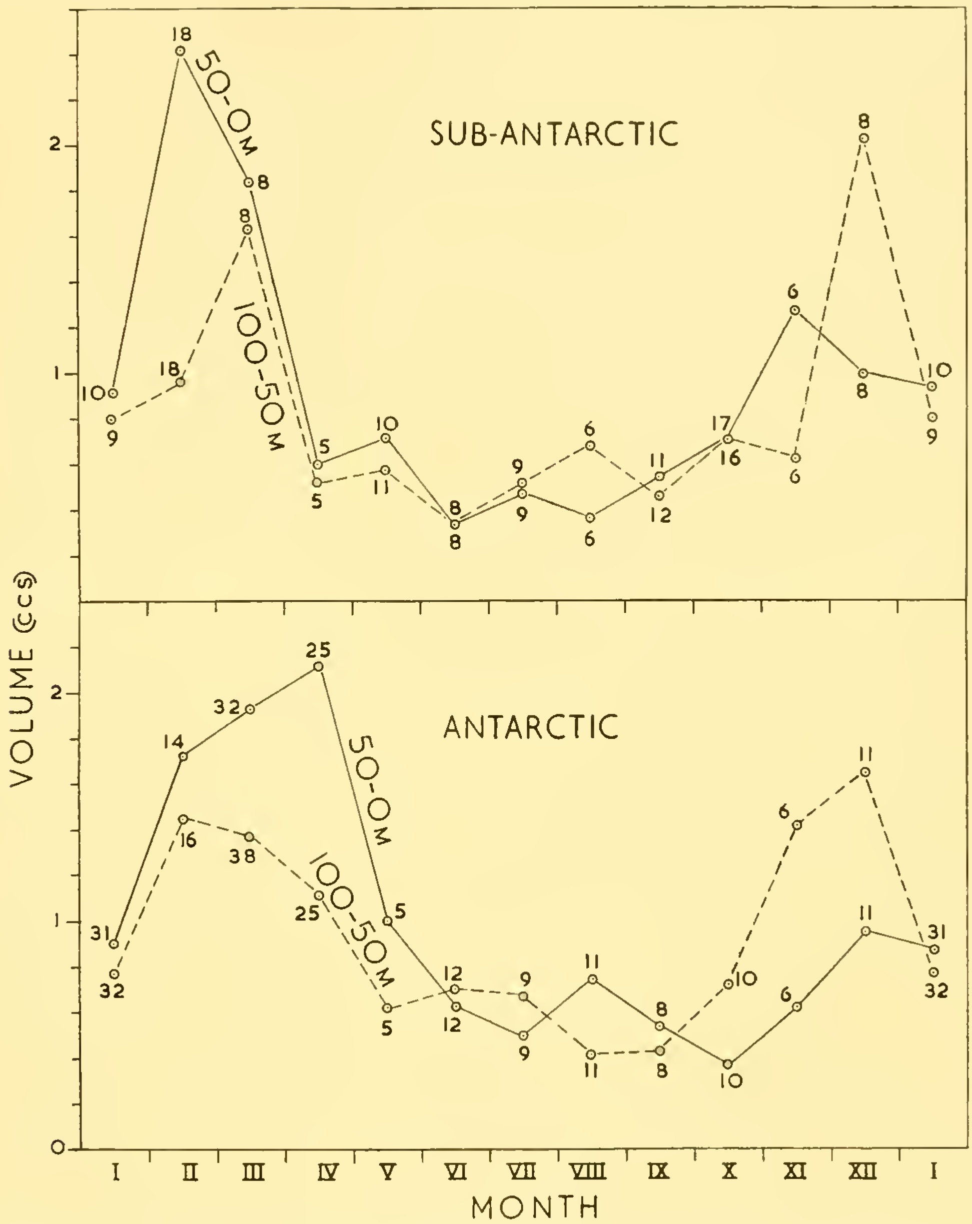

Fig. 8. Seasonal variation in the mean concentration of zooplankton in the 100–50 m. and 50–0 m. horizons of sub-Antarctic and Antarctic surface water. The numbers on each curve refer to the number of observations in each month.

From Fig. 7 and Table 3 it is also clear that the largest seasonal fluctuations in plankton density take place in the surface waters, which of course are the seat of phytoplankton production. The degree of seasonal variation is better illustrated in Fig. 8, where the mean monthly volumes of the 50–0 and 100–50 m. hauls have been plotted graphically. The highest summer mean volume is about seven times as great as the lowest winter mean volume in the sub-Antarctic, and about six times as great in the Antarctic at the 50–0 m. level. In both zones there are two main periods of increase, the first in spring reaching its maximum at the 100–50 m. level and the second in autumn at the 50–0 m.

level. The second period of increase is apparently the greatest, although in the sub-Antarctic this may be due to a single very large volume of 10·5 cc. for the 50–0 m. sample at St. 2219.

Table 4. *The monthly variation in the mean total volume of plankton (i.e. the sum of all measurements from 1000 to 0 m.). Numbers of observations are given in brackets*

Zone	January	February	March	April	May	June
Sub-Antarctic	7·03 (6)	10·15 (17)	9·44 (8)	6·36 (5)	5·72 (10)	5·51 (7)
Antarctic	6·86 (30)	9·18 (14)	10·33 (31)	12·37 (23)	8·14 (5)	8·93 (10)
Zone	**July**	**August**	**September**	**October**	**November**	**December**
Sub-Antarctic	8·61 (7)	7·25 (6)	5·78 (10)	8·28 (14)	8·87 (6)	8·92 (5)
Antarctic	13·11 (7)	9·17 (9)	11·60 (6)	9·07 (10)	7·53 (6)	9·25 (11)

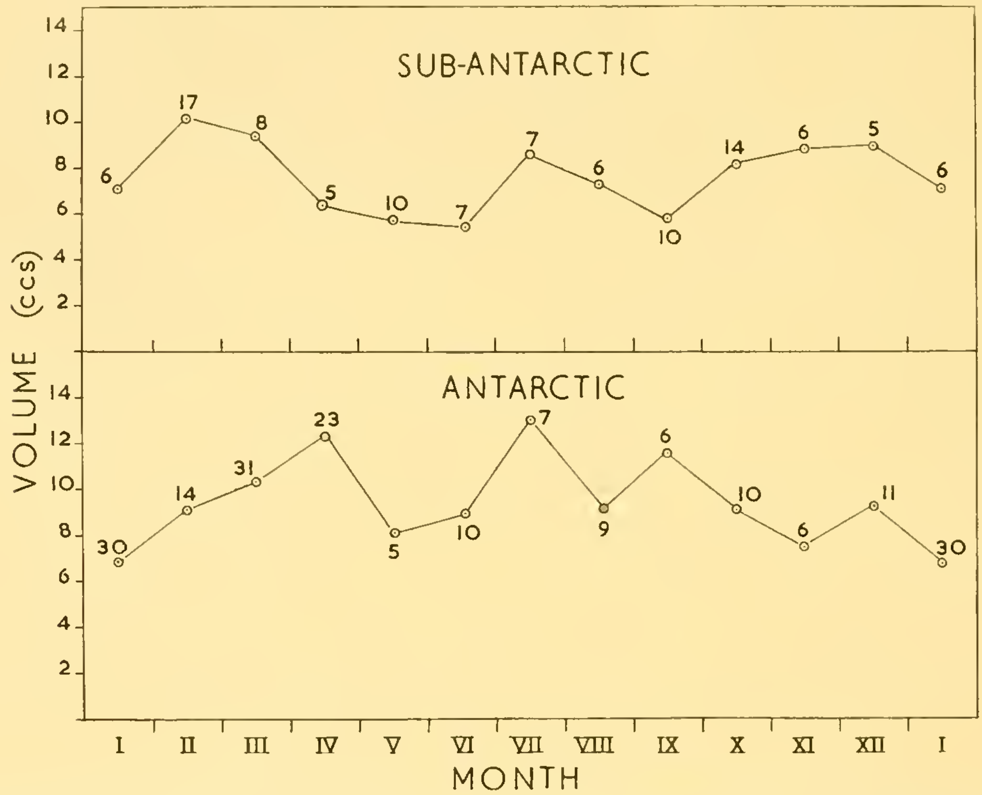

Fig. 9. Seasonal variation in the mean total volume of zooplankton in the whole water column sampled (i.e. 1000–0 m.) in the sub-Antarctic and Antarctic. Numbers on each curve as in Fig. 8.

It will be remembered that in calculating the monthly mean volumes for each depth interval the actual measurements had to be corrected to give the volume for a standard haul of 50 m. In this way variations in concentration at different levels in the whole water column can be assessed. When, however, the individual measurements at each depth are added together the resultant volume is a measure of the total standing crop of plankton in the whole water column sampled. Table 4 gives the mean monthly total volumes together with the number of observations in each month in the sub-Antarctic and Antarctic zones. It is compiled from all stations with a complete series of measurements from 1000 to 0 m., and the results are shown in Fig. 9.

The monthly mean volumes show that, compared to the surface waters, there is relatively little seasonal variation in the total volume of plankton, particularly in the Antarctic, where the July (mid-winter) volume is as great as that in April. A similar, but less marked, increase is also seen in the sub-Antarctic.

This rather unexpected result is due, without doubt, to the winter concentration of plankton in the Warm Deep Current between 1000 and 500 m., which represents a depth horizon much deeper than that of the Antarctic surface layer, which on an average extends to a depth of about 200 m.

These and the previous results discussed in this section show that in the Antarctic and to a lesser extent the sub-Antarctic there is an extensive winter vertical movement of plankton into the southerly flowing warm deep current. In this way the plankton which has summered in the northerly drifting Antarctic surface water is returned to the southward part of its environment.

For this reason the Antarctic and to a lesser extent the sub-Antarctic winter standing crop of zooplankton may be as large as the summer crop, though distributed through a greater depth of water. It should be noted, however, that in summer the zooplankton is associated with a period of great and rapid phytoplankton growth, and so the overall rate of grazing and zooplankton production is high. But in winter, when phytoplankton production is at a minimum and the bulk of the zooplankton is deep down and below the depleted euphotic zone, it is probable that zooplankton production is very slow and possibly at a standstill.

REGIONAL VARIATIONS IN THE STANDING CROP OF ZOOPLANKTON

VARIATIONS WITH LATITUDE AND TEMPERATURE

For a thorough comparison of the relative quantities of plankton in different latitudes the ideal material would include a series of meridional observations, extending from the equator to the ice-edge and repeated through the seasons. Although no such complete observations exist it is at least possible, by combining all the present data irrespective of longitude, to gain a very general idea of the major variations.

Fig. 10 shows the mean latitudinal variation at 5° intervals in the total quantity of plankton in the whole water column sampled, i.e. 1000–0 m.; it shows also the variation in the quantity of plankton in the upper 100 m. of water. The mean volumes and the number of observations in each group are given in Table 5, which takes into account 2171 of the total number of samples.

It is convenient to consider the upper 100 m. separately, since it has been shown in the previous section that the greatest seasonal changes in concentration occur in this layer. The values have been arrived at by averaging the sum of the 50–0 and 100–50 m. volumes at each station. In order to allow for these seasonal changes the data are treated in two seasonal groups: the summer group, November to April, representing the period of major increase in surface plankton concentration; and the winter group, May to October, the period of minimal surface concentration.

The 1000–0 m. values, as in the previous section, are found by summing the individual measurements of all samples between 1000 m. and the surface at those stations where a complete series exists.

As there are only ten stations between 0° and 30° S (Sts. 2886–2895) they have been omitted, and the range of observations covers sub-tropic, sub-Antarctic and Antarctic waters. Fig. 10 shows that except for the 100–0 m. winter volumes there is a gradual increase in average volume from low to high latitude reaching a maximum between 50° and 55° S, which is about four times greater than the average volume for 30–35°. This is followed, as one approaches the ice-edge, by a reduction to a volume between 65° and 70° S which is about half that between 50° and 55° S.

In summer the average quantity of plankton between 100 and 0 m. is a reflexion of the variation in the total quantity of plankton between 1000 and 0 m., which, of course, is consistent with the fact that in summer the bulk of the plankton is concentrated near the surface. In winter, however, there is no great latitudinal variation in the upper layer, and this is in contrast to the marked variation,

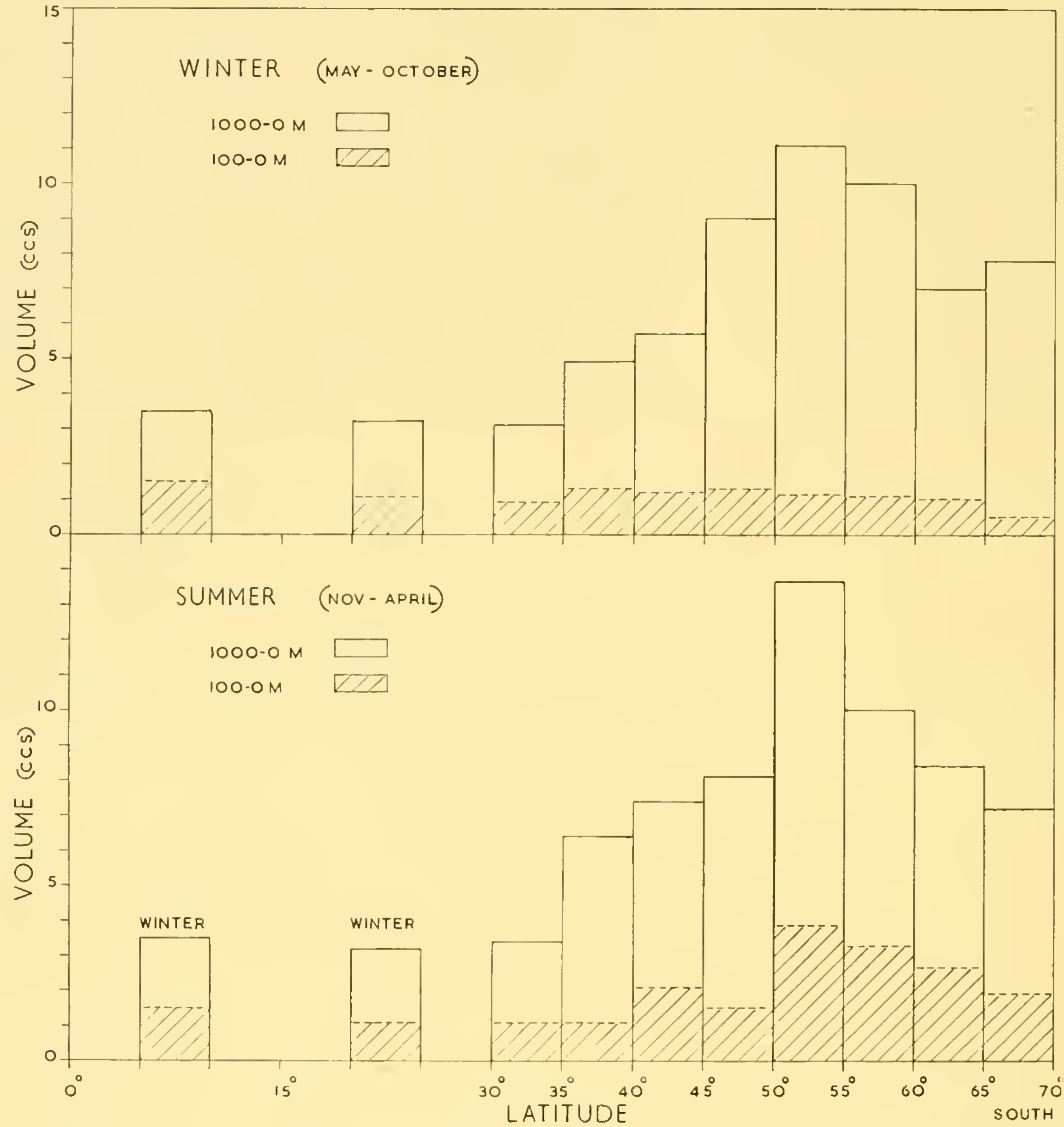

Fig. 10. Comparison of the mean quantities of zooplankton in different latitudes in winter and summer. Results are given for the 100–0 m. horizon and for the whole water column sampled (1000–0 m.). No summer observations are available between 0° and 30° S. Numbers of observations are given in Table 5.

similar to that in summer, of the total volume of plankton. This again is undoubtedly due to the seasonal vertical variation that occurs in the distribution of the plankton, the bulk of it being concentrated below 250 m. in winter, more particularly in the Antarctic but also in the sub-Antarctic.

The presentation of the data in the form of Fig. 10 has the disadvantage that it gives no indication of the range of variation in individual volume that occurs between the arbitrary latitudinal limits. In Fig. 11 all the individual total volumes from each station (i.e. 1000–0 m.) have been plotted according to their actual latitude in the form of a scatter diagram, and the latitudinal range has been

Table 5. *The variation according to latitude of the mean total volume (i.e. the sum of the measurements of all hauls between* 1000 *m. and the surface), and the mean volume in the upper* 100 *m. (i.e. the sum of the* 50–0 *m. and* 100–50 *m. measurements) in winter and summer. Numbers of observations are given in brackets*

[*Note.* Two groups of 15° interval cover the range 0–30° S; all other groups are in intervals of 5°.]

Season	Depth (m.)	Latitude (° S)				
		0–15	15–30	30–35	35–40	40–45
Winter (May–Oct.)	1000–0	3·48 (5)	3·22 (5)	3·10 (8)	4·86 (12)	5·71 (16)
	100–0	1·50 (5)	1·06 (5)	0·87 (11)	1·30 (15)	1·19 (18)
Summer (Nov.–Apr.)	1000–0	—	—	3·37 (7)	6·40 (6)	7·38 (14)
	100–0	—	—	1·08 (10)	1·08 (8)	2·09 (16)
		45–50	50–55	55–60	60–65	65–70
Winter (May–Oct.)	1000–0	9·03 (17)	11·11 (23)	9·95 (25)	6·96 (12)	7·80 (3)
	100–0	1·31 (19)	1·15 (27)	1·11 (28)	1·04 (15)	0·53 (3)
Summer (Nov.–Apr.)	1000–0	8·07 (18)	13·65 (27)	9·98 (42)	8·36 (36)	7·20 (25)
	100–0	1·53 (20)	3·85 (28)	3·25 (46)	2·65 (38)	1·93 (25)

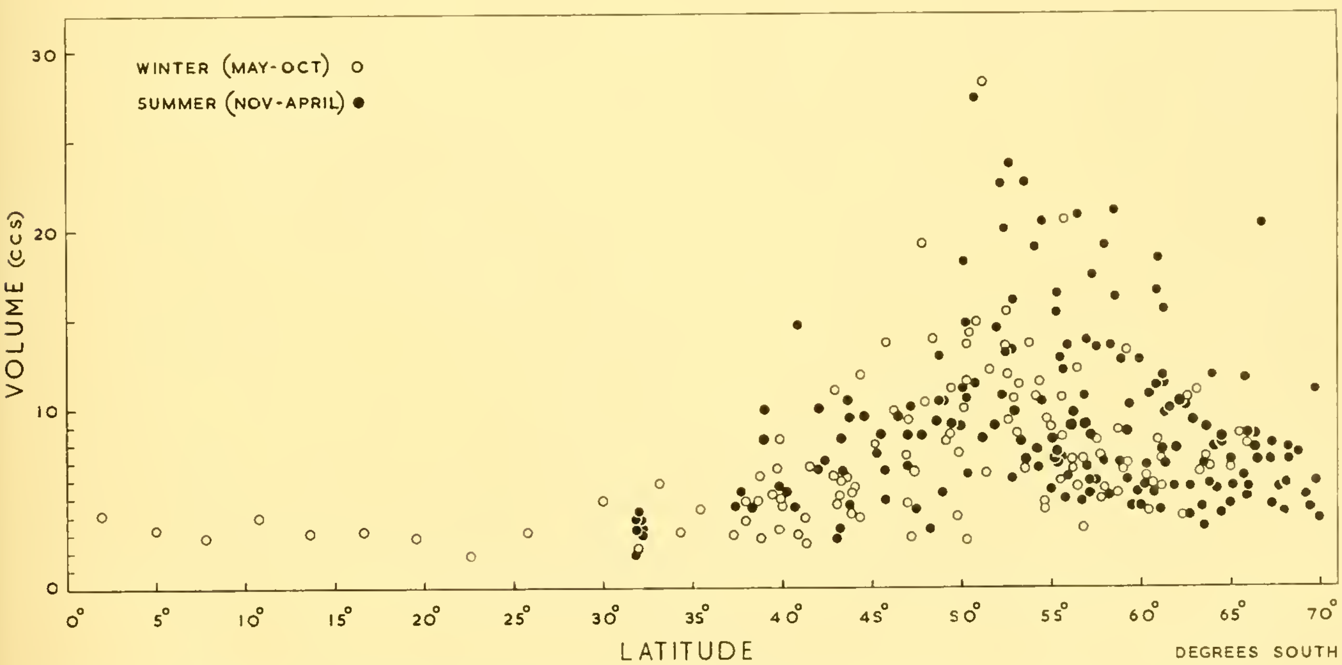

Fig. 11. Individual total volumes (i.e. 1000–0 m.) at each station plotted according to the latitude of the station. A few observations have had to be omitted for clarity.

extended from equator to ice-edge by the inclusion of the results from Sts. 2886–2895 in the Indian Ocean. It is apparent from the diagram that the greatest variation in volume occurs between 50° and 55° S, the highest latitudes being remarkable for the smallness of the catches and the lowest latitudes for the lack of variation in the individual volumes. In spite of the fact that there are so few observations north of 35° S, their difference from those in higher latitudes is most striking. Unfortunately, these are the only N70V tropical observations available, and it may be that they cover a period of poor standing crop in these latitudes. It is interesting in this respect, however, to note that King & Hida (1954, p. 49) remark upon similar latitudinal variations in range of data from the Pacific.

As previously stated, it has been necessary to combine results from all sectors of the Southern Ocean in order to get sufficient observations in all latitudes. The hydrology of the area is such that

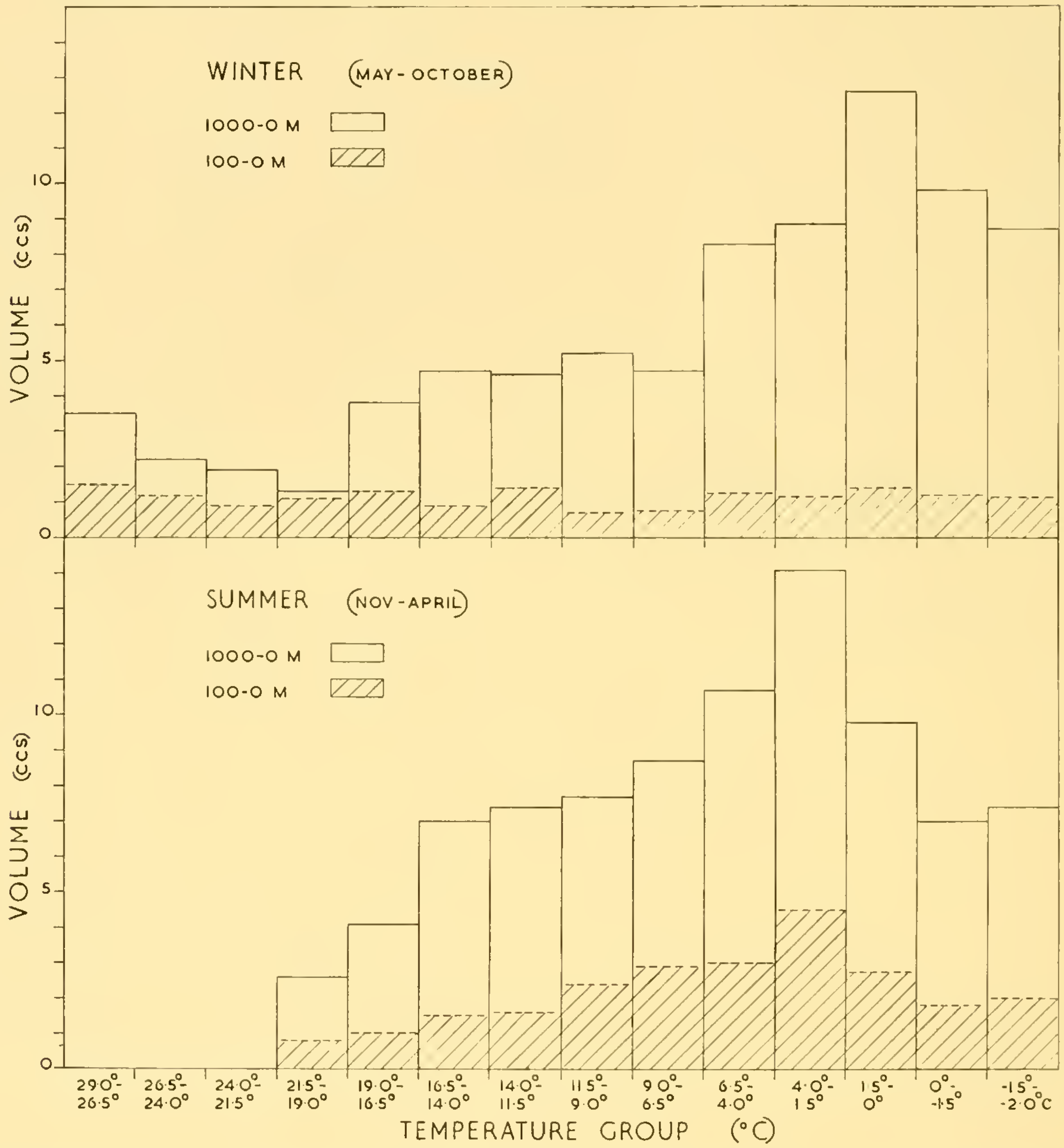

Fig. 12. Comparison of the mean quantities of zooplankton between arbitrary temperature limits in winter and summer. Results are given for the 100–0 m. horizon and for the whole water column sampled (1000–0 m). The temperature is the mean at each station for the 100–0 m. horizon. Numbers of observations are given in Table 6.

latitude is not a very realistic scale on which to compare volumes, since the position of the Antarctic Convergence—which is for many planktonic species a major influence upon their distribution—varies in such a manner that two stations in the same latitude but in different longitudes may be in quite different water masses or temperature zones. Thus in the meridian of 80° W St. 989 is 60° 38·6′ S, while in the meridian of 0° St. 2320 is 61° 10·6′ S; both are in the same approximate latitude, but the former is sub-Antarctic with a surface temperature of 3·43° C, while the latter is Antarctic with a surface temperature of 0·77° C. Any comparison of results from these two stations on a latitudinal basis would thus be misleading.

Variations in the 100–0 m. volumes are being considered, and the mean temperature of this layer at the time of sampling suggests itself as a more realistic scale on which to compare volumes, since it gives a more direct indication of the type of water from which the plankton came.

The observations previously presented in Figs. 10 and 11, have therefore been replotted in Fig. 12, based on Table 6, according to arbitrary temperature groups. The ten Indian Ocean stations which, although they cover a latitudinal range of nearly 30°, only cover a temperature range of 12° C, have been included in the winter observations. It will be noted that the temperature groups from 29·0 to 1·5° C are in intervals of 2·5° C, while the colder temperature groups are equivalent to an interval of 1·5° C. This adjustment seemed necessary owing to the great number of measurements from Antarctic waters which cover a relatively small temperature range (4·0 to −2·0° C, approximately) compared to sub-Antarctic waters (14·0–4·0° C approximately). The average volumes and the number of observations in each temperature group are given in Table 6.

Table 6. *The mean volume of plankton in the whole water column* (1000–0 *m.*) *and in the upper* 100 *m.* (100–0 *m.*) *between arbitrary temperature limits in winter and summer. Numbers of observations are given in brackets*

[*Note.* The temperatures are the mean temperatures for the 100–0 m. layer at each station.]

Season	Depth (m.)		Temperature (mean 100–0 m. ° C)						
			29·0 to 26·5	26·5 to 24·0	24·0 to 21·5	21·5 to 19·0	19·0 to 16·5	16·5 to 14·0	14·0 to 11·5
Winter (May–Oct.)	1000–0	Mean volume	3·48 (5)	3·2 (1)	2·90 (4)	2·32 (4)	3·79 (7)	4·73 (3)	4·60 (7)
	100–0	Mean volume	1·50 (5)	1·2 (1)	0·87 (4)	1·06 (8)	1·27 (7)	0·88 (5)	1·40 (8)
Summer (Nov.–Apr.)	1000–0	Mean volume	—	—	—	2·60 (2)	4·06 (7)	6·96 (5)	7·36 (5)
	100–0	Mean volume	—	—	2·60 (1)	0·84 (5)	1·03 (7)	1·46 (7)	1·57 (6)

Season	Depth (m.)		Temperature (mean 100–0 m. ° C)						
			11·5 to 9·0	9·0 to 6·5	6·5 to 4·0	4·0 to 1·5	1·5 to 0	0 to −1·5	−1·5 to −2·0
Winter (May–Oct.)	1000–0	Mean volume	5·21 (10)	4·70 (7)	8·31 (19)	8·85 (20)	12·63 (6)	9·83 (23)	8·67 (10)
	100–0	Mean volume	0·70 (10)	0·73 (8)	1·25 (22)	1·15 (22)	1·42 (10)	1·19 (25)	1·15 (11)
Summer (Nov.–Apr.)	1000–0	Mean volume	7·68 (11)	8·71 (13)	10·72 (17)	14·05 (29)	9·78 (30)	7·01 (41)	7·38 (15)
	100–0	Mean volume	2·39 (12)	2·91 (14)	2·99 (20)	4·47 (30)	2·74 (30)	1·84 (44)	1·98 (15)

From Fig. 12 it is seen that as the temperature of the water decreases the quantity of plankton in the whole water column and, except in winter, in the upper 100 m. of water increases. In summer a maximum is reached at temperatures between 4·0° and 1·5° C which is about six times the volume at temperatures between 21·5° and 19·0° C. There is a decrease in volume in waters colder than 1·5° C, but not to as low a value as the warmest temperature groups.

The winter 1000–0 m. volumes, which include the observations in 90° E, show that the colder waters are still the richest, although the maximum now occurs at temperatures between 1·5° and 0° C, owing no doubt to the seasonal cooling of the water. Apart from this there seems little seasonal change in total volume in waters colder than 4° C. In the warmer temperature groups, however, the total volume appears to be less in winter.

Comparison of Fig. 10 with Fig. 12 shows that the outstanding feature of each is that the maximum standing crop does not occur in the highest latitudes or at the lowest temperatures but in waters between 50° and 55° S (Fig. 10) and at a temperature of 4–0° C (Fig. 12).

This decrease might seem remarkable in view of the abundance of life in the colder Antarctic waters, but it will be remembered that *Euphausia superba* above 20 mm. in length are excluded from the volume measurements simply because, for all practical purposes, they are not sampled by the N70V. Except for the northerly region of the Weddell drift between 60° and 30° W, this species is abundant only in high latitudes and it has no counterpart farther north. If the volume of organic matter which it represents, as an element in the plankton, could properly be superimposed on the histograms in Figs. 10 and 12, there would probably be further increase up to the highest latitudes

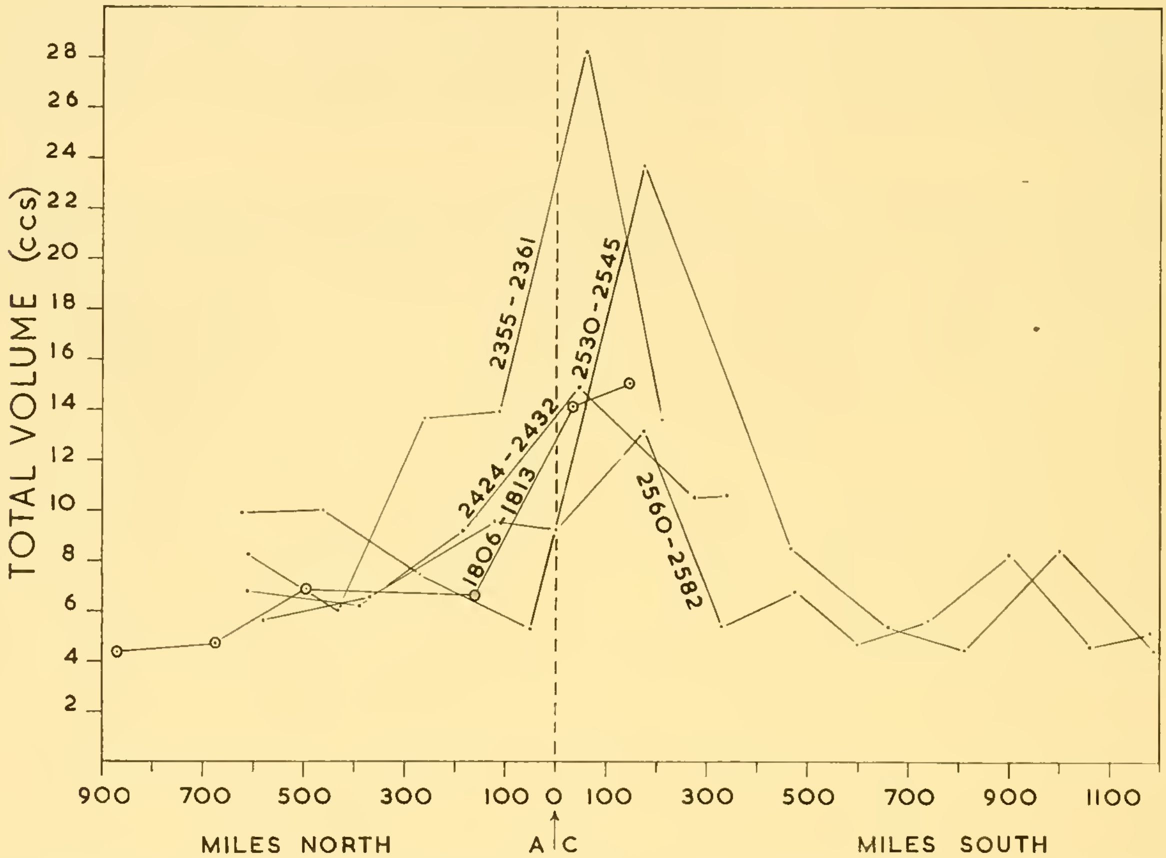

Fig. 13. The total volume at five series of stations in the meridian of 0° plotted according to the distance (in nautical miles) of the station north or south of the Antarctic Convergence. The serial numbers of the stations are shown.

and coldest waters. As an example of the remarkable concentrations of krill that do occur in those latitudes one can refer to observations made at sea; at St. WS 540 (57° 55′ S and mean temp. −0·23°C) in the Weddell Drift, for instance, a horizontal tow with a 1 m. net (N 100 H) in 36 sec. caught 13 litres (approximately) of krill. This represents a volume of plankton far greater than that of any other sample measured in this work.

While the importance of krill should not be underestimated in relation to the total standing crop of plankton in high latitude waters, it is also possible that the maximum shown in Fig. 10 between 50° and 55° S is due to the northerly drift of Antarctic surface water.

The Antarctic Convergence was crossed on forty-one occasions by the present series of observations, and 53° 20′ S—the average of its position on each occasion—lies within the area of maximum standing crop as represented in Fig. 10. It has already been noted, in the section on seasonal variations, that the largest catches are very often those at stations just south of the Antarctic Convergence.

Fig. 13 shows the total volume (1000–0 m.) at stations on five lines of observation in the meridan of 0° plotted according to their estimated position north or south of the convergence. The position of the Antarctic Convergence in each case was taken from Mackintosh (1946), and the distances are expressed in nautical miles. From the diagram it is evident that on each line there was a most marked increase in volume in a region 0–200 miles south of the Convergence. It is of interest that in the meridian of 0° there is a second smaller increase (900 miles south of the convergence) which occurs in the East Wind Drift. There are also instances of plankton concentrations near the Antarctic Convergence in other sectors, notably in 80° W at Sts. 991, 1224 and 1447; in 20° E at St. 2481; and in 160° E at St. 2206.

These increases in concentration occur in latitudes well north of those areas which have yielded the greatest catches of krill (Marr, personal communication), and in view of the fact that the Antarctic surface current moves gradually northwards the presence of large concentrations of plankton in the northern part of the Antarctic zone is consistent with the passive drift of plankton in this layer, in which it is concentrated in the summer months.

Table 7. *The mean concentration (i.e. vol. per 50 m. haul) at all depths sampled and the mean total volume (i.e. 1000–0 m.) in each zone. Allowance has been made for there being different numbers of summer and winter observations, except for the tropic zone where October observations only are available. Numbers in brackets are the totals of winter and summer observations at each depth*

Zone (m.)	50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
Antarctic	1·05 (174)	0·90 (183)	0·46 (188)	0·51 (190)	0·45 (184)	0·26 (180)	0·14 (38)	9·75 (162)
Sub-Antarctic	1·06 (116)	0·83 (116)	0·46 (119)	0·32 (116)	0·36 (115)	0·23 (111)	0·16 (35)	7·96 (102)
Sub-tropic	0·63 (46)	0·43 (46)	0·22 (46)	0·16 (43)	0·15 (41)	0·12 (38)	0·05 (5)	3·75 (32)
Tropic	0·77 (6)	0·68 (6)	0·25 (6)	0·13 (6)	0·07 (6)	0·05 (6)	0·04 (5)	3·43 (6)

The present data have so far been treated in as detailed a manner as they allow. By using an even broader treatment, it is possible to arrive at a tentative estimate of the relative standing crops of plankton in the major geographical zones covered by the observations.

Table 7 gives the mean concentration of plankton (i.e. volume per 50 m. haul) for all depth intervals down to 1500 m., and the mean total quantity of plankton (1000–0 m.) in tropic, sub-tropic, sub-Antarctic and Antarctic zones. Allowance has been made for the difference in each zone of the number of summer and winter stations (except in the tropics, where only October results are available). The results are plotted in Figs. 14 and 15 respectively.

Fig. 14 shows that at all depths there is a general increase in concentration from tropic to Antarctic waters, and that in each zone the greatest concentration occurs in the shallowest depth horizon.

Fig. 15 gives an overall picture of a greater standing crop of plankton in the Antarctic than in any other region, the ratio tropic: sub-tropic: sub-Antarctic: Antarctic being roughly 1:1·3:2·7:3·3. These estimates are, of course, only tentative and refer to the limited part of the total zooplankton standing crop sampled by the N70V.

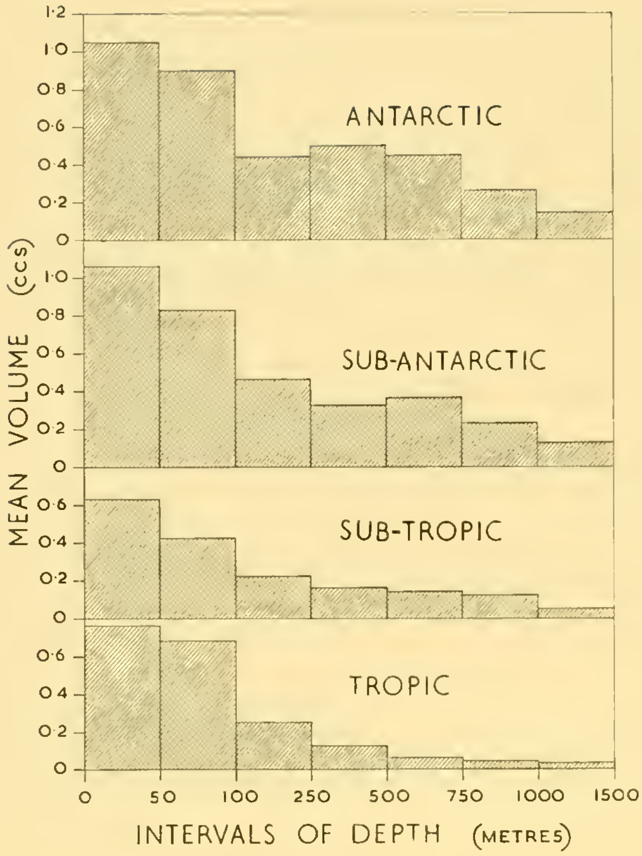

Fig. 14.

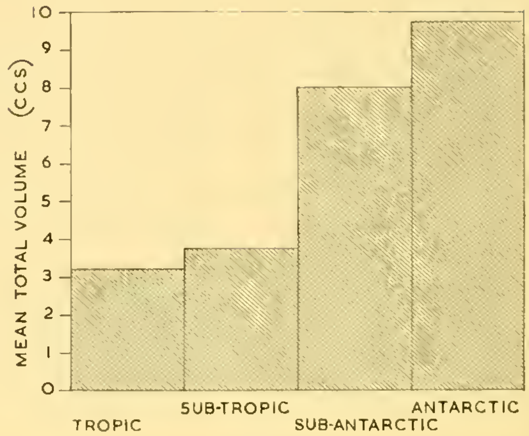

Fig. 15.

Fig. 14. Comparison of the mean concentration (i.e. volume per 50 m. haul) of zooplankton at seven intervals of depth in the Antarctic, sub-Antarctic, sub-tropic and tropic zones. This and Fig. 15 are based on results given in Table 7.

Fig. 15. Comparison of the mean total volume (1000–0 m.) in the Antarctic, sub-Antarctic, sub-tropic and tropic zones.

CIRCUMPOLAR VARIATIONS WITHIN THE ANTARCTIC ZONE

The data discussed in the previous section have shown that when the distribution of the standing crop of zooplankton is considered in a north-south direction large-scale variations are observed. These are undoubtedly related to the considerable north-south gradients that occur in the physical and chemical character of the principal water masses.

In the Southern Ocean hydrological differences in an east-west direction are small and all the main water masses, with the exception perhaps of the Antarctic Bottom Water (Deacon, 1937), have a circumpolar continuity. This is reflected, as Baker (1954) has shown, in the continuous circumpolar distribution of nearly all the commoner species of Antarctic phytoplankton and zooplankton.

Hart (1934, 1942) has shown that for the Antarctic phytoplankton there are some localized neritic areas, particularly near South Georgia, where the standing crop is exceptionally great in summer. In the Antarctic oceanic areas, however, which he provisionally divided into the Northern, Intermediate and Southern regions, the standing crop was much less, and there was little regional variation during the period of main increase. It is of some interest therefore to examine the zooplankton volumes in comparable months for any obvious regional differences within the Antarctic zone, even though the data do not allow such a detailed treatment as that of Hart (1942) or Baker (1954).

The total volume of plankton at each station (i.e. from 1000 to 0 m.), has been plotted on a circumpolar chart (Fig. 16.) together with the mean positions of the Antarctic and sub-tropical convergence and the approximate mean limits of the West Wind, Weddell, and East Wind Drifts; observations in

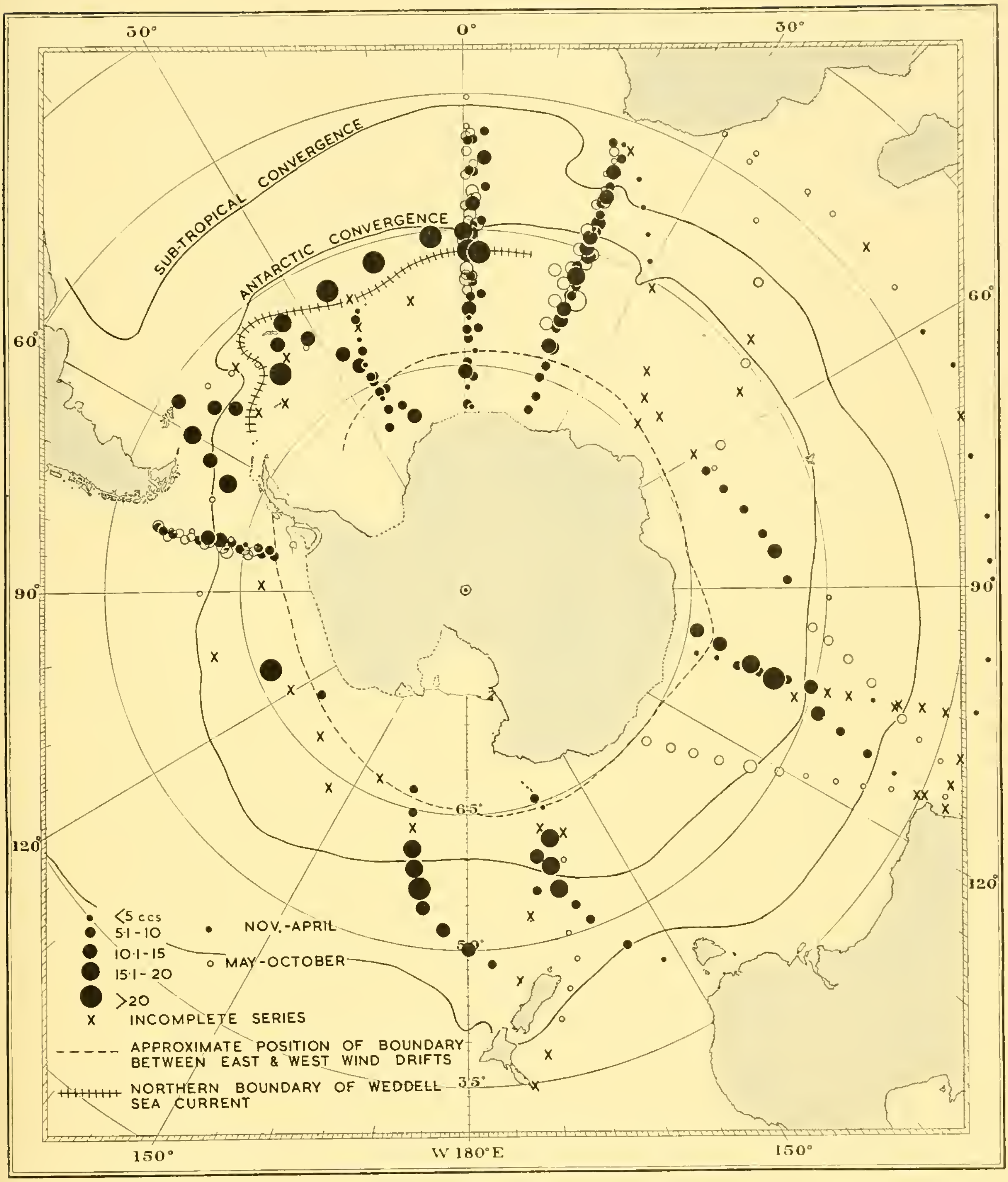

Fig. 16. The total volume of the zooplankton (1000–0 m.) at each station plotted according to the position of the station. A few observations in 0°, 20° E and 80° W have had to be omitted for clarity.

May to October are unshaded and the positions of stations with an incomplete series of hauls used elsewhere in this paper are marked with a cross.

Although there are some gaps in the observations, notably in the Pacific sector, the chart shows a number of features, some of which have been dealt with at length in previous sections. The large standing crop of plankton just south of the mean position of the Antarctic Convergence, for instance, is very evident, particularly in the Atlantic sector, and if the actual position of the convergence on each line were considered this would be more accentuated (see p. 219).

The area of Weddell Sea influence is surprisingly poor in plankton, as also is the East Wind Drift. As explained in the previous section, however, no allowance can be made for the great quantities of *Euphausia superba* which are known to occur in these regions. If this were possible it would be seen that these two surface-water drifts support perhaps the greatest concentration of plankton in the whole of the Southern Ocean.

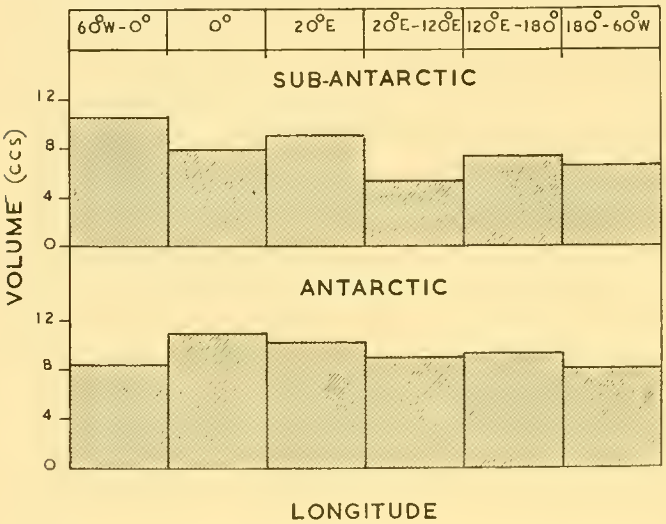

Fig. 17.

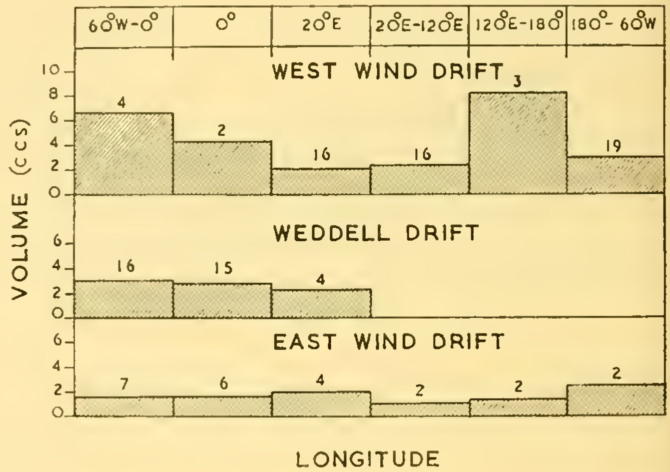

Fig. 18.

Fig. 17. Comparison of the total volume of zooplankton (1000–0 m.) in various sectors of the sub-Antarctic and Antarctic. Allowance has been made for the differences in the number of winter and summer observations in each sector.

Fig. 18. Comparison of the mean volume of zooplankton in the three principal Antarctic Surface Drifts during the main period of increase (November–April), together with the number of observations in each sector.

Table 8. *The variation in mean total volume (i.e. 1000–0 m.) between various sectors of the sub-Antarctic and Antarctic zones. Allowance has been made for there being different numbers of summer and winter observations in each sector. Total numbers of winter and summer observations in each sector are given in brackets*

	60° W–0°	0°	20° E	20–120° E	120° E–180° W	180–60° W
Sub-Antarctic	10·65 (5)	7·84 (28)	8·89 (19)	5·27 (15)	7·50 (16)	6·84 (18)
Antarctic	8·40 (28)	11·19 (35)	10·25 (36)	9·14 (20)	9·39 (12)	8·14 (31)

The mean total volume (i.e. 1000–0 m.) of plankton in different regions of the Antarctic, and also of the sub-Antarctic, are compared in Table 8, the results being represented diagrammatically in Fig. 17 (allowance has been made for the different numbers of winter and summer observations). The bulk of the observations are from the Atlantic sector and have been treated in three groups, 60° W–0°, 0° and 20° E. Data from the other areas have had to be treated in groups of larger intervals of longitude which correspond roughly to the main geographical divisions of the Southern Ocean, 20–120° E being the Indian Ocean sector, 120–180° the Australian-New Zealand sector, and 180–60° W the

Pacific sector. From the results it is apparent that there are no large-scale variations in the mean volumes in the different oceanic areas.

The presence in the Antarctic of three main surface drifts, the West Wind, East Wind and Weddell Drifts, suggests the possibility of comparing the east-west distribution of plankton within their approximate boundaries. For this purpose the volumes for the 100–0 m. horizon are more realistic since they are referable to the Antarctic surface layer (p. 200). The results for the main period of increase are given in Table 9 and Fig. 18, and show that the observations are too few to allow anything except tentative conclusions to be drawn from them. In the Weddell and East Wind Drifts there appears to be no large-scale regional variation. The results from the West Wind Drift are very irregular, and as the largest mean volumes occur between longitudes where there are few observations it is unlikely that the variations are significant. The figure shows, however, that, compared to the East Wind Drift, the quantity of plankton is greater in the West Wind Drift in all longitudes.

Table 9. *Comparison of the mean volume of plankton in the upper* 100 *m.* (100–0 *m.*) *of main surface drifts in different areas during the main period of increase* (*November–April*). *Numbers of observations are given in brackets*

[WWD = West Wind Drift; WC = Weddell Current; EWD = East Wind Drift]

Depth (m.)		60° W–0°			0°			20° E			20–120° E		120° E–180°		180–60° W.	
		WWD	WC	EWD	WWD	WC	EWD	WWD	WC	EWD	WWD	EWD	WWD	EWD	WWD	EWD
100–0	Mean	6·52 (4)	3·08 (16)	1·51 (7)	4·30 (2)	2·67 (15)	1·50 (6)	2·12 (16)	2·22 (4)	1·92 (4)	2·42 (16)	0·90 (2)	8·23 (3)	1·35 (2)	3·03 (19)	2·40 (2)

COMPARISON WITH THE FINDINGS OF OTHER WORKERS

The conclusions reached in the previous two sections regarding the regional distribution of the standing crop of zooplankton in the Southern Ocean may be summarized as follows.

From tropical latitudes there is a north-south gradient in the quantity of plankton which reaches a maximum between 50° and 55° S. This is an area which in most meridians lies just south of the Antarctic Convergence in the West Wind Drift. In more southerly waters there is an apparent decrease in the quantity of plankton, which may, however, be accounted for by the increased concentration of krill (a large active animal poorly sampled by the N70V except as larvae) that occurs in these regions.

In the Antarctic zone there appears to be, from existing evidence, little circumpolar variation at comparable times of the year.

It remains now to compare the major conclusions of this work with the results of other workers. Although there is a great deal of information on the distribution and variation in standing crop in all oceans of the world there is such diversity in the gear and methods used both to catch the plankton and to measure its volume that any comparison on anything except a very general basis is of doubtful value.

Much of the work is concerned with variations in coastal and offshore waters, and relatively little is known about conditions in the open ocean apart from the results of a few major oceanic expeditions on which quantitative plankton work has formed part of the programme. The relative distribution of the standing crop of plankton in the North and South Atlantic has been described in some detail by Friedrich (1950), who used the Meteor data supplemented by observations in other regions not covered by the 'Meteor'. These allowed areas of relative plankton density to be plotted on a chart in a similar fashion to that of Henschel (1936) but with the geographical range considerably extended (Friedrich, 1950, fig. 2, p. 113). It is not intended to treat the 'Discovery' data in such detail, but rather will they be compared with the results of other expeditions, including those of the 'National', 'Deutschland', 'Meteor', 'Dana', 'Carnegie', and the B.A.N.Z.A.R.E., to see by how much in each case the catches in high latitudes differed from those in low latitudes. These results must be used with reservation, since they are widely scattered in time and place, and they are derived from different methods and techniques; furthermore, in arriving at the latitudinal means plotted in Fig. 19 no allowance has been made for the east to west variations in standing crop that are known to occur in certain latitudes (e.g. that of the Sargasso Sea).

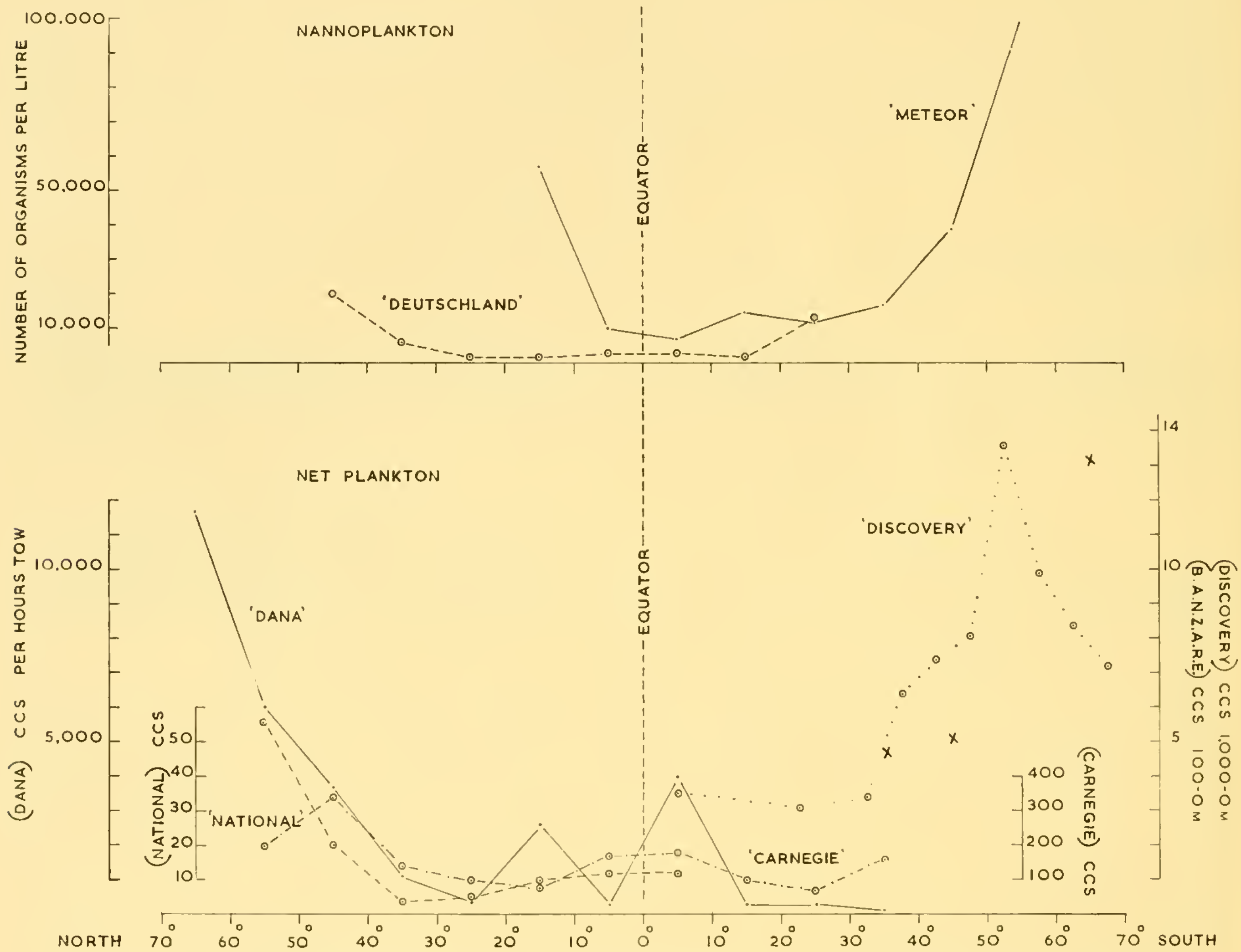

Fig. 19. The results of other expeditions compared with the summer mean total volumes (1000–0 m.) previously described in fig. 10. The few B.A.N.Z.A.R.E. results are indicated by a ×. Sources of data are given below.

Fig. 19 and Table 10 compare the results of all the expeditions with the latitudinal variations in the 1000–0 m. summer volumes which have been previously discussed in greater detail (p. 214 and Fig. 10). It should be noted that the vertical scale is different for the results of each expedition, as are the units in which some of them are expressed. The sources of the data are summarized below.

The Deutschland (Lohmann, 1919, table 6, p. 16) and Meteor results (Hentschel, 1936, table 4, p. 8) both refer to the numbers of nannoplankton organisms in 1 l. of sea water in the upper 50 m. (i.e. the mean of the 0 and 50 m. catches). As the observations are confined to the euphotic layer the counts must comprise at least 50 per cent phytoplankton and so are not strictly comparable to the net plankton catches of the other expeditions which consist principally of zooplankton. For this reason in Fig. 19, the Deutschland and Meteor results have been considered separately from the other data.

Table 10. *The results of various expeditions arranged to show the variation of catch with latitude, together with the approximate ratio between the catch in high latitudes and that in low latitudes. Numbers of observations, where available, are given in brackets*

[*Note.* The 'Deutschland' and 'Meteor' results refer to numbers of organisms, and the results of the other expeditions to the volume of the catch.]

Expedition	Author	Type of plankton	North 70–60	60–50	50–40	40–30	30–20	20–10	10–0	South 0–10	10–20	20–30	30–40	40–50	50–60	60–70°	Approximate ratio high : low latitude catch
'Deutschland'	Lohmann	Nanno-plankton	—	—	20,000	6,000	1,700	1,750	2,500	2,500	1,500	6,000	18,000	—	—	—	13 : 1
'Meteor'	Hentschel	Nanno-plankton	—	—	—	—	—	57,613	10,385	7,321	15,285	12,961	16,838	39,417	99,196	—	14 : 1
'National'	Hensen	Fine-net plankton	—	56·4 (17)	20·2 (11)	3·8 (34)	4·8 (10)	9·6 (8)	12·1 (14)	12·2 (32)	—	—	—	—	—	—	5 : 1
'Carnegie'	Wilson	Fine-net plankton		191 (2)	343 (8)	137 (12)	98 (13)	81 (10)	167 (12)	181 (14)	99 (27)	69 (7)	156 (11)	—	—	—	5 : 1
'Discovery II'	Sheard	Medium-net zooplankton	—	—	—	—	—	—	—	←(See Table 5)→							4·5 : 1
B.A.N.Z.A.R.E.	Sheard	Medium-net zooplankton	—	—	—	—	—	—	—	—	—	—	4·7 (2)	5·2 (7)	—	13·4 (9)	—
'Dana'	Jespersen	Macro-plankton	11,711 (59)	5,921 (26)	3,743 (14)	1,137 (51)	360 (35)	2,675 (6)	250 (1)	3,958 (3)	308 (4)	325 (2)	125 (3)	—	—	—	10 : 1

The results for the National or Plankton expedition are based on the settlement volumes of quantitative fine-net hauls mostly from *c.* 200 m. to the surface (Hensen, 1895, table 2, p. 8).

The Dana results are compiled from Jespersen (1923, fig. 1; 1935, table 36) and are the volumes (measured by drainage in a graduated sieve) of macroplankton, caught per 1 hr. tow (with *c.* 50 m. wire out) using a $1\frac{1}{2}$ or 2 m. stramin net.

The Carnegie results are those from Wilson (1942, pp. 15–168), and they represent the combined settlement volume in cc. of Pacific Ocean samples at 0 and 50 m. with $\frac{1}{2}$ and 1 m. nets.

The B.A.N.Z.A.R.E. results are the displacement volumes of vertical hauls with a 70 cm. Discovery net and are given in Sheard (1947, table 8, p. 11). As there are so few of them only the mean 100–0 m. volumes for latitudes 30–40° S, 40–50° S and 60–70° S are shown in Fig. 19; they are indicated by a cross.

The results of all the expeditions (Fig. 19) show a marked similarity of gradation, from the maximal quantities of plankton in high latitudes to the minimal values in low latitudes. There is, however, great variation in the ratio, which ranges from 14:1 ('Meteor') to 4·5:1 ('Discovery'). This is probably due both to the varying degrees of sampling in different latitudes and times of year, and to the differences in the sorts of organism caught. On the whole the greatest ratios are from nannoplankton and macroplankton catches, and were the Discovery data for these particular groups of organisms available they would probably show a comparable—if not greater—difference. Dr T. J. Hart believes that centrifuging would yield at least a 10:1 ratio for Antarctic microplankton as against that of warm seas. (This is merely a personal opinion based on unpublished results of some 120 Antarctic stations and a few sub-Antarctic and sub-tropic stations during 1933–35.) The Antarctic macroplankton would include 'krill', and again the ratio would be considerably increased, since there is no comparable form in warmer seas (see p. 218).

The smallest catches are not necessarily those nearest the equator and the Atlantic results of the 'National', 'Meteor', and 'Dana' expeditions show a marked rise in the quantity of plankton in this region. This is due largely to local areas of fertility near the Ascension and Cape Verde Islands (the *Kongo-Zunge* and *Kapeverden-Zunge* of Hentschel, 1936, fig. 2. p. 10; see also Jespersen, 1935, p. 30). The Deutschland results, in similar latitudes but in the Central Atlantic area, show a smaller increase (Lohmann, 1919, fig. 2).

In the Pacific also there is an increase in the abundance of plankton near the equator, as is shown by the Carnegie results. Graham (1941), using plankton dry weight as a measure of productivity, has confirmed this, while King & Demond (1953) have shown that the area of greatest abundance is north of the equator when related to a convergence and to the south when there is no marked convergence. In spite, however, of local areas of increase in the tropics the overall picture from Fig. 19 is one of greatest standing crop of plankton in the cold waters of high latitudes.

Of the many expeditions that have penetrated the Southern Ocean as far as the pack-ice only the B.A.N.Z.A.R.E. results have been analysed in relation to the standing crop of plankton (Sheard, 1947). The samples, which were collected during the 1930–31 summer season (November–April) from sub-Antarctic and Antarctic waters are on the whole greater in volume than those described for similar months and depths in this paper. This may, however, be due to the inclusion of gelatinous organisms or phytoplankton in the measurements given by Sheard. From his results (Sheard, 1947, table 8) it is apparent that the vertical distribution of the plankton is typical of summer months with most of the plankton concentrated in the upper 100 m. of water. There are too few observations for a close comparison to be made with the variations in a north-south direction shown from the results of other expeditions in Fig. 19. The three mean values for latitudes 30°–40° S, 40°–50° S, and 60°–70° S which are indicated by a '×' show, however, that the B.A.N.Z.A.R.E. results are not at variance with the Discovery data in so far as the greatest catches were in the Antarctic zone. Furthermore, the Antarctic volumes were also greater than those of catches with similar nets in waters off New South Wales (Sheard, 1947, p. 17).

SUMMARY

1. This paper is based on material collected with the Discovery pattern 70 cm. vertical closing net. The volumes of 2185 samples from 366 stations were measured by the displacement method, and the results are given in the Appendix.

2. The data from repeated lines of stations are treated diagrammatically. They show that throughout the sub-Antarctic and Antarctic the vertical distribution of the standing crop of zooplankton is on the whole similar in any one month.

3. The average monthly volumes of samples in the sub-Antarctic and Antarctic show that during the summer months the bulk of the zooplankton is concentrated in the surface waters day and night. But in the winter there is a migration of plankton into deep water, and the largest concentrations occur in the warm deep current.

4. There appears to be little seasonal variation in the total standing crop of zooplankton in the whole water column sampled (i.e. 1000–0 m.).

5. Regional differences are considered, and it is shown that there is a gradient in the quantity of zooplankton from low to high latitudes reaching a maximum between 50° and 55° S. The largest samples are not taken by the N70V in the highest latitudes or the coldest waters. But it is pointed out that the very large concentrations of *Euphausia superba* (above 20 mm. in length) that occur in certain regions of the Antarctic, are for all practical purposes not sampled by the N70V.

6. A tentative estimate is made of the relative standing crops of zooplankton (or that limited part of it sampled by the N70V) in the major geographical zones covered by the observations.

7. Within the Antarctic zone as a whole, there appears to be little circumpolar variation in the standing crop of zooplankton.

8. The standing crops of zooplankton in the West Wind, Weddell and East Wind Drifts are compared and, in so far as rather limited data allow, it is shown that in all sectors of the Southern Ocean the richest area is that of the West Wind Drift.

9. The results are compared in a very general way with those of other workers, and although the data are not strictly comparable, it is shown that the standing crop of zooplankton in the Antarctic is at least four times as great as that in the tropics.

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The displacement volume (in cc.) of samples taken with the 70 cm. vertical closing net, together with the sum of the volumes of all hauls between 1000 m. and the surface (i.e. 1000–0 m.). The following contractions are used to indicate in which major geographical zone the stations occurred: A = Antarctic; SA = Sub-Antarctic; ST = Sub-Tropic; T = Tropic.

* Station completed before sunset.

† Sample rich in phytoplankton. No volume measurement is given where it was impossible to separate the zooplankton from the phytoplankton (see p. 198).

( ) Some of sample missing.

Table 11 *a*. *Observations near the meridian of* 0°

Station	Date	Latitude S	Longitude	Zone	Depth (m.) 50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
					1936							
1806	20. ix. 36	35° 28·7′	00 18·5′ E	SA	1·2	0·9	0·9	0·6	0·5	0·3	0·3	4·4
1807	21. ix	38° 40′	00 27·8′ E	SA	0·6	1·0	0·7	0·9	1·3	0·3	0·5	4·8
1808	22. ix .	41° 36·5′	00° 28·6′ E	SA	1·4	0·6	0·9	1·0	2·3	0·7	0·7	6·9
1809	23. ix	44° 48′	00° 07·4′ E	SA	—	—	1·0	0·9	2·1	0·7	0·7	—
1810	24. ix	47° 14·8′	00° 06·2′ E	SA	0·9	0·7	0·8	1·1	1·7	1·3	1·9	6·5
1812	26. ix	50° 29·8′	00° 09·8′ E	A	0·7	0·8	1·5	3·2	5·3	2·6	2·1	14·1
1813	27. ix	52° 28′	00° 21·3′ E	A	0·9	0·8	1·7	3·6	7·5	1·0	1·1	15·5
					1938–39							
2311	11/12. iv. 38	50 05·2′	00 03′ W	A	4·4	1·3	0·7	8·3	2·6	0·9	2·0	18·2
2313	12. iv	52° 27′	00 29·2′ E	A	1·1	0·9	0·7	8·4	7·9	1·0	0·8	20·0
2316	14/15. iv	57 15·5′	01 13·4′ E	A	1·2†	0·6†	1·1	1·4	0·4	0·6	1·0	5·3
2318	15/16. iv	58 58·7′	01 00′ E	A	4·0	2·3	1·8	3·6	0·7	0·3	0·5	12·7
2320	16/17. iv	61 10·6′	00° 43·7′ E	A	2·1	0·9	1·2	1·6	1·2	0·7	1·9	7·7
2322	17/18. iv	63° 53′	00° 24·4′ E	A	1·1	0·7	2·3	4·0	2·8	0·8	1·0	11·7
2355	6/7. vii	39° 51·4′	01° 06·8′ E	SA	0·6	0·9	0·9	1·0	2·7	2·2	2·5	8·3
2356	7. vii	42 56·8′	01° 21·2′ E	SA	0·1	0·5	0·8	1·5	1·8	1·5	1·5	6·2
2357	8/9. vii	45° 51·4′	01° 18·2′ E	SA	0·3	0·4	1·4	4·5	5·1	2·0	2·8	13·7
2358	9. vii	48° 24·6′	00° 51′ E	SA	1·0	0·8	1·7	4·2	4·3	1·9	3·3	13·9
2359	10. vii	51° 11·4′	00° 25·2′ E	A	0·4	1·9	3·0	8·6	9·7	4·5	3·8	28·1
2361	11. vii	53° 50·6′	00° 00·8′ E	A	1·0	0·6	1·3	3·5	4·2	3·0	3·5	13·6
2385	10. viii	39° 56·9′	00 14·1′ E	SA	0·1	0·5	0·9	1·2	1·5	0·9	0·8	5·1
2386*	12. viii	44 04·9′	00 15·4′ E	SA	0·1	0·1	0·4	1·0	2·2	1·8	1·7	5·6
2387*	14. viii	49° 08·2′	00 41·5′ E	SA	0·1	0·1	1·3	2·4	2·8	1·6	1·4	8·3
2389	15. viii	52° 35·3′	00° 04·5′ E	A	1·5	0·5	1·3	3·1	5·0	1·9	1·0	13·3
2391	16. viii	55° 03·3′	00° 19·1′ E	A	1·3	0·6	0·6	3·2	1·7	1·6	2·4	9·0
2393	17. viii	56° 42·3′	00° 38·3′ E	A	0·3	0·2	1·2	1·4	2·1	1·6	1·9	6·8
2424*	19. ix	39 53·7′	00° 38·9′ E	SA	0·1	0·1	0·3	1·3	3·5	1·4	1·1	6·7
2425	20. ix	43° 28·4′	00° 41·1′ E	SA	0·2	0·3	0·6	1·7	2·4	1·0	1·2	6·2
2426	21. ix	46° 58·4′	00° 53·2′ E	SA	0·2	0·2	1·0	1·8	4·1	2·0	1·1	9·3
2428	23. ix	51° 57·7′	00° 35·8′ E	A	0·8	0·5	1·2	3·5	5·9	3·0	1·2	14·9
2430	24. ix	54° 14·1′	00° 29′ E	A	0·5	0·3	1·0	3·0	3·4	2·3	2·0	10·5
2432*	25. ix	55° 36·7′	00° 30·4′ E	A	0·1	0·1	0·5	2·7	4·9	2·3	1·8	10·6
2458*	22. x	40° 02·4′	01° 08·1′ E	SA	0·8	0·1	0·5	1·2	1·0	1·0	0·5	4·6
2459*	23. x	43° 21·1′	01 25·7′ E	SA	0·2	0·2	1·9	1·3	—	0·6	—	—
2460	24/25. x	46° 33·6′	01° 42·8′ E	SA	0·6	0·7	1·4	2·6	2·7	1·8	2·0	9·8
2461	25. x	49° 37·6′	02° 01·4′ E	SA	0·7	0·4	2·5	2·9	3·1	1·5	0·8	11·1
2463	26. x	52° 41·8′	02° 11·4′ E	A	0·8	1·1	3·5	1·1	1·4	1·4	1·0	9·3
2465	27. x	55° 16·6′	01° 38·4′ E	A	0·4	0·2	0·9	2·6	2·6	1·2	0·6	7·9
2492*	28. xi	40° 12·8′	00° 37·6′ W	SA	1·3	1·0	0·5	1·1	1·1	0·4	1·2	5·4
2494*	30. xi	43° 18·1′	00° 54·6′ E	SA	0·3	0·3	4·9	1·3	1·1	0·4	0·8	8·3
2495*	1. xii	47° 11·2′	01° 17·5′ E	SA	0·1	0·5	2·6	3·7	2·6	0·6	1·0	10·1
2496	2 xii	50° 20·7′	01° 03·3′ E	A	1·6	1·3	1·6	6·9	2·5	0·9	—	14·8
2498	3. xii	52° 53·5′	00° 50·3′ E	A	2·8	2·8	2·4	2·5	2·0	0·7	0·8	13·2
2501*	5 xii	55° 30·2′	01° 23·7′ E	A	1·8	2·3†	0·6	1·0	1·0	1·6	—	8·3
2530	11/12. i. 39	39° 03′	02° 35′ E	SA	0·3	1·4	2·0	1·2	2·5	2·5	5·0	9·9
2531	12. i	42 07·9′	02° 50·9′ E	SA	1·4	0·5	2·6	1·6	2·1	1·8	1·9	10·0
2532	13/14. i	45° 18·9′	03° 09·8′ E	SA	1·2	1·8	1·1	1·9	1·1	0·4	—	7·5
2533*	15. i	48° 58·4′	02° 47·1′ E	SA	0·4	0·7	0·1	2·6	1·0	0·5	0·8	5·3
2535	16. i	52 40·8′	02 45·4′ E	A	0·7†	3·5†	8·8	6·3	3·2	1·2	1·1	23·7
2538*	18. i	57° 11·9′	03° 33·7′ E	A	0·2†	0·2†	2·1	2·9	1·7	1·4	—	8·5
2541	19/20. i	60 41·7′	03° 13·9′ E	A	0·8	0·8	1·3	1·3	0·7	0·4	0·4	5·3
2543*	20. i	63 24·7′	02° 44·7′ E	A	1·9†	0·3†	1·1	0·4	0·5	0·3	0·4	4·5
2545	21. i	66 23·7′	02° 16·2′ E	A	1·8	1·5	1·3	2·3	1·0	0·6	0·4	8·5
2547*	22. i	69 30·2′	02° 04·7′ E	A	0·4†	0·7†	0·9	1·1	0·9	0·4	0·6	4·4
2582*	20. ii	39° 53·9′	00 39·1′ E	SA	0·2	0·2	0·6	1·5	1·8	1·4	2·6	5·7
2583	21. ii	43 27·6′	00 50′ E	SA	1·8	0·8	1·7	1·0	0·5	0·7	1·4	6·5
2584	22. ii	46° 29·1′	00° 54·9′ E	SA	0·4	1·1	1·3	1·9	3·8	1·1	1·7	9·6
2585	23. ii	49° 33·4′	01° 06′ E	SA	0·9	0·4	1·4	3·7	2·0	0·8	1·1	9·2
2586	24. ii	52 29·1′	00 59·4′ E	A	2·8	3·2	1·1	2·7	2·5	0·8	2·1	13·1
2588	25. ii	55° 08·5′	00° 42·4′ E	A	0·1†	0·1†	1·2	2·0	1·1	1·0	1·6	5·5
2590	26/27. ii	57° 32′	00° 40·1′ E	A	0·5†	0·9	0·4	2·8	1·3	0·8	2·0	6·7
2592	27/28. ii	59° 30·7′	00° 23·6′ E	A	0·1†	0·1†	1·4	1·9	0·6	0·5	0·5	4·6
2594	28/1. iii	61° 51·7′	00° 11·7′ E	A	0·5	0·5	0·7	1·9	0·8	1·2	—	5·6
2596	1/2. iii	64° 29′	00° 12′ E	A	0·3†	0·8	1·2	2·5	1·2	2·3	1·1	8·3
2598	2. iii	67° 15·6′	00° 44·5′ E	A	0·6	0·5	0·9	1·5	0·7	0·4	0·5	4·6
2600	3/4. iii	69° 11·2′	00° 24·2′ E	A	0·4	0·2	2·0	1·2	0·6	0·7	0·6	5·1

Table 11*b*. *Observations near the meridian of 20° E*

Station	Date	Latitude S	Longitude	Zone	Depth (m.) 50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
					1936							
1788	7. vi. 36	59° 11·7′	17° 01·9′ E	A	1·0	3·6	2·5	3·0	1·5	1·6	—	13·2
1790	8. vi	56° 26·9′	17° 22·9′ E	A	0·6	0·5	1·4	5·9	2·7	1·1	—	12·2
1792	9. vi	54° 20·1′	17° 53·5′ E	A	0·7	0·8	1·9	3·1	3·3	1·7	—	11·5
1794	10. vi	52° 37·5′	18° 22·7′ E	A	0·9	0·5	1·3	3·5	4·1	1·6	—	11·9
1796	11. vi	50° 19·7′	18° 40·3′ E	A	1·8†	1·1	2·0	3·9	2·3	2·5	—	13·6
1798	12. vi	48° 00·3′	18° 54·4′ E	SA	0·8	0·6	1·3	2·6	2·5	2·6	—	10·4
1799	13. vi	45° 10·1′	18° 50·5′ E	SA	0·5	0·9	2·0	2·0	1·1	1·5	—	8·0
1800*	15. vi	41° 20·3′	18° 54·3′ E	SA	0·1	0·1	0·4	0·9	1·6	0·8	—	3·9
1801	16. vi	38° 53′	18° 52·5′ E	ST	0·3	0·3	0·6	1·0	0·5	0·1	—	2·8
					1938–39							
2335*	22. iv. 38	67° 10′	20° 24·5′ E	A	1·1	1·0	1·1	1·6	1·3	1·0	—	7·1
2338	23. iv	63° 41·7′	20° 01·2′ E	A	1·1†	0·8	1·7	2·9	2·0	0·4	—	8·9
2340	24/25. iv	61° 35·4′	19° 45·9′ E	A	1·1†	0·8†	1·7	3·6	1·6	1·2	—	10·0
2342	25. iv	58° 53·9′	19° 33·9′ E	A	1·2†	1·1†	3·0	3·2	2·9	1·3	—	12·7
2344	26. iv	56° 18·4′	19° 32·6′ E	A	2·3†	1·3†	1·0†	2·8	2·1	0·3	—	9·8
2346	27. iv	53° 35·5′	19° 29·3′ E	A	0·5	0·6	0·9	3·2	1·0	0·9	—	7·1
2348*	29. iv	48° 58·1′	19° 25·5′ E	SA	0·2	0·2	1·7	2·7	4·7	0·9	—	10·4
2349*	1. v	43° 08·6′	19° 15·3′ E	SA	0·1	0·1	0·5	2·6	1·0	0·4	—	4·7
2350	2. v	39° 11·6′	19° 04·9′ E	ST	0·4	0·5	1·0	0·8	0·1	—	—	—
2372‡	16. vii	53° 10·6′	15° 47·5′ E	A	0·4	0·8	0·6	2·3	4·0	3·2	—	11·3
2374*	19. vii	55° 41·8′	21° 08·6′ E	A	0·6	1·6	2·6	8·4	4·5	2·8	—	20·5
2377*	22. vii	50° 19·8′	21° 22·2′ E	A	0·6	0·1	0·5	3·4	—	2·0	—	—
2378	23. vii	46° 20·3′	20° 41·8′ E	SA	0·5	0·7	1·2	—	4·1	1·8	—	—
2379	24. vii	43° 13′	19° 59·7′ E	SA	0·6	0·6	0·6	0·4	1·7	2·1	—	6·0
2380	25. vii	39° 51·4′	19° 18·3′ E	ST	1·0	0·6	0·6	0·5	0·4	0·2	—	3·3
2412	24. viii	55° 41·9′	20° 29·4′ E	A	2·4	0·5	0·8	1·9	1·7	1·1	—	8·4
2414	25. viii	53° 11·6′	20° 25·9′ E	A	0·2	0·4	0·7	1·6	2·5	3·1	—	8·5
2416	26. viii	50° 15·5′	20° 43·7′ E	A	0·4	0·3	0·8	2·6	4·6	2·4	—	11·1
2417	27/28. viii	47° 47·5′	20° 22·5′ E	SA	0·3	0·3	1·1	2·7	2·7	1·3	—	8·4
2418*	29. viii	43° 17·4′	19° 24·4′ E	SA	0·1	0·1	0·2	1·8	1·7	1·2	—	5·1
2419*	30. viii	38° 46·5′	19° 00·6′ E	ST	0·1	0·3	1·1	1·7	0·9	2·2	—	6·3
2447*	1. x	54° 46·6′	19° 51′ E	A	0·4	0·3	1·0	2·4	3·3	2·0	—	9·4
2449	2. x	51° 34·7′	20° 16·4′ E	A	0·3	0·3	1·3	6·1	3·0	1·2	—	12·2
2450	3. x	47° 49·2′	19° 54·6′ E	SA	2·9	2·1	3·0	3·9	5·8	1·5	—	19·2
2451	4. x	44° 27·3′	19° 43·4′ E	SA	1·2	2·3	2·3	1·2	2·5	2·4	—	11·9
2452	5. x	41° 21·2′	19° 31·2′ E	SA	1·4	1·4	1·7	2·6	—	—	—	—
2453	6. x	37° 51·2′	19° 00·4′ E	ST	—	1·1	1·3	1·3	1·3	1·4	—	—
2478*	2. xi	54° 17·3′	20° 16·4′ E	A	0·3	0·2	0·9	2·0	1·6	1·7	—	6·7
2481*	3. xi	50° 44·2′	20° 33·2′ E	A	0·8	3·5	2·5	1·8	2·2	0·6	—	11·4
2482*	5. xi	47° 43·7′	20° 03·9′ E	SA	0·1	0·5	0·9	2·7	3·2	1·1	—	8·5
2483	6. xi	43° 47·4′	20° 00′ E	SA	3·4	0·9	2·3	1·3	0·9	0·7	—	9·5
2484*	7. xi	40° 45·4′	19° 49·3′ E	SA	2·1	0·6	8·9	1·7	0·7	0·7	—	14·7
2485*	8. xi	37° 26′	19° 52·4′ E	ST	0·9	0·2	1·0	0·6	1·1	0·8	—	4·6
2517*	11. xii	56° 56·9′	19° 30·3′ E	A	1·2	3·1	1·6	2·8	1·0	1·0	—	10·7
2519*	12. xii	51° 56·8′	19° 32·4′ E	A	0·1	1·9	1·9	2·9	1·3	0·9	—	9·0
2521*	13. xii	48° 45·2′	19° 37·9′ E	A	0·3	0·9	3·0	4·2	1·4	0·6	—	10·4
2522*	14. xii	45° 38·9′	20° 15·2′ E	SA	0·1	3·5	1·9	1·3	1·0	0·7	—	8·5
2523*	15. xii	42° 24·9′	20° 09·5′ E	SA	1·9	0·6	1·2	1·9	1·1	0·4	—	7·1
2524*	16. xii	38° 58·1′	20° 10·6′ E	ST	0·7	0·6	1·3	2·4	2·1	1·2	—	8·3
2559*	27. i. 39	68° 49·7′	19° 10·5′ E	A	0·3†	2·1	1·3	1·7	1·1	1·0	—	7·5
2563*	28. i	65° 06·5′	19° 16·5′ E	A	0·8†	0·5†	0·3	3·1	0·6	0·3	—	5·6
2565	29. i	61° 16′	19° 43·5′ E	A	2·1†	0·4†	1·6	1·3	0·9	0·6	—	6·9
2567	30. i	58° 12′	19° 46′ E	A	1·1†	0·5†	0·6†	1·2	0·9	0·8	—	5·1
2569	31. i	55° 21·1′	19° 39·3′ E	A	0·3†	0·5†	3·2	1·4	0·9	0·8	—	7·1
2571	1. ii	52° 43·4′	19° 34·4′ E	A	0·9†	0·6†	1·7†	0·7	1·1	1·1	—	6·1
2573	2. ii	49° 59·1′	19° 42·4′ E	A	0·3†	1·6	1·5	3·0	1·3	1·3	—	9·0
2574	3. ii	46° 59·9′	19° 56·2′ E	SA	1·0	0·7	0·8	3·1	1·7	1·2	—	8·5
2575	4. ii	43° 43·2′	20° 00′ E	SA	4·2	1·6	1·4	1·2	1·2	0·8	—	10·4
2576	5. ii	40° 12·6′	19° 31·7′ E	ST	0·4	0·4	0·5	0·5	—	—	—	—
2612	9. iii	61° 10·3′	19° 01·4′ E	A	0·7	1·3	3·0	3·4	2·3	1·1	—	11·8
2614	10. iii	59° 17·4′	19° 10·1′ E	A	0·4	0·9	1·2	1·4	1·4	0·7	—	6·0
2616	11. iii	57° 23·9′	19° 18·3′ E	A	0·6	0·9	1·3	1·6	1·2	0·4	—	6·0
2618	12. iii	55° 21·9′	19° 27·6′ E	A	1·5	1·0	2·0	1·5	0·9	0·4	—	7·3
2620	13. iii	52° 57·1′	19° 36·8′ E	A	2·4	2·2	3·2	4·1	3·6	0·5	—	16·0
2622	14. iii	50° 19·5′	19° 43′ E	A	1·0	0·4	1·2	2·5	0·8	0·5	—	6·4
2623	15. iii	47° 26·8′	19° 37·4′ E	SA	0·5	1·3	0·9	0·4	0·5	0·8	—	4·4
2624	16. iii	44° 34·2′	19° 22·9′ E	SA	1·7	1·7	2·6	1·4	1·1	1·1	—	9·6
2626*	18. iii	37° 47′	18° 31·9′ E	ST	1·0	0·3	1·0	1·1	1·2	0·8	—	5·4

‡ Not included in fig. 2.

Table 11*c*. *Observations near the meridian of* 80° *W*

Station	Date	Latitude S	Longitude	Zone	Depth (m.)							
					50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
							1932					
984*	24. x. 32	55° 14·4′	77° 48·6′ W	SA	0·3	0·4	1·9	1·0	1·0	0·8	—	5·4
986*	25. x	56° 28·9′	79° 28·2′ W	SA	0·2	0·2	0·8	1·4	1·3	1·8	—	5·7
987*	26. x	58° 23·8′	79° 28·9′ W	SA	0·3	0·3	0·8	2·0	1·0	0·9	—	5·3
989*	27. x	60° 38·6′	79° 50·1′ W	SA	0·3	0·2	0·9	2·2	1·8	0·4	—	5·8
991*	28. x	63° 12·8′	80° 02·7′ W	A	0·8	1·7	2·8	4·0	1·2	0·5	—	11·0
993*	29. x	65° 38·7′	80° 18·6′ W	A	0·2	0·2	2·5	3·3	1·5	0·8	—	8·5
							1933–34					
1220*	13/14. xii. 33	67° 45·3′	77° 50·6′ W	A	0·1†	0·1†	0·6	2·3	2·1	0·4	—	5·6
1221*	14. xii	66° 26·1′	78° 01·7′ W	A	0·3†	0·9†	2·3	1·8	2·0	0·5	—	7·8
1222*	14. xii	65° 02·7′	78° 01·7′ W	A	0·1†	0·2†	0·5	2·3	1·0	0·6	—	4·7
1223*	15. xii	63° 31·9′	78° 01·6′ W	A	0·4	1·7	2·3	1·1	1·2	0·2	—	6·9
1224*	15/16. xii	62° 11·5′	78° 01·1′ W	A	1·9	3·0	2·9	1·5	0·7	0·4	—	10·4
1225*	16. xii	60° 53·6′	77° 58·4′ W	SA	0·8	3·2	3·6	1·1	1·5	1·1	—	11·3
1226	16. xii	59° 31·7′	78° 04′ W	SA	2·0	3·0	2·8	1·3	1·1	—	—	—
1227*	17. xii	58° 05·4′	78° 17·4′ W	SA	0·9	2·9	2·4	(1·3)	0·9	0·9	—	—
1228	17. xii	56° 39′	78° 31·7′ W	SA	1·2	0·9	(2·6)	1·8	1·0	0·9	—	—
1229*	18. xii	55° 11·3′	78° 29·6′ W	SA	0·9†	1·6†	1·9	1·1	1·3	0·8	—	7·6
1312*	10. iii. 34	68° 18′	79° 33·8′ W	A	0·1†	1·0	0·3	2·0	1·2	2·5	—	7·1
1313*	11. iii	66° 02·4′	79° 22·2′ W	A	0·5	0·7	0·6	1·8	0·9	0·6	—	5·1
1314	11. iii	64° 31·5′	79° 14·5′ W	A	2·0	1·5	1·1	1·8	0·8	0·9	—	8·1
1315*	12. iii	62° 55·1′	79° 06·3′ W	A	1·7	1·8	1·5	2·1	1·4	0·8	—	9·3
1316	12. iii	61° 27·1′	78° 58·8′ W	A	3·4	1·1	2·0	1·9	0·7	0·7	—	9·8
1317*	13. iii	59° 55·2′	79° 00·4′ W	SA	0·9	1·1	0·8	1·1	0·9	0·5	—	5·3
1318	13. iii	58° 25·8′	78° 53·8′ W	SA	(1·5)	(2·0)	1·5	2·2	3·0	1·1	—	—
1319*	14. iii	56° 56·1′	78° 46·3′ W	SA	1·5	1·1	0·7	1·0	2·2	2·6	—	9·1
1320	14. iii	55° 45·1′	78° 29·2′ W	SA	1·0	1·2	0·8	0·6	1·0	0·4	—	5·0
1415	12. ix. 34	63° 40·6′	78° 03·5′ W	A	0·2	0·2	0·4	1·6	(1·3)	(0·6)	(0·8)	—
1416*	13. ix	62° 31·5′	78° 18·3′ W	A	0·2	0·2	0·3	1·0	1·2	1·1	—	4·0
1417	13/14. ix	61° 05·2′	78° 34·2′ W	SA	0·3	0·3	1·0	0·8	1·9	1·3	—	5·6
1418*	14. ix	59° 50·5′	78° 34·3′ W	SA	(0·1)	(0·2)	(0·4)	(0·7)	1·6	1·0	—	—
1419	14/15. ix	58° 23·6′	78° 25′ W	SA	(0·1)	0·4	0·5	1·3	1·7	1·4	2·3	—
1420*	15. ix	56° 53′	78° 13·8′ W	SA	0·1	0·1	0·8	0·5	1·1	0·8	—	3·4
1421	15. ix	55° 22·2′	78° 10·9′ W	SA	0·7	0·7	0·9	1·3	1·4	(1·2)	1·3	—
1441*	26. x. 34	55° 39·3′	78° 37·6′ W	SA	0·4	0·5	1·7	1·2	1·3	0·9	—	6·0
1442	26. x	56° 48·6′	78° 25·8′ W	SA	0·5	0·7	2·8	1·4	1·3	0·5	—	7·2
1443*	27. x	57° 48·7′	78° 24·2′ W	SA	0·2	0·4	2·9	1·2	1·5	0·9	—	7·1
1444	27. x	59° 02·6′	78° 44·8′ W	SA	0·7	0·5	2·1	2·0	2·1	1·2	—	8·6
1445*	28. x	60° 06·7′	79° 17·6′ W	SA	0·4	—	1·2	—	3·0	—	—	—
1446	28. x	61° 15·5′	79° 26·4′ W	SA	1·0	0·9	2·4	1·4	1·6	0·9	—	8·2
1447*	29. x	62° 37·7′	79° 28·6′ W	A	0·1†	2·4	4·8	0·8	1·5	0·7	—	10·3
1448	29. x	63° 43·8′	79° 21·8′ W	A	0·2†	0·3†	2·7	2·3	1·2	0·5	—	7·2
1449*	30. x	65° 03·4′	79° 23·6′ W	A	0·1	0·2	0·8	3·1	2·0	0·7	—	6·9
1450	30/31. x	66° 03·1′	79° 42·2′ W	A	0·4	0·5	1·2	3·2	2·1	0·6	—	8·0
1472	14/15. xi. 34	66° 31·6′	81° 18·4′ W	A	0·4	1·1	1·2	2·1	0·9	1·3	—	7·0
1473	15. xi	63° 47·5′	80° 40·2′ W	A	0·4†	1·4	1·6	1·2	1·8	0·4	—	6·8
1474*	16. xi	62° 49·9′	80° 28·3′ W	A	0·3†	1·7	1·3	1·1	0·6	0·6	—	5·6
1475	16. xi	62° 05′	80° 19′ W	A	0·9	0·7	3·2	1·3	0·6	1·0	—	7·7
1476*	17. xi	60° 20·7′	79° 53·9′ W	SA	0·5	0·5	2·8	1·6	0·8	0·6	—	6·8

Table 11*d*. *Observations in other areas*

Station	Date	Latitude S	Longitude	Zone	Depth (m.) 50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
					Longitude 20° W							
804	11. i. 32	55° 30·3′	21° 02·6′ W	A	1·8†	0·6†	1·5	3·0	1·1	—	—	—
805*	12. i	56° 41·4′	20° 38·2′ W	A	0·1†	0·2†	1·0	1·9	0·8	0·9	—	4·9
806	12. i	57° 27·2′	21° 28·8′ W	A	0·1†	0·2†	0·7	3·2	1·2	0·6	—	6·0
807*	13. i	58° 47·7′	21° 40·4′ W	A	—	0·1†	0·7†	1·7	0·9	0·5	—	—
808	13. i	59° 56′	22° 20·7′ W	A	0·1†	0·1†	0·7†	2·4	0·6	0·7	—	4·6
809*	14. i	61° 09·9′	22° 36·9′ W	A	0·1†	1·2	2·1	1·6	1·1	0·8	—	6·9
811	15. i	62° 44′	23° 18·4′ W	A	1·0	0·7	0·5	0·8	0·6	0·4	—	4·0
812*	16. i	64° 12·5′	22° 57′ W	A	2·1	0·8	0·8	1·1	0·3	0·4	—	5·5
813	16. i	64° 55·9′	23° 13′ W	A	0·7	0·7	1·2	2·0	0·7	1·8	—	7·1
814*	17. i	66° 02·8′	22° 35·1′ W	A	0·3	0·6	1·0	1·1	1·5	1·1	—	5·6
815	17/18. i	66° 57·3′	22° 38·3′ W	A	0·3	0·4	0·6	1·2	1·0	0·7	—	4·2
816*	18. i	68° 09·6′	22° 01·7′ W	A	0·2	0·5	0·7	1·3	2·0	1·1	—	5·8
817*	19. i	69° 59′	23° 53′ W	A	0·3	0·5	0·6	1·0	0·8	0·6	—	3·8
1990	10. iii. 37	57° 02·2′	31° 28·5′ W	A	1·8	1·7	1·5	4·5	2·5	1·8	—	13·8
1994	12. iii	60° 35·6′	26° 40·4′ W	A	2·3†	1·8†	2·6	2·2	1·4	0·5	—	10·8
1996	13. iii	62° 32·5′	24° 32′ W	A	2·7†	1·2†	2·4	2·2	1·0	0·7	—	10·2
1998	14. iii	64° 16·4′	22° 46·6′ W	A	1·8†	1·5†	1·7	1·1	0·7	1·1	—	7·9
2000	15/16. iii	66° 00·4′	20° 54·1′ W	A	1·4†	0·5†	1·8	2·4	1·3	1·2	—	8·6
2002	16/17. iii	68° 19·5′	17° 55·2′ W	A	0·9†	0·9	1·1	2·8	1·2	0·9	—	7·8
2004	17. iii	69° 49·7′	15° 28·8′ W	A	1·0	2·8	1·4	2·7	1·8	1·3	—	11·0
					Longitude 110° E							
877	17. v. 32	35° 12·5′	114° 42·5′ E	ST	2·1	0·9	0·6	0·6	—	—	—	—
878	18. v.	38° 01′	115° 38·6′ E	ST	0·9	0·8	0·9	0·6	0·9	0·5	—	4·6
879	19. v	40° 56·7′	116° 46·5′ E	SA	0·3	0·5	0·4	0·4	0·5	0·9	—	3·0
880	20. v	43° 53·1′	117° 50·8′ E	SA	0·7	0·6	1·2	0·5	0·6	0·8	—	4·4
881	21. v	47° 00′	119° 00·3′ E	SA	0·5	0·9	0·6	0·6	0·6	1·5	—	4·7
882	22. v	49° 52·9′	120° 28·6′ E	SA	0·6	0·4	0·7	1·5	2·9	1·5	—	7·6
883	23. v	52° 54′	122° 03·8′ E	A	0·2	0·7	1·4	3·0	3·2	2·0	—	10·5
884	24. v	56° 08·3′	124° 04·8′ E	A	0·8	0·5	0·8	1·8	2·1	1·1	—	7·1
885	25/26. v	58° 50·5′	125° 54·9′ E	A	2·1	0·5	0·7	2·1	1·8	1·6	—	8·8
886	26. v	61° 12·1′	127° 52·9′ E	A	1·0	0·6	1·2	1·8	1·6	1·2	—	7·4
887	26. v	63° 41·4′	130° 07′ E	A	0·9	0·8	0·7	2·3	1·1	1·1	—	6·9
1720*	26. iii. 36	63° 59·1′	100° 11·1′ E	A	0·7	0·6	0·9	2·9	3·8	2·9	—	11·8
1722*	28. iii	61° 14·7′	102° 03·1′ E	A	1·4	1·2	2·0	3·2	2·3	1·3	—	11·4
1725	29. iii	57° 17·4′	104° 52·6′ E	A	4·2	2·1	2·3	5·1	2·5	1·2	0·8	17·4
1727	30. iii	54° 32·2′	106° 25·9′ E	A	2·8	3·1	3·1	4·7	5·0	1·7	2·0	20·4
1729	31. iii	51° 48·2′	107° 50·2′ E	A	—	2·8	1·8	4·8	5·3	1·7	1·8	—
1730*	2. iv	48° 48·9′	109° 15·5′ E	A	0·5	0·6	1·5	4·0	3·9	2·4	—	12·9
1732*	3. iv	45° 41·3′	110° 53·3′ E	SA	0·2	0·1	0·3	0·9	2·3	2·8	1·9	6·6
1733*	4. iv	42° 00·8′	112° 24·3′ E	SA	1·2	1·0	1·1	1·3	1·1	0·9	1·2	6·6
1734	5. iv	38° 20·9′	113° 27′ E	ST	0·7	0·6	1·0	0·7	0·8	0·7	0·5	4·5
1735	6. iv	34° 51·9′	114° 33·1′ E	ST	0·9	0·8	—	—	—	—	—	—
2152	30. xii. 38	35° 15·3′	114° 45′ E	ST	0·7	0·3	—	—	—	—	—	—
2153	31. xii	37° 57·6′	114° 53·7′ E	ST	0·3	0·2	0·4	—	—	—	—	—
2154	1. i. 39	40° 37·3′	115° 06·9′ E	SA	0·4	0·1	0·4	0·6	—	—	—	—
2155	2. i	43° 09·3′	115° 16·7′ E	SA	0·3	0·2	0·9	0·6	0·4	0·9	—	3·3
2156	3. i	46° 01·3′	115° 27·1′ E	SA	1·6	—	0·9	0·8	1·5	0·5	—	—
2157	4. i	48° 26′	115° 44·7′ E	SA	1·5	0·4	1·4	3·1	—	—	—	—
2158	5. i	50° 19·1′	115° 52·1′ E	A	1·2	0·7	3·0	4·5	0·6	0·5	—	10·5
2160	6. i	53° 01·4′	115° 49·5′ E	A	1·6	1·0	1·7	3·1	1·3	1·1	—	9·8
2162	7. i	56° 06·2′	115° 51·4′ E	A	1·6	0·7	1·5	3·6	1·2	0·4	—	9·0
2164	8. i	58° 48·7′	115° 43·7′ E	A	0·5	0·5	0·7	2·2	0·8	2·3	—	7·0
2166	9. i	61° 06·9′	115° 35·1′ E	A	1·4†	0·8†	0·8	0·8	0·1	0·4	—	4·3
2168	10. i	63° 29·1′	115° 26·8′ E	A	0·2	0·3	0·7	1·2	0·7	0·3	—	3·4

Table 11 *d* (*cont.*)

Station	Date	Latitude S	Longitude	Zone	Depth (m.)							
					50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
			Longitude 160° E									
912*	24. vi. 32	61° 05′	158° 24·5′ E	A	0·3	0·3	0·5	0·8	1·0	—	—	—
919	25. vi	57° 50·4′	160° 23·1′ E	A	0·3	0·4	0·6	1·3	1·4	1·0	—	5·0
920	26. vi	54° 41·1′	162° 23·1′ E	A	0·4	0·2	0·8	1·1	1·0	1·3	—	4·8
922*	28. vi	50° 19·6′	163° 49·4′ E	SA	0·2	0·2	0·3	0·7	0·7	0·6	—	2·7
923*	29. vi	47° 11·7′	163° 41·4′ E	SA	0·2	0·2	0·4	0·5	0·8	0·7	—	2·8
924*	30. vi	44° 17·5′	165° 46·2′ E	SA	0·1	0·2	0·3	1·1	1·4	0·9	—	4·0
925*	1. vii	41° 20·5′	167° 55·5′ E	ST	0·2	0·1	0·3	0·8	0·4	0·8	—	2·6
926*	2. vii	38° 01·9′	170° 12·8′ E	ST	0·4	0·6	0·6	1·2	1·0	—	—	—
928*	3. vii	34° 39·2′	172° 25·9′ E	ST	0·7	0·2	0·2	—	—	—	—	—
1675	5. ii. 36	64° 29·5′	161° 00·4′ E	A	0·1	0·2	0·3	1·9	0·9	0·7	—	4·1
1677	6. ii	61° 05·2′	161° 47·5′ E	A	4·7	5·3	1·9	4·1	2·0	0·4	—	18·4
1679	7. ii	58° 00·1′	163° 00·8′ E	A	6·3	4·2	3·0	4·0	1·1	0·5	—	19·1
1680	8/9. ii	55° 20·2′	162° 49′ E	SA	5·3	0·8	2·2	5·5	1·7	0·9	—	16·4
1681	9. ii	53° 16·1′	161° 57·7′ E	SA	1·8	0·9	2·0	2·3	0·5	0·6	—	8·1
1682	10. ii	51° 12·8′	159° 32·3′ E	SA	2·8	0·6	1·4	1·1	1·1	1·3	—	8·3
1683*	13. ii	46° 59·2′	155° 38·8′ E	SA	1·1	1·0	1·0	1·8	1·2	0·7	—	6·8
1684*	14. ii	43° 45·5′	152° 00·5′ E	SA	0‡	0‡	0·4	1·6	1·3	1·3	—	4·6
2201*	22. i. 39	65° 48·1′	162° 17·6′ E	A	1·4	1·0	1·1	1·6	0·7	0·4	—	6·2
2204	23. i	62° 31·4′	162° 58·4′ E	A	—†	—†	1·0	0·9	0·7	0·8	—	—
2206	24. i	59° 26′	165° 08·9′ E	A	2·3†	1·9†	1·9	2·2	1·4	0·4	—	10·1
2208	26/27. i	55° 53·1′	167° 04·3′ E	SA	0·7	1·4	1·0	0·9	0·7	1·5	—	6·2
2209	27. i	53° 07·7′	168° 56·4′ E	SA	1·6	0·6	0·5	1·6	3·3	—	—	—

‡ Sample composed entirely of Sulps.

Table 11 *e*. *Observations from circumpolar cruises*

Station	Date	Latitude S	Longitude	Zone	Depth (m.)							
					50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
			Indian Ocean Sector									
845	9/10. iv. 32	38° 08′	20° 56·1′ E	ST	—	0·1	0·1	1·0	0·7	0·3	—	—
846	10. iv	40° 41·3′	23° 02′ E	ST	1·8	0·5	0·5	0·9	0·5	0·3	—	4·5
847	11. iv	43° 07·4′	25° 04·6′ E	ST	1·0	0·1	0·4	0·5	0·4	0·4	—	2·8
848	12. iv	45° 48·4′	27° 13·6′ E	SA	0·8	1·1	0·6	0·5	0·9	1·0	—	4·9
849	14. iv	48° 14·6′	29° 23·7′ E	SA	0·6	0·2	0·9	0·9	0·2	0·5	—	3·3
850	15. iv	50° 43·8′	31° 44′ E	A	1·0	—	1·8	1·3	—	—	—	—
852	18. iv	58° 39·5′	40° 03·9′ E	A	—†	—†	1·3	0·6	0·4	0·2	—	—
853	19. iv	61° 00·2′	43° 11·1′ E	A	—†	—†	1·1	0·9	0·5	0·6	—	—
854	20. iv	63° 30·2′	46° 24·9′ E	A	0·6	0·4	—	0·5	1·2	0·7	—	—
855	20. iv	61° 15′	48° 43·7′ E	A	—†	—†	—†	0·9	2·0	1·3	—	—
857	23. iv	60° 40·1′	59° 23·7′ E	A	—†	0·5	0·9	0·4	1·1	0·4	—	—
858	24. iv	60° 10·1′	63° 54·8′ E	A	0·6	0·5	1·0	1·5	1·3	0·8	—	5·7
859	25. iv	59° 19·1′	68° 51·8′ E	A	1·0	0·7	2·3	2·3	0·7	1·7	—	8·7
860	26. iv	57° 56·4′	73° 58·8′ E	A	0·8	0·5	0·6	2·4	2·6	0·1	—	7·0
861	27. iv	56° 28·9′	79° 18·2′ E	A	1·5	0·6	1·5	1·4	1·0	1·0	—	7·0
862	28. iv	55° 33·8′	83° 00·4′ E	A	3·0	1·1	1·3	1·4	4·2	1·8	—	12·8
863	29. iv	54° 15·3′	88° 22·4′ E	A	1·0	0·5	0·8	2·7	1·7	1·0	—	7·7
866	1. v	51° 22·6′	96° 26·4′ E	SA	0·6	0·6	0·6	2·8	1·1	0·7	—	6·4
867	2. v	49° 25·5′	98° 21·8′ E	SA	1·7	0·7	0·9	1·4	2·3	1·6	—	8·6
868	3. v	46° 55·4′	100° 45·6′ E	SA	0·8	0·4	0·6	1·3	2·4	1·8	—	7·3
869	4. v	43° 56·5′	103° 24·3′ E	SA	1·0	0·5	0·8	0·9	1·1	1·0	—	5·3
870	5. v	41° 41·7′	105° 16′ E	SA	—	0·7	0·6	0·6	0·5	0·5	—	—
871	6. v	39° 32·1′	107° 06·4′ E	SA	0·9	1·0	0·8	1·0	0·8	0·7	—	5·2
872	7. v	37° 09·1′	108° 47·2′ E	ST	0·6	0·4	0·2	0·7	0·5	0·6	—	3·0
873	8. v	34° 19·1′	110° 21·7′ E	ST	0·4	0·4	0·4	0·7	0·6	0·6	—	3·1
874*	9. v	32° 15·2′	112° 26·2′ E	ST	0·5	0·3	0·3	0·7	0·7	—	—	—
875	10. v	32° 12·8′	113° 48′ E	ST	0·6	0·4	0·6	0·6	1·1	0·3	—	3·6

Table 11 *e* (*cont.*)

Station	Date	Latitude S	Longitude	Zone	Depth (m.)							
					50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
					Pacific Sector (2213–2286), *Atlantic Sector* (2288–2310)							
2213	8. ii. 38	46° 27·6′	172° 05·3′ E	SA	0·1	0·4	1·1	0·8	1·0	—	—	—
2214	9. ii	48° 38·1′	176° 08·2′ E	SA	1·3	2·1	1·6	1·2	1·9	1·2	—	9·3
2216	10. ii	50° 06·9′	179° 42·8′ E	SA	2·4	1·4	2·4	0·9	2·3	1·7	—	11·1
2217	10/11. ii	52° 21·6′	176° 11·4′ W	SA	2·6	0·5	3·7	1·1	1·1	1·7	—	10·7
2218	11. ii	54° 29·6′	172° 08·6′ W	SA	2·3	1·0	1·4	1·8	2·1	1·8	—	10·4
2219	12. ii	56° 30·5′	171° 00·8′ W	SA	10·5	1·5	1·5	2·4	3·6	1·3	—	20·8
2220	13. ii	58° 38·8′	169° 33·6′ W	SA	4·9	2·3	3·2	3·9	1·5	0·4	—	16·2
2221	14. ii	60° 56·1′	168° 20·1′ W	A	5·5	1·1	1·0	4·3	2·8	1·9	—	16·6
2223*	16. ii	63° 19·4′	167° 20·9′ W	A	—†	—†	1·9	1·6	0·8	0·5	—	—
2224	16. ii	64° 51·3′	166° 34·6′ W	A	0·4	0·5	0·9	1·8	1·3	0·9	—	5·8
2226	17. ii	67° 19·6′	165° 07·4′ W	A	0·8	1·6	1·5	2·1	1·7	0·3	—	8·0
2232	19. ii	67° 10·1′	155° 17·1′ W	A	—†	—†	—†	3·5	1·1	—	—	—
2238	21. ii	63° 40·5′	144° 26·4′ W	A	—†	—†	1·0	0·6	0·7	0·4	—	—
2244	23. ii	67° 21·8′	134° 30′ W	A	—†	0·9	1·3	1·5	0·9	0·8	—	—
2250	25. ii	69° 56·6′	125° 33·3′ W	A	1·3	1·1	1·3	1·3	0·5	0·4	—	5·9
2255	27. ii	67° 40·8′	119° 10·4′ W	A	—†	1·3†	1·6	2·4	1·3	0·4	—	—
2261	1/2. iii	66° 50·8′	111° 40′ W	A	8·9	2·4	2·3	3·6	2·5	1·6	—	21·3
2268	4. iii	70° 11·1′	100° 56·4′ W	A	—†	0·8	0·9	3·1	2·0	0·5	—	—
2274	6. iii	67° 25·3′	87° 58·4′ W	A	—†	0·9	1·4	2·4	3·2	1·5	—	—
2280	8/9. iii	64° 25·9′	75° 47·1′ W	A	—†	1·6†	1·3	2·1	0·7	0·5	—	—
2285*	10. iii.	63° 26·1′	66° 57·9′ W	A	—†	0·7†	0·7	0·8	0·9	0·7	—	—
2286	11. iii	61° 18·9′	65° 24·5′ W	A	3·1	2·6	1·1	3·6	3·7	1·4	—	15·5
2288	12. iii	58° 18·2′	62° 42·8′ W	A	2·6	1·1	0·9	2·5	4·2	2·2	—	13·5
2289	13. iii	55° 18·3′	60° 04·5′ W	SA	4·1	1·9	1·5	3·2	2·5	2·3	—	15·5
2291	20. iii	53 02·3′	56° 20·9′ W	SA	1·1	2·3	2·9	4·1	1·9	2·2	—	14·5
2292	21/22. iii	55° 41·2′	53° 31·6′ W	SA	3·9	2·4	1·2	1·5	1·7	1·4	—	12·1
2293	22. iii	57° 34·9′	51° 06·2′ W	A	1·2	1·5	1·5	4·4	3·5	1·3	—	13·4
2295	23. iii	59° 58′	48° 28·1′ W	A	—	0·1	0·3	—	—	1·4	—	—
2298	25. iii	61° 09·6′	43° 15·6′ W	A	3·0	0·8	1·6	3·3	—	—	—	—
2300	26. iii	58° 33′	39° 54·7′ W	A	3·9	3·6	4·4	3·5	3·6	2·0	—	21·0
2302	27. iii	55° 56·3′	36° 42·9′ W	A	2·4	1·4	1·1	3·2	3·0	2·4	—	13·5
2304	4. iv	54° 03·9′	33° 54·4′ W	A	8·0	0·9	1·2	2·9	3·4	2·6	—	19·0
2306	6. iv	53° 32·4′	24° 16·4′ W	A	5·7	2·7	1·3	5·6	5·1	2·2	—	22·6
2308	8. iv	52° 14·4′	15° 07·8′ W	A	2·7	3·7	1·8	5·4	6·3	2·6	—	22·5
2310	10. iv	50° 46·2′	05° 14·1′ W	A	5·5	3·1	2·6	7·6	6·6	1·9	—	27·3
					Pacific Sector (2838–2844), *Atlantic Sector* (2845–2864), *Indian Ocean Sector* (2867–2881)							
2838	17/18. vi. 51	61° 22′	104° 01′ W	A	0·5	0·2	0·6	1·2	2·9	—	—	—
2839	19/20. vi	60° 32′	90° 23′ W	A	0·3	0·2	0·2	0·9	1·4	1·4	—	4·4
2841	21/22. vi	59° 01′	77° 38′ W	SA	0·5	0·3	0·3	1·5	2·1	2·1	—	6·8
2842	23. vi	63° 30′	77° 13′ W	A	0·5	0·3	0·6	0·6	3·9	0·6	2·1	6·5
2844	25. vi	60° 11′	70° 08′ W	A	0·2	0·2	0·5	1·2	2·0	2·1	1·4	6·2
2845	26. vi	57° 40′	65° 02′ W	SA	0·3	0·2	0·5	—	—	—	—	—
2848	5/6. vii	52° 35′	54° 51′ W	SA	0·5	0·2	0·5	2·1	2·1	—	—	—
2849	6. vii	53° 40′	51° 05′ W	SA	0·3	0·3	0·6	0·9	3·2	1·4	—	6·7
2850	7/8. vii	54° 47′	46° 55′ W	SA	0·3	0·3	0·3	0·5	1·7	2·4	2·3	5·5
2851	8. vii	56° 05′	42° 24′ W	A	0·3	0·2	0·6	1·2	1·4	2·9	1·5	6·6
2852	9. vii	57° 35′	37° 20′ W	A	0·5	0·3	0·3	1·4	2·7	0·9	0·9	6·1
2853	10. vii	58° 01′	33° 03′ W	A	0·3	0·2	0·5	1·1	2·0	1·5	—	5·6
2864*	16. vii	57° 26′	10° 21′ W	A	0·3	0·3	0·5	1·8	2·3	—	—	—
2867	17/18. viii	33° 12′	33° 50′ E	ST	1·4	1·1	1·1	1·1	0·6	0·6	—	5·9
2868	19/20. viii	38° 08′	38° 17′ E	ST	0·6	0·8	1·1	0·5	0·5	0·3	—	3·8
2869	21. viii	42° 58′	43° 31′ E	SA	1·5	3·0	1·7	1·4	2·6	0·8	1·5	11·0
2870	23/24. viii	48° 00′	48° 57′ E	A	0·8	0·5	1·2	1·5	—	—	—	—
2871	24. viii	50° 09′	51° 23′ E	A	0·5	0·5	1·5	3·6	3·0	0·9	—	10·0
2872	25. viii	52° 30′	54° 17′ E	A	0·2	0·2	0·5	2·3	3·5	—	—	—
2874	27/28. viii	57° 30′	60° 37′ E	A	0·2	0·3	1·5	3·0	2·6	0·8	—	8·4
2875	28/29. viii	59° 15′	64° 08′ E	A	0·5	0·5	0·6	2·3	2·3	0·8	—	7·0
2880	10. ix	54° 13′	84° 45′ E	A	0·9	0·5	0·6	1·7	—	—	—	—
2881	12. ix	49° 53′	91° 36′ E	SA	0·3	0·2	0·9	0·8	0·9	0·9	0·5	4·0

Table 11*f*. *Sub-tropical and tropical observations*

Station	Date	Latitude S	Longitude	Zone	Depth (m.)							
					50–0	100–50	250–100	500–250	750–500	1000–750	1500–1000	1000–0
					Across the Indian Ocean in 32° S							
1736	14. iv. 36	31° 58·1′	114° 52·2′ E	ST	2·0	0·6	0·8	2·5	1·7	—	—	—
1738*	16. iv	32° 10·6′	109° 16·3′ E	ST	0·4	—	1·4	0·9	0·8	0·8	—	—
1740	17/18. iv	32° 01·1′	103° 57·5′ E	ST	0·7	0·7	1·1	0·6	0·5	0·7	—	4·3
1742*	19. iv	31° 57·9′	97° 54·5′ E	ST	0·5	0·5	0·7	0·7	0·5	1·0	—	3·9
1744	20. iv	32° 07·2′	92° 10·8′ E	ST	0·6	0·4	0·6	0·5	—	0·3	—	—
1746*	22. iv	32° 02·1′	87° 02·5′ E	ST	0·3	0·8	0·5	0·4	1·0	0·9	—	3·9
1748	23. iv	31° 54·7′	82° 08·9′ E	ST	0·5	0·3	0·4	0·7	0·8	0·6	—	3·3
1750*	25. iv	32° 12′	75° 32·6′ E	ST	0·2	0·3	0·1	0·7	0·7	1·0	—	3·0
1752	26. iv	32° 04·5′	70° 43·9′ E	ST	0·3	—	0·4	0·5	0·7	0·5	—	—
1754*	28. iv	31° 48·9′	65° 30·3′ E	ST	0·1	0·2	0·2	0·3	0·4	0·7	—	1·9
1756	29/30. iv	32° 00′	60° 55·6′ E	ST	0·2	0·2	0·6	0·5	0·9	0·9	—	3·3
1758*	1. v	31° 55·6′	55° 06·5′ E	ST	0·2	0·1	0·4	0·6	0·8	0·9	—	3·0
1760	2. v	31° 57·6′	49° 57·4′ E	ST	0·3	0·6	0·5	—	0·6	0·2	—	—
1762*	4. v	31° 57·3′	44° 23·2′ E	ST	0·3	0·3	0·3	0·6	0·5	0·1	—	2·1
1763*	5. v	32° 05·7′	40° 44′ E	ST	0·4	0·1	0·5	0·5	0·4	0·2	—	2·1
1765*	7. v	32° 00·6′	33° 46·9′ E	ST	0·2	0·1	0·3	0·5	0·5	0·3	—	1·9
1766*	8. v	31° 54·7′	29° 48·1′ E	ST	0·5	0·5	0·5	0·5	0·7	0·5	—	3·2
					Longitude 90° E							
2886*	9. x. 51	29° 58′	90° 00′ E	ST	0·5	0·6	1·5	0·9	0·8	0·6	0·9	4·9
2887	10. x	25° 51′	90° 02′ E	ST	0·8	0·5	0·9	0·5	0·2	0·3	0·3	3·2
2888	11/12. x	22° 38′	90° 02′ E	ST	0·3	0·2	0·6	0·3	0·3	0·2	0·3	1·9
2889	12. x	19° 35′	90° 01′ E	ST	0·9	0·3	0·6	0·5	0·3	0·3	0·3	2·9
2890	13. x	16° 37′	90° 05·5′ E	T	0·6	0·6	0·8	0·6	0·3	0·3	0·3	3·2
2891	14/15. x	13° 37′	90° 00′ E	T	0·3	0·6	0·6	0·8	0·5	0·3	—	3·1
2892	15. x	10° 51′	89° 58′ E	T	1·1	0·6	0·8	0·8	0·5	0·2	0·5	4·0
2893	16/17. x	07° 52′	89° 50′ E	T	0·6	0·6	0·6	0·6	0·3	0·2	0·5	2·9
2894	17. x	05° 02′	89° 47′ E	T	0·9	0·9	0·6	0·5	0·2	0·2	0·5	3·3
2895	18/19. x	02° 00′	89° 40′ E	T	1·1	0·8	1·1	0·5	0·3	0·3	0·3	4·1

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SPERM WHALES OF THE AZORES

By

ROBERT CLARKE

CONTENTS

SPERM WHALES OF THE AZORES

By Robert Clarke

(Plates I, II, text-figs. 1–18)

INTRODUCTION

In the Azores or Western Islands there is a flourishing whale fishery conducted solely for the sperm whale. All the nine islands (except Corvo) engage in whaling, and in recent years between five and seven hundred whales have been killed annually in the Azores (Table 30, p. 283). The whales are hunted from open boats, and I have described in an earlier Discovery Report, *Open boat whaling in the Azores* (1954*a*),* the history and existing methods of this remarkable survival from nineteenth-century whaling. That technical account is complementary to the present report on the biology of the whales captured in the Azores. This is mainly based upon the examination of numbers

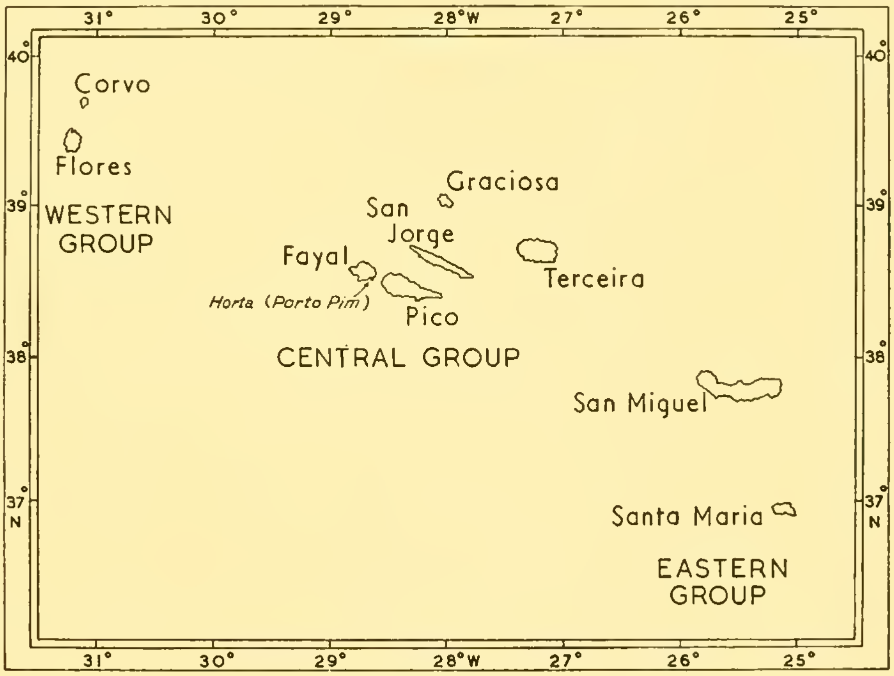

Fig. 1. The Azores.

of carcasses at the whaling station of Porto Pim at Horta on the island of Fayal (Fig. 1). The biological work at Horta began when I visited the Azores in 1949, but since that date the station (described on p. 343 ff. of the earlier report) has annually provided much additional information which I am most happy to acknowledge below.

Since the publication in 1938 of Matthews' report on the sperm whale the commercial importance of the species has grown, and its bionomics, especially in Japan, have received increasing attention. In the present study of sperm whales from the North Atlantic field I have therefore attempted, wherever possible, to compare the findings with those from stocks elsewhere rather than make the treatment merely parochial.

* For a short account see Clarke (1953).

Investigations on whales caught round a single island (Fayal) provide the bulk of the material for this report, so it is well to note that the nine volcanic islands of the Azores, lying towards the middle of the North Atlantic around 38° N. and some 900 miles from Lisbon (Fig. 17, p. 287), are a scattered archipelago disposed in three groups about 100 miles apart, nearly 400 miles separating Corvo in the west from Santa Maria in the east (Fig. 1). Fayal is situated in the Central Group. It is satisfactory to observe that, where the data allow comparison (pp. 280 and 282), the island of Fayal in its relation to whales appears to be a microcosm of the archipelago as a whole.

ACKNOWLEDGMENTS

I again thank all those who specially assisted me during my visit to Lisbon and the Azores in 1949: their names are given in the earlier report. I have made further visits, and now gratefully acknowledge the interest taken in my work by Commander Henrique dos Santos Tenreiro, Government Delegate to the Organismos das Pescas, and by the officers of the Grémio dos Armadores da Pesca da Baleia, especially the President, Senhor Francisco Marcelino dos Reis, and the Secretary, Dr João Carlos Duff Burnay Carvalhosa. To these gentlemen in Lisbon I am indebted for many privileged facilities in the Azores.

The present report could not have been written without the most generous assistance of two friends, Mr B. L. Collins of Horta, until recently British Consular Agent, and Senhor José Tavares dos Reis, manager of the whaling station at Porto Pim. When I left Horta in September 1949, Senhor Reis spontaneously offered to continue the routine examination of whale carcasses, and this scheme was kindly approved by Senhor Joaquim Martins do Amaral, owner of the station. Most of the results presented here are derived from notes and collections to which Senhor Reis has devoted much care and time over the years. I am happy also to recall his great help in 1949, and also the companionship of his whalemen at Porto Pim, where, on a flensing platform where neither he nor any other spoke English, Senhor Reis patiently laboured to see that this was no barrier to my work. Mr Collins, who gave me such warm support in 1949, has continued by his collaboration with Senhor Reis to look after my scientific interests in Fayal and attend to the forwarding of data and collections. Here I would like to thank Dr Antero Ramos Taborda, formerly Director of Customs at Horta, and the present Director, Dr Aristides Taborda, who have smoothed many difficulties in the carriage of scientific material. Senhor Jacinto Silviera de Medeiros of Horta has kindly provided details of the recovered harpoons recorded in Table 26, p. 277.

Occasionally I have referred to work done in the Antarctic during the 1947–8 whaling season when I sailed as Whale Fishery Inspector on board Fl. F. *Southern Harvester*. I am indebted to the owners, Messrs Christian Salvesen & Co., and to Captain Konrad Granøe, for the facilities and co-operation enjoyed at that time. I should like to thank also Captain H. Jespersen, managing director of Scottish Whalers Ltd., for facilities when in June 1951 I visited the whaling station at West Loch Tarbert, Harris, and examined a sperm whale which has its place in this report (p. 252).

At home I thank Mr Bernard Stonehouse, of the Falkland Islands Dependencies Survey, who has generously provided details of new-born sperm whales which he examined during a visit to the Azores in 1951 (Table 22, p. 269). Remarks on the male sexual cycle (p. 271) owe much to the kind assistance of my colleague Dr R. M. Laws. There are certain other acknowledgments in the text.

Dr F. C. Fraser of the Natural History Museum and my colleague Dr H. E. Bargmann have kindly read a preliminary draft of this report and given their helpful criticism. Finally I thank Dr N. A. Mackintosh, C.B.E., for his advice and guidance at all stages of the work.

MATERIAL

Carcasses of 322 sperm whales were examined, or partially examined, at Horta between 1949 and 1954. They comprised 148 male and 174 female whales (Table 1). Ovaries collected by Senhor Reis between 1950 and 1954 have been dissected in London. In 1953 and 1954 Senhor Reis collected testis material to augment that taken in 1949. He has also contributed five small foetuses. During a visit to the Azores in 1955 I was present on the platform at Horta when a remarkable specimen of the giant squid *Architeuthis*, described on p. 257, was recovered intact from a whale's stomach.

Table 1. *Sperm whales examined at Horta, Fayal, from* 1949 *to* 1954

		Males	*Females*	*Totals*
Clarke:	1949	24	19	43
Reis:	1950	—	36	36
	1951	—	32	32
	1952	53	33	86
	1953	27	28	55
	1954	44	26	70
Totals		148	174	322

Catch statistics are from various sources. In 1949 I was able to copy unpublished whaling returns from Fayal for 1939 to 1948. These provided monthly figures of sexed catches from 1939 to 1943, and of dated catches, giving lengths besides sex, from 1944 onwards. Returns for 1948 were particularly detailed and I have used those from Fayal, Flores and Cais do Pico in remarks on schooling and movements from the coast. Since 1949 Senhor Reis has completed the statistics from Fayal by supplying catch dates, sexes and lengths of those whales he did not examine anatomically. In this way detailed statistics of 693 male and 358 females were made available. However, before I came to work at Porto Pim on 9 July 1949 whales had always been measured from snout to tailstock only, although all measurements at Fayal since that date have been the total length, that is, including the length of the flukes. Accordingly it has been necessary when discussing average lengths of the catch by months (p. 285) and by years (p. 290) to treat separately the statistics collected before and after 9 July 1949. For the Azores generally the annual publication *Estatística das Pescas Marítimas no continente e ilhas adjacentes* gives catches and whaleboat numbers in each island for the period 1896–1950. Sexed figures of annual catches (1948–54) and monthly catches (1949, 1951–2) at the Azores have been got from statistics and graphs published in the *Relatório e Contas* of the Grémio dos Armadores da Pesca da Baleia (see Clarke, 1954, p. 303). The *Relatório e Contas* also provides similar data for Madeira (1951–4), although these catches are not sexed.

For purposes of comparison there are introduced some of the data from 103 male sperm whales examined on board Fl. F. *Southern Harvester* during the Antarctic season 1947–8.

SIZE RANGE

Size restrictions are not at present enforced in Portuguese whaling, and Table 2 and Fig. 2 show that catches in the Azores cover a wide range of sizes, and include a substantial proportion of females. Statistical data on females are now scarcely available to investigators whose material is drawn from catches of sperm whales made under the existing regulations of the International Whaling Commission, since female whales are almost totally protected by the agreed minimum length.

The present material includes measurements of new-born whales from the island of Pico. These are discussed on p. 269 where it will be shown that sperm whales in the North Atlantic are born when between 3·7 and 4·1 m. long, that is, between 12 and 13 ft., the mean length being 3·92 m. (12 ft. 10 in.).

The largest whale among 417 males taken at Fayal between 9 July 1949 and 1954 was 18·00 m. (59 ft. 1 in.) in length and was measured by Senhor Reis on 8 November 1953. Although this whale was still capable of further growth, the anterior thoracic vertebrae being still unfused, it must have

Table 2. *Length frequencies of the catch at Horta from 9 July 1949* to 1954*

Feet	*Males*	*Females*	*Feet*	*Males*	*Females*
20	1	—	40	12	1
21	—	—	41	16	—
22	2	3	42	17	—
23	1	—	43	14	—
24	1	1	44	5	—
25	2	4	45	21	—
26	4	5	46	10	—
27	4	1	47	13	—
28	3	3	48	29	—
29	—	5	49	24	—
30	3	8	50	25	—
31	8	17	51	31	—
32	11	20	52	19	—
33	9	13	53	18	—
34	14	24	54	17	—
35	17	37	55	6	—
36	12	22	56	3	—
37	14	17	57	—	—
38	13	12	58	—	—
39	17	9	59	1	—
			Totals	417	202

* See note on measurements on p. 241.

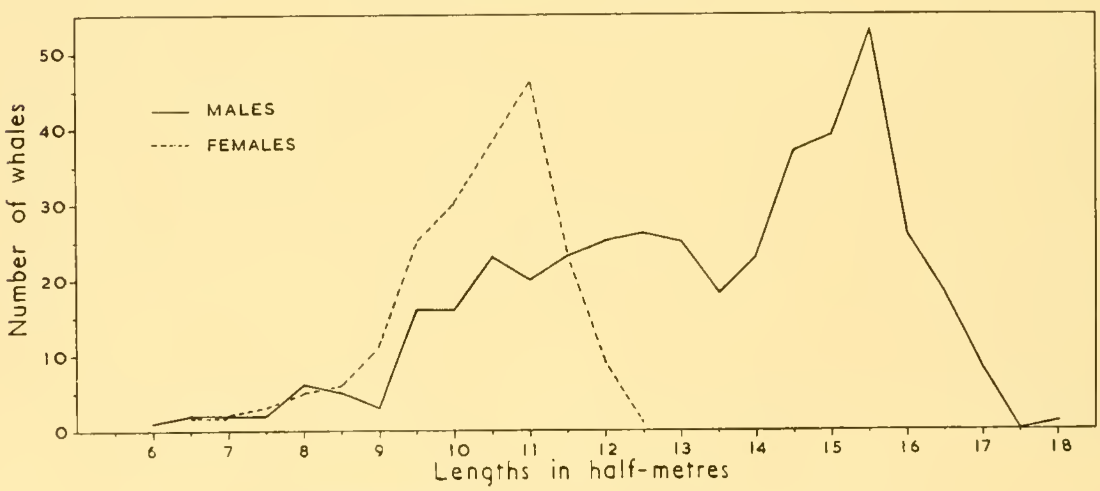

Fig. 2. Length frequencies of the catch at Horta, Fayal from 9 July 1949 to 1954.

been approaching the maximum size attainable by sperm whales. *The International Whaling Statistics* (XI–XXXIII) publish 68,765 measurements of male sperm whales killed between 1932 and 1953, and only eighty-four or 0·122% exceed 59 ft. Drouët mentions another 59-ft. sperm whale taken on the Azores ground, and adds that in the sperm whale fishery the Azores were noted for large whales (1861).

Of 202 females taken at Fayal between 9 July 1949 and 1954 the largest was 12·30 m. (40 ft. 4 in.) in length and was measured by Senhor Reis on 11 April 1953. I do not at present know any reliable record of a larger female sperm whale: the *International Whaling Statistics* record females up to 55 ft. in length, but it is well known (Matthews, 1938, p. 142) that a male sperm whale with its penis completely retracted is occasionally recorded as a female.

It would appear then that the maximum sizes attained by sperm whales in the Azores are not less than those attained by sperm whales elsewhere.

EXTERNAL CHARACTERS

Study of the external characters affords one means of examining the various stocks of sperm whales for possible differences, a matter which will be further discussed on p. 286 ff.

In sperm whales of the North Atlantic and adjacent seas the external characters have been described by several authors (Hentschel, 1910; Lillie, 1910; Hamilton, 1914; Cabrera, 1925; Wheeler, 1933; Boschma, 1938; and Bolognari, 1949). Observations referring specifically to Azores whales are recorded by Monaco (1888), Pouchet & Beauregard (1889), and Pouchet & Chaves (1890). All these references concern one or a few whales: the present sample is larger, consisting of the whales I examined in 1949 and the five small foetuses.

In studying variation, the external characters likely to yield most profit are the proportional measurements, the colour of the body surface, the dorsal fin and the number of humps posterior to it, and the number and pattern of grooves about the throat.

Proportional measurements

The body proportions of five foetuses and one adult whale are recorded in Table 3. To the standard measurements it has been possible to add no. 9*a*, the span of the flukes, because the widespread modern practice of docking the flukes immediately after capture is not followed in the Azores. In Table 3 the Azores measurements are compared with southern measurements from a male foetus in the length group 0–1 m. and from several whales of 13–14 m., the appropriate material among southern whales described by Matthews (1938, Table IV). It is unfortunate that proportional measurements of only one Azores whale could be made in 1949, but the comparison, so far as it goes, does not seem to establish any significant differences between the proportions of this individual and the range of those in southern whales. As much can be said for the foetal measurements, except to note that nos. 24 and 25 show such large discrepancies so considerably at variance with other comparisons as to suggest clerical errors here, or differences in interpreting the sense of measurements 24 and 25.

Colour

In Table 4 the markings of eighteen males and fifteen females have been classified into seven categories. Only one whale, a juvenile male 7·5 m. long, might be called entirely pigmented, being a uniform iron grey colour except for slight streaking between the umbilicus and the penis slit. The remainder had more or less white ventrally, or some light streaks or mottling. In a third of these the unpigmented area was a ventral white splash, usually in the umbilical region, but occasionally limited to patchy development around the throat region or the anus: the umbilical splash might be a small white knot, or flaring out on either side of the middle line as two horns or flags of whiteness directed posteriorly, or more extensive and stretching from umbilicus to reproductive aperture. About as many whales had white or light grey ventro-lateral streaks or flecks, of more or less extent, brushing out from the umbilicus backwards,* although sometimes sending an arm of diffuse streaking forward to the insertion of the flippers on either side. In 15% of the sample the last two categories were

* The 'umbilical whorl' of Matthews (1938, p. 109).

Table 3. *Measurements of five foetuses and one adult whale from Horta. The measurements, expressed as percentages of the total length, are compared with those from appropriate southern whales described by Matthews* (1938)

	Measurement	*Foetuses* ♀♀ 20·4 cm. (%)	♀♀ 22·5 cm. (%)	♀♀ 24·1 cm. (%)	♀♀ 37·2 cm. (%)	♂ 35·5 cm. (%)	*Adult* ♂ 13·60 m. (%)	*Whales described by Matthews* (1938) *Foetus* ♂ 20 cm. (%)	*Adults* ♂♂ 13–14 m. *No.*	*Adults* ♂♂ 13–14 m. *Range* (%)
1	Total length	100·0	100·0	100·0	100·0	100·0	100·00	100·00	—	—
2	Projection of snout beyond tip of lower jaw	2·0	1·8	2·1	4·0	3·1	5·14	—	6	4·32– 9·54
3	Tip of snout to blowhole	2·0	1·8	2·9	2·7	2·5	2·94	—	—	—
4	Tip of snout to angle of gape	9·8	9·3	11·2	12·1	11·0	20·51	10·00	3	20·20–27·80
5	Tip of snout to centre of eye	15·7	14·7	15·8	14·8	15·2	23·16	15·00	5	26·45–27·95
6	Tip of snout to tip of flipper	39·7	36·8	38·2	36·6	37·2	—	40·00	2	43·35–44·53
7	Centre of eye to centre of ear	5·4*	5·7*	5·4	5·1	4·8	3·01	—	1	2·56
8	Notch of flukes to posterior emargination of dorsal fin	35·3	36·8	34·9	36·3	35·2	31·39	45·00	6	34·05–37·10
9	Width of flukes at insertion	12·7	12·9	12·0	12·1	13·5	—	10·00	6	7·02– 7·84
9*a*	Span of flukes, tip to tip	17·2	18·7	20·3	22·0	23·1	26·10	—	—	—
10	Notch of flukes to centre of anus	31·2	32·4	31·5	32·0	31·6	32·13	27·50	6	27·60–32·95
11	Notch of flukes to umbilicus	47·1	52·4	47·7	49·7	49·9	49·34	55·00	6	43·50–51·05
13	Centre of anus to centre of reproductive aperture	2·0	1·8	1·2	1·6	9·6	11·54	12·50	5	10·95–13·14
14	Vertical height of dorsal fin	1·0	1·3	0·8	0·8	1·4	2·06	—	1	2·85
15	Length of base of dorsal fin	8·3	10·2	9·5	9·1	14·1	—	—	1	8·00
16	Axilla to tip of flipper	8·3	7·6	7·5	7·0	9·6	5·66	10·00	4	6·45– 8·72
17	Anterior end of lower border to tip of flipper	11·8	11·1	10·8	10·8	12·1	7·57	11·25	4	6·85– 9·40
18	Length of flipper along curve of lower border	12·3	11·5	11·2	11·3	12·7	11·02	—	—	—
19	Greatest width of flipper	5·9	5·8	5·8	5·6	6·2	4·71	5·00	4	4·24– 5·27
20	Length of severed head from condyle to tip	—	—	—	—	—	33·60	—	2	34·40–35·10
21	Greatest width of skull	—	—	—	—	—	—	—	—	—
22	Skull length, condyle to tip of premaxilla	—	—	—	—	—	—	—	—	—
23	Length of flipper from head of humerus to tip	—	—	—	—	—	8·60	—	—	—
24	Depth of body at dorsal fin	20·6	19·6	21·6	19·9	22·8	—	5·00	—	—
25	Height of head	23·0	20·9	24·5	23·7	24·5	18·30	11·00	4	14·70–15·75

* In the foetuses measuring 20·4 and 22·5 cm., the measurement no. 7 may not be reliable because the external ear may have been confused with small abrasions on the head.

combined by a ventro-lateral extension of the white splash as streaks backwards. In two whales, both females, the white areas were absent from the ventral surface and confined to a partially white lower jaw. This character, a lower jaw half-white or more downwards from the alveolar margins, was present in certain of the whales with ventral white areas, although a more common co-existent marking (found in 48% of the sample) was a combination of the half-white lower jaw with a white margin to the upper jaw (Plate I, fig. 2), occasionally accentuated by some white around the gape.

It is fairly clear from Table 4 that the sexes do not differ in their colour markings. Matthews, who does not separate males from females when discussing the colour of southern sperm whales, has employed similar categories and his results are included in Table 4. In general they are not unlike the Azores proportions: category 7 is an exception, and none of the Azores whales bore light flecks upon the flukes observed in 7% of the southern whales. But the present sample is a comparatively meagre one, and these differences alone do not suggest that colour variation in Azores whales is significantly different from that of southern stocks. Ohno & Fujino (1952, p. 133) have also reported on the body colour of southern sperm whales from the Antarctic, and Omura (1950, p. 92) has reported on those from the North Pacific. Comparing all four samples, it is not possible to distinguish any clear-cut difference between these whales from different seas.

Table 4. *Colour variations of whales examined at Horta in* 1949. *Where possible variations are compared with those recorded by Matthews* (1938)

	Colour marking	*No. of males*	*No. of females*	*Together* No.	*Together* (%)	*Matthews* (1938) *on* 70 *whales* (%)
1	Uniformly pigmented except for slight streaking	1	—	1	*3*	*8·5*
2	Ventral white splash	6	5	11	*33*	*32·7*
3	Ventro-lateral white or light grey streaks	7	6	13	*39*	—
4	Ventral white splash and ventro-lateral streaks both present	3	2	5	*15*	*24·3*
5	Light flecking on dorsal fin or posterior dorsal humps	1	2	3	*9*	*2·8*
6	Lower jaw half-white or more downwards from alveolar margins	3	3	6	*18*	*17*
7	Lower jaw half-white and white margin to upper jaw	7	9	16	*48*	*20*
	Number of whales whose colour was recorded	18	15	33	*100*	*100*

In his account of the progressive pigmentation of the foetus (1938, p. 119) Matthews implies that the extension of dorsal coloration towards the ventral surface is not completed until the foetus has achieved a length of approximately 3 m. However, the colours of the five small foetuses from Fayal (Table 5) suggest that pigmentation can be completed at a much smaller size, when the foetus is no more than 0·2 m. long. Moreover, Beddard (1915) described the colour of a southern sperm whale foetus 0·5 m. long as brownish black and mentioned no unpigmented areas. In Table 5 also, the notes on areas of pale pigmentation do not seem to suggest that the spread of pigment is always from above downwards.

The head whorl is a characteristic marking in flecks and streaks on the lower part of the head in some whales. A well-defined and extensive head whorl was regarded by old-time whalemen (Beale, 1839) as a sign of comparative age in the sperm whale. Matthews (1938, p. 119) doubts this assumption but he figures in his Plate V a well-developed head whorl. At Horta in 1949 it was only possible to record the degree of development of this character in a few individuals, because it was the custom to strip 'blackskin' from the whales as soon as they were hauled into the slipway (Clarke, 1954*a*, p. 343), and this practice disfigures and obscures the whorl. A whale of 16·0 m. (Clarke, 1954*a*, Plate XVI, fig. 5), where the whorl was so much developed as to make the animal 'grey-headed', was found to be physically mature.

Dorsal fin and posterior dorsal humps

The dorsal fin varies a good deal in size, and its limits are ill-defined so that measurements 14 and 15 in Table 3 are approximate only: the fin is always very broad transversely. In some whales it may be sufficiently low and broad to merit the old name 'hump', although 'dorsal fin' is no misnomer in other individuals (Plate I, figs. 1 and 5).

Table 5. *The external characters of five small foetuses from Horta. See also Plate I, fig.* 4

Foetus	♀ 20·4 cm.	♀ 22·5 cm.	♀ 24·1 cm.	♂ 35·5 cm.	♀ 37·2 cm.
Colour	Completely pigmented. The forepart of the body a dark slate-grey and the hind part a lighter tone of middle grey	A dull brownish grey, paler on the flippers and on the flanks and ventral surface anterior to the umbilicus. A diffuse pale area encircled the tail in front of the flukes	Almost uniform brownish grey, but with a pale lower jaw	Everywhere grey, except for a pale, almost white, lower jaw. The grey body colour was lighter around the eyes and on the tailstock and flippers	A dark slate-grey paler on the flanks, jaws, and forepart of the head; pale patches on the ventral surface of the flukes
Dorsal fin	Low and rounded	Low and rounded	Low and rounded	Low and rounded	Very low and rounded
Posterior dorsal humps	Slight hump in front of flukes	Five slight humps	Five very slight humps	Four slight humps	Slight hump in front of flukes
Throat grooves	None	None	Two faint, fairly symmetrical grooves	Two faint, fairly symmetrical grooves	Two faint indentations

Along the mid-line between the dorsal fin and the flukes there are from one to six small elevations which may be called the posterior dorsal humps. The old whalemen knew these collectively as the 'ridge' (Beale, 1839, p. 24). One hump is always present and is distinguished as a smooth rising of the tailstock just in front of the insertion of the flukes: the other posterior dorsal humps are more abrupt prominences in front of this one (Plate I, fig. 5). In Table 6 the frequencies of the numbers of posterior dorsal humps suggest that among males there may be a normal frequency distribution around four humps, but four, five or six humps seem to be equally common among females. Bolognari (1949) maintained, surprisingly enough, that posterior dorsal humps were absent in all whales (about seven) which he examined in the Mediterranean. Matthews (1938, p. 120) says that in southern whales 'the lesser humps are usually four or five in number....'

The posterior dorsal humps do not appear with increasing age, for there is no correlation between the number of humps and the body length, or the degree of physical maturity, or (in females) the number of old corpora lutea in the ovaries. Moreover, Table 5 shows that several humps can be present when the foetus is quite small.

Table 6. *Frequencies of the numbers of posterior dorsal humps in whales examined at Horta in* 1949

	No. of whales	
No. of humps	*Males*	*Females*
1	2	1
2	—	1
3	2	1
4	6	3
5	4	3
6	3	3
Whales examined	17	12

Throat Grooves

Longitudinal grooves in the throat region (Plate I, fig. 2) were present in all the whales (seventeen males and eleven females) examined for this character. It seems that, rarely, throat grooves may be absent in the sperm whale, for Matthews mentions one negative record in his southern sample. Those of the Azores whales exhibited great variation in number and arrangement: the examples reproduced in Fig. 3, selected from sketches made on the flensing platform, show a series of increasing complexity from one to as many as thirty-three grooves. The frequencies of their numbers, which are mere counts irrespective of depth, definition and size of groove, are shown in Table 7. It can only be said that most whales have fewer than about seven or eight grooves. But examination of their patterns

Table 7. *Frequencies of the numbers of throat grooves in whales examined at Horta in* 1949

	No. of whales	
No. of grooves	*Males*	*Females*
1	1	1
2	4	1
3	1	—
4	2	3
5	3	—
6	—	1
7	—	2
8	—	—
9	2	1
10	1	—
14	—	1
16	1	—
25	—	1
28	1	—
33	1	—
Whales examined	17	11

suggests an underlying plan. Four of the twenty-eight whales had only a pair of grooves, deep with well-defined limits, lying about the middle line. Another four had some shallow accessory grooves in addition to the two deep ones. Two whales had each three deep grooves and an accessory groove arranged more or less symmetrically, and a further two had regular sets of four deep grooves each. Seven others had sets of relatively shallow grooves in bilateral symmetry, each side comprising two to seven grooves, arranged in a diminishing series with the longer grooves nearest the middle line. The remaining seven whales had median sets of from five to thirty-three grooves. In any whale where the grooves were numerous these might be dissected and anastomosed, giving a cracked appearance to the throat. These patterns of bilateral and of median symmetry could all spring from the arrangement with two grooves, and this arrangement, rather than that (found in two whales) of a single median groove, would appear to be the primitive one. It is a condition which has been retained in most representatives of that other group of toothed whales, the Ziphiidae. Pouchet & Chaves (1890) have earlier compared the two deep throat grooves of *Hyperoodon* with a similar arrangement in a sperm whale they examined at San Miguel.

At Horta in 1949 a foetus 3·53 m. long had a pair of throat grooves, and Matthews has recorded them from a southern foetus of 3·0 m. But Table 5 shows that they can appear earlier, when the foetus is as small as 0·24 m., although possibly not at a younger age. There must be variation in the foetal age at which they appear, for Beddard (1915, 1919) found that they were absent not only in foetuses of 0·114 and 0·241 m., but also in one of 0·5 m., and they are not shown in Kukenthal's figure of a 0·74 m. foetus (1914, Plate 3*b*, fig. 35).

It might be supposed that numerous throat grooves are a sign of ageing, akin to the wrinkling of the neck in man, but their numbers show no correlation with age in the post-natal whales examined at Horta. Beddard (1900, p. 183) and Boschma (1938, p. 157) may be correct in suggesting that the grooves allow distension of the throat when swallowing large prey.

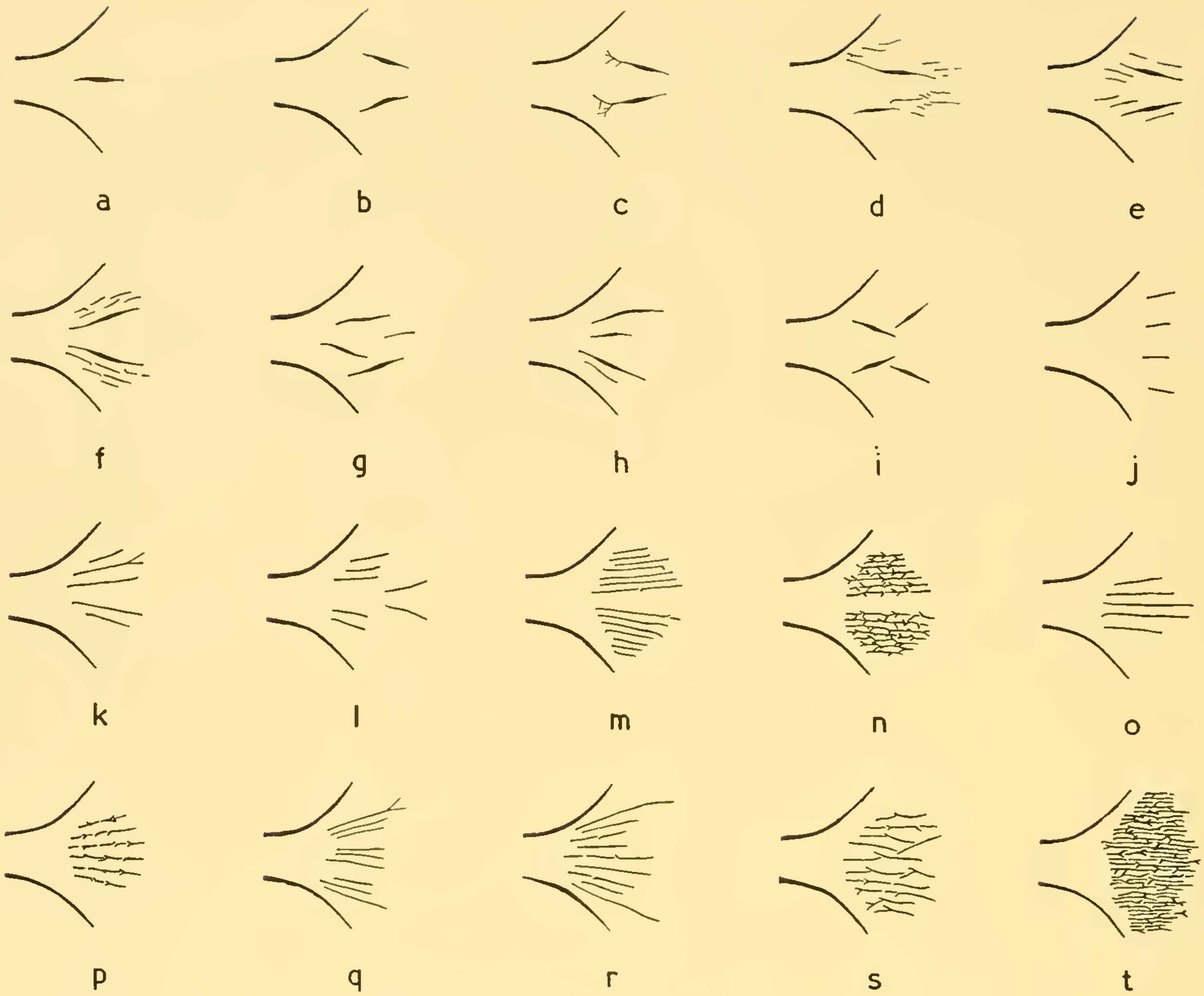

Fig. 3. Variation in the throat grooves of whales examined at Horta in 1949.

a F17, ♂ 7·5 m.; F38, ♀ 9·8 m.
b F2, ♂ 12·8 m.; F25, ♂ 12·2 m.; F29, ♂ 9·9 m.
c F33, ♂ 7·8 m.
d F6, ♂ 16·0 m.
e F3, ♂ 12·5 m.; F15, ♂ 7·8 m.
f F36, ♀ 10·2 m.
g F30, ♂ 13·6 m.
h F18, ♀ 11·3 m.
i F27, ♂ 11·1 m.; F34, ♀ 9·9 m.
j F31, ♀ 9·9 m.
k F5, ♂ 15·1 m.
l F16, ♀ 9·9 m.; F32, ♀ 9·5 m.
m F4, ♂ 14·9 m.; F24, ♀ 10·4 m.
n F26, ♀ 11·6 m.
o F8, ♂ 11·0 m.; F19, ♂ 12·7 m.
p F35, ♀ 9·5 m.
q F7, ♂ 11·4 m.
r F23, ♀ 10·2 m.
s F20, ♂ 14·6 m.
t F9, ♂ 11·3 m.

Two whales at Horta had additional grooves elsewhere on the body. One male had a pair of grooves immediately posterior to the umbilicus; a sperm whale examined in the 1947–8 Antarctic season had similar grooves. Another male of 16·0 m., notable for the conspicuous development of the corrugations on the flank and chest (Plate I, fig. 2), had four dented grooves on the chest between the flippers, and another deep groove on the post-anal ventral hump, that is, the rising between the anus and the flukes found in all sperm whales.

TEETH

In sperm whales the functional teeth are restricted to the lower jaw. The data in Table 8 seem enough to show that, at least in females of the North Atlantic, these teeth do not erupt until the whale is between 8·4 and 9·5 m. long, that is, between 28 and 31 ft. This agrees well with Bennett's observation (1836, p. 127) that 'when the young cachalot has attained a length of 34 ft., its teeth are perfectly formed, though not visible until it exceeds 28 ft.'. For Azores males, where less data are available, Table 8 only suggests that the teeth erupt at some length greater than 7·8 m. (26 ft.) and less than 11·0 m. (36 ft.). However, Matthews (1938, p. 122) mentions southern males of 8·8 and 10·4 m. with erupted teeth, so it is likely that males and females cut their teeth at similar body lengths.

Table 8. *Eruption of the mandibular teeth in whales examined at Horta between* 1949 *and* 1954. *The letters 'i' and 'm' indicate whether the whales were sexually immature or mature respectively. Males larger than* 11·0 *m. had erupted teeth. Females larger than* 9·5 *m. had erupted teeth and were sexually mature*

Lengths in metres	*No. of whales* — *Teeth not erupted*	*No. of whales* — *Teeth erupted*
	Males	
6·58	1 *i**	—
7·5	1 *i*	—
7·8	1 *i*	—
11·0	—	1 *i*
11·3	—	1 *m*
	Females	
6·58	1 *i**	—
7·2	1 *i*	—
7·3	—	—
7·4	—	—
7·5	1 *i*	—
7·6	1 *i*	—
7·7	—	—
7·8	—	—
7·9	—	—

Lengths in metres	*No. of whales* — *Teeth not erupted*	*No. of whales* — *Teeth erupted*
	Females	
8·0	2 *i*	—
8·1	—	—
8·2	—	—
8·3	—	—
8·4	—	1 *i*†
8·5	—	—
8·6	—	—
8·7	—	—
8·8	—	2 *m*
8·9	—	1 *i*
9·0	1 *i*	1 *i*
9·1	—	2 *m*
9·2	—	—
9·3	—	—
9·4	1 *m*‡	3 *m*§
9·5	—	2 *m*

* Whales F306, ♂ and F307 ♀, each 6·58 m. long, were calves.
† In whale F89 the teeth were just erupting.
‡ Whale F198 was in its first pregnancy.
§ In one of these whales (F94) the teeth were just erupting and the whale was in its first pregnancy.

Sperm whales of the North Atlantic are weaned when about 6·7 m. long (p. 275), so it is clear from Table 8 that the teeth are not cut until some long time after the age at weaning. The data in Table 8, so far as they go, suggest that the teeth of females erupt at a mean body length of about 8·8 m. (29 ft.), which is also the mean length at which females become sexually mature (p. 265). It may be that a causal connection exists between teething and puberty, although this possibility is not entirely supported by the notes and footnotes on sexual maturity and pregnancies in the table.

Like female Ziphioid whales, where functional teeth never erupt, young sperm whales with still toothless jaws seem to find no difficulty in securing the squids which are their staple food: of those nine Azores whales past weaning which had unerupted teeth, eight had stomachs containing small or moderate amounts of squids, and the stomach of the ninth (Whale F308, 7·2 m.) was crammed full with the bulky squid *Cucioteuthis unguiculatus*.

As Matthews has pointed out, there is no correlation between the number of teeth and the length of body or other attributes of age. This applies equally to the number of teeth erupted and to the total number including subcutaneous ones. A set of twenty-one mandibular teeth on each side could be palpated below the gum in a 3·53 m. foetus examined in 1949, and those whales with uncut teeth had sets, apparent as serial swellings along the gum (Plate I, fig. 6), of between twenty and twenty-five a side. Those with erupted teeth usually had two or three, and one whale as many as six, subcutaneous ones at the posterior end of the tooth row. In two whales, one male and one female, the extreme front tooth of one side was still embedded in the gum. The largest erupted teeth are always in or near the middle of the row, and I agree with Boschma (1938, p. 204) that Hunter was wrong in proposing that teeth in sperm whales are added to the row from behind with increasing age (1787, p. 400).

Table 9. *Frequencies of the numbers of erupted teeth in whales examined at Horta in* 1949 *and* 1951

	No. of whales			
	Males 1949		*Females* 1949 *and* 1951	
No. of teeth	*Left side*	*Right side*	*Left side*	*Right side*
	Maxillary teeth			
0	8	8	8	8
1	1	3	1	—
2	1	1	—	1
3	2	—	—	—
Totals	12	12	9	9
	Mandibular teeth			
16	1	—	—	—
17	—	1	—	—
19	—	1	2	—
20	1	1	2	3
21	3	2	8	4
22	3	2	4	7
23	3	3	2	4
24	2	3	4	2
25	2	2	3	6
26	1	1	1	—
Totals	16	16	26	26

Data are available on the teeth of sixteen male and twenty-six female whales from Horta. In 1949 both unerupted and erupted mandibular teeth were counted, but the counts in 1951 were limited to erupted teeth. Table 9 gives the frequencies of the numbers of erupted teeth, both maxillary and mandibular, in the forty-two whales. The tooth row is seen to contain from sixteen to twenty-six erupted mandibular teeth in males and from nineteen to twenty-six in females. Actually there is no real sexual difference in the range, for inclusion of the unerupted teeth closes it to nineteen to twenty-six for males and to twenty to twenty-six for females. The sexes also correspond closely in their average tooth numbers. This may be seen in Table 10, which includes averages from Japan and from the Southern seas as well as from the Azores. The figures for Japan are calculated from data given by Omura (1950, p. 97), who has concluded from frequency diagrams that, in general, the number of functional teeth is greater in males than in females. But the differences in Table 10, and also in his frequency diagrams, seem too small to be significant. In Table 10 also, the figures for Azores and southern whales (although from admittedly smaller samples) do not show, left and right, that the male averages are consistently a little greater than the female ones; some are a little smaller, which

Omura would not expect. Generally speaking, there seems to be no real difference in the number of teeth in male and female sperm whale populations.

Variation in the numbers of teeth, being independent of age and sex, might be likely to reflect any racial differences which may exist between stocks of sperm whales. Table 10 compares the average tooth numbers calculated from data on whales captured in the Azores and on three other whaling grounds. Omura (1950) specifically mentioned that his counts included unerupted as well as erupted teeth; Matthews' Table VII probably referred to erupted teeth only: therefore the Azores figures have been calculated separately from each kind of count. When this is borne in mind, Table 10 shows a striking agreement between averages, and suggests no racial differences between whales from the North Atlantic and North Pacific or from northern and southern seas.

Table 10. *Average numbers of mandibular teeth in whales from northern and southern whaling grounds*

		Males			*Females*		
			Averages ± σ			*Averages ± σ*	
	Locality	*No. of whales*	*Left side*	*Right side*	*No. of whales*	*Left side*	*Right side*
North	Azores (Fayal) 1949 and 1951	*e* 16	22·38 ± 2·32	22·44 ± 2·29	*e* 26	22·19 ± 1·93	22·62 ± 1·68
		a 14	22·93 ± 1·28	22·85 ± 1·55	*a* 12	23·92 ± 1·32	24·08 ± 1·19
	Japan (Omura, 1950)	*a* 266	23·05 ± 2·05	23·11 ± 1·97	*a* 119	22·50 ± 1·72	22·51 ± 1·64
South	South Africa and South Georgia (Matthews, 1938)	51 left, 52 right	22·92 ± 1·99	22·88 ± 1·89	8 left, 6 right	21·50 ± 3·12	23·33 ± 1·60
	Pelagic Antarctic (Fl. F. *Southern Harvester*, 1947–8)	*e* 98	22·18 ± 1·63	22·10 ± 1·57	—	—	—

e Counts of erupted teeth only.
a Counts which also include unerupted teeth apparent as swellings on the gum.

In some whales rudimentary teeth, usually more or less curved, may be seen protruding from the gum of the upper jaw at or near the edges of the sockets which receive the mandibular tooth cusps when the mouth is shut (Plate I, fig. 7). Boschma (1951) states that the maxillary teeth can be quite large, but all I have seen have been small compared with the mandibular ones. Table 9 shows that no Azores whale exhibited more than three maxillary teeth a side. These teeth were erupted in five out of twelve males* and in one out of nine females, suggesting that they are erupted more often in males than in females. About 20% of Omura's large sample of North Pacific whales (1950, p. 97), and about 50% of Matthews' southern whales (1938, p. 121), had erupted maxillary teeth. The corresponding figure was 51·5% for ninety-seven males examined aboard Fl. F. *Southern Harvester* in the Antarctic in 1947–8. It would be worth making further counts to see if the maxillary teeth really do erupt more frequently in southern than in northern whales. However, by an incision in the gum I have never failed to expose some maxillary teeth, even in whales where the upper jaw appears superficially toothless. No doubt Bennett (1836) was correct in maintaining that small maxillary teeth, whether patent or not, are a constant character in the sperm whale.

Among the twenty-six whales whose teeth were examined at Horta in 1949, there were three males which had from one to four broken teeth in the front of the lower jaw, and one female with four broken in the middle of the jaw. No carious teeth were observed.

* Table 9 does not give this information. The table shows that eight whales had no maxillary teeth erupted on the left side and eight had none erupted on the right. But there were only seven whales with no maxillary teeth erupted on either side.

PARASITES

In describing the parasites infesting whales in the Azores, I am chiefly concerned with any evidence they may provide regarding the racial identity or otherwise of sperm whales from different seas.

External parasites

At Horta in 1949 the practice of stripping blackskin (p. 245) sometimes hampered the search for such external parasites as skin diatoms and cyamids.

No diatom film was found on the nine males and seven females which could be examined for this infection at Horta. However, there was a yellow film of skin diatoms around the margins of the jaws of the male sperm whale no. WLT1, 14·3 m. long, examined at Harris in the Outer Hebrides of Scotland on 16 June 1951. My colleague, Dr T. J. Hart, has kindly examined scrapings from this film, and he comments as follows:

The diatoms from Sperm whale No. WLT1 are particularly interesting as they seem to be the same as (or perhaps very closely allied to) those found upon Sperm whales and other whales during the [Antarctic] Season 1930–1. I mentioned them as '*Navicula* sp.' without attempting detailed identification, though drawings and a photomicrograph by A. Saunders were published.* Recently Hustedt has shown that they should probably be referred to the genus *Stouroneis*, and has based a species *S. olympica* n.sp., upon specimens from the epiphytes on barnacles from a humpback whale captured in the Ross Sea area during the 1950–1 season, collected by Kapt. Sven Theinemann.† Dr Hustedt's paper raises several more controversial points concerning the taxonomy of these and other diatoms from the same habitat. Revision of our abundant earlier material must proceed much farther before I can convince myself of the propriety of these. However, the identity of Mr Clarke's Hebridean specimens with Kapt. Theinemann's and those in earlier 'Discovery' material seems almost certain, and this is the first evidence known to me of skin-film diatoms common to whales of both the northern and southern hemispheres. It may be significant that the cosmopolitan sperm whale, rather than the more regularly migrating rorquals, was the species upon which they were first noted in the North.

Diatom film has never been recorded from whales examined in the tropics. If then the same species of *Navicula* is indeed concerned both in the North Atlantic and in the Antarctic, this argues against racial segregation of the Sperm whales parasitized (p. 288).

Oval scars, caused by an unknown agency, were present around the gape and the margin of the upper jaw, and more sparsely along the flanks, of ten males and eleven females examined in 1949. Open pits, which later heal to oval scars, are found on the body surface of sperm whales and whalebone whales examined in low latitudes of the southern hemisphere. In the Antarctic the scars are always healed, so the presence of healed oval scars is evidence that a southern whale has spent some time in the tropics (Mackintosh & Wheeler, 1929, p. 373; Matthews, 1938, p. 126). The oval scars on whales examined at Horta were all healed, yet it is interesting to note that the sperm whale examined at Harris (in a much higher latitude) bore on the head, beside healed scars, eleven partially healed pits with scabs sloughing from them. Pike (1951) claims that, for the species of whales taken off British Columbia, the open pits and the scars are caused by a parasitic lamprey, but Nemoto (1955) maintains that not all such scars on North Pacific whales can be attributed to lampreys. Mr John Owen, who was whaling from Harris in 1951, informs me that a Fin whale, shot between the Flannan Islands and Iceland, had a fish attached to its body: when an attempt was made to collect the fish, it fell off and escaped, but left an oval mark which at once reminded Mr Owen of the scars he had seen

* HART, T. J. (1935), *The Diatoms af the Skin Film of Whales.* Discovery Rept. X, pp. 247–82, pl. XI.

† HUSTEDT, FRIEDRICH (1952). *Diatomeen aus der Lebensgemeinschaft des Buckelwals* (*Megaptera nodosa Bonn.*), Arch. Hydrobiol. Bd. XLVI, S. 286–98, figs. 1–14.

on southern whales. It does appear therefore that the healed scars found on whales in the Azores are not necessarily a sign of migration from warmer waters.

At Horta no cyamids or whale-lice were found on the twenty-three whales whose blackskin was sufficiently intact to make negative observations valid. However, they do undoubtedly occur on Azores whales, although presumably they are uncommon. I was shown a dried specimen at Horta, and Pouchet (1888, 1892) described from sperm whales in the Azores a new species, *Cyamus physeteris*, and a variety, *Cyamus boöpis* var. *physeteris*. Verrill described *C. fascicularis* from a sperm whale in Bermuda (1902, p. 21), but Barnard says that *C. fascicularis* is the same as *C. physeteris* (1932, p. 307). Recently Margolis (1955) has examined Pouchet's Azores material, and he finds that *C. boöpis* var. *physeteris* is actually *Cyamus catodontis*, a new species which Margolis in 1954 described from British Columbia. Although the occurrence of cyamids on sperm whales has been reported from several oceans (Hamilton, 1914, p. 140; Matthews, 1938, p. 126; Mizue & Murata, 1951, p. 91; Kakuwa, Kawakami & Iguchi, 1953, p. 184; and unpublished records of mine from the 1947–8 Antarctic season), the only other species so far identified from the sperm whale is *Paracyamus* (*Cyamus*) *boöpis* which Barnard (1932, p. 312) records from a whale at Durban. Margolis (1955, p. 128) suggests, however, that the cyamids on the Durban whale 'possibly are referable to *C. catodontis*'. Sperm whales of the North Atlantic are thus parasitized by two* species of whale-lice, *Cyamus* (*Neocyamus*†) *physeteris* and *Cyamus catodontis*, of which *C. catodontis* has been described from sperm whales of the North Pacific, and may possibly occur on those of the South Indian Ocean.

The degenerate copepod *Penella* was present twice at Horta, once on the tail of an adult male and once on the flukes of a pregnant female. Dr J. P. Harding of the British Museum (Natural History) has kindly assisted me to identify the species, which appears to be *Penella balaenopterae* Koren & Danielssen,‡ known from blue and fin whales north and south. *Penella* has been also recorded from sperm whales in the eastern North Pacific, the South Indian Ocean, and the Antarctic (Omura, 1950, p. 96; Mizue, 1950, p. 116; Matthews, 1938, p. 126; Mizue & Murata, 1951, p. 90; and my colleague Dr R. M. Laws' unpublished notes on biological work accomplished during the 1953–4 Antarctic season); none of these authors mentions the species of *Penella* concerned.

Two species of the stalked barnacle *Conchoderma* were collected at Horta. *Conchoderma virgatum* (Spengler) occurred as five individual epizoic on the stem of the first penellid specimen mentioned above. Nilsson-Cantell (1930, p. 251) records a similar association between *C. virgatum* and *Penella* from a southern blue whale. The second species, *Conchoderma auritum* (Linné),‡ occupies a characteristic position on the sperm whale's body. A cluster of nine individuals was attached to the base of the right front tooth of one whale (F 14) among twenty-five whose lower jaws were examined at Horta in 1949. I also recorded it in the Antarctic season of 1947–8 when four out of 103 whales had the parasites attached to the front two or three mandibular teeth (Plate I, fig. 3); Dr R. M. Laws recorded it in a similar position on one of seventy-four whales he examined in the 1953–4 Antarctic season. Other authors have reported the condition from the southern seas (Bennett,§ 1837, p. 42; 1840, II, p. 169), New Zealand (Covill, in Davis, 1874, p. 177), South Shetland Islands, South Georgia and South Africa (Nilsson-Cantell, 1930, p. 249; 1939, p. 235; Matthews, 1938, p. 126), Ireland (Lillie, 1910, p. 789; Collett, 1912, p. 633; Hamilton, 1914, p. 140), Aleutian Islands (Scheffer, 1939, p. 69),

* Chapman & Santler (1955) have recorded another species, *Cyamus globicipitis*, from a sperm whale in the Azores. *C. globicipitis* has not previously been recorded from a sperm whale. However, the authors inform me that they are not now certain of their identification and that their material has been mislaid, so for the present it seems best to neglect this record.

† Margolis (1955, p. 131) places *C. physeteris* in a new monospecific genus *Neocyamus*.

‡ Chapman & Santler (1955) have also recorded *Penella balaenopterae* from a sperm whale at Fayal, and *Conchoderma auritum* from the deformed lower jaw of whale F 153 (see page 254).

§ Bennett refers to the barnacle as the 'Otion Cuvieri'.

Bonin Islands (Mizue, 1950, p. 116) and Japan (Omura, 1950, p. 96). This curious form of parasitism, so locally restricted on the animal, is clearly world-wide in incidence, although uncommon. It appears to have been reported from no other toothed whale except the northern bottlenosed whale (Nansen, 1925, p. 237). *Conchoderma auritum* is restricted to the extreme tip of the sperm whale's mandible because it is only here that the flexible stalks, fixed to the very base of the front teeth, can remain uninjured when the mouth is tightly shut with the two rows of teeth snugly received into their maxillary sockets. This is shown by the special case of three whales with deformed lower jaws; one of these is mentioned by Mr A. G. Bennett (in Nilsson-Cantell, 1930, p. 251), one by Commander H. Buckle, Whale Fishery Inspector aboard Fl. F. *Balaena*, in his unpublished report on the 1950–1 Antarctic season, and the third was the whale F 153 examined at Horta in 1952 and mentioned on p. 255. Because of their deformity these three whales could not properly close their mouths, and each bore a heavy infestation of *Conchoderma auritum* along the length of the tooth rows (Plate II, fig. 1).

Internal parasites

The common internal parasite recorded at Horta was the ascarid nematode *Anisakis physeteris* Baylis, which was found plentifully infesting the first and second stomachs of all the whales examined. Stomach nematodes have already been recorded from an Azores whale by Monaco (1895, p. 308). Mr S. Prudhoe, of the British Museum (Natural History), who kindly identified the specimens collected in 1949, could not find amongst them *A. catodontis*, the other species parasitising the sperm whale and described by Baylis (1929, p. 544) from a single South African infection. But *Anisakis*, probably *physeteris*, is common in the stomachs of sperm whales everywhere (Bennett, 1840, II, p. 169; Hamilton, 1914; Matthews, 1938, p. 128; Scheffer, 1939, p. 68; Bolognari, 1949, p. 5; Cockrill, 1951; Rees, 1953).

The intestines of whales were opened once or twice in 1949, but the only obvious infestation was a tapeworm which protruded from the wall of the small intestine of one whale. The head was not recovered but five fragments, apparently belonging to one individual, measured 9·61 m. and have been identified as *Priapocephalus grandis* (Markowski, 1955, p. 390), a species recently recorded from a sperm whale in the Antarctic (Rees, 1953) as well as from blue, fin and sei whales and the southern right whale (Nybelin, 1922, p. 198; Baylis, 1932, p. 401; Markowski, 1955, p. 394). In 1954 Senhor Reis extracted from the gut of another whale several tapeworm fragments which were 40 m. (131 ft.) in total length. A fragment which was preserved has external characters corresponding to those of *Priapocephalus grandis*. Senhor Reis could find only one head, so he considers that all the fragments belonged to one individual. If he is correct, I do not know of any record of a longer cestode.

Another cestode formed opaque cysts in the blubber of some of the whales at Horta. Pouchet (1888) and Monaco (1895, p. 308) have earlier noticed them in whales captured in the Azores. Matthews (1938, p. 128) records such an encysted species, *Phyllobrothium physeteris*, as commonly occurring in southern whales, and 'cysticerci' are also mentioned by Bennett (1837, p. 42) and Hamilton (1914).

In these notes on parasites there appears to be nothing to suggest that Azores whales are racially distinct from sperm whales elsewhere.

DISEASE, DEFORMITY AND INJURY

Disease. The thirty-seven whales examined in 1949 were virtually free of disease. Two males (F 4 and F 17) bore on their flanks a few dingy white circular areas, about the size of florins, which might have been ringworm patches. I have seen these patches on sperm whales in the Antarctic. Matthews mentions something similar (1938, p. 126) and they also occur on whalebone whales (Mackintosh, 1942, p. 215). On the floor of the mouth below the tongue of one female (F36) was a firm ovoid tumour with a wrinkled surface, greyish-blue in colour; it measured 9 and 7 cm. across diameters, was 4·5 cm. deep, and weighed 119 gm. A whale examined in the 1947–8 Antarctic season had two such tumours in the same place, and Stolk (1953) describes and figures a similar condition in a sperm whale from the Antarctic, diagnosing it as chronic, non-specific tonsillitis. The whaling company in the island of San Miguel, Azores, the União das Armações Baleeiras de S. Miguel, Lda., has very kindly sent me a tumour from a sperm whale killed in September 1954. This tumour was found on the lower jaw: it is a hard fibroma, somewhat pear-shaped, with its greatest dimensions 17 × 12 × 7 cm., and it weighs 677 gm. The company inform me that the condition has never previously been observed among more than 1600 sperm whales captured in San Miguel during the last sixteen years. In 1952 Senhor Reis at Horta examined a female whale (F115, 10·30 m. long), which had some kind of inflammation of the invertebral discs, for the whale (which was physically mature) had a dark, hard substance between the thoracic vertebrae. The occurrence in the Azores of ambergris, which I believe to be a concretion of fæces in the hind gut (Clarke, 1954*b*), is discussed in my earlier report (1954*a*).

Deformity. It is interesting to record that whale F115, discussed above, was found to have no nipples.

I have earlier mentioned (p. 254) the deformed jaw-bone of whale F153, a male of 10·40 m. examined at Horta on 17 June 1952. The lower jaw* curved steeply upwards in the vertical plane, and was also slightly bent to the right (Plate II, fig. 1); the upper jaw was also deformed but to a lesser extent. There is one previous record of a deformed jaw from the Azores (Osorio, 1909, p. 140; pl. III, fig. 2). Besides the two records of this deformity from the Antarctic, by Mr A. G. Bennett and Commander H. Buckle (p. 254), I am informed by Captain Martin Marthinsen, of A/S Thor Dahl, that he shot a sperm whale with a scrolled jaw on the coast of Peru in 1951. Beale mentions two crooked jaws from the South Sea Fishery (1839, p. 36). Fischer (1867) and Sleptzov (1955, p. 49) figure one from Mauritius† and one from the far North Pacific respectively. Murie (1865) describes four* others, Thomson (1867) refers to 'four or five' in New Bedford, and Pouchet & Beauregard (1889) describe one from the Nantucket Museum. Sleptzov mentions that whales with 'broken' (*slomannii*) lower jaws have sometimes been caught, and Beale states that a crooked jaw is frequently encountered; but it does not appear common from these eighteen or nineteen records (which are all those known to me of a condition bound to excite comment), although it is certainly a characteristic deformity in the species. A deformed jaw might be supposed to interfere with feeding; yet Beale, Mr Bennett (1931, p. 69) and Commander Buckle all state that the whales were fat or gave a good oil yield, and the stomach of the Azores whale F153 was full of squids. So it appears that neither a deformed jaw nor a toothless jaw (p. 249) need handicap the sperm whale in its search for food.

Injury. As elsewhere in the world, all but the youngest whales in the Azores bear about the jaws and head the scars made by the hooks and suckers of the teuthid squids which are the principal food of the sperm whale (Plate I, fig. 2). These scars, according as they are more or less abundant, afford a rough distinction between age and youth.

In 1949 all whales, except the smallest ones, showed an irregular scalloping of the posterior margin of the flukes which had a somewhat ragged look when the scalloping was extensive (Plate II, fig. 5). The flukes are thin in this region and the notched edges are smoothly healed without discoloration or sign of scar tissue: they are probably nibbled by fishes which can give a clean bite, and it seems that the agency responsible for oval scars (p. 252) is not at work here. The degree of notching of the flukes

* The jaw from whale F153, and two of those described by Murie, are now in the collections of the British Museum (Natural History).

† The jaw from Mauritius was also described and figured by Beneden & Gervais (1880, p. 319; pl. XIX, fig. 10).

might be thought, like the abundance of cephalopod scars and oval scars, to give a clue to relative age, but it did not appear in 1949 to be correlated with the length of the whale.

One male exhibited slight notching of the flipper, an injury I have also occasionally seen in sperm whales and whalebone whales in the Antarctic.

Whale F20, a male of 14·6 m., bore on the front of the head nine shallow dents, quite healed, and each measuring about 5 cm. in diameter and 2 cm. in depth. I have seen three sperm whales in the Antarctic with such wounds, some of them deeper and wider than those described here. Sperm whales are generally believed not to see very well under water, and it seems likely that the dents in the forehead are caused by accidental collision with a hard and broken sea bottom. During the cruise of the *Discovery II* among the Azores in 1952, the ship operated an underwater television camera which revealed, in the channel between Pico and San Jorge, a pinnacled bottom at 100 m. with rock faces scoured of the cushion of sand or sediment, so it may be that in the Azores whales sometimes collide with rocks on the rare occasions when they venture upon soundings, either when searching for food (p. 261) or when chased inshore during a whale hunt.

The occurrence of broken teeth in a few whales has already been noticed.

FOOD

Between 1949 and 1954 notes were made on the abundance of food in the first and second stomachs of 294 sperm whales at Horta. In 1949 I also examined qualitatively the stomach contents of thirty-nine whales, and in July 1955 examined a giant squid, *Architeuthis* sp., recovered from a stomach. Most of the animals examined in 1949 had been dead for at least 18 to 19 hr., and, since digestion continues after death, the food was usually decomposed to some extent. The first compartment of the stomach has a non-digestive lining but even here some digestion takes place in the dead whale because juices leak over from the second or true stomach.

The staple food was squid, with large fish as a subsidiary, but not negligible, item of diet (Plate II, fig. 3).

Squid

From each stomach examined in 1949 the squids were carefully pulled out, counted, and assigned by eye to one of four arbitrary size-groupings. It was only occasionally that conditions on the flensing platform allowed a specimen to be accurately measured. All lengths and size-groups in this series refer to the standard length, that is, the distance from the tip of the body to the tip of the longest *non*-tentacular arm: the standard length is appreciably shorter than the total length which includes the tentacles. Sometimes the head-and-arms of these squids were found separated from the bodies, either severed at the 'neck' when swallowed by the whale or digested away afterwards: the count in such cases was made on the head-and-arms, for these could be more numerous than the bodies which, lacking clinging members, may not always have been swallowed. There was no difficulty in assigning trunkless squid to size-groups once a few complete specimens had been examined.

The results of size grouping are shown in Table 11. The lengths of the squids ranged from 0·6 to 2·4 m. (2 to 8 ft.). One might suppose that male sperm whales, being larger than females, would take rather larger squids, but actually males and females take food of much the same size: the average lengths of squids eaten by males and females were 0·95 m. (3 ft. 2 in.) and 0·92 m. (3 ft.) respectively. For squids from all whales the average size was 0·94 m. (3 ft. 1 in.). On board Fl. F. *Southern Harvester* in the Antarctic season 1947–8 I made a similar analysis (unpublished) of the lengths of sixty squids from the stomachs of male sperm whales. Here the diet was *Moroteuthis ingens* (Smith) and although the length range was also 2 to 8 ft., the average length was 1·3 m. (4 ft. 3 in.). This comparison seems to be a striking illustration of the greater size reached by marine animals in high latitudes.

Table 11 and the Antarctic data serve to rationalize the popular notion that sperm whales feed upon squid of gigantic size. This does not mean that true giants among squids are never taken, and I was fortunate to be on the platform at Horta on 4 July 1955 when a great specimen of *Architeuthis* sp. was recovered intact from the stomach of a sperm whale (Plate II, fig. 2). The squid measured 10·49 m. (34 ft. 5 in.) in total length, 4·96 m. (16 ft. 3 in.) in standard length, and weighed 184 kilos (405 lb.). Further details have been published elsewhere (Clarke, 1955). It is well to mention that a hunted sperm whale in the death struggle not uncommonly vomits, when the biggest squids may be lost from the stomach. Off Capelo, Fayal on 11 August 1949 I saw a dying sperm whale (F21, 16·0 m.) vomit the headless body of a squid which must have been about the same size as the specimen examined in 1955 at Horta; and I have seen in Madeira in 1954 a photograph of another vomited squid* of great size (Clarke, 1955). So it may be that these giants are taken less rarely than the evidence of stomach contents suggests. Nonetheless, for the present, I consider that Table 11 and the Antarctic data are representative enough of the size of the staple diet of sperm whales.

Table 11. *Food. Sizes of squids from stomachs examined at Horta in* 1949

Sizes of squids		*Male whales*		*Female whales*	
Length group	*Standard length*	*No. of squids*	(%)	*No. of squids*	(%)
Small	0·6 to 0·9 m. 2 to 3 ft.	41	*59*	28	*67*
Medium	0·9 to 1·5 m. 3 to 5 ft.	26	*37*	13	*31*
Medium-large	1·5 to 1·8 m. 5 to 6 ft.	2	*3*	0	*0*
Large	1·8 to 2·4 m. 6 to 8 ft.	1	*1*	1	*2*
Totals		70	*100*	42	*100*
Average size of squids		0·95 m.	3·2 ft.	0·92 m.	3·1 ft.

Architeuthis, thought to be *princeps*, was first recorded from the Azores by Girard (1892, p. 214) whose material came from fragments stranded on the north coast of San Miguel and recovered by whalemen. A. F. Chaves told Girard that the remains of giant squids were not rare around the Azores, being well known to the whalemen, who considered their presence to be a sign of the approach of sperm whales; but this belief is not shared by Azores whalemen today, at least not by those of Fayal and Pico, who say it is rare to find remains of *Architeuthis*. A whale killed off Terceira in 1895 (Monaco, 1896; Buchanan, 1896) yielded a large squid beak attributed by Joubin (1900, p. 46, plate XIV) to *Architeuthis* sp.?, although it differs in some respects from the beak of my specimen.

Turning again to the squids collected in 1949 (Table 11), I found that, saving two very digested individuals, all could be assigned to three species which were distinguished on the flensing platform as types A, B and C according to general characters briefly noted below. Specimens of each in good condition were preserved: Dr W. J. Rees of the British Museum (Natural History) has since kindly identified them.

(Type A) *Histioteuthis bonelliana* Férussac. Plate II, fig. 6. This squid, the smallest and most numerous of the three species encountered at Horta, was characterized by the shortness of the bluntly conical body compared with the great development of the head and arms; by the small fin set right back; by the digested remains of what had been a prominent interbrachial membrane; and by the conspicuous black light-organs scattered over the mantle and head and along the arms. The colour in fairly fresh specimens was a deep magenta, almost purple, suffusing the body and growing paler

* This specimen of *Architeuthis* has since been recorded by Rees & Maul (1956, p. 266).

on the head and arms. The standard length of the largest one measured was 0·68 m. and its wet weight was 2·01 kg. This species comprised practically all the 'small' group in Table 11. Joubin (1900, p. 20) first recorded *H. bonelliana* from the Azores: his specimens came from the whale mentioned above as killed off Terceira in 1895. *H. bonelliana* is also eaten by sperm whales captured off Madeira (Rees & Maul, 1956, p. 267).

(Type B) *Cucioteuthis unguiculatus* (Molina). Plate II, figs. 3, 6 and 7. A big, stoutly-built form, this species had a body large in proportion to the head, and short, thick arms: the fin was wide and circular, and extended most of the body length: the colour, mostly continuous over the smooth skin and uniform in tone, was a deep magenta in some specimens and purplish blue in others. Because of its colour the whalemen call this squid *lula azul.* The largest measured had a standard length of 1·96 m., the head and arms comprising 0·25 m. of this length. A trunkless head-and-arms of 0·34 m. could have belonged to a specimen approaching 3 m. or 10 ft. in standard length. Another head-and-arms, measuring 0·28 m., weighed 4·40 kg. when wet. Of forty-three specimens from all stomachs there were only two which were small enough to be classified in the 'small' size grouping (2 to 3 ft.) which otherwise was numerically large, comprising sixty-nine individuals of the other two species. It would appear therefore that *Cucioteuthis unguiculatus* is either a migrant form whose younger, smaller stages are not represented round the Azores, or that the younger stages inhabit a level not explored by the sperm whale. *C. unguiculatus* was first recorded from the Azores by Joubin (1900, p. 20), again from the Terceiran whale of 1895.

(Type C) *Tetronychoteuthis dussumierii* (d'Orbigny). Plate II, fig. 7. Two whales each contained one specimen. Typically fusiform, this squid had comparatively small head and arms, the latter being of slim build compared with those of *Cucioteuthis*: the fin was well developed, sagittate and placed right back: the surface of the mantle bore a close regular pattern of flattened papillose markings, giving it a raised tessellated effect. The colour was reddish, tinged with magenta. One specimen was 0·72 m. in standard length and the other (which was preserved) was 0·61 m. and its wet weight 1·13 kg. Sperm whales in Madeira also eat it (Rees & Maul, 1956, p. 261), and these records, as Dr Rees has pointed out to me, now extend the range of the species into the Atlantic,* for it has previously been known from two specimens widely separated in the Indian Ocean, one from Mauritius and one from the southward of Australia (Pfeffer, 1912, p. 98).

In 1952 Senhor Reis found one specimen of another species, identified by Dr Rees as *Loligo forbesi* Steenstrup, in stomach contents at Horta. Girard (1892) has earlier recorded *L. forbesi* from San Miguel and Pico in the Azores, but he does not mention whether his specimens came from a sperm whale's stomach.

To the species recorded from whales at Fayal during the present investigations must be added *Lepidoteuthis grimaldii* Joubin, from another Azores island, San Miguel. I saw and sketched a single specimen of this species when visiting the whaling station of São Vincent on 27 June 1949. It lacked the head and was partially digested, but must have been about 1·5 m. in standard length when entire. The fin was wide and deep, almost circular, and the body bore the well-marked scales which have prompted the generic name. The scales could be rubbed off, and, although soft, they felt between the fingers much like some fishes' scales. Joubin independently recorded the same impression in much the same language, and later had to defend his remarks against criticism (Joubin, 1900, p. 77). Of this singular squid there appear to be seven specimens known, and all are from the stomachs of cetacea. Including the San Miguel specimen there are four recorded from the Azores. Joubin named and described the species from two individuals, also headless, which were found in the sperm whale cap-

* The status of the larval form described by Pfeffer (1912, p. 102) as *Tetronychoteuthis massyae*, from the Atlantic south-west of Ireland, remains to be elucidated.

tured off Terceira in 1895 (Joubin, 1895, 1900, p. 70 ff., plates VI and VII): another fragment came from the stomach of a Risso's dolphin captured in the Azores by the Prince of Monaco (Joubin, 1900, p. 70; Richard, 1936, p. 46). The remaining three specimens are reported from Madeira where Mr G. E. Maul, Curator of the Museu Municipal do Funchal, informs me that between 1952 and 1954 he identified *L. grimaldii* once from the vomit of a dying sperm whale and twice from stomach contents at the whaling station of Caniçal. (See also Rees & Maul, 1956, p. 261.)

Two further squids complete the species composition of the known squid diet of sperm whales in the Azores. These are *Dubioteuthis physeteris* Joubin and *Ancistrocheirus lesueuri* (d'Orbigny & Férussac), which were not found in the present investigations but were recorded by Joubin (1900, p. 20) from the Terceiran whale which in 1895 yielded four of the six species previously discussed.

Table 12. *Squids recorded from the stomachs of sperm whales in the Azores*

Species	*Island*	*Identified by*
Histioteuthis bonelliana Férussac*†	Terceira	Joubin 1900, p. 20
	Fayal	Rees (in present report)
Cucioteuthis unguiculatus (Molina)	Terceira	Joubin 1900, p. 20
	Fayal	Rees (in present report)
Tetronychoteuthis dussumierii (d'Orbigny)†	Fayal	Rees (in present report)
Architeuthis sp.†	Fayal	Joubin 1900, p. 46
		Clarke 1955
Lepidoteuthis grimaldii Joubin†	Terceira	Joubin 1895; 1900, pp. 208 and 70 ff.
	San Miguel	Clarke (in present report)
Dubioteuthis physeteris Joubin‡	Terceira	Joubin 1900, p. 20
Ancistrocheirus lesueuri (d'Orbigny & Férussac)	Terceira	Joubin 1900, p. 20
Loligo forbesi Steenstrup	Fayal	Rees (in present report)

* Recorded by Joubin as *Histioteuthis Rüppelli* Vérany.
† Species also recorded from the stomachs of sperm whales in Madeira (Rees & Maul, 1956).
‡ Joubin (1900, p. 102) described *Dubioteuthis physeteris* from only one mutilated specimen. So I have not followed Appellöf who revised it as *Architeuthis physeteris* (see Pfeffer, 1912, p. 24).

Table 13. *Food. Species composition of squids from stomachs examined at Horta in* 1949

	Male whales		*Female whales*		*Totals*	
Species	*No. of squids*	(%)	*No. of squids*	(%)	*No. of squids*	(%)
Histioteuthis bonelliana Férussac	39	*57*	26	*62*	65	*59*
Cucioteuthis unguiculatus (Molina)	28	*42*	15	*36*	43	*39*
Tetronychoteuthis dussumierii (d'Orbigny)	1	*1*	1	*2*	2	*2*
Totals	68	*100*	42	*100*	110	*100*

Sperm whales in the Azores are thus known to feed on eight species of squids, and these are for convenience listed in Table 12. Of the eight species the first two are (at least in Fayal) the most important items in the diet. Table 13 shows that, among the squids counted in 1949, *Histioteuthis bonelliana* is most abundant, numbering 59% of the sample. But in nutritional importance it is secondary to *Cucioteuthis unguiculatus* which is a much larger, bulkier and heavier squid.

One might expect sperm whales at the Azores and at Madeira to have similar diets, and, so far, four of the eight squid species listed in Table 12 have also been recorded by Rees & Maul (1956) from whales in Madeira.

Fish

In 1949 the remains of large teleost fish were found in four of the twenty-eight stomachs which contained food. This incidence (14%) is practically the same as that which I found in the Antarctic season 1947–8, where seven stomachs (13%) contained fish among the fifty-six with food.

Particulars of the fish recorded in 1949 are included in Table 14. Sufficient remained of the barracuda (*Sphyraena* sp.) for it to be identified (Plate II, fig. 3). The remains of the Atlantic albacore (*Thynnus alalunga*) were recognized by the whalemen, who are also fishermen, as a *Peixe de galha* which Nobre (1935, p. 253) gives as the local Azores vernacular name of this species. Davis (1874, p. 262) mentions that the presence of albacore is a good sign when cruising for sperm whales, although his explanation is not that the whales are following the albacore, but rather vice versa, that the whales disturb flying fish which jump and so betray themselves to the albacore.

Table 14. *Fishes from the stomachs of sperm whales examined at Horta between* 1949 *and* 1954

Whale no., sex, and length	*Date*	*Position of capture*	*Species of fish in stomach*	*Standard length in cm.*	*Total length in cm.*	*Weight in kg.*	*Remarks*
F8, ♂, 11·0 m.	21 July 1949	—	*Sphyraena* sp.	(129)*	—	—	* Headless specimens partially digested
			?*Sphyraena* sp.	(82)*	—	—	Identification of second
			?*Sphyraena* sp.	(63)*	—	—	and third specimens uncertain (see Plate II, fig. 3)
F18, ♀, 11·3 m.	1 Aug. 1949	—	Large gadiform teleost	—	—	—	Digested: skull only
F19, ♂, 12·7 m.	10 Aug. 1949	—	*Thynnus alalunga*	—	—	—	Mostly digested: head and fragments of the backbone only
F21, ♂, 16·0 m.	12 Aug. 1949	Twenty miles south-west of Capelinhas Lighthouse, Fayal 38° 21′ N, 29° 08′ W.	*Ceratias holbölli*	—	—	—	Identified from a skin fragment (see Clarke, 1950, p. 30)
F292, ♂, 15·5 m.	19 Aug. 1954	—	*Ceratias holbölli*	74·4	—	8·18	Partially digested
F291, ♂, 16·5 m.	4 Aug. 1954	—	*Ceratias holbölli*	72·3	—	7·58	Partially digested
F261, ♂, 9·6 m.	18 June 1954	Ten miles west of Capelinhas Lighthouse 38° 37′ N, 29° 03′ W.	*Himantolophus groenlandicus*	42·2	—	3·52	Partially digested
F262, ♂, 12·0 m.	18 June 1954	Ten miles west of Capelinhas Lighthouse 38° 37′ N, 29° 03′ W.	*Himantolophus groenlandicus*	35·6	39·8	2·78	Almost intact (see Plate II, fig. 8.)
			Himantolophus groenlandicus	30·8	—	0·97	Partially digested
—	28 May 1954	South-west of Capelinhas Lighthouse	Two large ceratioid fishes	—	—	—	Described as badly digested and not sent to England
—	26 June 1954	South-west of Capelinhas Lighthouse	One large ceratioid fish	—	—	—	Described as badly digested and not sent to England
—	18 July 1954	South-west of Capelinhas Lighthouse	Three large ceratioid fishes	—	—	—	Described as badly digested and not sent to England
F322, ♂, 15·0 m.	29 Sept. 1954	South-west of Capelinhas Lighthouse	One large ceratioid fish	—	—	—	Described as badly digested and not sent to England

The fourth whale contained a piece of skin from a large specimen of the bathypelagic angler fish *Ceratias holbölli*, and this record has been discussed elsewhere (Clarke, 1950, p. 30). During 1954 Senhor Reis collected twelve more large ceratioids (Table 14), some almost intact, from sperm whale stomachs, and he and Mr Collins have kindly shipped to me the least damaged individuals, which comprise three specimens of *Himantolophus groenlandicus* (Clarke, 1954*c*) and two specimens of *Ceratias holbölli*. The latter, which are adult females, are the largest of this remarkable species so far recorded, both substantially exceeding the standard length of the type specimen (68 cm.) which hitherto was the largest known (Clarke, 1950, Table 1; Bertelsen, 1951, p. 135). Only larval forms of *Himantolophus groenlandicus* have previously been recorded from the North East Atlantic (Bertelsen, 1951, p. 265), so that the three specimens mentioned in Table 14 now record the adult female at the Azores. The table lists a minimum of eight whales which have eaten ceratioids among a total of 189 whales whose stomachs contained food when examined at Fayal between 1949 and 1954. This is an incidence of 4·2%: when data from the Antarctic season 1947–8 are included, where one stomach contained a ceratioid (*C. holbölli*) among fifty-six with food (Clarke, 1950), then the incidence among a sample of 245 stomachs is not much changed at 3·7%. Comparable in weight with substantial squids like *Cucioteuthis unguiculatus*, yet sluggish, revealed by their luminous lure, and with no other protection than their dermal spines, the large species of bathypelagic angler fishes are no doubt easy and acceptable prey whenever the sperm whale encounters their solitary individuals in the sea; and they may be considered characteristic though incidental items of the diet. One may note also that the present data seem to confirm my earlier suggestion (1951, p. 23) that large ceratioid fishes are commoner in the ocean than is generally supposed.

Two elasmobranchs can now (1956) be added to the list of fish species known to be eaten at the Azores. Mr Collins identified a black shark *Dalatias licha* from whale F365 (♀, 10·2 m.) on 16 September 1955, and a young basking shark *Cetorhinus maximus*, 2·50 m. long, recovered intact from a male of 14·4 m. on 10 February 1956 (Plate II, fig. 4). These records are not included in Table 14.

Other organisms

In 1949 one whale yielded one specimen, and another two, of the pelagic colonial tunicate *Pyrosoma atlanticum* var. ? *elegans*, the largest specimen measuring 0·28 m. In 1954 Senhor Reis recovered several specimens of *Pyrosoma* from one of the stomachs he examined. The bell of a jelly-fish, 0·19 m. in diameter, came from another stomach in 1949; Mizue (1950, p. 116) has also reported jelly-fish in the stomachs of sperm whales from the Bonin Islands. Senhor Jacinto Silviera de Medeiros, who has been much concerned with whales and whaling at Horta, described to me an organism which he found some years ago in a stomach and which appears to have been a gorgonid; other organisms normally demersal in habit, like octopods, scorpaenids, skates, and even the benthic spider crabs, have sometimes been reported from the stomachs of sperm whales elsewhere (Zencovich, 1935, p. 67; Tomilin, 1936, p. 494; Robbins, Oldham & Geiling, 1937; Omura, 1950; Pike, 1950; Mizue, 1951), so it would seem that the sperm whale occasionally visits the sea floor. Records of dents on the forehead, believed to be collision scars (p. 256), support this statement.

Abundance of food

The stomachs of all sperm whales contain indigestible remains like squid beaks, eye-lenses and 'pens'; the quantities of these relics are neglected in Tables 15–17 which refer only to bulk of digestible food.

Only a small fraction of either sex had empty stomachs among the whales examined at Horta between 1949 and 1954. The first stomachs of nearly half the 132 males were stuffed with food (Table 15). Among the 162 females the proportion of full stomachs was less by 14·6% (Table 16). But the two tables are not entirely comparable since Table 16 includes data from 1950 and 1951 when Senhor Reis examined the stomachs of females only. However, supposing the females were in fact feeding rather less heavily than the males, then it might be that the sexual condition of the classes of females gives them unequal advantages in feeding; that, for instance, the nursing cows might feed less heavily because they are hampered by calves which cannot dive deep. To test this possibility more data are required than those in Table 17, where the figures, although suggestive, are not sufficient to conclude that lactating whales get less food than other classes. There remains the possibility that females, being invariably in schools and feeding socially, have not the freedom in food gathering enjoyed by that proportion of males which are solitary upon the grounds. However, Mizue (1951, p. 85), reporting on a large sample of sperm whale stomachs examined in the North Pacific, concludes that the sexes do not differ in the quantity of food they take.

Table 15. *Males. Monthly abundance of food in stomachs examined at Horta between* 1949 *and* 1954

	No. of stomachs examined								
Amount of food	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	*Totals*	(%)
Much	19	13	12	8	5	3	0	60	*45·5*
Little	19	23	13	6	4	1	2	68	*51·5*
Nil	0	4	0	0	0	0	0	4	*3·0*
Totals	38	40	25	14	9	4	2	132	*100*

Table 16. *Females. Monthly abundance of food in stomachs examined at Horta between* 1949 *and* 1954

	No. of stomachs examined							
Amount of food	June	July	Aug.	Sept.	Oct.	Nov.	*Totals*	(%)
Much	1	16	13	13	5	2	50	*30·9*
Little	6	32	27	21	11	1	98	*60·5*
Nil	0	5	8	1	0	0	14	*8·6*
Totals	7	53	48	35	16	3	162	*100*

Table 17. *Females. Abundance of food in the stomachs of the classes of whales examined at Horta from* 1949 *to* 1954

	No. of stomachs examined				
Amount of food	Immature	Pregnant	Lactating	Resting	*Totals*
Much	3	12	10	25	50
Little	7	21	25	43	96
Nil	3	3	3	5	14
Totals	13	36	38	73	160

Reviewed month by month the data in Tables 15 and 16 are too few to say much about the seasonal abundance of food, except that there is sufficient food in any month between June and November for some whales to fill their bellies. Indeed, the main facts which emerge from these tables are that sperm whales are feeding around the Azores, and that their food supply is a substantial one.

BREEDING AND LIFE CYCLE

Sexual maturity

Any study of the life cycle of whales needs to discriminate between immature and mature individuals; and an estimate of the mean length at sexual maturity also permits the proportion of sexually immature whales to be calculated from catch figures which give only the sex and length of captures (see p. 285, Table 31, second footnote).

The volumes of both testes were measured in each of 124 whales during 1949 and from 1952 to 1954. For fifty-five whales the field-notes distinguish the left from the right testis, and there seems to be a tendency for the left testis to be the larger: in thirty-three whales the left was the larger, in seventeen both testes were the same size, and in five the right was the larger. Nishiwaki (1955, p. 147) also found that in sperm whales from the Antarctic the left testis was usually heavier than the right, although Nishiwaki & Hibiya (1951, p. 161) say that in sperm whales captured off Japan either side of the animal may have the heavier testis.

In Fig. 4, where testis size is plotted against body length of the Azores whales, the volumes of both testes have been added together. It is unfortunate that data are so few for whales between 8·0 and 9·5 m. because the trend of the points suggests that this range may be critical; but it does appear from

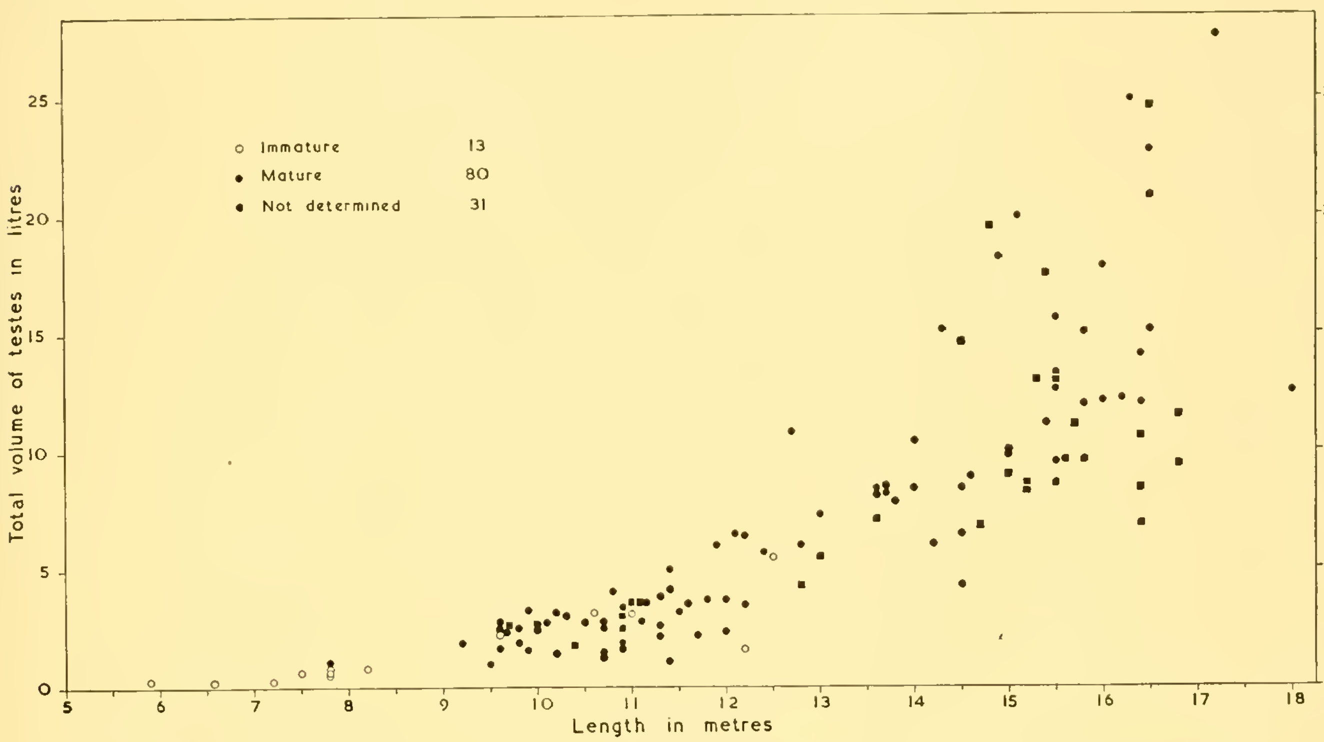

Fig. 4. Males. Length of body and total volume of testes in whales examined at Horta in 1949 and 1952–4.

the diagram that by the time most whales have reached a length greater than about 9·5 m. a significant increase in the size of the testis has begun.

Material from ninety-three whales, collected in 1949, 1953 and 1954, has also been examined histologically, because, as Mackintosh (1942, p. 219) has pointed out, histological examination is the only certain way of showing whether a male whale is immature or mature. Samples of testis tissue, fixed in Bouin's fluid, were sectioned at a thickness of 6 μ, and stained with haematoxylin and eosin. The testis samples were not fresh when fixed, for most were collected from whales which had been dead for 18 to 19 hr. and sometimes longer. But there was no difficulty in distinguishing immature tissue, with considerable interstitium and small seminiferous tubules, closed, or sometimes with a small lumen, but always with a simple germinal epithelium consisting only of spermatogonia and Sertoli cells, from mature tissue showing comparatively large tubules, open and with a proliferated epithelium and embedded in a comparatively sparse interstitium. Table 23, p. 271, shows the substantial difference between the diameters of immature and mature testis tubules. Remarks on the male sexual cycle deal with tubule diameters in greater detail (p. 271), but it is relevant here to note in Fig. 8, p. 272 that the testis tubules of most whales have reached a diameter appropriate to mature individuals by the time they are about 9·5 m. in length.

Of the ninety-three whales, thirteen were judged to be immature. In sections of testis from certain whales there was more or less immature tissue present in addition to mature tissue: these whales were F33, 7·8 m.; F247, 9·5 m.; F319, 9·8 m.; F321, 10·9 m.; F289, 11·3 m.; and F20, 14·6 m. Presumably they were recently mature. Tissue from the two longest immature whales (F226, 12·2 m., and F3, 12·5 m.) seemed to be approaching maturity: all the tubules were open and in a few there were spermatocytes present.

Table 18. *Males. Lengths of sexually mature and immature whales examined at Horta in* 1949, 1953 *and* 1954. *Maturity was determined by histological examination of the testes. The larger mature whales are omitted*

Lengths in m.	*Immature*	*Mature*
5·8– 5·9	1	—
6·0– 6·1	—	—
6·2– 6·3	—	—
6·4– 6·5	—	—
6·6– 6·7	1	—
6·8– 6·9	—	—
7·0– 7·1	—	—
7·2– 7·3	1	—
7·4– 7·5	1	—
7·6– 7·7	—	—
7·8– 7·9	3	1
8·0– 8·1	—	—
8·2– 8·3	1	—
8·4– 8·5	—	—
8·6– 8·7	—	—
8·8– 8·9	—	—
9·0– 9·1	—	—
9·2– 9·3	—	1
9·4– 9·5	—	1
9·6– 9·7	1	4
9·8– 9·9	—	4
10·0–10·1	—	2
10·2–10·3	—	3
10·4–10·5	—	1
10·6–10·7	1	4
10·8–10·9	—	4
11·0–11·1	1	2
11·2–11·3	—	3
11·4–11·5	—	4
11·6–11·7	—	2
11·8–11·9	—	2
12·0–12·1	—	3
12·2–12·3	1	2
12·4–12·5	1	1
12·6–12·7	—	1
12·8–12·9	—	1
13·0–13·1	—	1
13·2–13·3	—	—
13·4–13·5	—	—
13·6–13·7	—	4
13·8–13·9	—	1
14·0–14·1	—	2
14·2–14·3	—	2
14·4–14·5	—	3
14·6–14·7	—	1
14·8–14·9	—	1

The lengths of sexually mature and immature whales are shown in Table 18. Although most whales larger than 9·5 m. were mature, the table shows a considerable overlap, the smallest mature and the largest immature whale being 7·8 m. (26 ft.) and 12·5 m. (41 ft.) long respectively. All sperm whales cannot be expected to mature at the same length, but, so far as one may judge from comparable tables for whalebone whales (Mackintosh, 1942, p. 218), the present overlap is perhaps more than might be expected. There is always the possibility of a clerical error here and there in recording measurements and noting collections under the difficult conditions of the flensing platform, but Senhor Reis' methods are so careful that I think such mistakes are unlikely. By inspection of present figures it is difficult to judge the 'best' value in Table 18 for a mean length at which males become sexually mature. It is put here at 9·6 m. (31 ft.) which makes some allowance for the overlap. It is not more than 9·6 m. and may be less, for at present there is information on only three whales of lengths between 8·0 and 9·5 m.

For guidance in the field it may be noted from Fig. 4 that sperm whales of the North Atlantic may be considered mature if the combined volumes of their testes amount to 3·5 l. or more. (This statement neglects the abnormally large volume, 5·5 l., of the testes of the longest whale judged immature.) Whales may be considered immature if the combined volumes of their testes are less than 1·0 l. The maturity of those with intermediate testis volumes should be left in doubt.

Table 19. *Females. Lengths of sexually mature and immature whales examined at Horta from* 1949 *to* 1954. *The larger mature whales are omitted*

Lengths in m.	*Immature*	*Mature*	*Lengths in m.*	*Immature*	*Mature*
6·6–6·7	1	—	8·6– 8·7	—	2
6·8–6·9	1	—	8·8– 8·9	1	2
7·0–7·1	—	—	9·0– 9·1	2	6
7·2–7·3	1	—	9·2– 9·3	1	3
7·4–7·5	2	—	9·4– 9·5	1	12
7·6–7·7	2	—	9·6– 9·7	—	5
7·8–7·9	1	1	9·8– 9·9	—	14
8·0–8·1	2	—	10·0–10·1	—	6
8·2–8·3	—	—	10·2–10·3	—	10
8·4–8·5	1	2	10·4–10·5	—	14

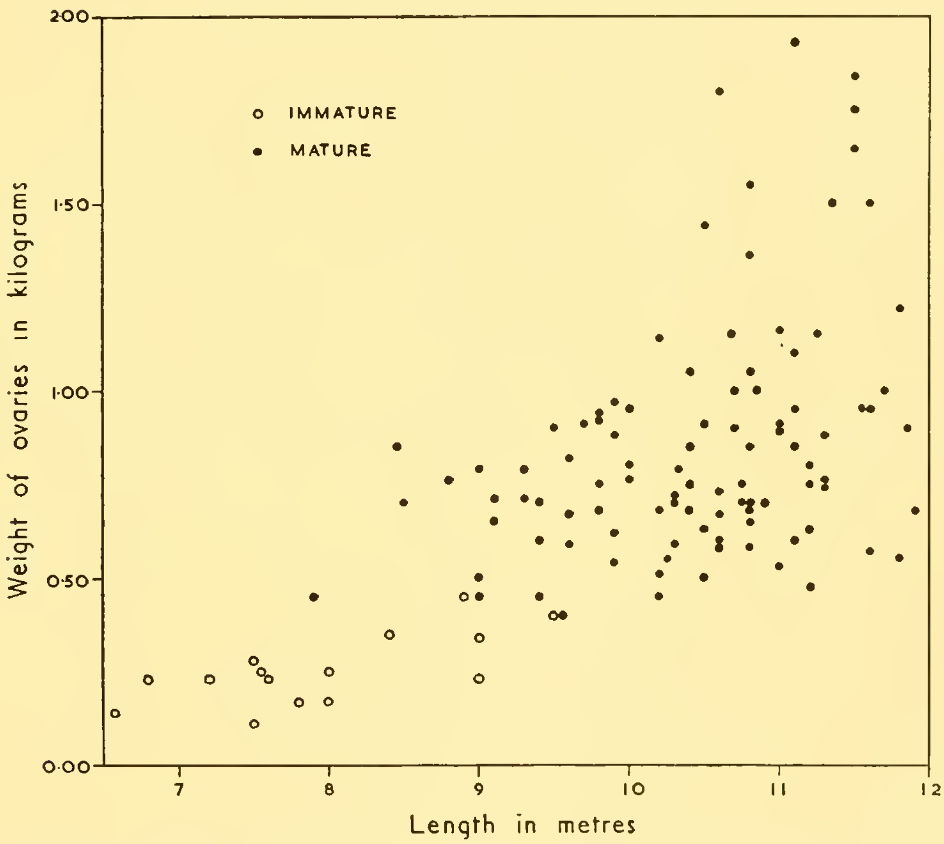

Fig. 5. Females. Length of body and weight of ovaries in non-pregnant whales examined at Horta from 1949 to 1954.

Sexual maturity in female sperm whales has been investigated by examining pairs of ovaries collected from 165 whales at Horta between 1949 and 1954. Ovaries from sixteen whales bore no corpora lutea, either functional or regressed, and so were immature. From Table 19 it is seen that females become mature within the range 7·9 to 9·5 m. (26 to 31 ft.). The data, so far as they go, indicate 8·8 m. (29 ft.) as the mean length at sexual maturity.

Fig. 5 shows that any female with ovaries weighing 0·5 kg. or more may be expected to be mature.

Table 20 compares these results from the North Atlantic with findings on the sexual maturity of sperm whales from the North Pacific and from the southern hemisphere. Because whaling in the Azores is not restricted by the size regulations enforced elsewhere, the North Atlantic data have the advantage of including more immature whales of both sexes than have been available in any area, except the pelagic Antarctic where Nishiwaki (1955) considered sixteen of his large sample of males to be immature. For male whales captured off Japan workers have failed to detect any change in the rate of increase of testis size when plotted against body length, and this is probably due to the scarcity of the smaller (immature) whales in their samples. Nishiwaki & Hibiya (1951, 1952) and Nishiwaki (1955) have based their findings on the presence or absence of spermatozoa in histological preparations of the testis. Since there is evidence that male sperm whales have a sexual cycle (p. 273), it is doubtful whether the presence or absence of sperms is a very reliable means of discriminating between mature and immature animals. Nishiwaki & Hibiya estimated that males from the North Pacific matured at a length of 35 to 37 ft. Because of the enforced size regulation they examined no material from whales shorter than 35 ft., so it may well be that the four whales they considered to be immature corresponded to large immature animals of the overlap in Table 18. Unless small whales become available to workers in the North Pacific, it is not possible to say whether or not male whales from the North Atlantic and North Pacific mature at different mean lengths. Probably there is no real difference, because, turning to females, it is seen that those data from the North Pacific which were mostly collected in 1948, when the length restriction had not been raised above 30 ft. and which therefore include most immature females (three), suggest that female whales mature at 30 ft. or a little less (Omura, 1950). This is virtually identical with the present estimate for Azores females. Recent work, reviewed by Pike (1953), has shown that whalebone whales mature at a greater length in the southern than in the northern hemisphere. Consequently it is interesting to note that, although data on southern female sperm whales are few and include no immature animals, there have been two estimates (based on testis size, and on the presence or absence of sperms) which suggest the considerable mean lengths at sexual maturity of 39 ft. and 41 ft. respectively for male sperm whales in the southern hemisphere (Matthews, 1938, p. 129; Nishiwaki, 1955, p. 148). Further work is required, but there may be a real difference here between northern and southern sperm whales.

Breeding

Table 21 gives details by months of forty-two sperm whale foetuses examined at Horta between 1949 and 1954. The foetal lengths fall clearly into a group representing early pregnancies, ranging from 0·15 to 1·25 m., and into a second group of late pregnancies with lengths between 3·10 and 4·10 m. Foetuses from the Bonin Islands, North Pacific, show a similar grouping (Mizue, 1950, p. 118). That there should be two such distinct groups, without intermediate lengths being represented, points at once to the presence of a breeding season, and to a period of gestation which extends over more than one year.

In Fig. 6 the foetal measurements from Horta are twice plotted against months in successive years. The bottom left-hand and the top right-hand groups of points are now seen to represent on this two-year time scale the early and late stages of foetal growth. The average length of the foetus in each month, at the mean time in the month, has been calculated and marked in the figure, and a freehand curve drawn giving the best fit to these average values. The number of foetal measurements is not large, but there are fairly adequate data for the average size of the early pregnancies in July and September and for the late pregnancies in July; the curve joins these three average points, and the sparser points for other months are seen to be fairly distributed about the curve. The curve is pecked for the first two months, April and May, when early foetuses are minute and when few data can in any case

Table 20. *Recent estimates of the lengths of the sexes at sexual maturity*

Ocean	Locality	Author	Males: Immature	Males: Mature	Males: Not determined	Males: Estimated length at sexual maturity	Females: Immature	Females: Mature	Females: Estimated length at sexual maturity	Remarks
North Atlantic	Azores	Clarke (in present report)	13	80	31	Range 26–41 ft. Mean 31 ft. or less	16	149	Range 26–31 ft. Mean 29 ft.	Estimate for males mainly by the histology of testes supported by the rate of increase of their size and of testis tubule diameter with body length
North Pacific	Japan	Omura, 1950, pp. 103 and 106	—	—	331	*	3	149	30 ft. or a little less	* The author found no change in the rate of increase in weight of the testes when plotted against body length
	Japan	Nishiwaki & Hibiya, 1951	*4	*86	0	35–37 ft.	†3	†77	—	Estimate for males by the histology of testes (presence or absence of spermatozoa). The authors found no change in the rate of increase in weight of the testes when plotted against body length * Numbers estimated from the authors' Table 1 † Numbers estimated from the authors' Fig. 7
	Japan and Bonin Islands	Miyazaki, 1952	—	—	*	†	2	165	—	* Size of the large sample of males not stated † The author (p. 22) observed a change in the rate of increase of testis weight at '40 ft. or so' of body length
	Japan and Bonin Islands	Sakiura, Nozawa & Ozaki, 1953	—	—	*	†	1	103	Not estimated	* Size of the sample of males not stated. † The authors state (p. 18) 'Consequently, it is impossible to divide Sperm whales into mature and immature through measurement of volume or weight of testis alone'
	Bonin Islands	Mizue, 1950, p. 117	—	—	*35	42–44 ft.	†	†	Range 28–35 ft.	Estimate for males by the rate of increase of testis weight and size * Numbers estimated from the author's Fig. 5 † Size of the sample of females not stated
	Bonin Islands	Nishiwaki & Hibiya, 1952	0	55	0	Less than 38 ft.	0	1	—	Estimate for males from the histology of testes (presence or absence of spermatozoa)
	British Columbia	*Rep. Fish Res. Bd. Can.* 1954, p. 94	—	—	—	—	—	—	*	* The report states (p. 94) 'female sperm whales longer than 31 ft. are mature'
Antarctic and South Indian Ocean	South Georgia and Natal	Matthews, 1938, pp. 129 and 144	*0	*36	*31	* Range 38–41 ft. Mean about 39 ft.	0	14	Probably 30–31 ft.	* Estimate for males by the rate of increase of testis size with body length. From the results Matthews judged seven to be immature out of sixty-seven males. There were no immature testes among a series of samples examined histologically from thirty-six whales
Antarctic	Antarctic pelagic	Nishiwaki, 1955	*16	*148	797	41 ft.	—	—	—	Estimate from histology of the testis (presence or absence of spermatozoa), supported by testis size * Numbers estimated from the author's Fig. 2

be expected from female whales which are scarce round the Azores in these months (p. 284): also the curve has been flattened very slightly here so that it starts in April and not in May, on the assumption that growth of the embryo follows the characteristic mammalian pattern of being slow in its earliest stage.

Table 21. *Foetuses measured at Horta from* 1949 *to* 1954

		Foetal sex, and length in m.	
Month	*Day and year*	*Early pregnancies*	*Late pregnancies*
June	3 (1953)	—	♂ 3·15
			♂ 4·00
	27 (1950)	♀ 0·15	—
July	1 (1954)	♀ 0·39	—
	6 (1950)	—	♂ 3·25
			♂ 3·40
	10 (1950)	♂ 0·42	♀ 3·40
		♀ 0·45	♀ 4·10
	13 (1950)	—	♀ 3·78
	16 (1952)	♂ 0·38	—
		♀ 0·38	—
	20 (1951)	♀ 0·50	♀ 3·40
	21 (1952)	♀ 0·22	—
	23 (1953)	—	♀ 4·00
			♀ 3·50
	25 (1949)	—	♂ 3·53
	(1953)	♀ 0·24	—
	28 (1954)	—	♂ 3·78
Aug.	8 (1951)	♀ 0·64	—
	(1952)	—	♀ 3·90
	15 (1951)	♂ 0·35	—
	25 (1950)	♀ 0·21	—
		♂ 0·74	—
	26 (1949)	—	♂ 3·10
	31 (1951)	♀ 0·50	—
Sept.	1 (1951)	♀ 0·74	—
	(1952)	♂ 0·93	—
	3 (1952)	♀ 0·30	—
		♂ 0·48	—
		♀ 0·92	—
	14 (1954)	♀ 0·75	—
		♂ 0·75	—
	16 (1954)	—	♂ 3·50
	20 (1950)	♂ 0·54	♀ 3·30
Oct.	1 (1951)	♀ 1·14	—
		♀ 1·25	—
	2 (1953)	♂ 0·68	—
Dec.	22 (1950)	♀ 1·20	—

The large foetuses of late summer look as though they are approaching term. Moreover, comparison of the classes of females in July and August catches (Table 24, p. 274) suggests that the proportion of pregnant whales diminishes in August whereas the proportion of lactating whales increases. This change may conceivably be due to local movements, changes in the pattern of segregation from the coast of the classes of females, but otherwise it does suggest that whales are giving birth around the Azores between July and August. But direct and valuable evidence comes from the record of four new-born sperm whale calves which Mr Bernard Stonehouse examined at Cais do Pico, adjacent to Fayal, in August 1951 (Table 22). All were taken in a single excursion of the whaleboats. The fourth to be examined was too much decomposed for any certain observations, but the other three all bore the raw stalks of umbilical cords. The first two calves were possibly only a few hours old when taken. The 'clear yellow fluid' in the stomach of one, and the 'yellow opalescent fluid' in that of the other, may well have been the 'witches' milk' or colostrum which in mammals precedes the true milk at the first suckling. The third had an empty stomach, and although this animal could conceivably have been delivered prematurely during the mother's convulsion when lanced, nonetheless its size compares closely with the sizes of the other two. The brown liquid in the hind gut of these calves is not necessarily the faeces of a nursing milk diet, but may be the meconium, relics and waste material of foetal growth. The presence together of colostrum and meconium would make such infants new-born indeed.

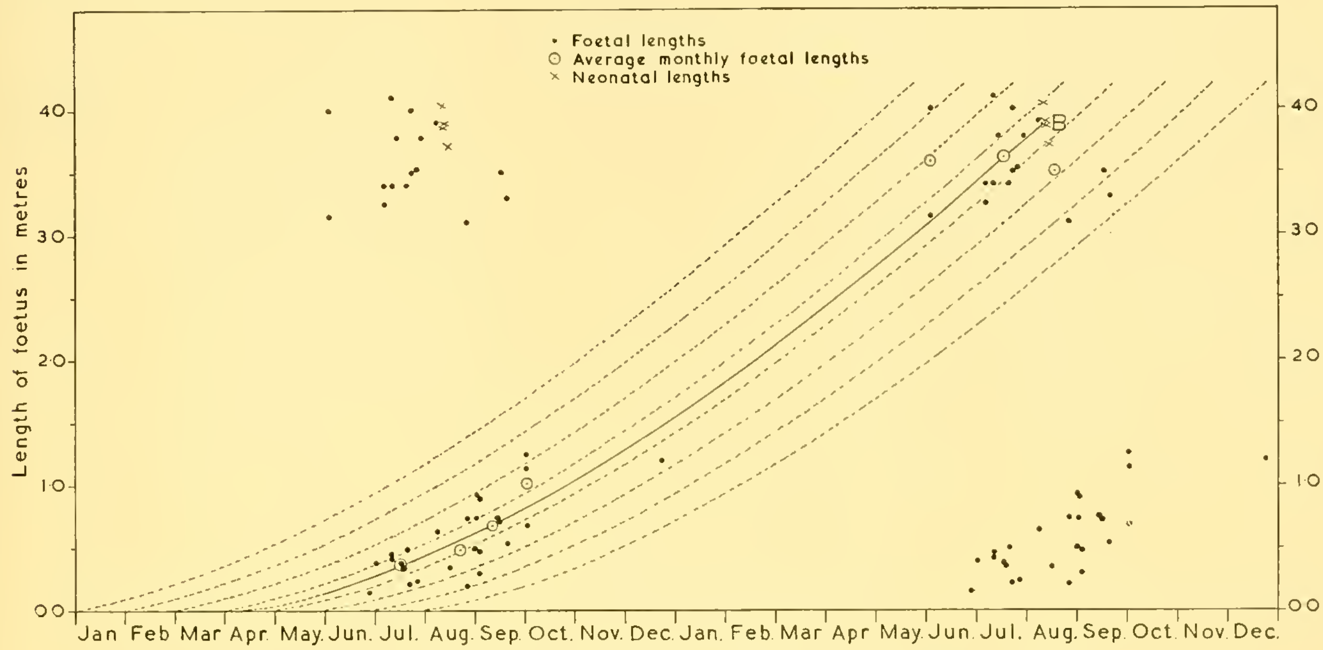

Fig. 6. Foetal growth curve for foetuses measured at Horta from 1949 to 1954.

Table 22. *New-born calves examined by Mr B. Stonehouse at Cais do Pico in August* 1951

Date	Length Ft.	in.	M.	*Sex*	*Remarks*
11 Aug.	13	3	4·04	♂	Raw stalk of umbilical cord present, 6 in. long. Stomach contained a yellow opalescent fluid: there were no squid beaks or parasites. The hind gut contained a dark brown cloudy liquid
12 Aug.	12	8	3·86	♂	Raw stalk of umbilical cord present, 6–7 in. long. Stomach contained a clear yellow fluid: there were no squid beaks or parasites
12 Aug.	12	9	3·89	♂	Raw stalk of umbilical cord present. Stomach was empty, without squid beaks or parasites. The hind gut contained a brown liquid
14 Aug.	12	2	3·71	♂	Very badly decomposed

When the lengths of the neonates including the fourth, decomposed one, are plotted in Fig. 6, the extrapolation of the mean curve of foetal growth is seen to pass precisely through the point representing the mean neonatal length, which in the figure is point B, the point of birth.

From the length of the largest foetus recorded in Table 21 and the smallest neonate in Table 22, the length of the new-born sperm whale (at least in the North Atlantic) is seen to range from 3·71 m. (12 ft. 2 in.) to 4·10 m. (13 ft. 4 in.), and the average length for the five measurements is 3·92 m. (12 ft. 10 in.). Included within this range is the length of a neonate which Wheeler (1933) examined in the month of September in Bermuda. Except for Wheeler's record, new-born calves of any species of the great whales seem not to have been available previously, and estimates of neonatal length have been approximations based on the length of the smallest calf and the largest foetus examined. For sperm whales such estimates have been close to the present, more exact, information. Matthews (1938, p. 138) gave '4 m. or a little more' in southern whales; Bennett (1836, p. 129; 1840, II, p. 167) measured a full-time foetus which was '14 feet in length and 6 in girth', a record which Melville (1851, p. 397) and Davis (1874, p. 185) seem to have used in their estimates; Matsuura (1836) and Mizue & Jimbo (1950, p. 127) gave 14 to 15 ft. for neonates in the North Pacific.

Turning again to Fig. 6 it is seen that the mean curve of foetal growth shows a gestation period of sixteen months. A little uncertainty about the lowest part of the curve (the beginning of pregnancy) has already been noticed, but a sixteen months period agrees precisely with Matthews' findings (1938, p. 142) and is very close to the seventeen months gestation period found by Mizue & Jimbo (1950, p. 128). There is no doubt that Harmer (1933, p. 410) and Matsuura (1935, 1936) under-estimated when they suggested that pregnancy lasted about 12 months or a little more.

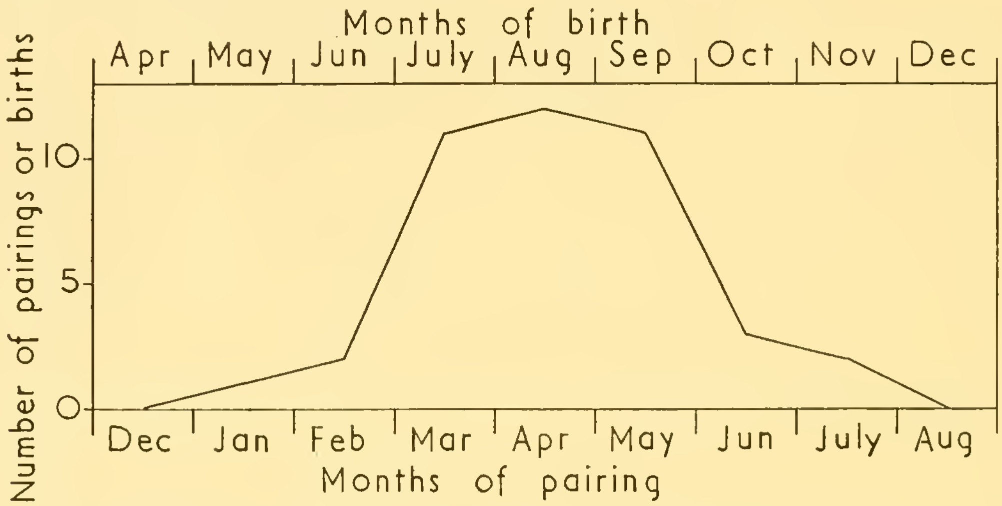

Fig. 7. Pairing and birth frequencies from foetuses examined at Horta between 1949 and 1954.

The extent of the pairing or sexual season has been determined by drawing lines in Fig. 6 parallel to the mean growth curve but taking their origin at monthly intervals from it; the number of pregnancies within the lines defining each interval was then counted, being the number of pairings for the month of origin of the interval. Plotting the number of pairings against months gave the frequency of pairing (Fig. 7). The pairing season would seem to be protracted, lasting for seven months between January and July, although most activity is contained in the three months between March and May. Assuming there is no substantial variation in the rate of foetal growth, the same curve plotted sixteen months later represents the birth frequency, which is also shown in Fig. 7. The seven months season of parturition lasts from May to November, but is mostly concentrated between July and September. Matthews found that in southern sperm whales the season also lasts seven months, although it is mostly contained in five months of the southern summer and autumn. Comparing the months, north and south, it is clear that the peaks of calving (and, of course, of pairing) are in the same season of the year in each hemisphere but of course in opposite months, a point which will be discussed later (pp. 288–9). Bennett (1840, II, p. 178) observed sperm whales copulating in the South Seas in August, a month which accords with Matthews' findings. Mizue & Jimbo's results in the North Pacific give a season of only $2\frac{1}{2}$ months, although they put the peaks of pairing and of parturition in March and August respectively.

The present conclusions on the breeding of whales round the Azores are supported by the experience of Fayal whalemen. They tell me that schools of nursing females appear between July and September and are most numerous in August. Further, they have not seen whales copulating and can volunteer no theories on how copulation takes place. This is to be expected if the majority of pairings take place between March and May when there are very few females on the Azores ground.

An independent observation of nursing schools tends to generalize for the archipelago the local evidence from Fayal. Collett (1912, p. 636) records that in the summer of 1904 Captain Otto Sverdrup saw round the Azores large schools of sperm whales, including many females with new-born young.

One cannot say how important the Azores may be as a calving ground for sperm whales of the North Atlantic, but it seems clear that around the islands in the latter half of summer whales of the local stock drop calves which have been conceived away from the Azores in the spring of the previous year and probably well to the southward where the main part of the stock is believed to spend the winter (p. 285).

Turning now to the sexual cycle, one needs to ascertain whether males have a sexual season, and if so, when it starts and how long it lasts; and in females what are the normal periods of oestrus, gestation, lactation and anoestrum.

Male sexual cycle

Unfortunately, all months of the year are not represented among the eighty testis samples collected from mature whales at Horta. The collection refers to the period May to November, although only one whale was sampled in May and one in November (Table 23).

Table 23. *Males. Mean diameters of testis tubules of immature and mature whales examined between May and November at Horta in* 1949, 1953 *and* 1954

		Mean diameter of tubules in microns	
Class	*No. of whales*	*Range*	*Average*
Calf	1	(35)	(35)
Immature	12	58–93	76
Mature			
May	1	(172)	(172)
June	19	135–185	161
July	30	128–176	158
Aug.	16	126–174	146
Sept.	8	119–161	134
Oct.	5	134–152 (182)*	144
Nov.	1	(152)	(152)
May–Nov.	80	119–185	150

* Anomalous tubule diameter of whale F246. See Fig. 9 and p. 273.

In all mature testis sections it was possible to find some tubules with a more or less abundant proliferation of the germinal epithelium. In some sections there were tubules packed with cells, an appearance in the whale testis which has been described by other writers and taken as a sign of spermatogenic activity. But no tubules in the present material clearly exhibited active spermatogenesis of the normal mammalian pattern, and it may be that since the samples were not fixed until some 18 to 19 hr. after death, the packed appearance in tubules is an artefact caused by desquamation of cells into the tubule lumina. The particular characteristics of these sections were what appeared to be various stages in the degeneration of spermatids, or less commonly and in quite small numbers, of spermatozoa. These appearances, combined with the absence of any clear indications of spermatogenesis, suggest that the testes have been active in a period other than the months, June to October, when all except two of the samples were collected. Evidence from the mean diameters of testis tubules confirms that such a sexual season does exist in the male sperm whale.

In those male mammals which have a sexual cycle, the seminiferous tubules commonly exhibit a cyclic variation in their diameters, which are greatest during the sexual season. Statistical analysis of tubule diameters has already been used for whale investigations by Chittleborough (1955) in studies on the male humpback whale.

Tubule diameters were measured in all testis samples, mature and immature, of whales examined at Horta. For each whale ten tubules were measured and the mean taken. Each section was searched for tubules cut in true cross-section, and selecting circular outlines in this way helped to make the

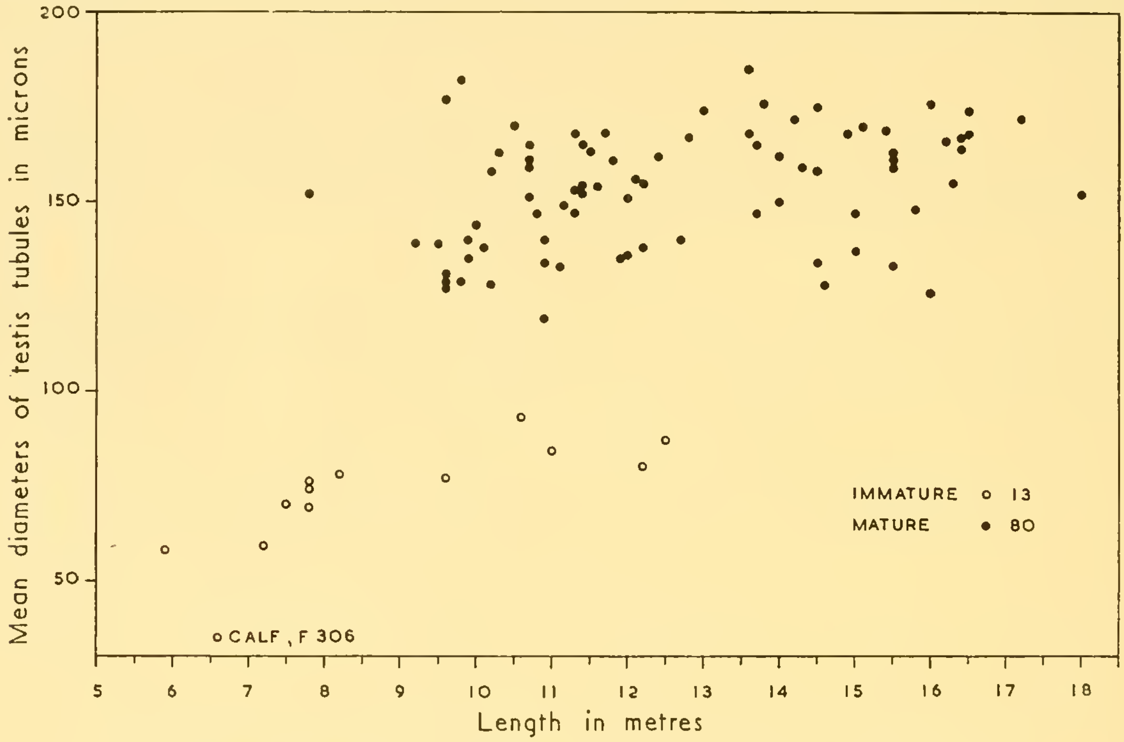

Fig. 8. Males. Length of body and diameter of testis tubules in whales examined at Horta in 1949, 1953 and 1954.

tubule samples random for size. The outlines of the tubules were first traced under a camera lucida and afterwards each was measured across two diameters at right angles, using a card previously calibrated from a graduated slide. Table 23 is a summary of all the measurements.

In Fig. 8 the mean diameters of testis tubules are plotted against the lengths of whales. In immature whales there seems to be a regular and gradual increase of tubule diameter with increasing body length, although the plot for the proven calf, F306 (p. 275, Table 25) which had the smallest tubules in the series, is somewhat apart from the main trend of the points. After sexual maturity there is clearly no correlation between tubule diameter and body length, and this is to be expected if a sexual cycle exists. A noteworthy feature of the diagram is the pronounced gap between plots of the largest immature and the smallest mature tubules. This again is to be expected if a sexual cycle exists and the material has been collected outside the sexual season. If there were no sexual season, or if there were and the material had been collected in the sexual season, one might expect a few maturing whales, the plots of whose tubule diameters would bridge the gap in Fig. 8.

Dates of capture of the whales and the mean diameter of their testis tubules are plotted in Fig. 9, which also shows the average monthly tubule diameter plotted at the average date in the month. The diagram shows that there is a steady decline in the diameters from month to month, from a high range of values in June to a low range in September. There are not sufficient data for October to say whether or not the apparent rise in this month is real. There is one anomalous plot, for whale F246, 9·8 m. long, captured on 2 October 1953: the mean tubule diameter was 182 μ, but in this whale the testis sampled was very much larger (1·35 l.) than its pair (0·57 l.), and a few tubules in the section seemed still to be maturing; so it would appear to be abnormal, presumably an individual which has matured out of season: it has been neglected when calculating the average tubule diameter for October (Table 23).

My colleague, Mr D. E. Cartwright, working from the correlation coefficient between date and tubule diameter (−0·58 for the sample from eighty whales), has calculated that the probability is much less than 1% that the decline over the months is merely due to chance. The tubule diameters

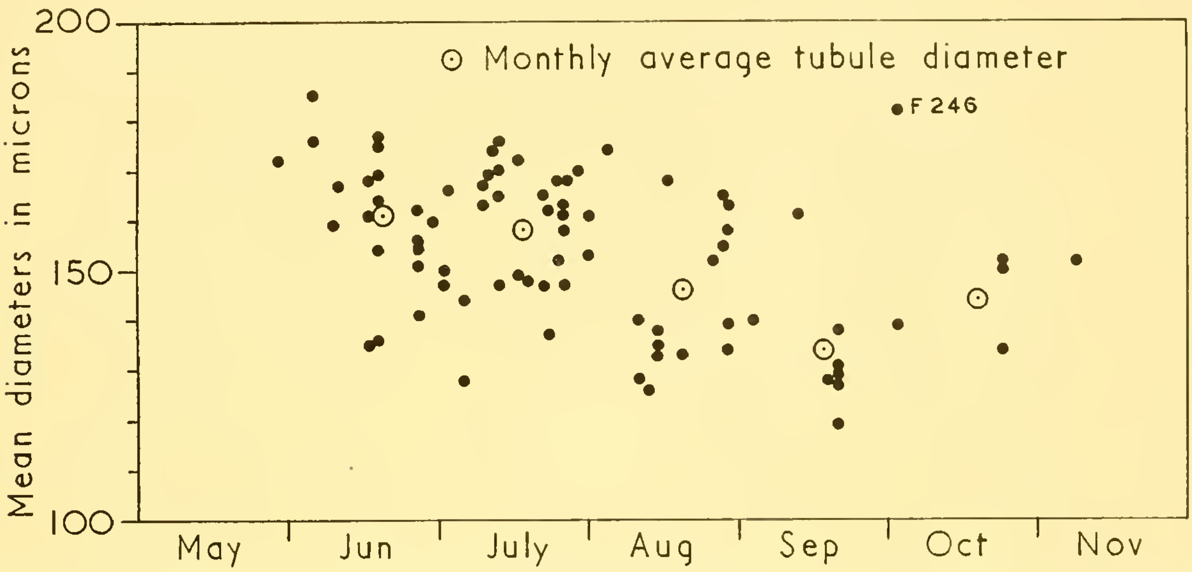

Fig. 9. Males. Diameters of testis tubules in sexually mature whales and the dates these whales were examined at Horta in 1949, 1953 and 1954.

have presumably declined from greater diameters during a period when the tubules, characterized in the present collection by degenerating spermatids or spermatozoa, have been active with spermatogenesis outside the months shown.

Thus the observed decline, combined with the other histological evidence, shows that the male sperm whale has a sexual cycle, and that the sexual season occurs later than October and earlier than June.

This sexual season is a protracted one, for Fig. 9 indicates that tubule diameters in any one month vary widely, but steadily, at least for the three months (June, July and August) where data are most plentiful and where the monthly differences between the smallest and largest diameters are almost identical, being 50, 48 and 48 μ respectively (Table 23).

Except for rare instances where a mechanism exists separating the period of germ cell production from the period of pairing, sexual seasons coincide when they occur in both sexes of an animal. The season of the female sperm whale is mostly contained between March and May (p. 270), so it is most probable that the sexual season of the male is in spring also.

Matthews (1938, p. 132) considered that there was probably no sexual cycle in the southern male sperm whale. However, Nishiwaki & Hibiya (1951; 1952, p. 123), reporting on two collections from testes of North Pacific whales, one collection made between July and October, and the other between March and June, found 'more spermatozoa...with less effort' in the second collection, and they suggested that some cyclic activity might exist in the testis.

Female sexual cycle

The season of oestrus in female sperm whales in the North Atlantic has been estimated to last for seven months, between January and July with most activity contained between March and May (p. 270). The present data give no information on the pattern of the oestrous cycle. Matthews (1938, p. 141) found indications of periodicity in corpora lutea frequencies from fourteen southern whales, and he suggested details of a dioestrous cycle. Corpora lutea frequencies are available for 154 whales examined at Horta between 1949 and 1954, but their frequency curve shows no regular periodicity.

Regarding ovulation, it may be said that one calf is normally produced at a birth. There is no instance of multiple ovulation in the present material, although twinning is known to occur in sperm whales and was first mentioned by Bennett (1840, p. 179) and later by Beneden & Gervais (1880, p. 308). Matthews, in his Table X, recorded twins once in seventy-four foetal records, and Matsuura (1936) mentioned another instance among 228 records. Combining these gives a twinning incidence of 0·66%, which is the same as Paulsen's figure for twinning in foetal blue whales, discussed by Slijper (1949, p. 418). Whether, or how often, such twins survive after birth is not known.

Table 24. *Adult females. Pregnant, lactating and resting whales examined at Horta from* 1949 *to* 1954

Sexual condition	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	*Totals*	(%)
Pregnant	3	19	7	10	3	—	1	43	*27*
Lactating	1	6	14	13	5	—	—	39	*25*
Resting	2	27	24	10	10	3	—	76	*48*
Totals	6	52	45	33	18	3	1	158	*100*

One whale, both pregnant and lactating, has been entered twice.

It will be remembered that gestation is estimated to last for sixteen months in sperm whales of the North Atlantic. Judging from what little is known of other toothed whales, the subsequent period of lactation is likely to be protracted. Lactation apparently lasts for eight months in the common porpoise (Møhl-Hansen, 1954,), for twelve months in the pilot whale (*Rep. Fish Res. Bd. Can.* 1954, p. 55), and for as long as eighteen months in the bottlenosed dolphin in captivity (McBride & Kritzler, 1951, p. 266), although the period is likely to be less for this species at large. Allen concluded that the calf of the pigmy sperm whale, 'stays with the mother during the first year' (1941, p. 26). The present study estimates the lactation period in the sperm whale by first examining the proportions of whales lactating, pregnant and resting among the catches at Horta; and then by determining the growth of the calf to weaning.

Table 24 shows the 'classes' of adult females among whales examined at Horta between 1949 and 1954. With one doubtful exception (Whale F268, examined on 1 July 1954) all whales were pregnant whose ovaries bore a functional corpus luteum. The absence of recently ovulated whales in the Fayal catches is to be expected, because scarcely any females arrive off the islands before June, when the sexual season is mostly over (Fig. 7). If the classes of females in the catch are considered to be representative of those in the actual population, then the proportions of whales pregnant, lactating and resting should be roughly proportional to the duration of each phase of the sexual cycle. Since gestation is estimated to last sixteen months, the percentages in Table 24 suggest that lactation should last about fifteen months. This rough estimate is helpful as a working figure in examining the growth of the calf to weaning. The proportion of resting whales indicated in Table 24 is discussed at the top of page 276.

In 1954 Senhor Reis examined two whales, one male (F 306) and one female (F 307) and each 6·58 m. long, whose stomachs contained milk. Details of these are included in Table 25 which records the stomach contents of small whales (less than 8·0 m. in length) examined at Horta. The twelve whales larger than 6·7 m. had been feeding on their own account. Thus the stomachs of ten contained squids: whale F 128, measuring 6·8 m., must also have been feeding independently because its stomach contained nematode worms; and Dr S. K. Kon, of the National Institute for Research in Dairying, informs me that the 'chestnut-coloured water' in the stomach of whale F 118 is far more likely to have been discoloured by squid chyme or blood than by digested milk. The data in Table 25, so far as they go, bracket the length at weaning between 6·6 and 6·8 m., and it may for the present be said that the sperm whale calf in the North Atlantic is weaned when about 6·7 m. or 22 ft. in length.

Table 25. *Stomach contents of whales less than* 8·0 *metres long, examined at Horta from* 1949 *to* 1954

Serial no.	*Date*	*Length in m.*	*Sex*	*Stomach contents*
F 12	25 July 1949	5·9	♂	Blood and water
F 306	3 Sept 1954	6·58	♂	Milk and water in the first stomach, and cloudy water in the second
F 307	3 Sept. 1954	6·58	♀	Milk and water in the first stomach, and cloudy water in the second
F 128	1 Sept. 1952	6·8	♀	Water and worms
F 248	14 Oct. 1953	7·2	♂	Water, worms and a little digested squid
F 308	14 Sept. 1952	7·2	♀	First and second stomachs crammed with squid
F 138	14 Sept. 1952	7·5	♀	Much food in the first stomach, less in the second
F 260	18 June 1954	7·5	♀	Sparse amount of squid
F 37	25 Aug. 1949	7·6	♀	Moderate amount of squid and many squid beaks
F 118	21 July 1952	7·6	♀	Chestnut-coloured water in the first stomach
F 13	25 July 1949	7·8	♂	A little water
F 15	1 Aug. 1949	7·8	♂	Moderate amount of squid and a few squid beaks
F 33	25 Aug. 1949	7·8	♂	Sparse amount of squid and masses of squid beaks
F 114	16 July 1952	7·8	♀	Water, worms and a little squid
F 238	13 July 1953	7·8	♂	Much food in the first stomach, less in the second

The whaling statistics collected at Horta between 1944 and 1954 record four other whales smaller than 6·7 m. There is no information on the stomach contents of these, but they are grouped with the three recorded in Table 25 to make a total of seven whales presumed to be calves. Five were caught in July and two in September. Fig. 10 reproduces the foetal growth curve with the lengths of the calves plotted at their appropriate dates a year beyond the point of birth. One might have plotted them two years beyond birth, but the proportion of lactating whales in the catch has given indications of a nursing period lasting about fifteen months, which is not much more than a year. In Fig. 10 the mean curve of foetal growth is extended with a slight reduction in slope to pass through the mean length of calves in July at the mean time in the month. The extrapolation of this curve fairly passes through the point for the two proven calves in September: and the curve attains to 6·7 m., the point of weaning, at thirteen months after the mean point of birth. So far as the seven records go, Fig. 10 suggests there is no difference in the growth of the sexes during the nursing period, males and females both being weaned at the same length. From Fig. 10 the normal period of lactation in the sperm whale is taken to last about thirteen months.

Resting or anoestrum completes the sexual cycle. In normal conditions the resting whale must inevitably come into oestrus in the first sexual season following the end of lactation. This season is three years after conception; so anoestrum lasts about seven months. The proportion of resting whales in the catches (Table 24) must therefore be very much higher than in the actual population. There may be a climacteric in female sperm whales, in which case some proportion of the present sample would actually have been barren and not resting, but allowance for such post-climacteric animals would be unlikely to reduce the proportion in the catch of resting whales from 48% to the figure of about 12% required by the cycle now put forward. It is however possible that the pregnant and nursing whales are segregated to some extent, being sequestered at such a distance from the coast as not to be fully represented in the catches (p. 280). The sexual cycle does not invariably include anoestrum, because there are three reports from Horta of females pregnant whilst still lactating. One is in the whaling returns for 1948; the second refers to a whale examined in 1951 (Table 24, footnote), and Senhor Jacinto Silviera de Medeiros has told me of a third.

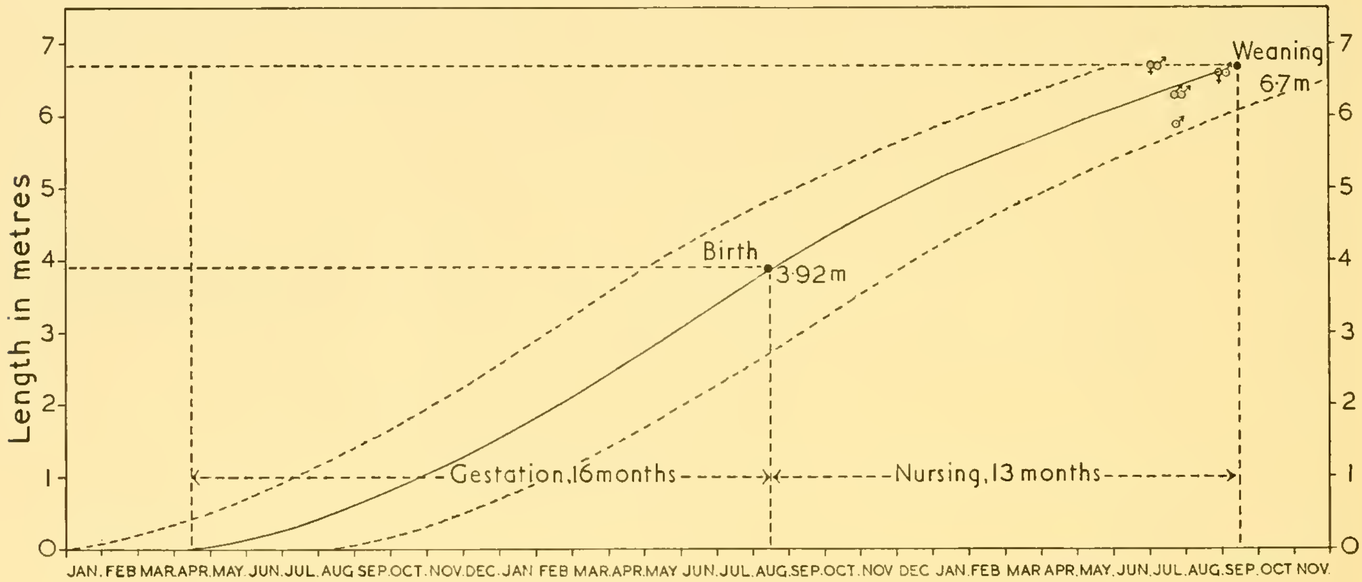

Fig. 10. Sperm whales in the North Atlantic. Growth curve from conception to weaning.

The present study concludes that the sexual cycle of the female sperm whale normally lasts three years. Matsuura (1936) estimated a two-year cycle, but he believed that gestation lasted only one year. Matthews (1938, p. 142) tentatively suggested a cycle of nearly two years; but he assumed a lactation period of at least six months by analogy with the condition in whalebone whales, and he considered anoestrum to be absent or of very short duration. There was only one resting whale among the fourteen adult females in Matthews' material, but they were all examined between July and September, that is, during the first half of the southern sexual season, when one would not expect to encounter numbers of resting whales.

Growth and age

The foregoing study of foetal and calf growth in the sperm whale shows that growth from conception to weaning is not only absolutely but also relatively slower than growth during this period in the great whalebone whales where, for instance, gestation in blue and fin whales lasts a little less than a year and lactation six or seven months, the calves being weaned at about 16 and 12 m. respectively (Mackintosh & Wheeler, 1929).

The present material offers little information about growth after weaning. For catches between 1949 and 1954 the length frequency curve for the shorter whales (Fig. 2, p. 242) shows no strong peaks which might suggest age groups, nor are the data sufficient for analysis by successive years to see if any features of the length frequencies persist from year to year. Laws (1953) has used periodic growth rings in teeth for age determination of elephant seals, and it appears that this method has been successfully applied in studies on the pilot whale in Newfoundland (*Rep. Fish. Res. Bd. Can.* 1954, p. 54; 1955, p. 58). In cross-section the teeth of sperm whales also show concentric rings which may be associated with age: sperm teeth from female whales have been collected at Horta since 1953, but these teeth have not yet been sectioned and examined.

Regarding growth to sexual maturity it can only be noted that male and female sperm whales of the North Atlantic are estimated (pp. 264–5) to mature at similar means lengths: these are 9·6 m. (31 ft.) or less, and 8·8 m. (29 ft.) respectively. Should it be found that they mature at similar ages, then the great difference in size between the sexes must develop after sexual maturity, when the physiological demands of the female's protracted breeding cycle are likely to slow down her growth relative to that of the male.

At Horta observations have been made on the progressive ankylosis of epiphyses to centra in the vertebral column, but these are not yet sufficient to yield any reliable conclusions about physical maturity.

Table 26. *Sperm whales fastened, then lost in the Azores but subsequently captured, being identified after a lapse of years by marked harpoons*

	Fastened then lost		Captured		
Sex	*Date*	*Locality*	*Date*	*Locality*	*Interval in years*
—	1918	North of San Jorge	1920	Caxorro Bay, Pico	2
♂	1911	Prainha do Sul, Pico	1943	Prainha do Sul, Pico	32
Probably ♀	1929	San Jorge Channel	1951	Capelo, Fayal	22

Some information on the longevity of sperm whales is provided by three instances of lost harpoons recovered from whales in the Azores. Senhor Jacinto Silviera de Medeiros, of Horta, has kindly provided me with the details which are recorded in Table 26. The island whalemen preserve the ancient custom of 'marking craft' (Clarke 1954*a*, p. 318), and so it happens that in a captured whale there is occasionally found and identified a hand harpoon surviving after the lapse of years from some previous encounter when the whale was fastened but subsequently lost. In the present instances the sex of the three captures was not noted, but the second is recorded in Table 26 as a male since it boiled out fifty barrels, a yield of oil which only a male can be expected to give; and the third after twenty-two years at large only boiled out twenty barrels, and so was almost certainly a female. Table 26 is therefore evidence that male and female sperm whales may live for at least thirty-two and twenty-two years respectively.

SCHOOLING

The sperm whale is a typically gregarious species. The schooling habit, besides its intrinsic interest, deserves attention because it appears to affect discussion of breeding and the sex ratio.

The supposed polygamous habit of sperm whales, briefly discussed by Matthews (1938, p. 159), is accepted here. Polygamy must greatly influence the pattern and stability of the various kinds of schools.

In certain whaling returns examined at Horta, there were entries which stated whether each capture had been solitary or in a school when sighted. The returns available were confined to the catches of three islands or districts in 1948. From the data Table 27 has been constructed. It illustrates at once a characteristic of the species, namely, that females are invariably in schools, whereas males may be in schools or they may be solitary.

These solitary whales were known to the old whalemen as 'lone bulls'. When a solitary sperm whale is encountered anywhere at sea, there are usually other solitary individuals in the same area. Captain D. McKenzie (in Maury, 1852, p. 238) said that 'four or five may be as many miles from each other'. I have a similar impression from what I have seen in the Azores and in the Antarctic, and heard from whale-gunners. In the Antarctic I have never encountered solitary sperm whales which were less than about one mile apart. Except for a single mention, made in general terms without comment, of sperm whales schooling in the Antarctic (Mizue & Murata, 1951, p. 90), the experience of scientists and whalemen is that individuals in high latitudes north and south appear to be always solitary: these have been likened to rogue elephants, to the aged outcasts of herds. But Matthews (1938, p. 158) has pointed out that the bulk of sperm whales from Antarctic catches are not yet physically mature. It was natural enough in the past to suppose that lone bulls were aged, for these whales, whether encountered in high latitudes or elsewhere, are comparatively large animals. But lone bulls, although past sexual maturity* are by no means necessarily aged nor sexually effete, and in this polygamous species a good proportion of them must simply represent those mature animals which have temporarily failed to secure harem schools of females or which have not schooled with other bachelors.

Table 27. *Sperm whales. Schooling. Monthly proportions in schools of whales caught at Fayal, Cais do Pico, and Flores in* 1948. *The fractions are the actual ratios of that part of the catch recorded as seen in schools to the total catch in each month. Percentages are given for males only, since it is seen that females are invariably in schools*

Island or district	Jan. ♂♂	Jan. ♀♀	Feb. ♂♂	Feb. ♀♀	Mar. ♂♂	Mar. ♀♀	Apr. ♂♂	Apr. ♀♀	May ♂♂	May ♀♀	June ♂♂	June ♀♀	July ♂♂	July ♀♀	Aug. ♂♂	Aug. ♀♀	Sept. ♂♂	Sept. ♀♀	Oct. ♂♂	Oct. ♀♀	Nov. ♂♂	Nov. ♀♀	Dec. ♂♂	Dec. ♀♀	*Total* ♂♂	*Total* ♀♀	♂♂ (%)
											Proportions in schools																
Fayal	—		—		4/4		3/4		—		5/7	3/3	20/24	13/13	5/8	1/1	15/19	1/1	6/6	1/1	3/3	1/1	—		61/77	20/20	79
Cais do Pico	1/2		—		2/3		11/12		0/2		4/5		6/10	23/23	5/6		6/12	12/12	2/5	7/7	5/6		—		45/63	42/42	71
Flores	—		1/1		—		—		5/6		2/3		6/10	3/3	20/24	11/11	5/6	11/11	0/1		1/1		—		40/54	25/25	74
Total	1/2		1/1		6/7		14/16		5/6		11/15	3/3	32/44	39/39	30/38	12/12	29/30	24/24	8/14	8/8	9/10		—		146/164	67/67	75
♂♂ (%)	(50)		(100)		86		88		63		73		73		79		74		57		90		—				

The males in schools may be mixed with a greater number of females, when the males of such mixed schools are known as 'proprietor bulls' or 'schoolmasters': the epitome of this association is the harem school with one schoolmaster. Beale (1839, p. 51) says the harems have between one and three schoolmasters. Other schools may consist solely of males, when they are called 'bachelor schools'. The common porpoise also forms bachelor schools (Mohl-Hansen, 1954). Whales in bachelor schools are not necessarily sexually mature although they may be (Schubert, 1951). A bachelor school well known to the old whalemen is the band of young vigorous males, probably just sexually mature but not yet large enough to secure harems, which used to be called the 'forty barrel bulls'. Bennett (1840, p. 171) has noticed that older, larger whales can also form bachelor schools; some of the winter schools around the Azores may be such (pp. 279 and 284). The schools of females are nearly always, perhaps always, accompanied by their proprietor bulls, although I have seen nursery schools at sea where schoolmasters seemed to be absent, at least temporarily, from these bands of nursing whales and calves. Just as there are nursery schools, it is evident from the run of the catches at Horta that (as may be expected) there are schools consisting predominantly of pregnant whales. A kind of mixed school not so far mentioned appears to be that of juvenile males and females, weaned but

* Nishiwaki (1955, p. 148) estimated that 0·5% were sexually immature from a sample of 961 males caught in the Antarctic.

still quite young, which associate (in Captain McKenzie's phrase) 'as boys and girls go to school together', and later separate when one or both sexes become mature.

Generally it may be said that when whales are on the grounds in strength, the various schools, in regard to the classes of whales comprising them, are no more exclusive than these broad categories suggest, and that a good deal of mixing, say of sexually mature and immature whales, may be common. Thus off Fayal on 13 August 1949 I took part in the hunting of a school or pod of fourteen whales (Clarke 1949; 1954*a*, p. 327). Next day eight of these were worked up at Horta, and they proved to be three males and five females. One of the males, presumably the schoolmaster, was sexually mature, and the other two were immature: four of the females were mature and one was immature.

The old whalemen distinguished 'pods' or 'gams' numbering up to about twenty whales (such as frequent the Azores in summer), 'schools' or 'shoals' of some twenty to fifty, and the 'herd' or 'body of whales' comprising some fifty to several hundred. There are few spectacles more impressive than a large herd of sperm whales. Like some land mammals which have mass migrations, sperm whales seem to herd only when migrating, and the herd may be expected eventually to fragment into the more usual schools and pods. For instance, during her eighth commission the Royal Research Ship *William Scoresby*, on 8 August 1950 in 27° 18′ S., 33° 26′ E., encountered a nursery herd which I estimated conservatively at between 100 and 150 sperm whale cows and calves. The herd was obviously on passage and was travelling south. Boyer (1946) mentions a vastly greater herd, estimated at more than one thousand whales, which was sighted off the coast of Peru in August 1945, and which was also migrating south. At least some part of the summer whales of the Azores travel in herds when migrating, for Senhor Antonio Linnares dos Santos, of Terceira, told me about a herd of some 150 sperm whales sighted on passage in August 1948: Gilmore (1951, p. 683) refers to 'harem herds' around the islands, but I have not known the schools or pods actually frequenting the archipelago to number more than fifteen or twenty whales.

Table 27 suggests that there are seasonal variations in the proportions of males schooling. A quarter of the males in the total catch are solitary. In each month there are always more whales in schools than there are solitary. In winter the majority of males are schooling, and, since no females are recorded in Table 27 until June, the schools here are bachelor ones. This is likely to be the general case, for very few females linger around the islands in winter (p. 284). There are somewhat fewer males in schools during the summer months, when it is believed that the main stock of whales (male and female) migrates into Azores waters (p. 284): this apparent reduction in males schooling may possibly be due to a readjustment of the schooling pattern, whereby some of the bachelor schools of winter break up and part of their males become absorbed into mixed schools and part are excluded as lone bulls. In October, when the catches are substantially reduced and emigration may be supposed to be well advanced, Table 27 suggests that lone bulls are more numerous than at any other time: this might be expected with the departure of most of the mixed schools. In November, when emigration seems likely to have been completed or almost completed, most of the males are again in schools and this may be explained by the bachelor schooling for winter of many of the lone bulls left in October. These inferences are based on meagre figures and they are put forward only tentatively here to try and illuminate a subject which has not otherwise been treated statistically.

Some data are available regarding the distance at which whales have been sighted from two adjacent islands (Pico and Fayal) in 1948. In the best weather conditions blows can be sighted up to distances of thirty or even thirty-five miles from the high cliffs (Clarke, 1954*a*, p. 309). In Fig. 11 are plotted the distances at which schools and lone males were sighted in each month of 1948: the mean monthly positions of captures of each habit are joined by lines. The plots, so far as they go, do not show any obvious difference in the way schools and lone males are disposed from the coast in respect to each other: their distribution is possibly random, and the apparent shifting offshore of the mean position of both habits in summer is just as likely to be due to the improved conditions for sighting whales in summer as to any real movement away from the coast. In regard to the schools themselves (of whose composition by sex or class Fig. 11 gives no clue) it has earlier been suggested (p. 276) that pregnant and nursery schools may be sequestered at a greater distance from the coast than other sorts of schools. McBride & Kritzler (1951) observed that captive females of the bottlenosed dolphin, in late pregnancy and in parturition, segregated themselves from other dolphins in their tank.

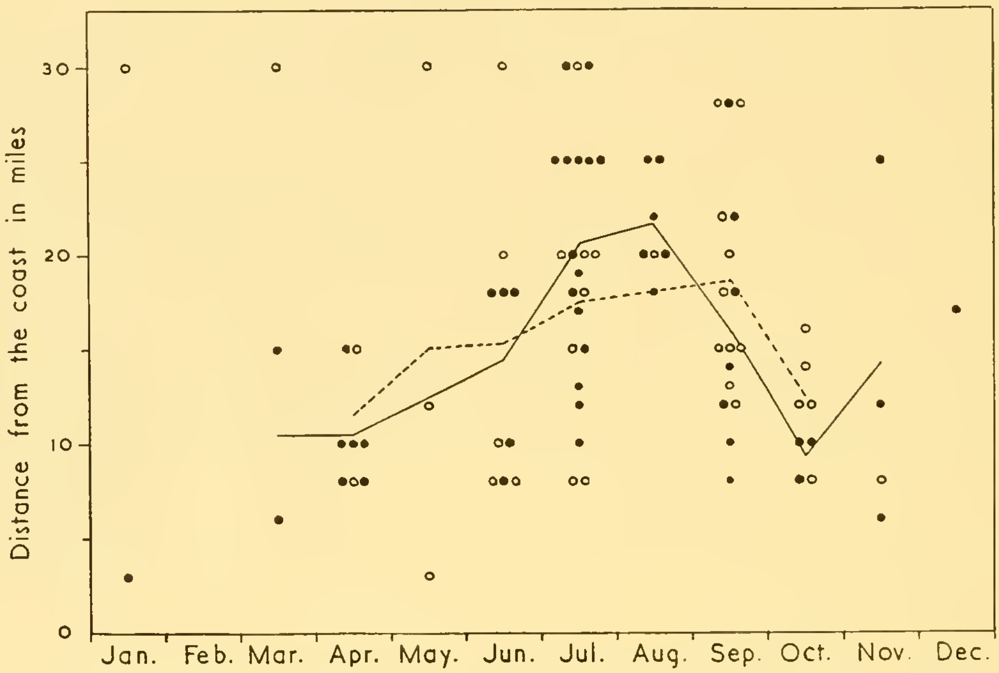

Fig. 11. Distances from the coast of schools and lone males sighted from Fayal and Cais do Pico month by month in 1948. —•— Schools. ..o.. Lone males.

SEX RATIO

There is no reason to suppose that one sex outnumbers the other in sperm whales, but males clearly predominate in the catches at the Azores.

Since females are small and (elsewhere than the Azores and Madeira) are widely protected, the world catch figures of sperm whaling are no guide to the natural sex ratio in the sea. Among the quite small sample of forty-two foetal whales examined at Horta between 1949 and 1954 there were seventeen males (Table 21, p. 268). Mizue & Jimbo (1950, p. 120) found 46·2% of males among 535 foetuses from the North Pacific: the *International Whaling Statistics*, for seven seasons of Peru whaling between 1937 and 1951, show 53·1% males among 944 foetuses. When these counts for the North and South Pacific are combined, the sexes are found to be equal in foetal numbers, the proportion of males being 50·57%. It appears therefore that in foetal life there are as many female sperm whales as there are males. The foetal sex ratio is not necessarily the same as the post-natal ratio, but it is worth mentioning that the old-time sperm whalemen (whose experience was world-wide) maintained that in post-natal animals the females outnumbered the males (Wilkes, 1845, v, p. 528).

One thousand three hundred and seventy-nine sperm whales were caught at Fayal between 1939 and 1954 and 64·6% were males (Table 28). As may be seen in Table 28, the sex ratio of caught whales at Fayal fairly closely reflects the ratio in the catch from the whole archipelago: in the period 1948–54 there were 69·3% of males in the Fayal catches and 68·82% in the catch from the Azores. The monthly catches at Fayal show that, although an excess of males persists in all months, the excess is greatest in winter and is progressively reduced in summer, until in August the numbers of each sex approach equality (Table 29); in the months following August the proportion of males steadily increases again. These changes, which will be discussed later (p. 282), must reflect changes in the natural sex ratio of the stock of whales round the island.

Table 28. *Annual catches and sex ratios at Horta between* 1939 *and* 1954, *and in the Azores between* 1948 *and* 1954

	Horta, Fayal		*Azores*	
Year	*Catch*	*Males* (%)	*Catch*	*Males* (%)
1939	32	*56*	—	—
1940	67	*63*	—	—
1941	72	*46*	—	—
1942	48	*71*	—	—
1943	101	*67*	—	—
1944	56	*64*	—	—
1945	67	*36*	—	—
1946	79	*65*	—	—
1947	91	*59*	—	—
1948	97	*79*	673	*68·8*
1949	107	*66*	466	*66·5*
1950	130	*72*	423	*64·5*
1951	138	*66*	741	*70·9*
1952	102	*68*	623	*68·2*
1953	98	*63*	528	*67·2*
1954	94	*71*	683	*72·6*
Totals	1379	*64·6*	4137	*68·82*

Table 29. *Monthly catches and sex ratios at Horta between* 1939 *and* 1954

Month	*Catch*	*Males* (%)	*Month*	*Catch*	*Males* (%)
Jan.	19	*95*	July	408	*59*
Feb.	18	*78*	Aug.	305	*57*
Mar.	32	*100*	Sept.	215	*60*
Apr.	42	*81*	Oct.	118	*66*
May	32	*84*	Nov.	31	*84*
June	134	*69*	Dec.	25	*96*

Three likely factors may help to account for the characteristic excess of males in the Azores catches. When opportunity for selection affords, the Azores islanders, like whalemen elsewhere, take the larger whales; and this means a relatively greater catch of males. This factor should not, however, be over-emphasized, because my impression is that there are frequently sufficient whaleboats at sea to deal with all the whales which are of a size worth catching in a school. A second factor is that some proportion of the female stock may be beyond the range over which the whaleboats normally operate from the island coasts: it is likely that (p. 280) the schools of pregnant and of lactating whales tend to segregate further from the coast than other classes of females and most of the males. The third factor arises from the seasonal movements of the stock: it appears that the main stock of whales moves away from the Azores before the onset of winter, leaving behind a proportion of the males; and the presence of these winter 'residents' helps to produce in the catches an excess of males throughout the early and late summer months when the main stock is both reaching and leaving the islands, except in July when the catches are at their peak and the stock may be considered at full strength round the Azores (p. 284).

DISTRIBUTION AND SEASONAL MOVEMENTS

That sperm whales are plentiful round the Azores is shown by the contribution the islands make to the world catch. Table 30 and Fig. 12 compare the Azores and world catches for the period 1910–53. The table and figure give no clue to what fraction of the world stock of sperm whales frequents the Azores: they rather betray the vagaries of sperm whaling, such as the fluctuating demand for sperm oil in peace and war, and the exploitation of new grounds for steam whaling. But the table does show that over a period of forty-three years the shore fishery of this small archipelago, hunting with hand harpoons from open boats of limited range, has accounted for 8·64% of the world catch of 151,699 sperm whales. This indicates the presence of a fair stock of whales round the Azores.

Local distribution

Concerning the area frequented by the stock one may only quote Wilkes who said that the Western Islands Ground did not extend more than two hundred miles from the islands and lay principally to the south of them (1845, v, p. 520).

The whales caught by the islanders are sighted at three to thirty miles from the coast. It is interesting that some part of the stock has this coastal habit, because the sperm whale is generally considered to frequent the open ocean far from land. When sperm whales are found close to the coast the region seems to be one where vulcanism or other cataclysm has raised the land sheer from the depths: here the sperm whale may approach the coast yet still retain a depth of water below. Such regions are the coasts of Chile and Peru and the coasts of oceanic islands. Thus, in the Azores, depths of several hundred fathoms may be encountered within a mile of the coast. Many of the old-time sperm whaling grounds were oceanic islands where whaling was often conducted in sight of the shore. From Townsend's charts (1935, showing the positions of sperm whales taken by American whaleships 1761–1920), from the earlier whale charts of Maury (1852) and Bolau (1896), and from the nineteenth-century narratives (Beale, 1839, ch. xv; Wilkes, 1845, v, p. 517 ff.; Scammon, 1874, p. 214 ff.; and Clark, 1887, p. 8 ff.) it is possible to count some thirty-five archipelagoes or isolated islands noted for sperm whaling and distributed through all the oceans. Of all these, only the Azores, Madeira, and the Bonin Islands are still exploited, the Bonin Islands by Japanese steam whaling. It has been suggested that the sperm whale is especially attracted to oceanic islands, and attempts have been made to explain the attraction. Colnett (1798, p. 147), McKenzie (in Maury, 1852, p. 238) and Seabury (in Clark, 1887, p. 10) believed that sperm whales came to the Galapagos Islands to calve. Wilkes (1845, p. 512) and Maury (1874, p. 59) believed that food was more plentiful off oceanic islands, saying, by way of illustration, that food brought in oceanic currents accumulated round the Azores.

The haunts of the old whaleships are not perhaps sufficient evidence to say categorically that sperm whales especially frequent the neighbourhood of oceanic islands. Yet it may well be that the food supply around them is enhanced; that, other things being equal, the upthrust of volcanic peaks—interrupting a wide and deep water column—presumably causes some vertical mixing which breaks down the discontinuity layer and allows local increase in organic production. It has at least been shown (p. 262) that around the Azores there is certainly a substantial food supply for the sperm whale.

Seasonal changes

Fig. 13 shows the monthly catches of male and female sperm whales at Fayal from 1939 to 1953. That these curves for Fayal are in general representative of the whole archipelago is seen by comparing Fig. 14 which shows the catches for those years (1949, 1951 and 1952) where aggregate Azores statistics are available to me. It is clear from Figs. 13 and 14, and from the sex ratios in Table 29, that the catches

Table 30. *Annual catches for the world and for the Azores from 1910 to 1953*

Year	*Catches of whales*			*Year*	*Catches of whales*		
	World	*Azores*	*Azores (%)*		*World*	*Azores*	*Azores (%)*
1910	155	112	*72·3*	1932	811	179	*22·1*
1911	302	120	*39·7*	1933	1423	266	*18·6*
1912	619	72	*11·6*	1934	1999	234	*11·7*
1913	465	68	*14·6*	1935	2481	379	*15·3*
1914	757	35	*4·6*	1936	5068	387	*7·6*
1915	861	33	*3·8*	1937	7392	417	*5·6*
1916	1083	71	*6·5*	1938	3763	417	*11·1*
1917	513	128	*24·9*	1939	5511	400	*7·3*
1918	1092	183	*16·8*	1940	4671	552	*11·8*
1919	1219	132	*10·8*	1941	5641	425	*7·5*
1920	873	124	*14·2*	1942	4957	525	*10·6*
1921	796	78	*9·8*	1943	5503	663	*12·0*
1922	912	121	*13·3*	1944	2614	591	*22·6*
1923	740	177	*23·9*	1945	1669	443	*26·5*
1924	950	71	*7·5*	1946	3461	592	*17·1*
1925	1475	151	*10·2*	1947	7546	565	*7·5*
1926	1775	199	*11·2*	1948	9850	673	*6·8*
1927	1441	166	*11·5*	1949	9016	466	*5·2*
1928	1989	185	*9·3*	1950	8186	423	*5·2*
1929	2074	212	*10·2*	1951	18264	741	*4·1*
1930	1311	99	*7·6*	1952	11557	623	*5·4*
1931	597	80	*13·4*	1953	8317	528	*6·3*
				1910–1953	151,699	13,106	*8·64*

Figures for 1910–37 are from Clarke (1954*a*, p. 284, Table 1). Revised figures for 1938–53 are from the *International Whaling Statistics* (XXXIII), and the *Relatório e Contas* published by the Grémio dos Armadores da Pesca da Baleia.

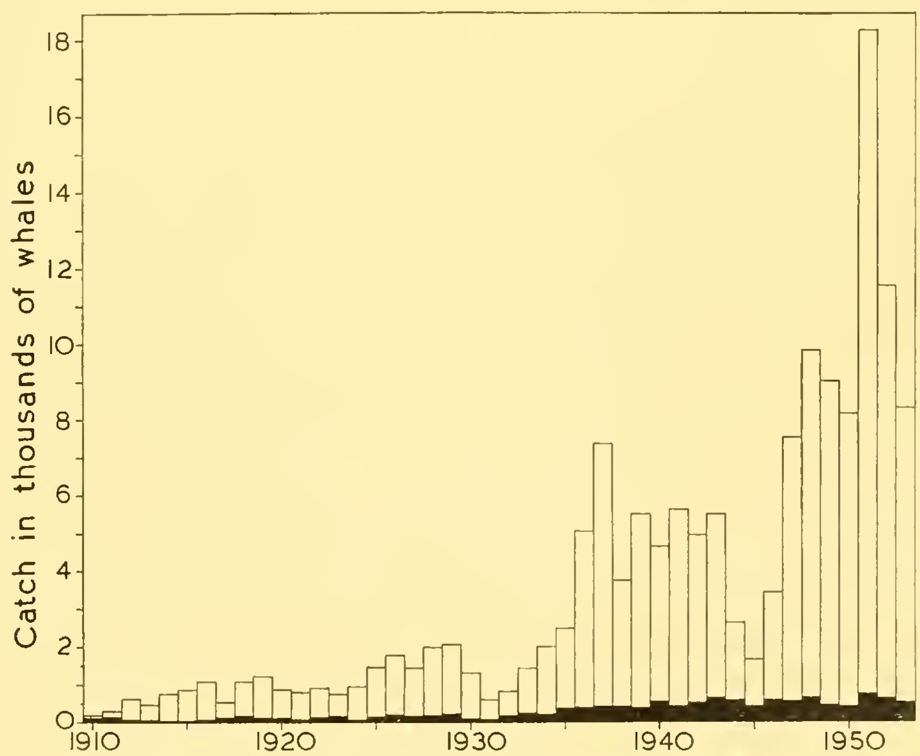

Fig. 12. Annual catches for the world and for the Azores from 1910 to 1953.

in the Azores show marked seasonal changes both in quantity and constitution. These changes, coupled with the fact that no foetuses of middle size have been recovered from pregnant whales (Table 21, p. 268), must reflect a movement to and from the islands.

The catch curves show that, whilst whaling in the Azores is conducted in all months of the year, most of the whales are caught in summer. However, it is well to remember that whales are likely to be more plentiful in winter than is suggested by the small catches of this season, because the winter rains and gales may defeat the cliff look-outs and keep the whaleboats on shore. The winter catches are nearly all males: only twenty-four females were among the 199 whales caught between November and May in 1939–54 (Table 29). It appears that, save for one or two large, possibly aged stragglers (Table 31),

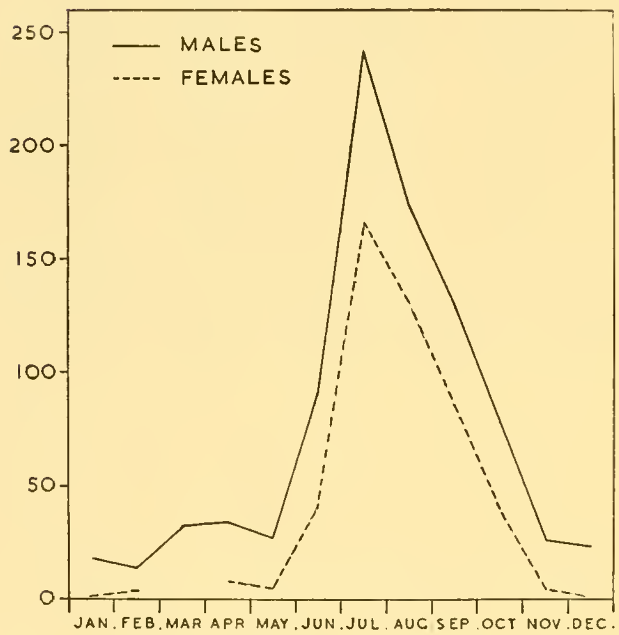

Fig. 13. Monthly catches at Horta from 1939 to 1954.

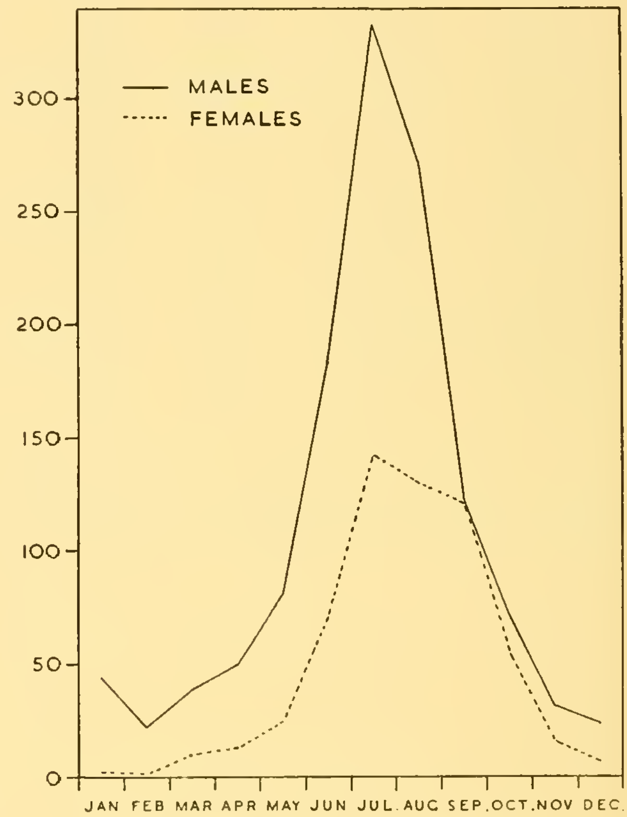

Fig. 14. Monthly catches in the Azores for 1949, 1951 and 1952.

the female stock have left the Azores by November and do not begin to return until May, reaching Fayal in June. The minor fraction of the male stock exploited in winter is thought to be mostly disposed in schools (p. 279), and comprises animals which are practically all sexually mature, indeed, those recorded from the greater part of winter (January to May) are all mature (Table 31). It may be that the winter males are moving into the Azores from elsewhere, but it is perhaps more reasonable to suppose that they are a fraction of the stock which winters around the islands and does not take part in the emigration of the end of summer. So far as the catch curves may reflect the movements of the population, it appears that the main stock, that is, the females and the major part of the males, returns to the Azores at the beginning of summer and achieves its greatest strength in July. The catches decline in subsequent months, when the whales are considered to be emigrating. The proportion of immature males is highest when the catches are at their peak in July: the highest proportion of immature females occurs in September, perhaps because some of the older, larger females may leave the grounds rather earlier than the younger whales. The emigrant schools of autumn include the nursing cows with calves newly recruited around the Azores during the calving season of the summer months (p. 271).

Table 31. *Average lengths* and percentages of sexually immature† whales in monthly catches at Horta between* 1944 *and* 1954

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						Males						
1944–8 *July* 1949												
No. of whales	4	4	16	12	11	29	83	44	36	22	8	9
Average length in m.	14·75	15·93	12·32	13·06	14·00	12·28	12·12	12·71	11·98	12·10	13·19	13·50
9 *July* 1949–54	14	8	16	22	13	50	108	68	65	25	15	13
Average length in m.	13·85	14·11	14·76	12·35	14·61	13·13	12·57	13·42	13·55	13·20	13·51	12·98
Immature (%)	0	0	0	0	0	10	12	7	5	8	7	8
						Females						
1944–8 *July* 1949												
No. of whales	—	—	—	—	5	16	60	40	25	10	1	—
Average length in m.	—	—	—	—	9·56	9·89	9·50	9·57	9·27	9·48	11·4	—
9 *July* 1949–54	1	2	—	8	—	8	63	52	41	22	4	1
Average length in m.	11·8	10·1	—	10·86	—	9·91	10·51	10·07	9·81	10·20	10·80	11·4
Immature (%)	0	0	—	0	—	12	6	10	17	9	0	0

* It has been necessary to separate whales measured before and after 9 July 1949, since measurements prior to that date did not include the length of the flukes (see p. 241).

† For the same reason, no attempt has been made to estimate the proportions of immature animals among whales caught before 9 July 1949. Anatomical material was collected from most of the whales caught afterwards, so it is known whether or not they were mature. The minority which were not examined biologically have been classified by applying the estimates of mean lengths at sexual maturity (p. 262).

Migrations

Matthews (1938, p. 159) has noted that among sperm whales there is a general movement, apparent from Townsend's charts (1935), towards temperate waters in summer and towards low latitudes in winter. Regarding the North Atlantic field these charts show that in winter the old whaleships took plenty of sperm whales at the Cape Verde Islands and few at the Azores, whereas in summer few were taken at the Cape Verdes but plenty in the Azores. Since whales may be expected to migrate in a north–south direction, and since the Cape Verde Islands, lying around 16° N., are to the south of the Azores, it is probable that Townsend's summer and winter charts reflect the migrations responsible for the seasonal changes of the whale stock around the Azores.* To the south-eastward also lies the former winter whaling ground of the Canary Islands, and these may also contribute summer whales to the Azores. Madeira lies between the Canaries and the Azores: from such figures (unsexed) as are available in the annual reports of the Grémio dos Armadores da Pesca da Baleia, I note that the peak of the present Madeiran open boat sperm whale fishery is in spring, three months earlier than in the Azores, and that there are indications of a second abundance in autumn and early winter (Fig. 15). Because males are not distinguished from females in Fig. 15, the significance of the curve is somewhat obscured. Yet its appearance, so markedly different from the cumulative curve for Azores males and females, is not unlikely if Madeira lies in the path of whales spreading seasonally to and fro between the Azores and the Canaries.

One cannot be certain whether or not many sperm whales of the local stock move northwards beyond the Azores in summer, but the unimodal catch curves (Figs. 13 and 14) at least show that the stock does not move in a body to a higher latitude and return in autumn. If any whales do straggle to the northward they are likely to be males rather than females, for at latitudes higher than those of the

* In 1889 Beneden anticipated this view that sperm whales caught round the Azores in summer come from the southward.

Azores there are no reliable* records of female sperm whales in the North Atlantic catches comprising those from Scotland (Haldane, 1909, 1910; Thompson, 1918, 1928), Newfoundland, Iceland, Faeroe Islands, West Greenland and Norway* (*International Whaling Statistics*, 1938–55). Townsend's charts show only one sperm whaling ground to the north of the Azores. This was the Commodore Morris Ground where whaling was conducted in summer about 600 miles westward of Land's End. Possibly the Azores contribute a few summer whales to this ground which may also receive some of those sperm whales, practically all males, which, judging from the catches of (unrestricted) steam whaling at Setubal, appear to pass the coast of continental Portugal in spring and early summer, and again in late autumn and early winter, presumably on their way to and from higher latitudes (Fig. 16†); in this connection also it is worth noting that Thompson's figures (1918, 1928) show that the season for sperm whaling off Scotland was in high summer, especially August, which is a poor month for Setubal.

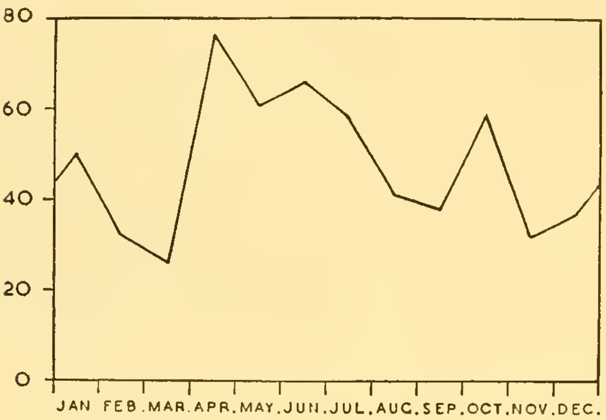

Fig. 15. Monthly catches of males and females in Madeira from 1951 to 1954.

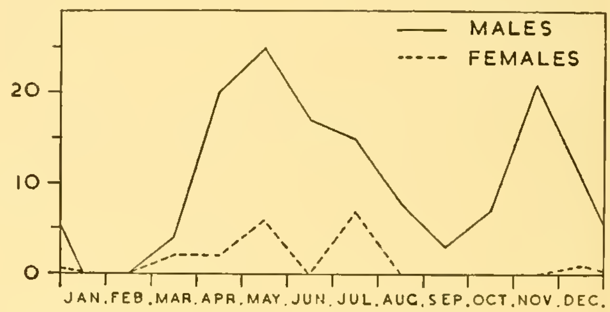

Fig. 16. Monthly catches at Setubal, Portugal from 1946 to 1950.

These remarks on the migrations of sperm whales in the eastern North Atlantic, summarized in Fig. 17, are based on the circumstantial evidence of catch statistics and they are intended as no more than conjectures. The catches involved are not large and it would be profitable to analyse on similar lines the detailed records maintained by the Grémio dos Armadores da Pesca da Baleia of all whales caught at the Azores, Madeira and Setubal since 1946. However, unless adequate whale marking can be done in the North Atlantic we may expect no definite conclusions on the distribution and migrations of sperm whales in these seas.

RACIAL IDENTITY OF THE STOCK

The present report, whilst particularly concerned with the Azores, has also attempted a comparative treatment looking for any differences which may exist between the various stocks of sperm whales in different oceans. The available data, although not sufficient for any firm conclusions, do appear to merit a general discussion.

Published reports based on data from a series of sperm whales are limited at present to samples from stocks of the Southern Seas (South Georgia and South Africa), of the eastern North Pacific (Japan and the Bonin Islands) and of the North Atlantic (Azores).

* Six whales from Norway are recorded in the *International Whaling Statistics* as females, but none measured less than 44 ft. and they were doubtless males. See p. 243.

† From records in the *Estatistica das Pescas Maritimas* (1946–50) of 131 male and eighteen female sperm whales caught at Setubal, Portugal.

Most information, so far as it goes, suggests that the three stocks do not differ significantly. Proportional measurements from the north are confined to only one Azores male and five foetuses, but there are no special differences between these and the corresponding southern measurements (p. 243). Colour varies to some extent among individual whales, but the variation does not appear to be different in the three stocks (p. 245). The number of posterior dorsal humps (p. 246) and the number and arrangement of the throat grooves (p. 247) are two other variable characters, but they have received

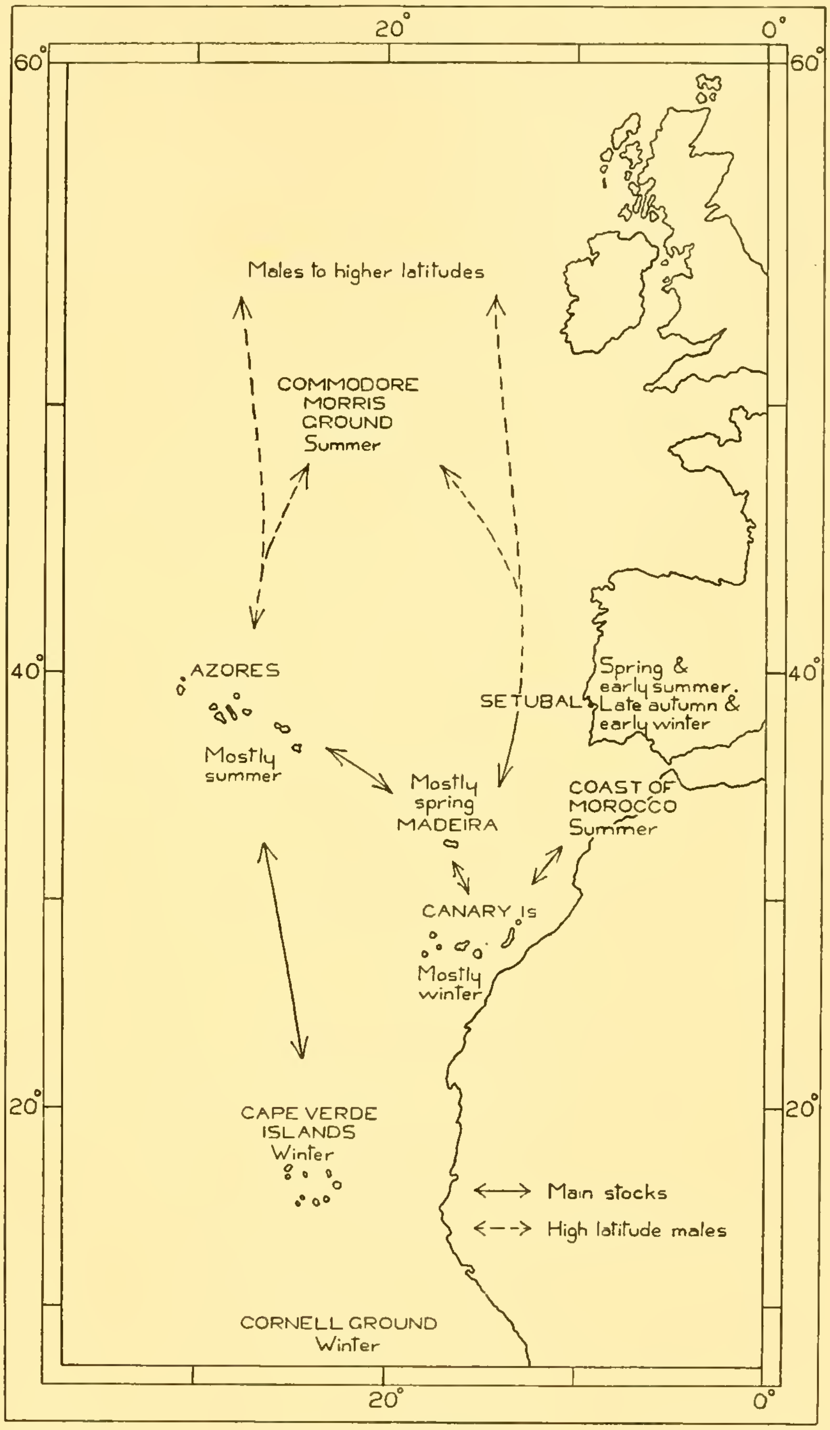

Fig. 17. Conjectured migrations of sperm whales in the eastern North Atlantic. The arrows represent a seasonal spread rather than definite routes. The whaling seasons shown for the Azores, Madeira and Setubal are derived from modern catches; those for the Commodore Morris Ground, Coast of Morocco, Canary Islands, Cape Verde Islands, and the Cornell Ground are from Townsend's charts of old-time whaling.

little attention except in Azores whales. No differences are apparent in the range and average numbers of mandibular teeth in whales from the three regions (p. 251). Information on parasites is rather extensive geographically, coming from several localities besides the three main ones (p. 252 ff.). Since diatom film has never been observed on whales from tropical and equatorial regions, it is particularly interesting that sperm whales from Scotland in the north and from South Georgia in the south should be parasitized by what appears to be the same skin diatom, a species of *Navicula* (p. 252). The stalked barnacle *Conchoderma auritum* is known from sperm whales north and south. *C. virgatum*, epizoic on a penellid from an Azores sperm whale, is recorded with the same habit from a southern blue whale, and no doubt more attention to this species would record it from the southern sperm whale also. The same applies to the degenerate copepod *Penella balaenopterae* recorded from a sperm whale in the Azores and from southern blue and fin whales. Of the three species of whale lice so far identified from sperm whales, *Cyamus* (*Neocyamus*) *physeteris* is known only from the North Atlantic, but *C. catodontis* has been recorded from North Atlantic and North Pacific sperm whales; and it has been suggested that the third species *Paracyamus* (*Cyamus*) *boöpis*, from the South Indian Ocean, may be identical with *C. catodontis*. Of the internal parasites, the nematode *Anisakis physeteris* is cosmopolitan in sperm whales. The cestode *Priapocephalus grandis* is recorded from northern and southern stocks.

There are a few attributes which might suggest some possibility of segregation. Some further work might be undertaken to see if maxillary teeth do erupt more often in southern than in northern whales (p. 251). Discrepancies at present exist between the sizes at which male sperm whales are considered to reach sexual maturity in different oceans. On present estimates males of the North Atlantic mature at a mean length some 4 to 6 ft. (1·2 to 1·8 m.) shorter than North Pacific males and 8 to 10 ft. (2·4 to 3·0 m.) shorter than southern males. However, because of size regulations, few of the smaller (immature) whales have been available to workers in the North Pacific and the southern seas. Were they available, it is likely that the observed difference between North Pacific and North Atlantic males would vanish, since females of these two stocks mature at about the same size. One may not say whether or not the difference would vanish (though it would probably diminish) when applied to southern males, because there is no precise information on the size at maturity of southern females which might be a guide (p. 266). A last point is the established fact that the sexual seasons of northern and southern female sperm whales both occur in the spring of their respective hemispheres, that is, they are the same in season but in opposite months (p. 270). This is presumably true of males also (p. 273).

The sperm whale is a species whose 'headquarters...is the tropics' (Matthews, 1938, p. 159), and one whose females do not seem to range beyond about 40° N. and S., that is, not so far as the limits of the continents, except in regard to the Cape of Good Hope. One would therefore expect that any differences between the stocks would be more likely to be between whales of the oceans east and west, rather than between those of the north and south. Yet there is at present no evidence, apart from the very doubtful matter of a size difference in males at sexual maturity, to suggest that sperm whales of the North Pacific differ significantly from those of the North Atlantic. If there is no segregation, then continuity is presumably maintained by those males which in summer move beyond the continental limits into the circumpolar ocean. Few sperm whales have yet been marked in the Antarctic, and there is no reliable evidence of east–west interchange in Maury's solitary remarks that he had 'often met sperm whales off the Cape of Good Hope and off Cape Horn, making their passage from sea to sea' and that he knew of a sperm whale killed on the Atlantic seaboard* of the

* Maury mentions only 'the coast of the United States', but the state of the Union at that date (1852) shows that the Atlantic seaboard was intended.

United States and recognized by a marked harpoon as one earlier struck upon the coast of Peru (1852, p. 239).

Concerning northern and southern sperm whales, the possibility among males of a size difference at sexual maturity has prompted me to compare from seven oceans the smoothed length frequencies of 54,456 males and 3475 females, which are all the relevant data available to me and comprise records in the *International Whaling Statistics*, the records from Fayal, and unpublished figures in the British Museum records. The curves which were constructed tend to suggest that both males and females may grow a foot or two longer in the southern hemisphere, but they are not conclusive and I have therefore refrained from publishing them here. What is required is a comparative study of the mean lengths at which physical maturity is achieved in the different oceans.

Should any difference in growth and size be eventually established between northern and southern sperm whales, then the difference would either be due to environment or to racial segregation. Since the parasitic diatom *Navicula* sp. appears to be bipolar, it is likely that the northern and southern stocks mingle to some extent in equatorial and tropical latitudes where the whales presumably carry sufficient residual diatom population to effect contagion even though a diatom film is not visible. If such mingling occurs, and if there were any racial difference between the stocks, then the female sexual seasons at opposed times might be supposed to function as a mechanism preserving the racial difference. But this is unlikely because the difference in time of the female sexual seasons is presumably a physiological adaptation to the environment, and any whales which move from one hemisphere to another would no doubt change their breeding rhythm accordingly, just as do certain ruminants when introduced into the opposed hemisphere (Olstad, 1930; Marshall, 1937). I am inclined to think that if any difference in size does exist between northern and southern sperm whales, then its origin is environmental rather than genetic. Possibly the food supply is greater in the southern hemisphere.

Turning to the Azores stock, there is no reason to believe that this is isolated in any way. Apart from Wilkes' remark (p. 282) that whaling was not conducted beyond some 200 miles from the islands, there is no evidence that the summer whales are confined to the neighbourhood of the Azores, but any segregation which may occur is presumably not maintained to the southward where in spring pairing takes place among the migrant part and where we may suppose there is latitudinal continuity, and consequent genetic interchange, with other Atlantic sperm whales.

CONDITION OF THE STOCK UNDER WHALING

My account of the Azores whale fishery (Clarke, 1954*a*) describes how open boat whaling, after a long period of depression or indifferent prosperity, was intensified in the years which followed the outbreak of the Second World War. The numbers of whaleboats and motor tow-boats were increased and the catching power improved by the introduction of radio-telephone communication between cliff look-outs and the motor boats. In such times of expanding industry it seems desirable, as Figueiredo has earlier pointed out (1946, p. 216), that the effect of whaling and the requirements of conservation should be kept under review as much in the Azores as in modern steam whaling centres elsewhere.

The effect of whaling

Since the major part of the Azores stock of whales, including all or virtually all the females, is believed to migrate to the southward or southeastward in winter (p. 285), the survival of the stock is likely to be favoured by the fact that no whaling is nowadays conducted around the Cape Verde Islands or the

Canaries, except for a little intermittent steam whaling from Spanish Morocco. On the other hand, the Azores are a ground where some calving takes place in high summer and where schools of nursing cows with their calves may be encountered (p. 271). Moreover, the fishery has been an unrestricted one when compared with sperm whaling in most other parts of the world where precise restrictions are enforced on the minimum length at which whales may be killed. Against this general background Table 28 (p. 281) and Table 32 and Fig. 18 may be reviewed.

Table 32. *Average lengths and percentages of sexually immature whales in the annual catches at Horta from* 1944 *to* 1954

	Males			*Females*		
Year	*No.*	*Average length* $\pm\sigma$ *in m.*	*Immature* (%)	*No.*	*Average length* $\pm\sigma$ *in m.*	*Immature* (%)
1944	36	13·35 ± 2·14	—	20	9·12 ± 0·99	—
1945	24	11·94 ± 2·54	—	43	9·47 ± 0·53	—
1946	51	12·44 ± 2·38	—	28	9·57 ± 0·82	—
1947	54	12·68 ± 1·92	—	37	9·81 ± 0·88	—
1948	77	11·53 ± 2·88	—	20	9·35 ± 0·94	—
1949 before 9 July	36	13·24 ± 1·77	—	9	10·09 ± 0·63	—
1949 on and after 9 July	34	12·76 ± 3·07	21	23	9·86 ± 0·82	17
1950	94	13·53 ± 2·20	8	36	10·33 ± 1·11	3
1951	91	12·80 ± 2·33	9	47	10·57 ± 1·09	8
1952	69	13·69 ± 2·10	1	33	9·94 ± 1·26	12
1953	62	13·52 ± 2·30	6	36	10·53 ± 0·24	3
1954	67	12·84 ± 2·47	4	27	9·73 ± 1·14	18
9 July 1949–54	417	13·22 ± 2·40	7·2	202	10·22 ± 1·13	9·4

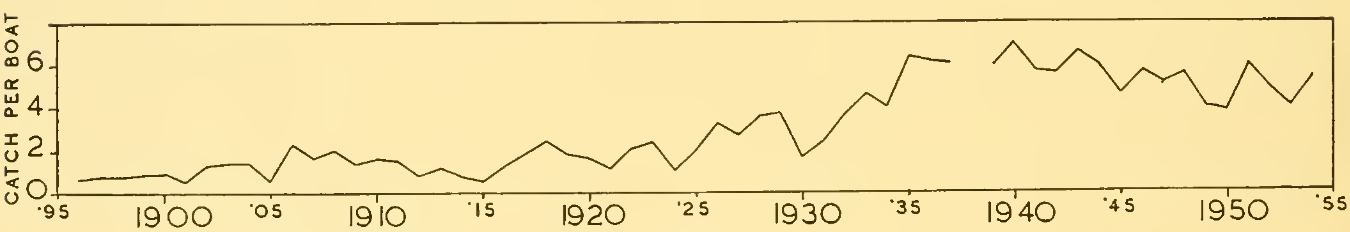

Fig. 18. Annual catch of whales per whaleboat in the Azores from 1896 to 1954.

It is a healthy sign in Table 28 that the annual sex ratios show no trend towards increase in the female catch, either at Fayal (1939–54) or in the Azores generally (1948–54).

Table 32 shows the average lengths of whales in the annual catches at Horta, Fayal between 1944 and 1954. Before 9 July 1949 the length measurement did not include the length of the flukes, so the period 1944–54 must be reviewed in two parts and not as a whole. Similarly, percentages of sexually immature animals have only been calculated for whales treated on and after 9 July 1949, when all have been measured in total length (see p. 241 and Table 31, footnote). The table summarizes all the length data I have from the Azores, and, since the catches are small, the following comments are made with reserve. Neither males nor females show any trend towards decrease in their average lengths over the years. These average lengths are substantially greater than the mean lengths at which the sexes are estimated to become sexually mature (9·6 m. or less for males and 8·8 m. for females, p. 262). Between 9 July 1949 and 1954 the immature animals of one sex appear to have been taxed no more heavily than those of the other; the satisfactorily small proportions of immature animals fluctuate from year to year, but there is no discernible trend towards increase in the percentages immature over this period. Table 32, so far as it goes, suggests that the stock is not suffering depletion; but the table needs to be extended to include the length* data collected since 1946 by the Grémio dos Armadores da Pesca da Baleia for all whales killed in all the islands.

Regarding the archipelago as a whole, the only figures (apart from sex ratios) which are available to me and which may be expected to suggest the effect of whaling are the aggregate catches of whales per whaleboat† in successive years, shown graphically in Fig. 18 for the period 1896–1954. The graph is of limited assistance because it takes no account of variations in the catching effort,‡ which mainly depends upon the demand for sperm oil. Fluctuations due to weather and oceanographical factors are also to be expected. However, the general trend of the graph is a rising one until 1940: afterwards there is a slight trend towards decline. The catch per whaleboat should continue to be reviewed year by year. The Grémio dos Armadores da Pesca da Baleia preserves detailed returns which permit the more reliable index of catch per whaleboat's day's work to be calculated. If the decline should persist in spite of good demands for sperm oil, then the industry may have real cause for alarm. However, considering Tables 28 and 32 and Fig. 18 together, and bearing in mind the limitations of the latter, the general conclusion is perhaps that on present evidence the stock of whales round the Azores does not yet appear to be overfished. In Madeira also where whales of the same stock may possibly be involved (p. 285), there seems to have been no overfishing (Figueiredo, 1956).

Conservation

Meanwhile the Portuguese authorities are making provision for the conservation of the whale resources of the Azores and Madeira and of continental Portugal. Since 1925 whaling regulations have existed which gave protection to nursing cows and their calves, whales 'not adult' and of 'small yield' (Grémio dos Armadores da Pesca da Baleia, 1925, Article 33). These have now been replaced by new and comprehensive regulations which, in addition to protecting nursing and sucking whales, also provide for length restrictions, for the duration of whaling seasons, for the limiting of catches in any season or whaling area, and for other measures which may be considered necessary for preserving the whale stocks (Ministério da Marinha, Lisboa, 1954, Articles 71 and 72). At the present time the actual restrictions and limits have yet to be defined.

Elsewhere than the Azores and Madeira, whaling for sperm whales is conducted with steam whale-catchers and there is generally enforced the International Whaling Commission's minimum length restrictions on caught whales of 38 ft. in pelagic whaling and 35 ft. in shore whaling, intended to give substantial protection to females. Reference to Table 2, p. 242, will show that a length restriction at 35 ft. would have reduced the total Fayal catch by 27·0% from 9 July 1949 to the end of 1954; males would have been reduced by 15·1% and females by 51·5%. It is doubtful whether sufficient larger whales could in practice have been selected to make up the deficit in oil production (p. 281). An

* Possibly the measurements returned to the Grémio from other islands of the Azores, and from Madeira, refer to lengths exclusive of the flukes (see p. 241). These are of limited value, and it would be helpful to check the matter to ensure that all statistics refer to the total length, measured in a straight line from the tip of the snout to the notch of the flukes, a convention universal in whaling elsewhere.

† The figures for whaleboats used in preparing Fig. 18 (from Clarke, 1954*a*, Table 10) may not all be accurate for the earlier years, for I learn that sometimes returns are believed to have been made, not of the numbers of whaleboats actually employed, but of the maximum numbers permitted by the authorities. Such an error would reduce the catch per whaleboat in any particular year.

‡ Fluctuations in the sperm oil market, the increase in catching potential which resulted from the introduction of motor boats for towing purposes, and other factors which affected the catching effort between 1896 and 1949, are discussed at length in my account of the Azores whaling industry (1954*a*, p. 300 ff.).

alternative size restriction might be one designed to protect immature females. Judging from Table 19, p. 265, this could be placed at 30 ft. or about 9 m. It may be that this restriction would protect immature males also, since it is possible that males may mature at a shorter mean length than the present estimate of 9·6 m. (p. 264). In any case, a polygamous species can afford to lose more immature males than immature females, although it is well to bear in mind that we do not know how much bigger a male sperm whale may need to grow after maturity before it can gain access to a harem and become an effective breeder.

It is important to remember that the effects of whaling with modern whalecatchers may not be compared with those resulting from an open boat fishery conducted from the shore. The whaleboats of the Azores depend primarily upon the limited horizon of the cliff look-outs; and they are further limited in catching power by the skill and strength of their crews, and in range by the hours of pulling, sailing and towing between dawn and dusk of a single day. In these conditions they are exploiting, apparently without undue depredation, only the fringes of a stock which presumably extends well beyond their range and which therefore has a reserve for replenishment which the whaleboats cannot plunder. Much more of the stock would, however, be within the range of a steam whalecatcher and the rapid execution of its harpoon gun. Should the modern catcher ever be introduced to the Azores it is unlikely that the stock, and therefore the industry, would long survive without rigorous controls including the substantial protection of females at present afforded elsewhere by the international regulations.

The open boats of the Azores and Madeira are relics from a vanished age of whaling. But in the setting of these islands and their particular economy, open boat whaling is an efficient industry with the lowest of operating costs. The increased catches, whether sustained or not, which may be expected to result from steam whaling, would not necessarily compensate for the vastly increased expenditure in capital, running costs and crew salaries. It is in production of oil and by-products that improvements are most desired, and these are going ahead.*

Nevertheless, the question will some day arise whether or not to replace the open boats by powered catchers. I hope that those who decide will bear in mind that the problem is not entirely one of financial profit or loss. Open boat whaling is a fine way of life and deserves to be fostered as a part of the Portuguese inheritance. The Azores and Madeiran whalemen, like their compatriots the dorymen of the Grand Banks, keep for Portugal a reserve of experience got by sailors nowhere surpassed in skill and courage.

SUMMARY†

Complementary to an earlier account of the open boat fishery (Clarke, 1954*a*), this report deals with the biology of sperm whales exploited round the Azores. Throughout, the findings are compared with what is known of sperm whale stocks elsewhere.

The material comprises data and collections from 148 male and 174 female whales examined anatomically at Horta, Fayal, between 1949 and 1954; five small foetal whales from Fayal; and published and unpublished whaling statistics, from Fayal and the Azores generally, between 1896 and 1954.

* Visiting the Azores in the summer of 1955 I found that the numerous ancient try-works, which I had seen in 1949 producing an inferior oil from blubber and wasting the meat and bone, had all been superseded, except at Porto do Castelo, Santa Maria. All whales now caught in the archipelago, other than at Santa Maria, are towed to one or other of the four steam-powered factories operating in San Miguel, Fayal, Flores and Cais do Pico (Clarke, 1954*a*). A fifth factory will soon be operating at Lagens do Pico.

† This summary has been published as a separate paper in Portuguese and English (Clarke, 1956*a*).

All sizes of sperm whales are taken in the Azores. Of 417 males at Horta, the largest measured 18·00 m. (59 ft. 1 in.). The largest of 202 females measured 12·30 m. (40 ft. 4 in.), which is the greatest reliable measurement of a female known to the author.

External characters are examined. Proportional measurements of five foetuses and one adult male are not significantly different from measurements in a comparable range of southern whales. Colour markings show no sexual differences in their variation and no obvious differences from those of other stocks. Foetal pigmentation is discussed. Behind the dorsal fin of all whales there are from one to six 'posterior dorsal humps' whose variation is examined. Variation in the number and pattern of throat grooves suggests these are derived from an arrangement of two grooves like that characterizing ziphioid whales.

The mandibular (functional) teeth are erupted late, when the female is between 8·4 m. (28 ft.) and 9·5 m. (31 ft.) long, that is, at the time of sexual maturity, and probably at about the same time in males. Erupted teeth in males varied from sixteen to twenty-six on each side, and in females from nineteen to twenty-six. Average numbers of teeth are similar in males and females, and in whales from the North Atlantic, the North Pacific, and the Southern Seas. Maxillary (rudimentary) teeth were erupted more often in Azores males than in females.

External parasites of Azores whales are the whale-lice *Cyamus physeteris* and *C. catodontis*, the degenerate copepod *Penella balaenopterae*, and the stalked barnacles *Conchoderma virgatum* and *C. auritum*. Diatom film was not observed, but a whale examined in the Scottish Hebrides bore a skin diatom *Navicula* sp., apparently identical with the species infesting antarctic sperm whales. Internally the nematode *Anisakis physeteris* occurs in the stomachs of all Azores whales, the tapeworm *Priapocephalus grandis* is recorded from the gut, and another cestode forms cysts in the blubber.

One or two pathological conditions are noticed, but whales caught in the Azores are generally free from disease. A characteristic but rare deformity of the sperm whale is a crooked lower jaw, a new example of which is recorded from the Azores. Some slight injuries to the body surface are discussed.

Squids are the staple food, and those measured from stomachs in 1949 had an average standard length of 0·94 m. (3 ft. 1 in.). Giant squids are occasionally taken; one whale captured at Fayal in 1955 had swallowed intact a specimen of *Architeuthis* sp., weighing 184 kg. (405 lb.) and measuring 10·49 m. (34 ft. 5 in.) in total length and 4·96 m. (16 ft. 3 in.) in standard length. Azores whales are known to feed on eight species of squids. The diet at Fayal was *Histioteuthis bonelliana* (59% by numbers), *Cucioteuthis unguiculatus* (39%) and *Tetronychoteuthis dussumierii* (2%), but of these the bulky *C. unguiculatus* has the greatest nutritional importance. Large fish are a subsidiary item in the diet, and at Fayal these included black shark, basking shark, barracuda and albacore, and two species of large bathypelagic angler fish, *Ceratias holbölli* and *Himantolophus groenlandicus*. The sperm whale occasionally eats demersal or benthic organisms and so must visit the sea floor at times. The amount of food in stomachs shows that, at least between June and November, there is a substantial food supply for whales around the Azores.

Estimates of the mean length at sexual maturity of Azores sperm whales, concluded from the size and histology of the testes and the condition of the ovaries, are 9·6 m. (31 ft.) or less for males, and 8·8 m. (29 ft.) for females.

Dated records of foetal lengths show that pregnancy lasts sixteen months. The pairing season lasts from January to July, with most activity between March and May. The calves are born from May to November, but mostly between July and September. From the sizes of the largest foetus recorded and of four new-born whales, it is established that, at least in the North Atlantic, the mean length of the sperm whale at birth is 3·92 m. (12 ft. 10 in.).

Histological evidence, mainly a statistical analysis of testis tubule diameters, shows that the male sperm whale has a sexual season.

Multiple ovulation (twinning) only occurs in 0·66% of foetal records.

The sizes of two proven calves, and of the smallest whales feeding on their own account, show that the mean length of the calf at weaning is about 6·7 m. (22 ft.). By examining the proportions of adult females pregnant, lactating and resting, and by plotting dated records of whales shorter than 6·7 m. in a figure reproducing the foetal growth curve, the nursing period is estimated at about thirteen months. The female sexual cycle thus normally lasts three years (sixteen months gestation, thirteen months lactation, seven months anoestrum). Rarely anoestrum does not intervene, for there are occasional reports of females pregnant whilst still lactating.

After weaning all that can be said at present about age is that recovered harpoons show that male and female sperm whales can live for at least thirty-two and twenty-two years respectively.

Females are invariably in schools but males may be in schools or solitary. Schools are discussed qualitatively as juvenile, bachelor, and harem schools; and quantitatively as pods, shoals and herds. At the Azores changes occur in the proportions of males schooling in successive months.

In foetal life there are as many female sperm whales as males, and the post-natal ratio is likely to be similar. Reasons are advanced for the excess of males in the Azores catches.

The sperm whale, although an oceanic species, is believed to frequent the coasts of oceanic islands (such as the Azores), perhaps because of an enhanced food supply.

Monthly catches and sex ratios show that the Azores stock migrates. A minor fraction, virtually all males, frequents the islands in winter; but the females and most of the males begin to arrive in May, the stock reaching its greatest strength in July. It does not move as a body north of the Azores. The main stock is believed to spend the winter to the southward, probably around the Cape Verde Islands and also the Canaries. Conjectures are made regarding the migrations of sperm whales in the eastern North Atlantic.

A review of known facts about the world stocks of sperm whales finds no evidence of racial segregation, except for a possibility, deserving further study, that northern and southern whales differ in their growth.

Average lengths and the proportions of immature whales in the catches, and the catch per whaleboat from year to year, do not suggest that the Azores stock is overfished at present; but a helpful conservation measure would be a length restriction at 30 ft. (about 9 m.), designed to protect immature females. Introduction of steam whalecatchers, unless rigorously controlled, is likely to endanger the stock. In the economic setting of the Azores, whaling from open boats is an efficient business and deserves to be fostered unchanged.

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PLATE I

Fig. 1. Bull sperm whale photographed from a helicopter south of Terceira, 23 July 1956. (See Clarke, 1956*b*) Note the dorsal fin, and the unflexed, extended posture characteristic of a sperm whale when loitering undisturbed at the surface.

Fig. 2. The throat grooves, here comprising two deep grooves with several accessory grooves (shown diagrammatically in text-fig. 3*d*, p. 248). Note also the scratches caused by squids (seen most clearly in the lower part of the picture), the white margin to the upper jaw, and (on the left of the picture) the corrugations on the surface of the chest. Whale F6, sperm ♂, 16·0 m., at Horta, 12 July 1949.

Fig. 3. Stalked barnacles (*Conchoderma auritum*) parasitic on the front teeth of whale SH67, sperm ♂, 15·5 m., on board Fl. F. *Southern Harvester*, in 60° 40′ S, 81° 24′ E, 9 December 1947.

Fig. 4. Foetal sperm whales from Horta. *Above*, ♂, 35·5 cm., 15 August 1951; *below*, ♀, 24·1 cm., 25 July 1953. (See Table 3, p. 244, and Table 5, p. 246.) Note the rudimentary form of the flukes, the blowhole (in the lower picture), and the slight elevation of the dorsal fin, which in the upper picture has been indented with cord used in packing the specimen. *Photo: P. M. David.*

Fig. 5. The dorsal fin (here pronounced), and six posterior dorsal humps, of which the last (apparent as a dark spot on the ridge of the tailstock in front of the insertion of the flukes) rises not abruptly but smoothly, and so is not high-lighted in the picture. Whale F18, sperm ♀, 11·3 m., at Horta, 1 August 1949.

Fig. 6. The mouth of a young sperm whale, showing the lower jaw with teeth not yet erupted. Just visible are serial swellings which mark the positions of unerupted teeth. Note also the half-white pigmentation of the lower jaw. The 'blackskin' about the jaws has been stripped for fishing bait (see Clarke, 1954*a*, p. 343). Whale F17, sperm ♂, 7·5 m., at Horta, 1 August 1949.

Fig. 7. Maxillary teeth erupted close to the sockets which receive the mandibular teeth. Detail from the palatal region of whale SH334, sperm ♂, 16·9 m., on board Fl. F. *Southern Harvester*, in 63° 26′ S, 90° 00′ E, 2 January 1948.


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PLATE II

Fig. 1. Deformed lower jaw, heavily infested the length of the tooth row with *Conchoderma auritum*. Whale F153, sperm ♂, 10·4 m., at Horta, 17 June 1952. *Photo: Constantino de Freitas Amaral.*

Fig. 2. A giant squid, *Architeuthis* sp., recovered intact from the stomach of a sperm whale. In standard length as shown the squid measured 4·96 m., the tentacles extending outside the picture to complete a total length of 10·49 m. From whale F346, sperm ♂, 14·3 m., at Horta, 4 July 1955.

Fig. 3. Stomach contents of whale F8, sperm ♂, 11·0 m., at Horta, 21 July 1949. (See also Fig. 6.) Two specimens of *Histioteuthis bonelliana* lie near the metre rule; the large squids towards the right are heads and bodies of *Cucioteuthis unguiculatus*. There are also present the remains of a barracuda (*Sphyraena* sp.), two similar fishes, and a jellyfish.

Fig. 4. A young basking shark (*Cetorhinus maximus*), ♂, 2·50 m. long, recovered intact from the stomach of a sperm whale, ♂, 14·4 m., at Horta, 10 February 1956. *Photo: B. L. Collins.*

Fig. 5. The flukes, showing the hind margin irregularly scalloped as a result of damage by an unknown agency, possibly fishes. Whale F30, sperm ♂, 13·6 m., at Horta, 16 August 1949.

Fig. 6. Stomach contents, a detail from Fig. 3. The two pale squids, spotted with black photophores, are *Histioteuthis bonelliana*. Above and below them are the heads-and-arms of *Cucioteuthis unguiculatus*.

Fig. 7. Stomach contents of whale F18, sperm ♀, 11·3 m., at Horta, 1 August 1949. The large, pigmented squid, with wide, extensive and circular fin, is a complete specimen of *Cucioteuthis unguiculatus*. A white bulge of viscera protrudes through a tear in the mantle. The smaller, pale squid is *Tetronychoteuthis dussumierii*.

Fig. 8. A bathypelagic angler fish, *Himantolophus groenlandicus*, 39·8 cm. in total length, from the stomach of whale F262, sperm ♂, 12·0 m., at Horta, 18 June 1954 (see Table 14, p. 260). Note the lure and the limpet-like dermal spines. *Photo: P. M. David.*


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[*Discovery Reports. Vol. XXVIII, pp.* 299–398, *Plates III–V, February,* 1957.]

DISCOVERY INVESTIGATIONS STATION LIST

1950–1951

CONTENTS

DISCOVERY INVESTIGATIONS STATION LIST

1950–1951

(Plates III–V)

INTRODUCTION

This list contains particulars of the observations made during the sixth commission of the R.R.S. 'Discovery II' from May 1950 to December 1951. Earlier observations by the same ship have already been published in *Discovery Reports*, vols. I, III, IV, XXI, XXII and XXIV, and although the present stations have been separated from those by a gap of eleven years, numerical continuity has been maintained with the pre-war station numbers.

The sixth commission of the R.R.S. 'Discovery II' was planned primarily to round off the general survey of the Southern Ocean, which had been one of the major tasks of the Discovery Committee. Most of the region had been well covered during the pre-war years, but there were insufficient observations in some areas, especially in the winter months. The voyage was therefore timed to cover one summer and two winter seasons in the South. In addition, opportunity was taken to co-operate with various home and dominion authorities in making observations of mutual interest.

The first seven Stations (2653–2659) were worked in conjunction with the Marine Biological Association of the United Kingdom, from the continental shelf into deep water west of the English Channel. The ship then proceeded through the Mediterranean to the Indian Ocean, making miscellaneous observations in the Bay of Biscay, through the Straits of Gibraltar, in the Mediterranean and through the Straits of Bab-el-Mandeb at the southern end of the Red Sea. The first major item of the programme then followed: a line of stations from the equator to 30° South in 90° East. This line was later continued south to the ice-edge. Some Stations (2706–2725) were then worked off the east Australian coast at the request of the Council for Scientific and Industrial Research, Division of Fisheries, and this was followed by a line of stations across the Tasman Sea. After a second Antarctic voyage comprising a line of stations in 150° W, the ship returned to Australia and made further observations at Stations 2778–2801 in conjunction with the Australian authorities. This completed the work in Australian waters and a repetition of the stations on the southern section of the 90° E. line initiated the circumpolar cruise, which took the ship across the Tasman Sea, the Pacific, Atlantic and Indian Ocean Sectors of the Antarctic, and eventually back to Australia. On the homeward voyage further stations were worked in the Central Indian Ocean, in 90° E., and again through the Straits of Bab-el-Mandeb, the Red Sea and Mediterranean.

The chemical estimations at Stations 2653–2659 were done at the Laboratory of the Marine Biological Association of the United Kingdom, Plymouth, and those at Stations 2706–2725 and 2778–2801 at the laboratories of the Council for Scientific and Industrial Research, Division of Fisheries in Australia. At all other stations analyses were carried out on board the ship. The salinity and oxygen determinations at Stations 2664–2704, 2726–2777 and 2802–2816* were made with new techniques which were found to be unsatisfactory and were abandoned after Station 2816*. Although these salinity and oxygen figures are considered to be of doubtful accuracy and no precise estimation

* For the oxygen determinations the final station was 2820.

can be made of the probable errors involved, they and the computed σt values are included in the list, but they are printed in italics to distinguish them from those which are known to be reliable.

Phosphates have been determined as previously by the Atkins-Deniges molybdenum-blue method (Harvey, 1948), but the colour comparisons were made in a selenium cell photometer. Silicates were determined by the method of Armstrong (1951). Nutrient salt concentrations are expressed in milligramme atoms per cubic metre.

Depths measured by unprotected reversing thermometers are recorded in the column headed 'Depth by thermometer': those depths recorded in the column headed 'Depth (metres)' were determined from the amount of wire paid out and from the most probable slope of the wire found by interpolation between the thermometric depth measurements. The small index figure placed above the figure for depth shows from which hoist of reversing water sample bottles the sample was obtained.

The following Beaufort notation has been used to express the state of the weather:

b	blue sky with clear or hazy atmosphere, or sky not more than one-quarter clouded.
bc	sky between one-quarter and three-quarters clouded.
c	mainly cloudy (not less than three-quarters clouded).
d	drizzle or fine rain.
f	fog.
g	gloomy.
h	hail.
i	intermittent.
m	mist.
o	overcast sky (i.e. whole sky covered with unbroken cloud).
p	passing showers.
q	squalls.
r	rain.
rs	sleet.
s	snow.
u	ugly, threatening sky.

Capital letters are used to indicate occasions when the phenomenon noted is intense. On occasions where the intensity is slight the small suffix 'o' is added. Continuity of the phenomenon is indicated by repetition of the symbol.

The state of sea and swell is expressed by the appropriate number in the Douglas Sea and Swell Scale, which is as follows:

	Sea		Swell
0	Calm	0	No swell
1	Smooth	1	Low swell, short or average length
2	Slight	2	Low swell, long
3	Moderate	3	Moderate swell, short
4	Rough	4	Moderate swell, average length
5	Very Rough	5	Moderate swell, long
6	High	6	Heavy swell, short
7	Very high	7	Heavy swell, average length
8	Precipitous	8	Heavy swell, long
9	Confused	9	Confused swell

The times of the observations are given in ship's time expressed on the 24-hour system ending with midnight (0000). The hours to be added to or subtracted from ship's (or zone) time to give G.M.T. are noted in the 'Remarks' column, this difference holding good until another entry is made. Times in heavy type refer to biological observations made between sunset and sunrise.

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

B	Oblique.
BT	Bathythermograph.
DC	Conical dredge. Mouth 16 in. (40·5 cm.) in diameter, with a canvas bag.
DLH	Large rectangular dredge. Heavy pattern, 4 ft. (1·2 m.) wide.
DRS	Small rectangular dredge.
H	Horizontal.
KT	Kelvin sounding tube.
LH	Hand lines.
N 50	50 cm. silk tow net. Mouth circular 50 cm. (19·6 in.) diameter: 200 meshes to the linear inch.
N 70	70 cm. tow net. Mouth circular, 70 cm. (27·5 in.) diameter: mesh graded, at cod end of silk, with 74 meshes to the linear inch.
N 100	1 m. tow net. Mouth circular, 1 m. (3·3 ft.) diameter, stramin with 10–12 meshes to the linear inch.*
N 100 BS	Modification of the N 100 net in which the cod end of the net is turned in and drawn up part way inside the net. Here it is supported on bridles from the net ring. No net bucket is used, and the plankton is collected in the annular bag of netting. The method is described by Sheard (1941).
NH	Hand net.
NHP	A modification of Harvey's phytoplankton net. A metal funnel (aperture 30·5 cm.) leads to a recording mechanism and thence to a sleeve-shaped silk net of 200 meshes to the linear inch, terminating in a conical bucket. The apparatus is hauled vertically at approximately 10 m. a minute, and the mechanism records the volume of water filtered.
OTL	Otter trawl. Head rope 40 ft. (12·2 m.) long: mesh at cod end $1\frac{1}{4}$ in. (3·2 cm.).
Sh. Coll.	Shore collecting.
STK	Kullenberg piston core sampler. 30 ft. (9·1 m.) effective length.
TYF	Young fish trawl. A bag of stramin with 10–12 meshes to the linear inch, attached to a circular frame 2 m. (6·6 ft.) in diameter.
V	Vertical.
XSR	Seismic reflection shooting. An explosive charge is detonated on the sea surface and the reflected sound waves recorded.

The net hauls at Stations 2706–2725 are marked with a †. The plankton catches from those hauls are in the possession of the Division of Fisheries of the Council for Scientific and Industrial Research, Australia.

The addition of the symbols B, H or V to those used for tow nets, indicates whether they were hauled obliquely, horizontally or vertically. Where the depth interval indicates that a net fished vertically was closed, this was effected on the Nansen principle. The maximum depths reached by horizontal and oblique nets were determined where possible by the use of Kelvin Sounding Tubes and this is recorded by the insertion of the symbol KT in the 'Remarks' column.

Soundings taken by the echo-sounding machine are marked with an asterisk.

At the end of the list (p. 398) will be found a summary of the stations with references to the charts (Plates III–V) on which the station positions are marked.

REFERENCES

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* Earlier versions of the N 100 were of graded mesh.

R.R.S. 'DISCOVERY II', STATIONS 2653–2911

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2653	48° 20′ N, 05° 39′ W	1950 11 v	0730	110*	E×N	11–16	E	2	E'ly	2–3	c	1017·8	12·8	11·1
2654	48° 20′ N, 06° 06′ W	11 v	1200	124*	E×N	7–16	E×N	2	E×N	2	o	1017·6	14·4	12·8
2655	48° 20′ N, 06° 34′ W	11 v	1505	133*	E×N	7–10	E	2	E×N	2	c	1017·4	15·0	13·3
2656	48° 18′ N, 06° 59′ W	11 v	1800	154*	E	4–6	—	0	E'ly	2	bc	1016·8	13·3	12·2
2657	48° 18′ N, 07° 30′ W	11 v	2200	165*	ENE	7–10	E'ly	2	E'ly	2	c	1015·7	12·8	11·7
2658	47° 50′ N, 07° 40′ W	12 v	0200	693*	NE	11–16	NE	3	NE	4	c	1014·6	13·3	12·8
2659	47° 24′ N, 07° 52′ W	12 v	0715	4003*	ENE	17–21	NE	3	NE	4	bc	1012·1	14·4	12·8

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2653	24	0	—	11·86	35·47	27·00	0·6	—	—	1·2	—	N 70 V	50–0	0915	—	Zone −1 hr
		10	—	11·73	35·47	27·03	0·6	—	—	1·7	—	,,	100–50	—	0933	
		20	—	11·17	35·46	27·12	0·7	—	—	2·1	—	N 100 B	73–0	0955	1008	KT
		50	—	11·08	35·47	27·15	0·5	—	—	1·9						
		100	—	11·07	35·47	27·15	0·7	—	—	2·1						
2654	24	0	—	11·51	35·38	27·00	0·7	—	—	2·1	—	N 70 V	50–0	1217		
		10	—	11·50	35·40	27·01	0·6	—	—	2·0	—	,,	100–50	—	1229	
		20	—	11·19	35·43	27·09	0·6	—	—	1·9	—	N 100 B	53–0	1309	1327	KT
		50	—	10·87	35·44	27·16	0·7	—	—	2·1						
		100	—	10·85	35·43	27·15	0·7	—	—	2·0						
2655	24	0	—	11·92	35·47	26·99	0·6	—	—	2·4	—	N 70 V	50–0	1515		
		10	—	11·79	35·45	27·00	0·7	—	—	2·5	—	,,	100–0	—	—	Net failed to close
		20	—	11·10	35·45	27·13	0·6	—	—	2·8	—	,,	100–50	—	1536	
		50	—	11·00	35·44	27·13	0·6	—	—	2·6	—	N 100 B	68–0	1607	1618	KT
		100	—	11·00	35·47	27·16	0·5	—	—	2·5						
		130	—	11·00	35·44	27·13	0·6	—	—	2·7						
2656	24	0	—	12·26	35·48	26·93	0·6	—	—	2·1	—	N 70 V	50–0	1815		
		10	—	12·21	35·44	26·91	0·8	—	—	2·2	—	,,	100–50	—	1827	
		20	—	11·64	35·45	27·02	0·5	—	—	2·3	—	N 100 B	130–0	1920	1935	KT
		50	—	11·00	35·47	27·16	0·6	—	—	2·4						
		100	—	11·00	35·48	27·16	0·6	—	—	2·6						
		150	—	11·00	35·44	27·13	0·6	—	—	2·4						
2657	24	0	—	12·66	35·62	26·96	1·2	—	—	2·0	—	N 70 V	50–0	2208		
		10	—	12·66	35·59	26·93	0·5	—	—	2·2	—	,,	100–50	—	2218	
		20	—	11·86	35·57	27·08	0·5	—	—	2·1	—	N 100 B	53–0	2251	2303	KT
		50	—	11·17	35·55	27·19	0·5	—	—	2·4						
		100	—	11·15	35·53	27·18	0·6	—	—	2·4						
		150	—	11·16	35·53	27·18	0·7	—	—	2·4						
2658	25	0	—	12·75	35·54	26·89	0·6	—	—	1·2	—	N 70 V	50–0	0223		
		10	—	12·61	35·58	26·94	0·6	—	—	1·3	—	,,	100–0	—	—	Net failed to close
		20	—	12·17	35·57	27·02	0·4	—	—	1·7	—	,,	100–50			
		50	—	11·84	35·58	27·09	0·6	—	—	2·4	—	,,	250–0	—	—	Net failed to close
		100	—	11·65	35·57	27·12	0·6	—	—	3·3	—	,,	250–100			
		150	—	11·52	35·56	27·13	0·6	—	—	3·3	—	,,	500–250	—	0350	
		190[1]	187	11·45	35·55	27·14	0·7	—	—	3·5	—	XSR	—	0355		
		270[2]	274	11·27	35·56	27·18	0·7	—	—	4·0	—	N 100 B	144–0	0415	0435	KT
		370[2]	—	11·10	35·55	27·20	0·8	—	—	4·7						
		580[2]	582	10·24	35·49	27·31	1·0	—	—	8·3						
2659	25	0	—	13·88	35·65	26·73	0·4	—	—	0·8	—	N 70 V	50–0	0732		
		10	—	13·86	35·66	26·75	0·3	—	—	1·0	—	,,	100–50			
		20	—	13·62	35·66	26·80	0·3	—	—	0·5	—	,,	250–100			
		50	—	12·34	35·62	27·02	0·5	—	—	1·8	—	,,	500–250			
		100	—	11·91	35·58	27·08	0·5	—	—	2·3	—	,,	750–500			
		150	—	11·73	35·60	27·12	0·6	—	—	2·6	—	,,	1000–750	—	0945	
		200	—	11·58	35·58	27·14	0·6	—	—	2·6	—	N 100 B	133–0	1301	1323	KT
		300	—	11·41	35·55	27·15	0·8	—	—	3·5	—	XSR	—	1340		
		400	—	10·96	35·49	27·18	0·8	—	—	4·8						
		590[3]	592	10·47	35·49	27·27	1·0	—	—	7·1						
		790[3]	794	9·95	35·66	27·49	1·3	—	—	10·0						
		900[2]	896	9·81	35·69	27·54	1·2	—	—	10·2						
		990[2]	—	9·43	35·69	27·60	1·2	—	—	10·8						
		1090[3]	—	8·93	35·67	27·68	1·3	—	—	11·7						
		1190[3]	1192	7·98	35·55	27·73	1·2	—	—	12·3						
		1480[2]	1478	5·53	35·18	27·78	1·3	—	—	13·3						
		1980[2]	—	3·86	35·01	27·84	1·3	—	—	19·1						
		2490[2]	2488	3·20	34·97	27·87	1·4	—	—	28·6						
		2890[1]	2894	2·86	34·95	27·88	1·6	—	—	35·6						
		3380[1]	—	2·63	34·92	27·87	1·5	—	—	38·7						
		3770[1]	3771	2·54	34·87	27·84	1·6	—	—	40·8						

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
		1950												
2660	44° 31′ N, 09° 06′ W	13 v	0940	4559*	—	0	—	0	Conf.	0	c	1010·5	15·0	13·9
2661	44° 15′ N, 09° 11′ W	13 v	1215	2921*	S'ly	4–6	—	1	Conf.	2	c	1009·7	15·0	13·9
2662	43° 56′ N, 09° 17′ W	13 v	1415	3083*	S'ly	4–6	—	1	Conf.	2	bc	1008·5	15·0	13·9
2663	43° 41′ N, 09° 22′ W	13 v	1620	1514*	ESE	4–6	—	1	E'ly	2	c	1008·2	15·0	13·9
2664	35° 40′ N, 07° 14′ W	16 v	0300	1243*	SW	7–10	SW	4	SW	4	bc	1011·5	18·3	16·1
2665	35° 48′ N, 06° 36′ W	16 v	0915	536*	SSW	11–16	—	1	SSW	4	bc	1013·6	18·9	16·1
			1105	520*	—	—	—	—	—	—	—	—	—	—
2666	35° 54′ N, 05° 38′ W	16 v	1615	433*	SSW	4–6	—	1	—	—	b	1010·5	21·1	17·8
2667	37° 18′ N, 03° 04′ E	18 v	1115	2763*	W	22–27	W	4–5	W	5–6	b	1013·2	20·0	17·8
2668	37° 25′ N, 05° 15′ E	18–19 v	2300	2761*	S'ly	7–10	S	3	S	3	bc	1014·2	19·4	18·3
			0013	2758*	—	—	—	—	—	—	—	—	—	—
			0025	2763*	—	—	—	—	—	—	—	—	—	—
2669	37° 37′ N, 07° 24′ E	19 v	1000	2824*	ESE	7–10	—	1	W	2	b	1013·0	20·0	18·3

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
2660	25	—	—	—	—	—	—	—	—	—	—	**XSR**	—	1002		
2661	26	—	—	—	—	—	—	—	—	—	—	**XSR**	—	1226		
												,,	—	1236		
2662	26	—	—	—	—	—	—	—	—	—	—	**XSR**	—	1432		
												,,	—	1440		
												,,	—	1448		
2663	26	—	—	—	—	—	—	—	—	—	—	**XSR**	—	1638		
												,,	—	1646		
2664	29	0	—	17·83	*36·36*	*26·38*	0·8	—	—	25·0	*5·18*	**N 100 H**	0–5	**0324**	**0349**	
		20	—	17·71	*36·36*	*26·41*	0·4	—	—	59·2?	—	**TYFB**	131–0	**0328**	**0354**	KT
		30	—	17·44	*36·36*	*26·47*	0·4	—	—	19·3	*4·70*	**N 70 V**	50–0	**0425**		
		40	—	17·04	*36·33*	*26·54*	0·5	—	—	4·6	—	,,	100–50			
		50	—	16·78	*36·35*	*26·61*	0·3	—	—	25·2	*5·20*	,,	250–100			
		75	—	15·91	*36·31*	*26·79*	0·8	—	—	9·7	—	,,	500–250			
		100	—	15·86	*36·26*	*26·76*	0·6	—	—	6·2	*5·29*	,,	750–450	—	**0534**	
		150	—	15·24	*36·15*	*26·82*	0·4	—	—	5·5						
		200	—	14·05	*35·84*	*26·84*	5·0	—	—	7·8	*4·73*					
		300	—	12·86	*35·64*	*26·93*	5·8	—	—	8·0						
		400	—	12·11	*35·61*	*27·06*	4·0	—	—	6·3	*4·68*					
		490[1]	494	11·42	*35·55*	*27·14*	7·1	—	—	9·0	*4·04*					
		590[1]	—	10·94	*35·48*	*27·17*	9·6	—	—	11·2	*3·16*					
		790[1]	788	10·12	*35·61*	*27·43*	11·9	—	—	13·6	*3·59*					
		1000[1]	—	9·63	*35·68*	*27·56*	11·8	—	—	15·5	*3·48*					
		1210[1]	1207	9·60	*35·86*	*27·71*	10·9	—	—	17·8	*3·93*					
2665	29	0	—	18·15	*36·29*	*26·24*	2·3	—	—	7·0	*4·82*	**DLH**	536	0958	1011	
		20	—	18·02	*36·40*	*26·36*	2·4	—	—	4·8	—	**N 70 V**	50–0	1113		
		30	—	17·95	*36·27*	*26·27*	0·4	—	—	4·2	*4·90*	,,	100–50			
		40	—	17·66	*36·42*	*26·46*	0·7	—	—	2·7	—	,,	250–100	—	1133	
		50	—	17·37	*36·38*	*26·50*	0·5	—	—	6·4	*4·79*					
		75	—	16·25	*36·31*	*26·71*	1·6	—	—	5·2						
		100	—	15·91	*36·20*	*26·71*	3·4	—	—	1·9	*4·30*					
		150[1]	146	15·23	*36·06*	*26·75*	3·9	—	—	3·4	*4·52*					
		200[1]	—	14·26	*35·90*	*26·84*	8·3	—	—	9·1	*4·45*					
		290[1]	—	15·57	*36·36*	*26·91*	8·0	—	—	7·6	*3·81*					
		390[1]	—	12·28	*35·53*	*26·97*	7·3	—	—	6·8						
		440[1]	437	12·67	*36·08*	*27·31*	5·3	—	—	6·3						
2666	29	0	—	18·53	*36·40*	*26·23*	0·2	—	—	2·8	*4·16*	**N 70 V**	50–0	1632		
		20	—	17·58	*36·38*	*26·45*	0·6	—	—	3·3	—	,,	100–50			
		30	—	17·42	*36·31*	*26·43*	0·7	—	—	2·5	*4·32*	,,	250–100	—	1712	
		40	—	16·63	*36·36*	*26·67*	0·4	—	—	4·1						
		50	—	16·58	*36·27*	*26·60*	0·3	—	—	2·8	*3·98*					
		75	—	16·64	*36·29*	*26·61*	0·4	—	—	6·4						
		100	—	16·63	*36·22*	*26·56*	0·5	—	—	4·5	*4·40*					
		150	—	14·54	*37·10*	*27·71*	2·1	—	—	6·1	*4·02*					
		190[1]	191	15·84	*36·38*	*26·86*	1·0	—	—	3·9						
		280[1]	—	13·37	*38·01*	*28·66*	3·5	—	—	8·0						
		370[1]	372	12·92	*38·26*	*28·96*	4·9	—	—	12·4						
2667	1	—	—	—	—	—	—	—	—	—	—	**XSR**	—	1126		
												,,	—	1134		
												,,	—	1140		
												,,	—	1151		
2668	2	0	—	18·10	—	—	—	—	—	—	—	**TYFB**	183–0	**2332**	**2353**	KT
		—	—	—	—	—	—	—	—	—	—	**XSR**	—	**0013**		
		—	—	—	—	—	—	—	—	—	—	,,	—	**0025**		
2669	2	—	—	—	—	—	—	—	—	—	—	**NH**	0	1000	1030	
												XSR	—	1008		
												,,	—	1020		

2

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2670	37° 34′ N, 09° 39′ E	1950 19 v	2215	—	E × N	11–16	E	4	E'ly	3	b	1016·0	18·9	17·2
2671	36° 21′ N, 13° 34′ E	20 v	2200	—	ESE	4–6	ESE	2	—	—	b	1022·7	20·0	18·9
2672	35° 54′ N, 15° 54′ E	27 v	1600	3288*	SW	7–10	SW	2	—	—	b	1020·9	24·4	21·7
2673	34° 27′ N, 16° 28′ E	28 v	0215	1538*	—	0	—	0	—	—	b	1019·8	20·6	18·9
			0236	1554*	—	—	—	—	—	—	—	—	—	—
			0243	1558*										
2674	33° 15′ N, 19° 39′ E	28 v	2045	2322*	—	0	—	0	—	—	b	1019·8	22·8	21·1
			2100	2328*	—	—	—	—	—	—	—	—	—	—
			2108	2330*										
2675	33° 15·5′ N, 23° 56′ E	30 v	0710	1924*	NNW	17–21	NNW	4	NW	4	b	1016·8	20·6	18·3
2676	33° 13′ N, 25° 30′ E	30 v	1600	2280*	WNW	22–27	WNW	6	NW	5–6	bc	1012·8	20·6	18·3
2677	32° 32′ N, 28° 20′ E	31 v	0715	2946*	W	7–10	W	4	W	4	b	1011·5	21·1	20·0
2678	32° 28′ N, 28° 49′ E	31 v	1000	2739*	W × S	7–10	W	3	W	4	b	1012·0	21·1	20·0
			1230	2754*	—	—	—	—	—	—	—	—	—	—
			1445	2776*	—	—	—	—	—	—	—	—	—	—
2679	12° 50′ N, 43° 14′ E	7 vi	1030	184*	NW	7–10	NW	2	—	—	b	1010·0	30·0	28·3
2680	12° 40′ N, 43° 40′ E	7 vi	1500	293*	ESE	7–10	ESE	2	—	—	b	1006·2	30·0	26·7
2681	12° 02′ N, 44° 23′ E	7 vi	2015	1426*	—	0	—	0	—	—	b	1005·0	30·6	27·2
2682	11° 53′ N, 45° 14′ E	8 vi	0330	1145*	SW	11–16	SW	3	SW	3	bc	1004·1	31·1	27·8

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Mg.—atom m.³: Nitrate + Nitrite N_2	Mg.—atom m.³: Nitrite N_2	Mg.—atom m.³: Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	TIME: To	Remarks
2670	2	—	—	—	—	—	—	—	—	—	—	NH	0–2	**2220**	**2300**	
												LH				
2671	2	—	—	—	—	—	—	—	—	—	—	NH	0	**2200**	**2240**	
												XSR	—	**2230**		
2672	10	—	—	—	—	—	—	—	—	—	—	XSR	—	1608		
												,,	—	1615		
2673	11	—	—	—	—	—	—	—	—	—	—	XSR	—	**0236**		
		—	—	—	—	—	—	—	—	—	—	,,	—	**0243**		
2674	11	—	—	—	—	—	—	—	—	—	—	XSR	—	**2100**		
		—	—	—	—	—	—	—	—	—	—	,,	—	**2108**		
2675	12	—	—	—	—	—	—	—	—	—	—	XSR	—	0740	—	Zone −2 hrs
2676	12	—	—	—	—	—	—	—	—	—	—	XSR	—	1616		
2677	14	—	—	—	—	—	—	—	—	—	—	XSR	—	0740		
2678	14	—	—	—	—	—	—	—	—	—	—	STK	2754	1024	1430	
		—	—	—	—	—	—	—	—	—	—	XSR	—	1445		
		—	—	—	—	—	—	—	—	—	—	,,	—	1453		
2679	21	0	—	29·81	36·55	22·97	0·3	—	—	0·0	4·43	N 70 V	50–0	1037	—	Zone −3 hrs
		30	—	26·52	36·29	23·87	0·6	—	—	0·0	—	,,	100–50	—	1048	
		50	—	23·75	36·04	24·52	0·8	—	—	0·1	—	N 70 B	60–0	1143	1203	KT
		75	—	19·91	36·11	25·65	1·8	—	—	0·0	1·11	N 100 B				
		100	—	17·35	35·81	26·07	2·0	—	—	0·0	0·90					
		150	—	22·61	40·05	27·90	1·2	—	—	0·3						
		175	—	22·56	40·05	27·91	1·3	—	—	0·3	1·00					
2680	21	0	—	30·84	36·73	22·75	0·2	—	—	0·0	4·3	N 70 V	50–0	1514		
		10	—	29·92	36·36	22·80	0·2	—	—	0·2	4·5	,,	100–50			
		30	—	26·35	36·08	23·75	0·2	—	—	0·5	—	,,	250–100	—	1543	
		50	—	24·52	36·09	24·33	0·6	—	—	0·3	3·7	N 100 B	130–0	1625	1637	KT
		75	—	20·28	35·91	25·40	1·8	—	—	0·2						
		100	—	19·00	35·73	25·60	1·6	—	—	0·5	0·7					
		150	—	16·56	35·64	26·12	2·1	—	—	0·2	0·6					
		200	—	15·90	35·62	26·27	2·0	—	—	0·5	<0·4					
		280	—	15·30	35·90	26·61	2·0	—	—	0·3	0·4					
2681	21	0	—	30·31	36·44	22·72	0·3	—	—	0·2	4·4	N 70 V	50–0	**2032**		
		10	—	29·84	36·33	22·80	0·3	—	—	0·1	—	,,	100–50			
		30	—	28·63	36·31	23·19	0·4	—	—	0·0	4·6	,,	250–100			
		50	—	25·72	36·09	23·97	0·4	—	—	0·1	4·7	,,	500–250			
		75	—	21·98	35·91	24·93	1·5	—	—	0·1	—	,,	750–0	—	**2142**	Net failed to close
		100	—	19·38	35·84	25·58	2·1	—	—	0·0	0·9	TYFB	200–0	**2246**	**2320**	Depth estimated
		150	—	16·14	35·64	26·22	2·2	—	—	0·3	0·6					
		200	—	15·41	35·57	26·34	2·4	—	—	0·5	0·5					
		300	—	14·87	35·82	26·65	2·5	—	—	0·3	0·6					
		400	—	14·85	35·82	26·65	2·1	—	—	0·4	0·6					
		500	—	15·09	36·31	26·97	2·0	—	—	0·3	0·7					
		600[1]	—	14·56	36·35	27·12	2·0	—	—	0·3	0·7					
		790[1]	794	14·76	36·69	27·34	1·8	—	—	0·4	0·6					
		990[2]	993	19·06	38·44	27·65	1·5	—	—	0·7	0·8					
		1200[2]	1201	17·89	38·48	27·98	1·7	—	—	0·3	0·6					
2682	22	0	—	30·05	36·58	22·91	0·4	—	—	17·2	4·3	N 70 V	50–0	**0353**		
		10	—	29·71	36·47	22·95	0·2	—	—	5·2	—	,,	100–50			
		30	—	29·35	36·45	23·06	0·2	—	—	4·7	4·4	,,	250–100			
		50	—	27·73	36·29	23·48	0·2	—	—	4·2	4·7	,,	500–285	—	—	Net closed prematurely

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2682 *cont.*	11° 53′ N, 45° 14′ E	1950 8 vi												
2683	00° 54′ S, 90° 00′ E	20 vi	2000	3124*	WSW	7–10	WSW	2	S	4	bc	1008·0	27·8	27·2
2684	04° 06′ S, 90° 00′ E	21 vi	2000	3541*	S × W	17–21	S × W	4	S'ly	4–5	cp	1007·9	27·8	27·8
2685	07° 03′ S, 90° 07′ E	22–23 vi	2000	4960*	S	17–27	S	5	S	7	bc	1007·2	27·8	26·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2682 *cont.*	22	75	—	25·15	36·13	24·17	0·5	—	—	5·1	—	**N 70 V**	750–500	—	**0505**	
		100	—	23·12	35·90	24·60	1·2	—	—	59·6	2·7					
		150	—	17·26	35·59	25·92	2·0	—	—	38·4	0·5					
		200	—	15·77	35·61	26·29	1·7	—	—	23·8	0·6					
		300	—	14·36	35·75	26·71	2·1	—	—	28·4	0·6					
		390[1]	386	14·03	36·26	27·17	1·8	—	—	32·2	0·6					
		490[1]	—	14·05	36·31	27·20	2·0	—	—	33·4	0·6					
		590[1]	585	13·63	36·29	27·28	1·9	—	—	37·4	0·6					
		790[1]	—	12·64	36·27	27·47	1·9	—	—	47·5	0·8					
		990[1]	989	17·34	37·86	27·65	1·5	—	—	36·1	0·7					
2683	4	0	—	28·61	34·61	21·93	0·29	0·0	—	20·8	4·5	**N 70 V**	50–0	**2002**	—	Zone −6 hrs
		10	—	28·63	34·58	21·89	0·53	0·0	—	30·2	—	,,	100–50			
		20	—	28·61	34·65	21·95	0·24	2·1	—	14·6	4·5	,,	250–100			
		30	—	28·62	34·56	21·88	0·33	0·0	—	6·1	—	,,	500–250			
		50	—	28·60	34·56	21·89	0·25	0·3	—	25·2	4·5	,,	750–0	—	—	Net failed to close
		75	—	28·60	34·58	21·90	0·30	0·0	—	36·6	—	,,	750–500			
		100	—	28·57	34·51	21·86	0·39	0·0	—	9·1	3·8	,,	1000–750	—	**2229**	
		150	—	19·06	35·12	25·11	1·45	41·4	—	18·3	2·1	**N 100 H**	0–1	**2256**	**2312**	
		200	—	14·64	34·94	26·02	1·94	63·0	—	31·9	1·9	**N 70 H**	0–1	**2258**	**2310**	
		300	—	11·24	34·94	26·70	1·65	75·0	—	35·6	2·0	**N 70 B**	124–0	**2305**	**2322**	KT
		400	—	11·29	35·03	26·76	1·69	88·5	—	33·1	2·0	**N 100 B**				
		510[2]	509	9·73	34·90	26·94	1·80	60·3	—	42·9	1·8					
		600[2]	—	8·94	34·94	27·10	2·25	77·0	—	57·6	1·4					
		800[2]	795	7·84	34·88	27·22	2·20	81·5	—	73·0	1·3					
		990[2]	989	6·09	34·83	27·43	1·93	97·2	—	105	1·2					
		1190[1]	1190	5·24	34·76	27·47	2·17	97·2	—	116	1·1					
		1490[1]	—	3·89	34·78	27·64	1·97	95·3	—	110	2·0					
		1990[1]	1989	2·60	34·70	27·71	1·79	42·8	—	105	2·6					
		2490[1]	—	2·09	34·67	27·72	1·61	61·6	—	106	2·8					
		2990[1]	2985	1·67	34·70	27·78	1·57	10·2	—	110	2·4					
2684	5	0	—	28·53	34·36	21·76	0·27	—	—	59·6?	4·4	**N 70 V**	50–0	**2001**		
		10	—	28·53	34·34	21·75	0·35	—	—	15·3	—	,,	100–50			
		20	—	28·53	34·76	22·06	0·34	—	—	15·0	4·5	,,	250–100			
		30	—	28·53	34·67	21·99	0·54	—	—	110	—	,,	500–250			
		50	—	28·39	34·67	22·04	0·41	—	—	17·5	4·4	,,	750–500	—	**2131**	
		75	—	27·48	34·72	22·37	0·54	—	—	13·1	—	**N 100 H**	0–1	**2316**	**2333**	
		100	—	26·15	34·88	22·92	0·61	—	—	11·7	3·6	**N 70 H**	0–1	**2319**	**2331**	
		150	—	18·07	34·67	25·02	1·35	—	—	35·5	1·9	**N 70 B**	183–0	**2324**	**2335**	KT
		200	—	12·51	34·87	26·41	1·65	—	—	35·5	1·1	**N 100 B**				
		300	—	11·13	34·83	26·64	1·56	—	—	32·9	2·3					
		400	—	10·41	34·88	26·81	1·72	—	—	39·9	2·2					
		490[2]	494	9·14	34·79	26·95	1·85	—	—	52·8	2·0					
		580[2]	—	8·41	34·79	27·07	2·04	—	—	66·4	1·5					
		760[2]	759	7·26	34·56	27·05	2·00	—	—	81·5	1·5					
		950[1]	954	6·22	34·76	27·35	2·13	—	—	97·0	1·2					
		1440[1]	—	4·17	34·72	27·57	2·10	—	—	119	2·7					
		1920[1]	1921	2·82	34·69	27·67	1·80	—	—	113	2·7					
		2410[1]	—	2·09	34·69	27·73	1·78	—	—	115	1·5					
		2890[1]	2891	1·70	34·69	27·76	1·68	—	—	114	2·4					
2685	6	0	—	27·53	34·83	22·44	0·33	0·3	—	11·6	4·3	**N 70 V**	50–0	**2003**		
		10	—	27·53	34·85	22·45	0·30	0·0	—	14·7	—	,,	100–50			
		20	—	27·53	34·87	22·47	0·29	0·3	—	15·0	4·3	,,	250–100			
		30	—	27·53	34·78	22·40	0·29	0·0	—	9·2	—	,,	500–250			
		50	—	27·53	34·83	22·44	0·30	0·0	—	12·9	4·4	,,	750–500	—	**2125**	
		75	—	23·73	35·16	23·86	0·74	4·3	—	25·2	—	**N 70 B**	166–0	**2357**	**0012**	KT
		100	—	20·38	35·08	24·74	1·40	27·8	—	23·3	2·0	**N 100 B**				
		150	—	17·06	35·03	25·54	1·68	37·9	—	32·5	1·6					
		200	—	12·97	34·78	26·25	1·88	45·1	—	46·0	1·7					
		300	—	10·90	34·88	26·72	2·09	45·8	—	47·0	1·8					
		400	—	10·11	34·90	26·88	2·04	75·8	—	47·3	2·2					
		570[2]	573	8·34	34·76	27·05	2·40	68·0	—	41·8	1·8					
		770[2]	—	7·07	34·81	27·29	2·36	80·6	—	39·5	1·8					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2685 *cont.*	07° 03′ S, 90° 07′ E	1950 22–23 vi												
2686	12° 23′ S, 89° 53′ E	24 vi	2000	5505*	SSE	33–22	SSE	6	SSE	7	cqur	1007·3	23·3	21·7
2687	17° 19′ S, 90° 12′ E	26–27 vi	2000	5556*	ESE	21–11	ESE	4	E'ly	4	bcrq	1013·8	23·9	22·8
2688	20° 19′ S, 90° 02′ E	27 vi	2000	3272*	E'ly	7–10	E'ly	2	E	3	bc	1016·6	22·8	21·1
2689	23° 51′ S, 89° 58′ E	28–29 vi	2000	5186*	ESE	11–16	ESE	3–4	SE	3	bcrq	1021·2	19·4	18·3

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2685 *cont.*	6	980[1]	980	5·58	34·49	27·22	2·20	69·3	—	37·8	1·2					
		1170[2]	1173	4·87	34·67	27·45	2·47	80·6	—	41·7	2·2					
		1490[1]	—	4·28	34·72	27·55	2·20	81·5	—	39·5	1·4					
		2000[1]	2002	2·60	34·72	27·72	2·04	80·6	—	39·2	2·2					
2686	9	0	—	26·33	34·16	22·32	0·21	—	—	6·1	4·7	N 70 V	50–0	2006		
		10	—	26·33	34·16	22·32	0·22	—	—	3·4	—	,,	100–50			
		20	—	26·33	34·14	22·31	0·22	—	—	0·6	4·6	,,	250–100			
		30	—	26·33	34·14	22·31	0·18	—	—	0·2	—	,,	500–250	—	2049	
		50	—	26·33	34·13	22·29	0·21	—	—	3·3	4·7	N 100 B	148–0	2200	2222	KT
		75	—	26·33	34·14	22·31	0·19	—	—	1·8	—					
		90	—	23·32	34·78	23·69	0·73	—	—	1·8	3·0					
		140	—	17·59	34·70	25·17	1·13	—	—	5·9	1·2					
		180	—	14·63	34·70	25·84	1·27	—	—	7·6	2·4					
		270	—	11·90	34·60	26·31	1·34	—	—	4·3	1·4					
		360[2]	358	10·54	34·74	26·68	1·43	—	—	8·0	2·1					
		460[2]	—	9·65	34·79	26·87	1·02	—	—	17·4	3·3					
		560[2]	560	8·06	34·65	27·01	1·18	—	—	18·0	3·1					
		740[1]	739	6·37	34·63	27·24	1·56	—	—	21·5	1·7					
		930[1]	—	5·31	34·65	27·38	1·62	—	—	—	1·7					
		1110[1]	1114	4·58	34·69	27·49	1·64	—	—	—	1·7					
2687	9	0	—	24·57	34·60	23·18	0·27	0·0	—	16·9	4·8	N 70 V	50–0	2004		
		10	—	24·57	34·60	23·18	0·41	0·0	—	4·7	—	,,	100–50			
		20	—	24·57	34·58	23·17	0·32	0·0	—	13·5	4·8	,,	250–100			
		30	—	24·57	34·56	23·16	0·33	2·1	—	4·9	—	,,	500–250			
		50	—	24·57	34·56	23·16	0·23	1·3	—	3·6	4·7	,,	750–500			
		75	—	24·57	34·60	23·18	0·40	2·8	—	4·2	—	,,	1000–750			
		100	—	24·52	35·01	23·52	0·31	2·1	—	5·5	4·2	,,	1500–1000	—	2244	
		150	—	19·06	35·01	25·04	0·92	10·1	—	22·1	3·4	N 100 H	0–1	2353	0013	
		200	—	14·83	34·72	25·81	1·24	22·0	—	32·6	2·8	N 70 B	163–0	0000	0020	KT
		300	—	13·31	35·23	26·52	0·97	6·5	—	24·5	4·1	N 100 B				
		400	—	11·32	34·99	26·73	0·88	12·8	—	13·7	0·2					
		470[2]	473	9·67	34·74	26·83	0·93	10·0	—	12·5	4·8					
		580[2]	—	8·16	34·61	26·97	1·26	20·0	—	23·8	4·2					
		800[2]	796	6·31	34·63	27·24	1·90	53·5	—	64·5	2·3					
		990[2]	—	5·43	34·65	27·36	1·94	50·6	—	57·7	2·1					
		1460[2]	1457	3·82	34·65	27·54	1·91	85·2	—	60·8	2·5					
		1980[1]	1975	2·63	34·76	27·75	1·80	56·2	—	55·8	3·1					
		2470[1]	—	2·07	34·70	27·75	1·74	75·7	—	59·6	3·3					
		2960[1]	2957	1·70	34·70	27·78	1·63	62·0	—	55·8	3·5					
		3450[1]	—	1·44	34·70	27·80	1·67	34·3	—	54·0	3·8					
		4440[1]	4436	1·15	34·70	27·82	1·65	45·6	—	59·6	4·0					
2688	11	0	—	23·75	34·74	23·54	0·20	—	—	24·5	5·0	N 70 V	50–0	2000		
		10	—	23·75	34·74	23·54	0·20	—	—	9·8	—	,,	100–50			
		20	—	23·74	34·74	23·55	0·24	—	—	8·6	4·9	,,	250–100			
		30	—	23·74	34·74	23·55	0·24	—	—	6·1	—	,,	500–250			
		50	—	23·73	34·76	23·56	0·23	—	—	9·8	4·9	,,	750–500			
		75	—	22·56	35·01	24·09	0·44	—	—	11·6	—	,,	1000–650	—	—	Net closed at 650 m.
		100	—	21·05	35·21	24·66	0·53	—	—	12·9	3·9	,,	1500–1000	—	2212	
		150	—	18·63	35·21	25·30	0·73	—	—	17·8	3·6	N 100 H	0–1	2307	2335	
		200	—	18·17	35·82	25·88	0·27	—	—	8·3	4·8	N 70 B	121–0	2314	2338	KT
		300	—	14·88	35·55	26·44	0·46	—	—	6·1	5·6	N 100 B				
		400	—	11·90	35·12	26·72	0·80	—	—	7·3	5·5					
		490[1]	485	10·47	34·92	26·83	0·75	—	—	8·9	4·6					
		580[2]	581	9·24	34·72	26·88	0·91	—	—	13·5	5·3					
		780[2]	—	6·45	34·47	27·10	1·50	—	—	32·0	4·2					
		1000[1]	996	4·43	34·47	27·34	1·86	—	—	49·7	3·1					
		1170[2]	1172	3·89	34·49	27·41	1·97	—	—	49·7	3·2					
		1480[1]	1478	3·05	34·67	27·64	1·96	—	—	51·0	3·1					
		2340[2]	2337	1·87	34·67	27·74	1·93	—	—	51·5	3·7					
2689	12	0	—	22·00	35·43	24·56	0·45	4·2	—	6·7	5·1	N 70 V	50–0	2005		
		10	—	22·03	35·43	24·55	0·49	7·1	—	10·0	—	,,	100–50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2689 *cont.*	23° 51′ S, 89° 58′ E	1950 28–29 vi												
2690	26° 24′ S, 89° 54′ E	29–30 vi	2000	5235*	ESE	11–16	ESE	3	SE	3–4	co	1027·2	17·8	13·9
2691	29° 42′ S, 90° 06′ E	30 vi	2000	2823*	NW	7–10	NW'ly	2	—	—	bcpr	1023·1	15·0	13·9
2692	31° 53′ S, 113° 04′ E	5 vii	2030	4830*	SSW	11–16	SSW	4	SSW	4	bc	1019·1	15·0	12·2
2693	31° 52′ S, 113° 36′ E	6 vii	0230	4782*	SSW	11–16	SSW	4	SW	4	bc	1021·2	15·0	11·1

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
2689 *cont.*	12	20	—	22·03	*35·41*	*24·54*	0·39	5·7	—	9·6	*4·9*	N 70 V	250–100			
		30	—	21·98	*35·43*	*24·57*	0·46	5·7	—	5·9	—	,,	500–250			
		50	—	21·98	*35·46*	*24·59*	0·32	3·5	—	18·7	*5·0*	,,	750–500			
		75	—	21·94	*35·44*	*24·59*	0·37	7·1	—	8·0	—	,,	1000–750			
		100	—	21·68	*35·61*	*24·79*	0·32	10·0	—	8·9	*5·1*	,,	1500–1000	—	2239	
		150	—	19·21	*35·81*	*25·60*	1·83?	5·3	—	7·6	*4·9*	N 100 H	0–1	2350	0010	
		200	—	17·67	*35·79*	*25·97*	0·43	6·3	—	9·2	*2·5*	N 70 B	113–0	2357	0012	KT
		300	—	14·18	*35·41*	*26·49*	0·57	15·7	—	8·3	*5·3*	N 100 B				
		400	—	11·50	*35·07*	*26·75*	0·78	30·0	—	8·8	*5·6*					
		500	—	10·63	*34·94*	*26·82*	1·07	35·6	—	9·8	*3·8*					
		610[2]	611	9·69	*34·78*	*26·85*	1·05	37·2	—	33·4	*4·6*					
		800[2]	798	7·32	*34·51*	*27·01*	1·37	58·5	—	33·8	*4·2*					
		1000[2]	999	4·56	*34·43*	*27·30*	1·78	57·0	—	38·6	*3·3*					
		1200[2]	—	3·86	*34·51*	*27·43*	2·07	93·0	—	40·8	*3·0*					
		1490[2]	1487	3·08	*34·60*	*27·58*	1·97	94·3	—	38·0	*3·1*					
		2490[1]	2490	1·92	*34·72*	*27·77*	1·78	95·7	—	36·6	*3·9*					
		2990[1]	2992	1·60	*34·69*	*27·77*	1·75	87·2	—	38·0	*3·5*					
		3500[1]	—	1·44	*34·69*	*27·78*	1·75	74·3	—	38·0	*3·4*					
2690	13	0	—	21·64	*35·57*	*24·77*	0·32	—	—	5·9	*5·9*	N 70 V	50–0	2000		
		10	—	21·65	*35·57*	*24·77*	0·33	—	—	6·1	—	,,	100–50			
		20	—	21·65	*35·52*	*24·72*	0·37	—	—	7·3	*4·7*	,,	250–100			
		30	—	21·65	*35·52*	*24·72*	0·54	—	—	5·5	—	,,	500–250			
		50	—	21·65	*35·50*	*24·71*	0·32	—	—	11·0	*5·2*	,,	750–500			
		75	—	21·65	*35·53*	*24·74*	0·29	—	—	5·9	—	,,	1000–750			
		100	—	21·22	*35·75*	*25·02*	0·31	—	—	6·1	*5·2*	,,	1500–0	—	2226	Net failed to close
		150	—	18·46	*35·81*	*25·79*	0·37	—	—	5·0	*5·1*	N 100 H	0–1	2340	2355	
		200	—	16·38	*35·71*	*26·22*	0·40	—	—	5·3	*5·2*	N 70 B	134–0	2346	0002	KT
		300	—	13·43	*35·37*	*26·61*	1·00	—	—	5·9	*5·3*	N 100 B				
		400	—	12·04	*35·14*	*26·71*	0·77	—	—	26·2	*5·5*					
		500	—	10·73	*34·90*	*26·77*	0·96	—	—	9·3	*5·6*					
		600[2]	598	9·91	*34·81*	*26·84*	0·87	—	—	8·7	*5·4*					
		800[2]	—	7·91	*34·49*	*26·90*	1·68	—	—	18·2	*4·3*					
		1000[2]	1000	5·03	*34·36*	*27·18*	1·75	—	—	31·8	*4·1*					
		1200[2]	—	4·04	*34·47*	*27·38*	1·83	—	—	34·4	*3·3*					
		1500[2]	1497	3·24	*34·58*	*27·55*	2·55	—	—	30·8	*3·4*					
		1940[1]	1936	2·52	*34·69*	*27·70*	1·97	—	—	32·3	*3·0*					
		2400[1]	2402	2·04	*34·67*	*27·73*	2·04	—	—	—	*2·9*					
		2890[1]	—	1·66	*34·69*	*27·76*	2·38	—	—	29·5	*3·5*					
		3380[1]	3379	1·37	*34·69*	*27·79*	1·72	—	—	30·0	*3·4*					
		4380[1]	4384	1·14	*34·67*	*27·79*	1·43	—	—	31·8	*2·7*					
2691	14	0	—	18·97	*35·91*	*25·74*	0·30	0·0	—	5·0	*5·2*	N 70 V	50–0	2000		
		10	—	18·95	*35·93*	*25·76*	0·25	0·0	—	6·4	—	,,	100–50			
		20	—	18·77	*35·97*	*25·84*	0·23	0·0	—	19·5	*5·2*	,,	250–100			
		30	—	18·67	*36·15*	*26·00*	0·26	0·0	—	5·4	—	,,	250–100	—	—	Repeat haul
		50	—	18·53	*35·90*	*25·84*	0·40	0·0	—	6·2	*5·3*	,,	500–250			
		75	—	18·39	*35·82*	*25·82*	0·37	0·0	—	4·3	—	,,	750–500			
		100	—	17·17	*35·62*	*25·97*	0·35	1·5	—	2·7	*5·4*	,,	750–500	—	—	Repeat haul
		150	—	14·60	*35·46*	*26·43*	0·42	0·0	—	3·1	*5·2*	,,	1000–750	—	2216	
		200	—	13·24	*35·28*	*26·58*	0·53	5·0	—	8·6	*5·5*	N 100 H	0–1	2306	2323	
		300	—	11·95	*35·01*	*26·63*	0·89	7·8	—	5·3	*5·6*	N 70 B	170–0	2317	2338	KT
		400	—	10·99	*34·96*	*26·76*	0·51	15·0	—	5·1	*5·5*	N 100 B				
		520[2]	520	10·17	*34·90*	*26·87*	0·43	14·3	—	5·8	*5·6*					
		620[2]	—	9·55	*34·74*	*26·85*	0·43	17·3	—	7·3	*5·5*					
		830[2]	832	7·39	*34·49*	*26·98*	0·43	30·8	—	16·3	*4·4*					
		950[1]	949	5·60	*34·40*	*27·15*	0·58	39·2	—	13·4	*4·4*					
		1140[1]	—	3·88	*34·27*	*27·24*	0·58	67·1	—	13·6	*3·8*					
		1420[1]	1422	3·40	*34·51*	*27·48*	0·45	66·0	—	13·1	*3·4*					
		1920[1]	1920	2·64	*34·67*	*27·68*	0·35	63·6	—	13·5	*3·5*					
		2420[1]	2416	1·97	*34·69*	*27·74*	0·97	63·0	—	14·7	*3·8*					
2692	20	—	—	—	—	—	—	—	—	—	—	XSR	—	—	—	Zone −8 hrs
2693	20	—	—	—	—	—	—	—	—	—	—	XSR				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
		1950												
2694	31° 53′ S, 114° 50′ E	6 vii	1030 1100	957* 893*	SSW	17–21	SSW	4–5	SW	4	bc	1022·9	17·8	13·3
2695	31° 53′ S, 115° 10′ E	6 vii	1240	362*	SSW	11–16	SW	4	SW	4	bcpr	1021·5	17·8	13·3
2696	32° 01·2′ S, 115° 17·5′ E	16 viii	1500	152*	ESE	11–16	SE'ly	3	SW'ly	2	B	1020·7	20·6	16·1
2697	32° 13′ S, 113° 44′ E	17 viii	0010	4512*	SSE	17–21	SE	4	SE	5	bc	1022·0	18·3	15·6
2698	35° 49′ S, 104° 48′ E	20 viii	0600	6302*	WSW	11–16	WSW	3	SW	4	bc	1020·5	13·9	11·1
2699	40° 48′ S, 94° 07′ E	25 viii	1500	3398*	WNW	22–27	WNW	5	WNW	7	bc	1005·1	10·0	8·9

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
2694	20	—	—	—	—	—	—	—	—	—	—	DC	957–893	1101	1106	
2695	20	—	—	—	—	—	—	—	—	—	—	DC	362	1301	1310	
2696	3	0	—	20·89	35·37	24·83	0·22	—	—	7·1	5·0	N 50 V	100–0	1505		
		10	—	20·88	35·34	24·80	0·29	—	—	6·4	5·7	N 70 V	50–0			
		20	—	20·83	35·30	24·79	0·26	—	—	7·4	4·9	,,	100–50	—	1526	
		30	—	20·83	35·30	24·79	0·31	—	—	7·4	4·9	N 70 B	} 57–0	1547	1557	KT
		50	—	20·33	35·35	24·96	0·34	—	—	7·8	4·9	N 100 B				
		75	—	19·99	35·37	25·07	0·30	—	—	7·1	5·0					
		100	—	19·88	35·37	25·10	0·32	—	—	6·5	4·8					
		145	—	19·67	35·37	25·15	0·30	—	—	6·1	5·0					
2697	3	0	—	20·03	35·41	25·09	0·38	1·2	—	6·2	2·8	N 50 V	100–0	0032		
		10	—	20·01	35·37	25·06	0·42	1·2	—	7·7	—	N 70 V	50–0			
		20	—	20·01	35·37	25·06	0·39	0·0	—	16·3?	2·4	,,	100–50			
		30	—	19·95	35·41	25·11	0·42	0·0	—	5·9	—	,,	250–100			
		50	—	19·48	35·41	25·23	0·49	1·2	—	6·0	2·4	,,	500–250			
		75	—	19·13	35·62	25·48	0·45	1·2	—	5·4	—	,,	750–500			
		100	—	18·55	35·73	25·72	0·67	1·2	—	5·5	3·7	,,	1000–750			
		150	—	17·89	35·81	25·94	0·65	6·0	—	4·6	4·8	,,	1500–0	—	0337	Net failed to close
		200	—	16·17	35·62	26·20	0·68	1·2	—	6·8	5·0	N 70 B	} 62–0	0353	0402	KT
		300	—	12·04	35·08	26·66	0·96	11·3	—	5·4	2·7	N 100 B				
		400	—	10·28	34·90	26·85	1·16	39·0	—	5·6	5·5					
		470[2]	472	9·37	34·65	26·80	1·53	40·5	—	6·6	5·2					
		590[2]	586	8·87	34·61	26·86	1·53	40·0	—	8·4	5·1					
		770[2]	774	7·30	34·47	26·98	1·61	54·0	—	23·9	4·5					
		970[2]	—	4·55	34·36	27·24	1·87	49·6	—	43·8	3·9					
		1160[2]	1163	3·55	34·42	27·38	1·99	53·5	—	72·6	3·4					
		1410[1]	1405	3·06	34·49	27·49	2·10	57·5	—	89·8	3·3					
		1900[1]	—	2·39	34·65	27·68	2·06	52·0	—	130	3·4					
		2390[1]	2387	2·02	34·67	27·73	2·06	53·0	—	135	3·5					
		2880[1]	2884	1·68	34·67	27·75	1·98	55·0	—	153	3·5					
		3870[1]	3871	1·24	34·67	27·79	1·92	56·2	—	163	3·9					
2698	6	0	—	14·02	35·55	26·63	0·62	2·5	—	2·6	5·6	N 100 B	} 124–0	0604	0617	KT. Zone −7 hrs
		10	—	14·02	35·55	26·63	0·67	1·5	—	3·0	—	N 100 BS				
		20	—	14·02	35·53	26·62	0·67	1·3	—	3·0	5·6	N 50 V	100–0	0644		
		30	—	14·02	35·57	26·64	0·65	1·5	—	3·0	—	N 70 V	50–0			
		50	—	14·02	35·52	26·60	0·79	1·5	—	4·1	5·6	,,	100–50			
		75	—	14·02	35·55	26·63	0·81	0·5	—	4·1	—	,,	250–100			
		100	—	14·02	35·57	26·64	0·81	0·8	—	3·0	5·6	,,	500–250			
		150	—	13·93	35·50	26·60	0·81	2·2	—	3·0	5·7	,,	750–500			
		200	—	13·88	35·50	26·62	0·74	2·6	—	3·0	5·6	,,	1000–?750			
		300	—	12·56	35·25	26·68	0·90	8·0	—	3·6	5·6	,,	1000–0	—	0933	Net failed to close
		400	—	10·96	34·96	26·77	1·15	12·2	—	6·1	5·6					
		500[3]	—	10·03	34·81	26·82	1·23	19·0	—	3·2	5·6					
		600[3]	598	9·46	34·72	26·84	1·35	20·6	—	6·4	5·3					
		800[3]	800	8·50	34·58	26·89	1·38	24·0	—	8·1	4·9					
		980[2]	975	6·29	34·40	27·06	1·89	38·0	—	20·9	4·3					
		1170[2]	—	4·20	34·34	27·27	2·06	67·0	—	44·3	4·0					
		1460[2]	1464	3·30	34·51	27·49	2·36	59·5	—	69·3	3·3					
		1960[2]	—	2·59	34·72	27·72	1·92	57·5	—	75·7	3·8					
		2460[2]	2458	2·20	34·70	27·74	2·20	67·0	—	109	3·5					
		2940[1]	2935	1·88	34·70	27·77	2·20	62·6	—	114	3·3					
		3900[1]	3900	1·27	34·70	27·81	2·03	63·5	—	124	3·8					
		4880[1]	—	0·98	34·67	27·80	1·99	68·4	—	135	3·9					
		5860[1]	5858	1·12	34·67	27·79	2·08	60·0	—	137	3·8					
2699	11	0	—	10·48	34·74	26·69	0·86	—	—	7·7	5·2	N 70 V	50–0	1542		
		20	—	10·63	34·76	26·67	0·97	—	—	8·4	—	,,	100–50			
		50	—	10·62	34·74	26·66	1·09	—	—	6·9	5·7	,,	250–100	—	1640	
		75	—	10·62	34·74	26·66	1·19	—	—	5·1	—					
		100	—	10·68	34·74	26·65	0·99	—	—	6·4	5·9					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2699 *cont.*	40° 48′ S, 94° 07′ E	1950 25 viii												
2700	40° 54′ S, 93° 59′ E	25 viii	2050	3392*	WNW	22–27	WNW	5	NW	7	bc	1000·7	10·0	8·3
2701	43° 32·5′ S, 94° 19′ E	26 viii	1610	3162*	WNW	22–33	WNW	5	WNW	6	bch	986·5	3·3	1·7
2702	46° 02′ S, 94° 24′ E	27 viii	1610	3264*	WNW	7–10	WNW	2	WNW	5	bc	970·2	1·7	−0·6
2703	49° 52′ S, 94° 46′ E	29 viii	1600	3727*	W	17–21	W	3	W'ly	4	o	998·2	1·1	0·0
2704	57° 54′ S, 98° 24′ E	1 ix	1400	4605*	ENE	17–27	—	—	ENE	4	OSq	960·6	−0·6	−0·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2699 *cont.*	11	150	—	10·57	34·72	26·65	1·02	—	—	9·2	5·7					
		200	—	10·46	34·70	26·66	0·83	—	—	20·4	5·8					
		300	—	10·35	34·70	26·68	0·98	—	—	9·2	5·8					
		400[1]	404	10·33	34·72	26·69	0·93	—	—	49·0	5·8					
		450[1]	—	10·37	34·81	26·76	0·84	—	—	26·5	5·7					
2700	11	0	—	10·71	34·69	26·60	—	—	—	—	—	N 100 B	84–0	2110	2128	KT
2701	12	0	—	7·12	34·18	26·78	1·13	25·6	—	6·1	6·2	N 50 V	100–0	1642		
		50	—	7·25	34·18	26·76	1·18	23·6	—	12·2	6·5	N 70 V	50–0			
		100	—	7·27	34·18	26·76	1·24	22·1	—	12·2	6·4	,,	100–50			
		150	—	7·26	34·18	26·76	1·18	19·7	—	9·2	6·7	,,	250–100			
		200	—	7·27	34·14	26·73	1·18	21·6	—	11·2	6·1	,,	500–250	—	2023	
		300	—	7·16	34·13	26·73	1·13	21·0	—	10·2	4·2	N 100 B	146–0	2040	2115	KT
		400	—	6·23	34·07	26·81	1·43	56·8	—	14·3	5·3					
		460[1]	463	6·01	34·07	26·84	1·23	45·5	—	18·9	4·4					
		630[2]	631	4·57	34·07	27·01	1·60	46·6	—	27·1	4·7					
		830[2]	—	3·24	34·07	27·15	1·60	55·6	—	39·3	5·4					
		960[1]	—	3·14	34·13	27·20	1·60	49·7	—	46·9	3·5					
		1460[1]	1456	2·51	34·36	27·44	1·53	49·7	—	56·2	3·1					
2702	14	0	—	6·26	34·13	26·85	1·61	42·0	—	4·6	6·1	N 50 V	100–0	1626		
		10	—	6·26	34·11	26·84	1·56	34·5	—	4·6	—	N 70 V	50–0			
		20	—	6·26	34·04	26·78	1·82	35·6	—	5·8	6·3	,,	100–50			
		30	—	6·25	34·04	26·78	1·59	29·8	—	5·0	—	,,	250–100			
		50	—	6·26	34·05	26·79	1·94	18·4	—	7·9	6·2	,,	500–250			
		75	—	6·26	34·04	26·78	1·64	23·4	—	4·6	—	,,	750–500			
		100	—	6·26	34·04	26·78	1·73	22·1	—	4·2	4·1	,,	1000–750			
		150	—	6·25	34·04	26·78	1·55	23·4	—	4·6	6·1	,,	1500–1000	—	2022	
		200	—	6·26	34·07	26·81	1·80	20·2	—	4·6	6·3	N 70 B	100–0	2042	2059	KT
		300	—	6·24	34·05	26·79	1·94	24·6	—	5·4	6·4	N 100 B				
		400	—	5·73	34·11	26·90	2·06	32·5	—	10·4	4·9					
		500[2]	—	4·71	34·09	27·01	2·03	21·0	—	13·8	4·8					
		600[2]	—	4·10	34·05	27·04	2·17	43·3	—	17·1	4·9					
		800[2]	797	3·14	34·13	27·20	2·47	43·3	—	32·0	4·5					
		1000[2]	—	2·79	34·22	27·30	2·36	47·3	—	37·5	3·9					
		1200[2]	1201	2·54	34·33	27·41	2·43	53·2	—	42·5	3·7					
		1500[1]	1504	2·43	34·43	27·51	2·06	44·9	—	46·5	3·5					
		1990[1]	1991	2·20	34·56	27·62	1·85	48·2	—	50·0	4·1					
		2490[1]	—	1·73	34·56	27·66	1·99	44·9	—	57·4	4·2					
		2990[1]	2990	1·25	34·56	27·69	2·12	45·7	—	68·3	4·3					
2703	16	0	—	2·91	33·80	26·96	1·51	45·0	0·20	6·4	6·6	N 50 V	100–0	1615		
		10	—	2·88	33·77	26·93	1·49	52·5	0·26	6·1	—	N 70 V	50–0			
		20	—	2·96	33·75	26·92	1·66	50·6	0·26	6·1	6·4	,,	100–50			
		30	—	2·96	33·77	26·93	1·77	35·0	0·26	6·1	—	,,	250–100			
		50	—	2·96	33·75	26·92	1·96	37·2	0·37	6·1	3·5	,,	500–250			
		75	—	3·01	33·75	26·91	1·96	39·3	0·20	6·1	—	,,	750–500			
		100	—	2·96	33·75	26·92	1·96	42·5	0·20	7·9	6·3	,,	1000–750			
		150	—	2·96	33·75	26·92	1·96	42·5	0·31	6·4	6·2	,,	1500–1000	—	2019	
		200	—	2·96	33·78	26·94	2·00	32·3	0·26	6·9	5·4	N 70 B	110–0	2057	2115	KT
		300	—	2·63	33·80	26·98	1·87	38·2	0·14	10·6	6·1	N 100 B				
		400	—	2·68	33·95	27·10	2·06	46·2	0·06	16·9	5·2					
		500	—	2·59	34·07	27·20	2·29	48·7	0·03	21·7	4·9					
		610[2]	609	2·64	34·13	27·24	2·01	59·3	0·00	28·5	4·0					
		790[2]	793	2·42	34·20	27·32	2·29	46·1	0·00	37·6	3·7					
		990[2]	—	2·30	34·36	27·46	2·06	53·1	0·00	38·1	3·8					
		1480[1]	1478	2·15	34·52	27·60	2·00	55·6	0·00	40·7	3·9					
		1800[1]	1796	1·98	34·49	27·58	1·82	56·7	0·00	45·0	4·1					
		1930[1]	1927	1·85	34·52	27·62	1·59	56·7	0·00	45·4	3·2					
2704	19	0	—	−1·68	34·00	27·38	2·34	42·0	0·32	24·2	7·5	N 50 V	100–0	1504	—	In pancake ice
		50	—	−1·61	34·04	27·41	2·29	45·3	0·32	22·5	7·6	N 70 V	50–0			
		75	—	−1·58	34·04	27·41	2·15	42·0	0·21	23·3	—	,,	100–50			
		100	—	−1·60	34·04	27·41	2·38	47·6	0·32	23·3	7·5	,,	250–100			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2704 *cont.*	57° 54′ S, 98° 24′ E	1950 1 ix												
2705	41° 01′ S, 139° 09′ E	10 ix	2000	5240*	W	4–6	W'ly	2	W'ly	4	b	1025·1	10·0	7·8
2706	37° 06′ S, 150° 10′ E	5 x	1300	86*	S	17–21	S	5	Conf.	4	bc	1013·4	15·6	12·8
2707	37° 06·5′ S, 150° 17′ E	5 x	1505	106*	S	17–21	S	4	Conf.	—	bc	1013·1	15·6	12·8
2708	37° 06′ S, 150° 24′ E	5 x	1642	342*	S	11–16	S	3	S'ly	3	c	1013·4	15·6	12·8
2709	37° 06′ S, 150° 35′ E	5 x	1900	3690*	SE	7–10	SE	2	SE	3	co	1015·2	15·6	13·3
2710	37° 06′ S, 150° 48′ E	5–6 x	2210	4241*	SE	7–10	S	2	SE	2	c	1013·1	15·6	13·9

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2704 *cont.*	19	150	—	0·67	*34·38*	*27·59*	2·66	40·7	0·12	35·8	*5·2*	N 70 V	500–250	—	—	Considerable stray
		200	—	1·22	*34·52*	*27·67*	2·57	42·0	0·12	38·4	*4·5*	,,	750–500	—	—	on wires at these
		300	—	1·39	*34·56*	*27·68*	2·38	49·0	0·03	41·6	*4·8*	,,	1000–750	—	—	depths [noted
		330	—	1·52	*34·70*	*27·80*	2·52	46·7	0·09	43·4	*3·4*	,,	1500–?	—	**2003**	Closing depth not
		390[2]	394	1·69	*34·67*	*27·75*	2·44	42·0	0·06	45·8	*3·4*	N 100 B	100–0	**2045**	**2105**	Depth estimated
		550[2]	552	1·74	*34·67*	*27·75*	2·48	49·0	0·00	46·7	*3·8*	N 100 B	250–150		**2119**	KT
		720[2]	—	1·66	*34·69*	*27·76*	2·34	46·7	0·00	46·7	*4·0*					
		890[2]	887	1·59	*34·69*	*27·77*	2·20	52·4	0·00	48·3	*3·9*					
		1340[1]	—	1·75	*34·70*	*27·78*	2·10	57·6	0·06	44·2	*3·6*					
		1780[1]	1779	0·86	*34·65*	*27·79*	2·48	58·2	0·00	54·2	*3·7*					
2705	27	—	—	—	—	—	—	—	—	—	—	TYFB	500–0	**2127**	**2206**	Depth estimated
												XSR	—	**2215**		
												,,	—	—	**2245**	
2706	23	0	—	16·46	35·30	25·89	0·13	0·6	—	3·0	5·39	N 70 B†	49–0	1420	1430	KT
		25	—	16·21	35·43	26·04	0·13	0·0	—	2·8	5·69	N 100 B†				
		50	—	13·71	35·30	26·50	0·23	3·9	—	2·9	5·17					
		75	—	13·51	35·41	26·63	0·32	2·5	—	3·3	5·42					
2707	23	0	—	17·01	35·35	25·80	0·16	0·0	—	3·7	4·52	N 70 B†	58–0	1645	1655	KT
		25	—	16·93	35·37	25·84	0·23	0·4	—	3·7	5·20	N 100 B†				
		50	—	15·37	35·46	26·26	0·61	10·9?	—	5·5	4·55					
		75	—	13·32	35·41	26·67	0·29	1·4	—	5·5	5·43					
		100	—	13·16	35·39	26·68	0·42	2·8	—	7·1	5·39					
2708	23	0	—	17·12	35·30	25·74	0·29	0·0	—	4·9	5·24	N 70 B†	93–01	1739	1755	KT
		25	—	17·03	35·32	25·77	0·29	0·0	—	4·6	5·32	N 100 B†				
		50	—	14·23	35·28	26·37	0·55	5·6	—	5·3	4·92					
		75	—	13·20	35·34	26·63	0·52	8·2	—	10·0	5·21					
		100	—	13·10	35·30	26·62	0·48	7·9	—	4·3	5·38					
		150	—	12·86	35·34	26·70	0·48	6·9	—	16·6?	5·37					
		200	—	12·54	35·34	26·76	0·42	5·8	—	4·9	5·34					
		300	—	12·56	35·44	26·84	0·42	3·0	—	4·6	4·90					
2709	23	0	—	16·18	35·43	26·05	0·42	1·1	—	1·6	5·19	N 70 B†	110–0	**2048**	**2103**	KT
		25	—	15·71	35·41	26·15	0·32	0·6	—	2·4	5·58	N 100 B†				
		50	—	14·32	35·32	26·38	0·32	2·3	—	6·4	5·55					
		75	—	13·63	35·35	26·55	0·55	6·5	—	1·8	5·20					
		100	—	13·49	35·23	26·49	0·52	6·3	—	3·6	5·36					
		150	—	12·92	35·26	26·63	0·71	7·5	—	7·5	5·07					
		200	—	12·30	35·21	26·72	0·77	8·6	—	6·1	4·97					
		300	—	10·66	34·87	26·75	1·06	15·1	—	6·7	4·74					
		400	—	9·55	34·65	26·77	1·13	16·9	—	7·2	4·93					
		570[1]	573	8·35	—	—	—	12·6	—	7·6	4·02					
		770[1]	—	6·80	34·36	26·96	1·61	24·4	—	11·0	3·67					
		970[1]	972	5·49	34·40	27·16	1·84	29·2	—	16·3	3·66					
		1470[1]	—	3·07	34·60	27·58	2·06	33·0	—	35·6	2·86					
		1960[1]	1962	2·40	34·72	27·74	2·03	32·0	—	36·1	3·25					
2710	23	0	—	15·32	35·41	26·24	0·39	0·2	—	—	5·86	N 70 B†	84–0	**0013**	**0027**	KT
		25	—	15·32	35·25	26·11	0·23	0·4	—	—	4·85	N 100 B†				
		50	—	14·36	35·26	26·33	0·29	0·7	—	—	5·93					
		75	—	13·39	—	—	—	—	—	—	4·79					
		100	—	13·44	35·34	26·58	0·52	3·6	—	—	5·62					
		150	—	12·95	35·23	26·60	0·48	5·0	—	—	5·55					
		200	—	12·25	35·08	26·62	0·68	9·2	—	—	5·17					
		300	—	10·51	34·88	26·79	0·94	6·5	—	—	5·12					
		400	—	9·35	34·74	26·88	1·19	18·8	—	—	4·82					
		590[1]	591	7·86	34·65	27·04	1·39	21·9	—	—	4·30					
		800[1]	—	6·44	34·45	27·08	1·58	26·0	—	—	4·09					
		1000[1]	997	5·00	34·49	27·29	1·87	30·0	—	—	3·72					
		1500[1]	—	3·03	34·54	27·54	2·00	30·8	—	—	3·36					
		2000[1]	2000	2·34	34·63	27·67	2·06	31·4	—	—	3·25					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2711	37° 06′ S, 151° 13′ E	1950 6 x	0235	4738*	SE	4–6	SE	2	SE	3	oc	1012·8	15·6	13·9
2712	37° 07′ S, 151° 33′ E	6 x	0700	4799*	E	7–10	—	0–1	SE	3	bc	1014·7	16·7	15·0
2713	37° 09′ S, 151° 55′ E	6 x	1100	4850*	E'ly	7–10	—	0–1	SE	3	bc	1012·1	17·8	15·0
2714	37° 10′ S, 153° 04′ E	6 x	2000	4768*	NE	7–10	NE	2	NE	3–4	og	1012·2	18·3	17·8
2715	37° 14′ S, 154° 05′ E	7 x	0400	4548*	N	7–10	N	3	N'ly	4	bcp	1009·2	18·3	16·7

Station	Age of moon (days)	Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	Time From	Time To	Remarks
		HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS				
2711	24	0	—	18·09	35·41	25·58	0·16	0·0	—	7·4	4·85	N 70 B†	146–0	0429	0449	KT
		25	—	17·33	35·39	25·75	0·16	0·0	—	6·6	—	N 100 B†				
		50	—	15·25	35·30	26·17	0·32	0·3	—	9·1	5·07					
		75	—	15·02	35·37	26·27	0·52	3·1	—	13·2	5·62					
		100	—	14·39	35·37	26·41	0·26	0·5	—	11·6	5·28					
		150	—	13·45	35·30	26·55	0·65	4·8	—	13·2	5·10					
		200	—	12·10	35·12	26·68	0·52	5·6	—	11·6	5·37					
		300	—	11·46	34·96	26·67	0·84	7·6	—	10·7	3·96					
		400	—	9·99	—	—	1·00	13·6	—	12·4	5·03					
		540[1]	544	8·47	34·63	26·93	1·42	17·7	—	19·8	4·67					
		740[1]	—	7·04	34·58	27·11	1·39	17·9	—	29·7	4·17					
		930[1]	928	5·62	34·51	27·23	1·74	28·4	—	39·6	3·61					
		1400[1]	—	3·36	34·56	27·52	2·03	27·6	—	90·8	3·23					
		1870[1]	1871	2·41	34·69	27·70	2·00	27·3	—	97·6	3·05					
2712	24	0	—	18·03	35·34	25·54	0·23	0·3	—	4·1	5·36	N 70 B†	110–0	0839	0854	KT
		25	—	18·03	35·43	25·61	0·23	0·0	—	5·0	4·88	N 100 B†				
		50	—	16·93	35·26	25·75	0·35	1·6	—	5·0	4·67					
		75	—	16·05	35·41	26·07	0·61	6·6	—	6·6	4·47					
		100	—	14·94	35·43	26·33	0·39	1·7	—	7·3	5·25					
		150	—	13·81	35·35	26·52	0·52	2·1	—	8·3	—					
		200	—	13·20	35·25	26·56	0·48	2·9	—	12·4	5·57					
		300	—	11·39	34·96	26·69	0·74	8·1	—	9·1	5·22					
		400	—	10·09	34·92	26·89	0·97	15·4	—	9·1	5·02					
		580[1]	583	8·20	34·43	26·82	1·23	26·8	—	14·9	4·26					
		770[1]	—	6·85	34·58	27·13	1·61	30·3	—	28·1	3·74					
		960[1]	961	5·39	34·49	27·24	1·64	38·0	—	39·6	3·10					
		1460[1]	—	3·15	34·60	27·57	2·16	43·6	—	94·2	3·43					
		1950[1]	1950	2·34	34·72	27·74	2·13	40·3	—	104	3·19					
2713	24	0	—	16·98	35·37	25·83	0·32	0·3	—	6·7	5·17	N 70 B†	154–0	1321	1337	KT
		25	—	15·52	35·41	26·19	0·26	0·1	—	7·9	5·95	N 100 B†				
		50	—	14·87	35·30	26·25	0·29	0·2	—	16·8	5·39					
		75	—	13·61	35·25	26·47	0·61	9·6	—	50·5?	4·78					
		100	—	13·13	35·25	26·57	0·87	19·9	—	11·7	4·57					
		150	—	12·83	35·19	26·59	0·55	8·2	—	3·4	5·62					
		200	—	12·54	35·26	26·71	0·52	8·3	—	7·6	5·65					
		300	—	11·30	35·03	26·76	0·74	16·1	—	5·9	5·40					
		400	—	9·82	34·85	26·88	1·13	24·6	—	8·4	5·04					
		580[1]	578	8·22	34·52	26·88	1·32	32·6	—	26·0	4·57					
		770[1]	—	6·79	34·51	27·08	1·71	39·2	—	22·7	4·16					
		950[1]	954	5·54	34·54	27·27	1·94	40·7	—	36·9	3·91					
		1440[1]	—	3·30	34·58	27·55	2·16	45·6	—	94·2	3·63					
		1930[1]	1931	2·37	34·63	27·67	2·16	45·6	—	102	3·74					
2714	24	0	—	17·15	35·39	25·79	0·10	0·8	—	18·5	5·66	N 70 B†	110–0	2132	2148	KT. ⅓ catch N 100 B retained
		25	—	16·10	35·43	26·07	0·13	0·6	—	3·9	5·80	N 100 B†				
		50	—	14·84	35·37	26·31	0·42	3·6	—	16·8	5·35					
		75	—	14·43	35·37	26·40	0·35	3·1	—	2·5	5·74					
		100	—	13·29	35·35	26·62	0·45	7·3	—	6·2	4·77					
		150	—	12·30	35·14	26·66	0·77	11·5	—	9·3	4·76					
		200	—	11·81	35·08	26·70	0·87	19·7	—	10·1	4·90					
		300	—	10·17	34·88	26·85	1·16	22·9	—	8·9	4·21					
		400	—	9·07	34·69	26·88	1·29	29·5	—	10·6	4·71					
		570[1]	569	7·81	34·63	27·03	1·61	36·0	—	15·1	4·27					
		770[1]	—	6·26	34·52	27·16	1·74	42·9	—	28·6	4·07					
		960[1]	962	5·01	34·61	27·39	1·94	46·4	—	42·8	3·83					
		1450[1]	—	3·12	34·52	27·51	2·10	51·6	—	100	3·52					
		1930[1]	1926	2·40	34·65	27·68	2·06	49·7	—	119	3·43					
2715	24	0	—	16·20	35·39	26·02	0·29	0·3	—	10·0	5·68	N 50 V	100–0	0400		
		25	—	16·11	35·43	26·07	0·35	0·0	—	3·3	5·77	N 70 V	50–0			
		50	—	16·03	35·43	26·09	0·35	0·0	—	2·5	5·76	,,	100–50			
		75	—	15·73	35·46	26·18	0·42	1·0	—	2·8	5·59	,,	250–100			
		100	—	15·44	35·44	26·23	0·42	4·2	—	3·0	5·44	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
2715 *cont.*	37° 14′ S, 154° 05′ E	1950 7 x												
2716	34° 09′ S, 155° 18′ E	8 x	0700	4960*	WNW	11–16	NW	3	NW	2	o	1014·0	18·9	17·8
2717	34° 02′ S, 154° 16′ E	8 x	1630	4971*	SW	11–16	SW	3	SW	3	bc	1017·6	17·8	15·0
2718	33° 55′ S, 153° 02′ E	9 x	0030	4883*	SSE	7–10	SSE	2	SE	3	bc	1023·6	17·8	14·4
2719	33° 52′ S, 152° 38′ E	9 x	0500	4777*	SSE	7–10	SE	2	SE	2	bc	1025·2	18·9	15·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
2715 *cont.*	24	150	—	14·44	35·34	26·37	0·61	8·5	—	5·8	4·53	**N 70 V**	750–500			
		200	—	13·52	35·28	26·52	0·65	7·7	—	0·0	4·91	,,	1000–750			
		300	—	11·84	35·08	26·70	0·81	16·3	—	1·7	4·54	,,	1500–1000	—	0649	
		400	—	10·41	34·88	26·81	1·00	22·1	—	3·3	4·37	**N 70 B**	97–0	0707	0727	KT
		590[1]	585	8·33	34·74	27·04	1·55	28·4	—	8·0	4·55	**N 100 B**				
		790[1]	—	6·79	34·58	27·14	1·71	21·4	—	18·0	4·25					
		980[1]	982	5·50	34·49	27·23	1·97	23·9	—	35·0	3·86					
		1480[1]	—	3·17	34·60	27·57	2·16	28·1	—	98·0	3·20					
		1980[1]	1981	2·34	34·69	27·71	2·06	27·6	—	98·0	3·49					
		2470[2]	2467	1·97	34·67	27·73	1·61	—	—	103	3·65					
		3470[2]	3473	1·28	34·67	27·78	1·35	—	—	122	4·00					
		4450[2]	4448	1·13	34·67	27·79	1·58	—	—	135	3·92					
2716	25	0	—	19·85	35·48	25·18	0·29	0·0	—	5·9	5·15	**N 70 B†**	146–0	0902	0916	KT
		25	—	19·81	35·53	25·24	0·19	0·1	—	16·0	5·23	**N 100 B†**				
		50	—	18·92	35·50	25·44	0·26	2·7	—	8·4	3·81					
		75	—	18·18	35·53	25·66	0·19	1·7	—	6·7	4·65					
		100	—	17·16	35·61	25·96	0·55	4·7	—	3·4	3·39					
		150	—	15·39	35·39	26·20	0·61	9·0	—	14·6	4·08					
		200	—	14·40	35·35	26·39	0·68	9·7	—	5·0	4·32					
		300	—	12·06	35·05	26·63	1·00	13·4	—	21·0	3·99					
		400	—	10·98	34·99	26·79	0·97	13·8	—	7·9	4·13					
		580[2]	579	8·69	34·67	26·93	1·26	14·6	—	17·7	4·10					
		760[1]	—	7·06	34·63	27·14	1·52	18·8	—	28·6	3·55					
		940[1]	941	5·42	34·58	27·32	1·61	24·3	—	69·0	3·41					
		1430[1]	—	3·16	34·63	27·60	2·03	26·0	—	94·0	3·23					
		1910[1]	1907	2·30	34·70	27·73	2·03	25·1	—	104	3·13					
2717	26	0	—	18·95	35·52	25·44	0·23	0·4	—	5·0	5·40	**N 70 B†**	77–0	**1829**	**1850**	KT. Part of catch **N 100 B** retained
		25	—	18·44	35·55	25·60	0·16	0·0	—	20·2?	5·25	**N 100 B†**				
		50	—	18·41	35·52	25·58	0·13	0·0	—	5·9	5·38	**NH**	0			
		75	—	18·19	35·59	25·69	0·19	0·0	—	5·0	5·70					
		100	—	17·77	35·57	25·78	0·39	1·8	—	6·7	4·40					
		150	—	16·82	35·46	25·93	0·55	4·1	—	5·0	4·23					
		200	—	14·75	35·34	26·31	0·68	7·1	—	30·3?	4·03					
		300	—	12·44	35·19	26·67	0·84	8·6	—	7·6	4·31					
		400	—	11·73	35·14	26·77	0·81	9·9	—	8·4	4·25					
		510[1]	513	9·31	34·79	26·93	1·29	15·7	—	15·2	3·78					
		680[1]	—	7·40	34·54	27·02	1·68	21·4	—	23·5	3·44					
		840[1]	838	6·32	34·47	27·11	1·77	22·1	—	30·3	3·60					
		1310[1]	—	3·67	34·63	27·55	2·35	24·9	—	86·0	3·02					
		1780[1]	1783	2·50	34·58	27·62	2·19	26·0	—	101	2·92					
2718	27	0	—	19·98	35·53	25·19	0·19	0·3	—	5·0	4·67	**N 70 B†**	117–0	**0223**	**0235**	KT
		25	—	19·98	35·53	25·19	0·23	0·1	—	18·5	5·22	**N 100 H†**				
		50	—	19·98	35·55	25·20	0·23	0·0	—	32·9	5·28					
		75	—	19·69	35·59	25·31	0·16	0·0	—	81·6	5·02					
		100	—	19·17	35·52	25·38	0·16	0·3	—	61·4	5·15					
		150	—	18·86	35·64	25·56	0·23	0·6	—	8·4	5·16					
		200	—	18·43	35·55	25·60	0·32	1·7	—	10·9	4·86					
		300	—	17·09	35·52	25·90	0·52	4·1	—	6·7	4·27					
		400	—	15·47	35·39	26·18	0·87	6·6	—	7·2	4·17					
		580[1]	580	10·79	34·90	26·76	1·06	13·2	—	14·3	3·84					
		790[1]	—	8·12	34·52	26·90	1·39	14·9	—	20·1	3·69					
		990[1]	985	6·39	34·51	27·13	1·71	19·4	—	32·8	3·84					
		1470[1]	—	3·50	34·56	27·51	2·10	30·1	—	90·0	3·28					
		1940[1]	1943	2·44	34·69	27·70	2·13	30·1	—	107	3·21					
2719	27	0	—	20·82	35·48	24·92	0·13	0·2	—	6·4	5·14	**N 70 B†**	90–0	0634	0653	KT
		25	—	20·83	35·50	24·94	0·13	0·1	—	13·5	5·31	**N 100 B†**				
		50	—	20·13	35·53	25·15	0·16	0·1	—	16·4	5·63					
		75	—	19·74	35·55	25·27	0·19	0·1	—	15·0	5·08					
		100	—	19·25	35·57	25·41	0·26	0·1	—	13·5	4·57					
		150	—	18·35	35·59	25·65	0·23	0·7	—	1·7	5·43					
		200	—	18·09	35·64	25·75	0·39	0·9	—	5·0	5·21					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
		1950												
2719 *cont.*	33° 52′ S, 152° 38′ E	9 x												
2720	34° 02′ S, 152° 27′ E	9 x	0820	4380*	SSE	7–10	SE	3	SE	2	bc	1025·6	18·9	15·6
2721	34° 05′ S, 152° 03′ E	9 x	1200	2193*	SE	7–10	SE	2	SE	2	bc	1025·6	18·3	15·0
2722	34° 04′ S, 151° 50′ E	9 x	1425	1282*	E	4–6	E	2	—	—	bc	1026·9	19·4	14·4
2723	34° 08′ S, 151° 33′ E	9 x	1645	289*	SE	7–10	SE	2	SE	2	b	1026·9	18·9	15·6
2724	34° 05′ S, 151° 29′ E	9 x	1900	150*	SE	4–6	SE	2	—	—	b	1028·1	18·3	15·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermo-meter	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
2719	27	300	—	16·48	35·46	26·01	0·55	4·4	—	8·4	4·54					
cont.		400	—	14·16	35·32	26·41	0·52	5·8	—	1·7	5·43					
		560[1]	564	10·77	34·90	26·76	1·00	13·0	—	26·9	4·53					
		740[1]	—	8·07	34·56	26·94	1·19	14·1	—	42·0	4·23					
		920[1]	916	6·56	34·52	27·12	1·52	19·9	—	33·6	3·85					
		1390[1]	—	3·80	34·51	27·44	1·97	25·4	—	99·0	3·41					
		1850[1]	1846	2·56	34·63	27·65	2·10	25·4	—	141	3·23					
2720	27	0	—	19·91	35·55	25·22	0·06	0·3	—	—	5·05	N 70 B†	90–0	0954	1010	KT
		25	—	19·83	35·52	25·21	0·03	0·2	—	—	4·97	N 100 B†				
		50	—	19·78	35·48	25·20	0·06	0·2	—	—	5·56					
		75	—	19·64	35·59	25·32	0·13	0·2	—	—	5·72					
		100	—	19·53	35·61	25·37	0·26	0·4	—	—	4·91					
		150	—	18·92	35·64	25·54	0·19	1·8	—	—	4·79					
		200	—	18·25	35·59	25·68	0·10	1·0	—	—	5·18					
		300	—	16·11	35·46	26·09	0·61	9·3	—	—	4·29					
		400	—	13·23	35·28	26·58	0·81	10·8	—	—	4·68					
		590[1]	586	10·46	34·94	26·85	1·06	19·2	—	—	4·29					
		760[2]	—	8·44	34·69	26·98	1·29	24·3	—	—	4·58					
		930[2]	925	6·68	34·56	27·13	1·58	30·0	—	—	4·01					
		1390[2]	—	3·80	34·56	27·48	2·19	35·0	—	—	3·58					
		1850[2]	1854	2·57	34·61	27·64	2·29	35·9	—	—	3·37					
2721	27	0	—	21·15	35·46	24·82	0·23	0·3	—	5·4	4·13	N 70 B†	99–0	1300	1321	KT
		25	—	21·08	35·52	24·88	0·23	0·0	—	2·5	5·26	N 100 B†				
		50	—	21·03	35·50	24·88	0·23	0·0	—	0·8	5·07					
		75	—	20·09	35·55	25·17	0·29	0·0	—	9·2	5·51					
		100	—	19·75	35·59	25·29	0·29	0·4	—	9·2	5·08					
		150	—	18·70	35·64	25·60	0·26	2·6	—	10·1	4·73					
		200	—	17·56	35·53	25·81	0·52	3·4	—	35·2	4·16					
		300	—	15·28	35·35	26·20	0·61	6·1	—	18·4	4·43					
		400	—	13·09	35·14	26·50	0·94	11·7	—	20·2	4·33					
		570[1]	565	10·12	34·83	26·82	1·26	15·6	—	23·5	4·46					
		760[1]	—	7·91	34·56	26·96	1·52	21·9	—	35·3	4·36					
		940[1]	941	6·32	34·49	27·12	1·81	26·9	—	58·8	3·87					
		1400[1]	—	3·51	34·58	27·53	2·19	31·7	—	121	5·12					
		1850[1]	1848	2·43	34·69	27·70	2·10	28·6	—	142	3·36					
2722	27	0	—	21·44	35·37	24·68	0·19	0·2	—	18·5	5·48	N 70 B†	114–0	1529	1548	KT
		25	—	21·33	35·57	24·86	0·29	0·1	—	10·1	5·09	N 100 B†				
		50	—	21·07	35·61	24·96	0·19	0·1	—	13·5	4·96					
		75	—	20·53	35·53	25·05	0·42	1·8	—	15·1	4·42					
		100	—	19·73	35·64	25·33	0·35	2·3	—	13·5	4·51					
		150	—	18·55	35·64	25·64	0·42	3·1	—	13·5	4·57					
		200	—	17·31	35·53	25·87	0·52	4·9	—	11·8	4·56					
		300	—	15·15	35·35	26·23	0·77	6·7	—	11·8	4·44					
		380[1]	381	12·83	35·14	26·55	1·06	12·1	—	13·5	4·12					
		580[1]	580	9·82	34·87	26·90	1·19	15·1	—	13·5	4·89					
		770[1]	—	7·88	34·61	27·01	1·71	22·6	—	18·5	4·43					
		960[1]	958	5·99	34·47	27·16	1·90	24·4	—	40·3	4·42					
2723	27	0	—	21·34	35·52	24·81	0·13	0·1	—	8·4	5·20	N 70 B†	93–0	1734	1748	KT
		25	—	21·22	35·44	24·79	0·19	0·2	—	10·1	5·30	N 100 B†				
		50	—	20·83	35·68	25·07	0·19	0·1	—	6·7	5·23					
		75	—	20·14	35·66	25·25	0·32	1·6	—	10·1	4·36					
		100	—	19·34	35·66	25·46	0·58	2·0	—	8·4	4·32					
		150	—	18·24	35·73	25·79	0·45	2·6	—	15·1	4·40					
		200	—	16·42	35·53	26·08	0·65	5·0	—	10·1	4·26					
		250	—	14·05	35·26	26·40	0·97	8·9	—	16·8	4·08					
2724	27	0	—	21·15	35·46	24·82	0·16	0·4	—	8·4	5·09	N 70 B†	108–0	1938	1953	KT
		25	—	21·13	35·39	24·77	0·13	0·0	—	13·5	4·69	N 100 B†				
		50	—	20·45	35·53	25·07	0·39	1·2	—	11·8	4·09					
		75	—	19·64	35·66	25·38	0·68	2·6	—	8·4	3·92					
		100	—	18·55	35·66	25·66	0·55	4·1	—	13·5	3·75					
		140	—	16·56	35·50	26·02	0·58	6·6	—	15·1	3·94					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. °C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2725	34° 05′ S, 151° 24′ E	1950 9 x	2020	139*	SE	4–6	SE	2	—	—	b	1028·0	18·3	15·6
2726	34° 06′ S, 152° 52′ E	18–19 x	2000	4919*	N	22–33	N	5	N	5	oq	1008·0	17·8	16·7
2727	34° 56′ S, 155° 16′ E	19–20 x	2000	4731*	NNE	28–33	NNE	6	NE	6	oq	1002·1	17·8	16·1
2728	35° 25′ S, 157° 50′ E	20–21 x	2000	4821*	NE	4–6	NE	2	Conf.	5	bc	1006·2	17·8	15·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2725	27	0	—	20·94	35·37	24·81	0·23	0·0	—	25·2	4·71	N 70 B†	87–0	2102	2114	KT
		25	—	20·94	35·43	24·85	0·19	0·0	—	17·7	4·77	N 100 B†				
		50	—	20·42	35·57	25·10	0·35	0·4	—	10·1	4·39	DLH	139	2125	2132	
		75	—	18·45	35·59	25·63	0·45	3·4	—	11·7	3·81					
		100	—	16·34	35·50	26·07	0·61	5·7	—	11·7	3·81					
		125	—	15·90	35·39	26·09	0·71	7·2	—	10·1	2·75					
2726	6	0	—	19·50	35·35	25·18	0·19	1·0	—	5·8	5·32	N 70 V	50–0	2052		
		10	—	19·45	35·39	25·22	0·26	—	—	6·5	—	,,	100–50			
		20	—	19·48	35·41	25·23	0·32	1·0	—	6·3	5·32	,,	250–0	—	—	Net failed to close
		30	—	19·48	35·39	25·21	0·19	1·0	—	2·6	—	,,	250–100	—	2128	
		50	—	19·46	35·37	25·21	0·23	1·0	—	5·3	5·28	N 70 B	117–0	0025	0046	KT
		75	—	19·46	35·39	25·22	0·13	3·3	—	4·7	—	N 100 B				
		100	—	19·46	35·44	25·26	0·23	2·8	—	22·1	5·32					
		150	—	19·17	35·43	25·32	0·32	1·7	—	10·0	4·95					
		200	—	18·77	35·52	25·49	0·35	1·7	—	14·7	4·80					
		300	—	17·98	35·50	25·68	0·48	4·3	—	6·8	4·62					
		400	—	14·01	35·21	26·37	0·84	23·2	—	6·3	4·38					
		770[2]	771	8·86	34·51	26·77	1·55	33·3	—	12·6	4·35					
		960[2]	—	6·94	34·42	26·98	1·87	42·2	—	26·3	4·33					
		1450[2]	1449	3·93	34·47	27·39	2·90	62·2	—	83·2	3·54					
		2430[1]	2432	2·12	34·61	27·68	2·97	62·2	—	116	3·40					
		3300[1]	3296	1·46	34·65	27·75	2·55	80·0	—	160	3·66					
		4270[1]	4267	1·15	34·65	27·77	2·64	84·4	—	179	3·60					
2727	7	0	—	18·30	35·37	25·50	0·19	0·0	—	7·6	5·62	N 50 V	100–0	2030		
		10	—	18·30	35·28	25·43	0·30	0·0	—	5·0	—	N 70 V	50–0			
		20	—	18·30	35·32	25·46	0·35	0·0	—	8·4	5·39	,,	100–50			
		30	—	18·28	35·28	25·43	0·28	1·1	—	4·2	—	,,	250–?	—	—	Net closed prematurely
		50	—	17·91	35·26	25·51	0·35	0·6	—	5·0	5·33	,,	250–0	—	—	Net failed to close
		75	—	15·44	35·19	26·04	0·87	11·0	—	10·1	—	,,	250–100			
		100	—	14·52	35·16	26·21	0·98	26·7	—	12·6	4·32	,,	500–250			
		150	—	13·09	35·14	26·50	0·69	15·5	—	10·9	5·18	,,	750–500			
		200	—	11·50	34·92	26·64	1·13	28·9	—	15·1	4·57	,,	1000–0	—	2330	Net failed to close
		300	—	10·52	34·74	26·68	1·45	30·0	—	19·3	4·56	N 70 B	117–0	2359	0020	KT
		400	—	8·91	34·56	26·81	1·43	51·1	—	11·7	4·68	N 100 B				
		520[2]	518	8·22	34·47	26·84	1·80	60·0	—	13·4	4·37					
		670[2]	671	6·80	34·36	26·96	1·90	54·4	—	24·4	4·13					
		830[2]	—	5·61	34·34	27·11	1·83	66·7	—	38·0	4·05					
		1220[2]	1223	3·54	34·38	27·36	2·63	77·8	—	87·3	3·29					
		1980[1]	1978	2·26	34·58	27·64	2·39	73·3	—	107	3·39					
		2810[1]	2806	1·56	34·67	27·76	2·39	74·4	—	124	3·89					
		3750[1]	3749	1·14	34·65	27·77	2·35	73·3	—	141	3·87					
2728	8	0	—	17·51	35·37	25·70	0·29	0·0	—	4·2	5·47	N 70 V	50–0	2008		
		10	—	17·54	35·37	25·69	0·42	0·0	—	5·9	—	,,	100–50			
		20	—	17·54	35·34	25·66	0·47	0·6	—	6·7	5·50	,,	250–100			
		30	—	17·54	35·28	25·62	0·50	0·0	—	4·2	—	,,	500–250			
		50	—	17·54	35·37	25·69	0·50	0·0	—	3·4	5·36	,,	750–500			
		75	—	16·38	35·39	25·98	0·48	1·7	—	1·7	—	,,	1000–0	—	2327	Net failed to close
		100	—	15·81	35·28	26·02	0·69	12·2	—	0·8	5·06	N 70 B	157–0	0032	0045	KT
		150	—	14·80	35·23	26·21	0·83	14·4	—	4·2	4·78	N 100 B				
		200	—	14·05	35·17	26·33	0·73	13·3	—	7·6	5·18					
		300	—	11·77	34·92	26·59	1·19	26·7	—	10·1	4·54					
		400	—	10·24	34·74	26·73	1·33	42·3	—	8·4	4·70					
		500[2]	497	9·13	34·56	26·77	1·56	41·2	—	6·7	4·34					
		590[3]	593	8·13	34·45	26·84	1·76	53·3	—	13·1	4·46					
		790[3]	—	6·40	34·31	26·98	2·66	62·3	—	36·0	4·25					
		990[3]	—	4·84	34·31	27·17	3·25?	80·0	—	57·0	3·93					
		1190[3]	1192	4·32	34·36	27·26	2·56	84·5	—	89·0	3·76					
		1480[1]	1475	3·19	34·40	27·41	2·76	86·8	—	112	3·22					
		1980[1]	—	2·36	34·54	27·60	2·80	82·3	—	119	3·27					
		2480[1]	2479	1·93	34·60	27·67	2·63	82·3	—	127	3·61					
		3460[1]	3463	1·24	34·61	27·75	2·70	82·3	—	165	3·73					
		4480[1]	4476	1·17	34·61	27·75	2·77	77·8	—	177	—					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2729	35° 37′ S, 160° 22′ E	1950 21–22 x	2000	3244*	NE	4–6	NE	2	Conf.	4	b	1007·5	18·3	16·1
2730	35° 58′ S, 163° 39′ E	22 x	2000	1586*	N	7–10	N'ly	2	N'ly	3	bc	1006·6	17·8	16·7
2731	36° 54′ S, 167° 18′ E	23 x	2000	1222*	NE	7–10	NE	2	NE	2	bc	1014·6	16·7	15·6
2732	38° 16′ S, 169° 35′ E	24 x	1045	563*	NE	7–10	NE	2	—	—	oc	1018·9	16·7	15·6
2733	43° 48′ S, 178° 58′ W	4 xi	0940	287*	NE	17–21	NE	4	NE	5	or	1008·1	12·2	9·4
			1050	334*	—	—	—	—	—	—	—	—	—	—
			1125	341*	—	—	—	—	—	—	—	—	—	—
2734	45° 00′ S, 173° 39′ W	5–6 xi	2000	4837*	W	4–6	—	0	NE	4	odm	999·2	12·8	12·2

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2729	9	0	—	17·19	35·39	25·79	0·40	0·0	—	2·5	3·64	N 50 V	100–0	2009	—	Zone −11 hrs
		10	—	17·03	35·37	25·81	0·42	1·1	—	2·2	—	N 70 V	50–0			
		20	—	16·94	35·39	25·84	0·43	0·0	—	2·5	5·32	,,	100–50			
		30	—	16·93	35·43	25·87	0·52	0·0	—	3·4	—	,,	250–100			
		50	—	16·83	35·43	25·90	0·40	2·8	—	8·4	5·50	,,	500–250			
		75	—	16·54	35·34	25·90	0·36	0·0	—	6·7	—	,,	750–500			
		100	—	16·35	35·39	25·98	0·42	0·0	—	5·9	5·22	,,	1000–750			
		150	—	15·70	35·34	26·10	0·62	17·7	—	1·7	4·77	,,	1500–1000	—	2333	
		200	—	14·10	35·19	26·33	0·92	26·7	—	3·4	4·27	N 70 B	162–0	0021	0038	KT
		300	—	12·76	35·05	26·49	1·06	32·2	—	5·0	4·41	N 100 B				
		400	—	10·69	34·83	26·72	1·31	40·0	—	6·7	4·66					
		480[3]	484	9·64	34·40	26·56	2·01	72·2	—	23·5	4·52					
		590[3]	—	8·40	34·54	26·88	1·66	65·6	—	14·3	4·40					
		790[3]	786	6·88	34·61	27·16	1·42	60·0	—	10·1	4·28					
		1000[2]	1002	5·38	34·38	27·16	2·18	82·2	—	43·6	3·68					
		1200[2]	—	4·36	34·40	27·29	2·22	91·2	—	66·5	3·60					
		1480[1]	1482	3·31	34·47	27·46	2·39	86·7	—	101	3·22					
		1980[2]	1982	2·43	34·56	27·60	2·53	89·0	—	112	3·37					
		2490[2]	—	1·94	34·61	27·69	2·39	85·6	—	119	3·62					
		2990[2]	2990	1·34	34·61	27·74	2·42	83·3	—	137	3·95					
2730	10	0	—	17·63	35·41	25·70	0·35	0·6	—	3·2	5·43	N 50 V	100–0	2006		
		10	—	17·63	35·41	25·70	0·33	0·0	—	2·6	—	N 70 V	50–0			
		20	—	17·24	35·41	25·79	0·40	0·0	—	2·6	5·46	,,	100–50			
		30	—	17·13	35·41	25·82	0·35	0·0	—	2·6	—	,,	250–100			
		50	—	16·93	35·43	25·87	0·42	0·0	—	2·6	5·42	,,	500–250			
		75	—	16·53	35·39	25·94	0·38	0·6	—	3·2	—	,,	750–500			
		100	—	16·11	35·39	26·04	0·54	13·3	—	2·6	5·17	,,	1000–750	—	2219	
		150	—	15·34	35·34	26·18	0·66	17·8	—	3·7	5·01	N 70 B	128–0	2235	2255	KT
		200	—	14·25	35·25	26·34	0·69	20·0	—	3·7	4·97	N 100 B				
		300	—	12·37	35·01	26·55	0·99	35·6	—	4·2	4·72					
		400	—	10·62	34·78	26·69	1·26	47·8	—	6·3	4·60					
		490[2]	493	9·88	34·74	26·79	1·40	50·0	—	10·5	4·26					
		580[1]	582	9·00	34·61	26·84	1·68	60·0	—	9·5	4·42					
		780[2]	—	7·06	34·38	26·95	1·87	61·2	—	20·0	4·23					
		970[2]	971	5·74	34·42	27·14	2·08	91·2	—	28·4	4·08					
		1170[2]	—	4·51	34·33	27·21	2·42	94·6	—	48·4	3·68					
		1480[2]	1477	3·40	34·42	27·40	2·56	92·3	—	72·6	3·32					
2731	11	0	—	15·78	35·32	26·06	0·42	0·0	—	5·8	5·73	N 50 V	100–0	2001	—	Zone −12 hrs
		10	—	15·78	35·32	26·06	0·42	0·0	—	6·3	—	N 70 V	50–0			
		20	—	15·72	35·32	26·07	0·38	0·0	—	8·4	5·71	,,	100–50			
		30	—	15·41	35·30	26·13	0·36	0·0	—	6·3	—	,,	250–100			
		50	—	15·25	35·32	26·18	0·38	0·0	—	9·5	5·36	,,	500–250			
		75	—	15·13	35·32	26·20	0·38	1·1	—	7·4	—	,,	750–500			
		100	—	14·44	35·28	26·33	0·57	5·6	—	5·8	5·52	,,	1000–750	—	2212	
		150	—	13·72	35·17	26·40	0·68	20·0	—	9·5	5·14	N 70 B	91–0	2229	2254	KT
		200	—	12·60	35·08	26·55	0·94	24·5	—	10·5	4·88	N 100 B				
		300	—	11·76	34·99	26·65	0·97	30·0	—	11·0	4·88					
		400[1]	403	10·48	34·78	26·72	1·28	49·0	—	13·1	4·48					
		480[2]	480	9·70	34·76	26·83	1·38	59·0	—	14·7	4·32					
		570[2]	574	8·58	34·47	26·79	1·45	65·6	—	18·4	4·36					
		760[2]	—	7·02	34·61	27·14	2·11	67·8	—	28·4	3·99					
		940[2]	942	5·47	34·29	27·07	2·14	69·0	—	50·5	3·95					
2732	12	—	—	—	—	—	—	—	—	—	—	DC	563	1110	1116	
2733	23	0	—	12·09	34·76	26·40	—	—	—	—	—	DC	287	1038	1039	
		—	—	—	—	—	—	—	—	—	—	DLH	334	1100	1105	
		—	—	—	—	—	—	—	—	—	—	DLH	341	1135	1148	
2734	24	0	—	12·03	34·99	26·60	0·60	5·3	0·15	10·1	6·46	N 50 V	100–0	2006		
		10	—	12·00	35·01	26·62	0·70	6·7	0·10	8·4	—	N 70 V	50–0			
		20	—	11·67	35·01	26·68	0·73	6·4	0·10	5·9	6·44	,,	100–0	—	—	Net failed to close
		30	—	11·58	35·05	26·72	0·62	6·7	0·10	5·0	—	,,	100–50			

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2734 *cont.*	45° 00′ S, 173° 39′ W	1950 5–6 xi												
2735	45° 34′ S, 165° 34′ W	7–8 xi	2000	5300*	WSW	17–21	WSW	4	WSW	4	bc	1021·6	10·0	7·2
2736	45° 28′ S, 152° 41′ W	10 xi	2000	5099*	E	7–10	E	1	S	3	bc	1022·0	7·8	5·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
2734 *cont.*	24	50	—	10·73	34·97	26·83	0·76	8·1	0·50	7·6	6·24	N 70 V	250–100			
		75	—	10·71	34·96	26·81	0·80	6·4	0·50	3·4	—	,,	500–250			
		100	—	10·63	34·88	26·77	0·85	9·4	0·30	5·0	6·29	,,	750–500			
		150	—	10·13	34·79	26·79	0·88	12·8	0·00	10·1	6·16	,,	1000–0	—	—	Net failed to close
		200	—	9·51	34·72	26·83	0·92	12·3	0·00	5·0	6·18	,,	1000–750			
		300	—	9·29	34·65	26·81	1·04	17·8	0·03	6·7	6·26	,,	1500–1000	—	0038	
		400	—	9·11	34·65	26·84	1·09	18·9	0·00	6·7	6·35	N 100 H	0–1	0042	0052	
		520[1]	522	8·55	34·58	26·88	1·13	25·4	0·00	10·1	5·07	N 70 B	117–0	0048	0110	KT
		790[2]	785	6·87	34·40	26·98	1·54	37·8	0·00	15·0	5·47	N 100 B				
		990[2]	—	5·96	34·29	27·01	2·18	38·4	—	21·9	4·77					
		1180[2]	1182	4·91	34·29	27·14	1·99	42·7	—	42·0	4·18					
		1480[2]	1483	3·81	34·34	27·31	2·22	44·5	—	72·0	3·69					
		1970[2]	1972	2·54	34·49	27·54	2·39	52·3	—	121	3·52					
		2480[1]	2479	2·10	—	—	—	—	—	—	3·36					
		2980[1]	—	1·76	34·67	27·75	2·01	55·7	—	138	—					
		3480[1]	3481	1·32	34·67	27·78	2·25	54·0	—	153	3·54					
		4490[1]	4487	0·93	34·65	27·79	2·08	47·8	—	165	3·06					
2735	26	0	—	10·00	34·61	26·68	0·74	11·6	0·20	6·7	6·77	N 70 V	50–0	2008	–	Zone −13 hrs
		10	—	10·00	34·65	26·69	0·76	18·0	0·17	4·2	—	,,	100–50			
		20	—	9·90	34·63	26·70	0·78	16·9	0·17	7·6	6·77	,,	250–100			
		30	—	9·88	34·65	26·71	0·76	14·7	0·20	7·6	—	,,	500–250			
		50	—	9·75	34·65	26·74	0·74	13·5	0·22	7·6	6·72	,,	750–500			
		75	—	8·99	34·65	26·86	0·83	13·5	0·34	6·7	—	,,	1000–750			
		100	—	9·00	34·65	26·86	0·90	11·6	0·48	9·2	6·50	,,	1500–1000	—	0026	
		150	—	8·79	34·65	26·89	1·02	10·2	0·31	7·6	6·36	N 100 H	0–1	0048	0105	
		200	—	8·74	34·61	26·88	1·02	12·4	0·17	5·9	6·40	N 70 B	66–0	0057	0118	KT
		300	—	8·95?	34·61	26·85	0·97	11·3	0·25	7·6	6·57	N 100 B				
		400	—	7·76	34·42	26·87	1·35	32·6	0·00	9·2	5·90					
		500	—	7·43	34·42	26·91	1·38	36·1	0·00	10·1	5·82					
		570[2]	566	7·02	34·34	26·92	1·44	32·6	0·00	12·6	5·41					
		760[2]	—	6·39	34·25	26·93	1·82	41·2	0·00	21·0	4·96					
		940[2]	938	5·85	34·29	27·03	1·82	57·4	—	30·2	4·67					
		1160[2]	1156	4·48	34·33	27·22	2·14	62·0	—	44·5	4·25					
		1460[2]	1461	3·46	34·42	27·39	2·22	56·5	—	79·0	3·83					
		1990[1]	1992	2·60	34·54	27·58	2·28	56·5	—	108	3·29					
		2490[1]	—	2·26	34·65	27·69	2·14	57·4	—	117	3·48					
		2990[1]	2989	1·96	34·67	27·73	2·22	52·4	—	124	—					
		3960[1]	3958	1·14	34·69	27·80	2·25	55·2	—	153	3·80					
		4960[1]	4958	1·00	34·67	27·80	2·28	54·0	—	161	3·88					
2736	0	0	—	9·07	34·40	26·65	0·88	12·7	0·17	7·6	6·84	N 50 V	100–0	2005	—	Zone −14 hrs
		10	—	8·74	34·38	26·70	0·93	16·2	0·23	5·0	—	N 70 V	50–0			
		20	—	8·71	34·36	26·68	0·93	16·2	0·20	2·5	6·89	,,	100–50			
		30	—	8·21	34·38	26·78	0·95	20·3	0·17	3·4	—	,,	250–100			
		50	—	7·97	34·38	26·81	0·92	22·0	0·37	3·4	6·92	,,	500–250			
		75	—	7·81	34·38	26·84	0·99	29·6	0·17	3·4	—	,,	750–500			
		100	—	7·64	34·40	26·87	1·11	28·4	0·37	4·2	6·62	,,	1000–750			
		150	—	7·90	34·36	26·81	1·01	22·6	0·20	3·4	—	,,	1500–950	—	2253	
		200	—	7·89	34·40	26·84	1·06	23·8	0·17	6·7	6·89	N 100 H	0–1	2301	2316	
		300	—	7·40	34·40	26·91	1·30	25·5	0·00	5·0	6·06	N 70 B	114–0	2308	2327	KT
		400	—	7·46	34·38	26·89	1·21	24·9	0·00	4·2	6·33	N 100 B				
		500	—	7·47	34·38	26·89	1·28	27·3	0·00	3·4	6·38					
		590[2]	594	6·46	34·27	26·94	1·59	38·9	0·00	10·1	5·39					
		790[2]	791	5·58	34·25	27·03	1·84	50·5	0·03	20·2	4·92					
		990[2]	—	4·48	34·25	27·16	2·74	53·4	0·00	35·3	4·49					
		1190[2]	1187	3·59	34·34	27·33	2·22	60·9	—	54·6	4·08					
		1490[2]	1489	2·94	34·47	27·49	2·25	67·3	—	82·3	3·72					
		2000[1]	1995	2·42	34·58	27·62	2·60	65·0	—	121	3·05					
		2500[1]	—	2·13	34·61	27·68	2·29	61·4	—	134	3·13					
		2990[1]	2992	1·87	34·65	27·72	2·15	63·8	—	133	3·33					
		3480[1]	3479	1·55	34·65	27·74	2·15	59·2	—	134	3·68					
		4470[1]	4472	1·23	34·67	27·79	2·15	67·3	—	144	3·92					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2737	48° 16′ S, 152° 22′ W	1950 11–12 xi	2000	4016*	W × N	22–27	W × N	5	W	5	od	1009·2	8·3	8·3
2738	50° 31′ S, 152° 09′ W	12–13 xi	2000	4581*	W	17–21	W	4	SW	4–5	o	1021·8	6·7	5·6
2739	52° 39′ S, 152° 00′ W	13–14 xi	2000	4874*	W	28–33	W	5	W	5	oq	1015·2	6·7	5·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2737	1	0	—	8·10	34·38	26·79	1·04	29·4	0·17	5·0	7·00	N 50 V	100–0	2004		
		10	—	8·09	34·38	26·80	1·07	26·6	0·17	5·0	—	N 70 V	50–0			
		20	—	8·09	34·40	26·81	1·00	24·8	0·14	5·9	6·99	,,	100–50			
		30	—	8·09	34·38	26·80	0·97	29·4	0·14	3·4	—	,,	250–100			
		50	—	7·66	34·38	26·86	1·00	28·0	0·17	3·4	6·92	,,	500–250			
		75	—	7·39	34·40	26·91	1·06	24·8	0·14	4·2	—	,,	750–500			
		100	—	7·35	34·40	26·91	1·11	41·4	0·26	3·4	6·74	,,	1000–750			
		150	—	7·28	34·38	26·91	1·16	46·0	0·23	5·9	6·68	,,	1500–1000	—	2348	
		200	—	7·28	34·40	26·92	1·21	42·0	0·20	4·2	6·62	N 100 H	0–1	0000	0020	
		300	—	7·29	34·40	26·92	1·18	38·0	0·03	5·9	6·52	N 70 B	164–0	0009	0030	KT
		400	—	7·29	34·38	26·91	1·21	41·4	0·00	5·9	6·52	N 100 B				
		500	—	7·22	34·38	26·92	1·28	32·7	0·00	5·0	6·50					
		600[2]	599	6·82	34·38	26·98	1·56	60·0	0·00	5·0	5·73					
		790[2]	—	6·06	34·29	27·00	1·68	65·4	0·00	18·5	5·34					
		990[2]	986	5·13	34·27	27·10	1·92	68·8	0·00	29·4	4·67					
		1190[2]	1186	3·99	34·16	27·14	2·36	66·2	—	37·8	4·97					
		1500[2]	1496	3·04	34·38	27·41	2·36	76·8	—	77·4	3·92					
		1990[1]	1986	2·50	34·56	27·60	2·39	73·3	—	121	3·34					
		2490[1]	2487	2·17	34·63	27·69	2·32	80·0	—	121	3·33					
		2990[1]	2994	1·88	34·63	27·71	2·18	65·4	—	121	3·87					
		3470[1]	3469	1·60	34·67	27·76	2·18	73·4	—	131	3·99					
2738	2	0	—	7·56	34·40	26·88	1·20	12·0	0·14	6·7	6·88	N 50 V	100–0	2010		
		10	—	7·56	34·40	26·88	1·24	25·4	0·14	8·4	—	N 70 V	50–0			
		20	—	7·56	34·38	26·87	1·20	19·5	0·17	6·7	—	,,	100–50			
		30	—	7·56	34·38	26·87	1·24	28·0	0·17	5·9	—	,,	250–100			
		50	—	7·53	34·38	26·88	1·28	28·0	0·20	7·6	6·92	,,	500–250			
		75	—	7·51	34·38	26·88	1·24	19·5	0·23	6·7	—	,,	750–500			
		100	—	7·49	34·40	26·89	1·26	21·7	0·23	6·7	6·80	,,	1000–750			
		150	—	6·93	34·40	26·97	1·55	21·2	0·20	6·7	6·65	,,	1500–1000	—	0136	
		200	—	7·05	34·38	26·95	1·60	17·2	0·14	6·7	6·59	N 100 H	0–1	0147	0210	
		300	—	7·02	34·40	26·96	1·65	25·7	0·11	7·6	—	N 70 B	113–0	0159	0220	KT
		400	—	6·71	34·36	26·97	1·70	25·7	0·09	9·2	6·30	N 100 B				
		500	—	6·51	34·33	26·97	1·70	41·7	0·03	22·7	—					
		570[2]	573	6·27	34·31	26·99	1·74	41·2	0·00	13·4	5·58					
		780[2]	—	5·55	34·27	27·05	1·93	52·6	0·00	20·2	5·05					
		980[2]	975	4·65	34·27	27·16	2·24	56·0	0·00	33·6	4·54					
		1170[3]	1172	3·64	34·33	27·31	2·63	62·9	—	44·5	4·35					
		1470[3]	1465	3·00	34·45	27·47	2·63	60·0	—	68·0	3·97					
		1900[1]	1899	2·49	34·56	27·60	2·63	67·2	—	84·8	3·57					
		2380[1]	2381	2·23	34·65	27·69	2·56	57·2	—	93·2	—					
		3360[1]	3357	1·53	34·67	27·76	2·50	47·4	—	112	3·95					
		4320[1]	4324	1·13	34·67	27·79	2·50	42·4	—	131	4·02					
2739	3	0	—	6·57	34·40	27·02	1·47	24·9	0·08	12·6	6·74	N 70 V	50–0	2006		
		10	—	6·57	34·38	27·01	1·39	17·4	0·12	8·4	—	,,	100–50	—	—	Great stray on wire
		20	—	6·57	34·38	27·01	1·33	22·6	0·12	19·3	6·79	,,	250–100			
		30	—	6·56	34·38	27·01	1·33	22·2	0·17	16·8	—	,,	500–250			
		50	—	6·51	34·36	27·00	1·39	24·4	0·14	10·9	6·75	,,	750–500	—	2353	
		75	—	6·53	34·40	27·03	1·44	24·9	0·12	8·4	—	N 100 B	183–0	0012	0032	KT
		100	—	6·48	34·34	27·00	1·45	31·3	0·14	24·4	6·81					
		150	—	6·24	34·33	27·01	1·58	37·7	0·08	14·3	6·46					
		200	—	6·13	34·33	27·02	1·56	28·4	0·06	17·6	6·27					
		300	—	5·52	34·25	27·04	1·54	27·2	0·08	16·8	6·56					
		400	—	5·35	34·25	27·06	1·68	40·6	0·00	20·2	6·19					
		500	—	4·82	34·22	27·09	1·64	34·8	0·00	16·0	6·49					
		600[2]	602	4·42	34·18	27·12	1·73	51·0	0·00	21·8	5·92					
		800[2]	—	4·29	34·29	27·21	1·99	48·1	0·00	42·0	4·69					
		990[2]	989	3·57	34·29	27·28	2·25	52·8	0·00	55·5	4·32					
		1190[2]	1187	2·90	34·34	27·40	2·39	65·0	—	72·3	4·11					
		1490[2]	1490	2·59	34·47	27·52	2·35	58·0	—	86·5	3·77					
		1990[1]	1985	2·28	34·65	27·69	2·08	38·9	—	97·5	3·58					
		2470[1]	2469	2·03	34·67	27·73	2·15	49·8	—	113	3·83					
		3450[1]	3454	1·25	34·69	27·79	2·04	50·4	—	138	3·93					
		4430[1]	4428	1·09	34·67	27·80	2·25	48·1	—	155	3·81					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2740	55° 01′ S, 151° 28′ W	1950 14–15 xi	2000	3703*	W × N	22–33	W	5	W	5	OM	1003·1	5·6	5·0
2741	57° 22′ S, 150° 56′ W	15 xi	2000	3178*	WNW	11–16	W	3	W	3	omd	988·8	0·6	0·6
2742	58° 33′ S, 150° 55′ W	16 xi	0920	2899*	SSW	7–10	SW	3	W	3	Bc	988·7	−1·7	−2·2
2743	59° 35′ S, 150° 48′ W	16 xi	2000	2681*	SSW	7–10	S	2	WSW	3	c	988·7	−2·8	−3·3

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	To	
2740	4	0	—	3·33	*34·09*	*27·15*	1·78	39·4	0·17	13·4	*7·42*	N 70 V	50–0	2120		
		10	—	3·29	*34·02*	*27·10*	1·78	42·6	0·17	15·1	—	,,	100–50			
		20	—	3·29	*34·02*	*27·10*	1·68	46·6	0·20	15·1	*7·22*	,,	250–100			
		30	—	3·29	*34·05*	*27·12*	1·78	36·7	0·17	13·4	—	,,	500–250			
		50	—	3·29	*34·05*	*27·12*	1·73	42·6	0·17	15·1	*7·46*	,,	750–500	—	0127	
		75	—	3·29	*34·04*	*27·11*	1·73	48·7	0·17	16·8	—	N 100 B	168–0	0149	0207	KT
		100	—	3·09	*34·05*	*27·14*	1·84	49·3	0·26	20·1	*7·39*					
		150	—	2·66	*34·07*	*27·20*	1·99	39·1	0·26	19·3	*7·26*					
		200	—	2·32	*34·05*	*27·21*	1·97	39·1	0·20	21·0	*4·55*					
		300	—	1·81	*34·05*	*27·25*	2·03	37·8	0·17	22·7	*7·30*					
		400	—	3·32	*34·25*	*27·28*	2·29	58·0	0·06	37·8	*5·21*					
		500	—	2·45	*34·27*	*27·37*	2·32	55·8	0·00	42·8	*2·75*					
		590[2]	592	2·14	*34·27*	*27·40*	2·35	55·8	0·00	48·7	*2·32*					
		790[2]	—	2·46	*34·33*	*27·41*	2·53	61·0	0·00	72·2	*4·30*					
		980[2]	975	2·48	*34·47*	*27·53*	2·42	51·3	0·00	82·3	*3·87*					
		1180[2]	1183	2·39	*34·58*	*27·63*	2·32	59·9	—	91·4	*3·92*					
		1460[2]	1459	2·36	*34·63*	*27·67*	2·28	57·0	—	94·1	*4·04*					
		1780[1]	1775	2·07	*34·65*	*27·70*	2·15	54·6	—	96·6	*4·01*					
		2280[1]	2281	1·73	*34·65*	*27·73*	2·08	51·2	—	121	*4·13*					
		2780[1]	2778	1·33	*34·65*	*27·76*	2·22	49·4	—	132	*4·08*					
		3250[1]	3249	1·02	*34·65*	*27·78*	2·35	46·0	—	151	*4·11*					
2741	5	0	—	−0·74	*34·09*	*27·42*	2·04	36·4	0·14	42·8	*8·23*	N 50 V	100–0	2018		
		10	—	−0·74	*34·05*	*27·39*	2·12	55·3	0·17	42·0	—	N 70 V	50–0			
		20	—	−0·77	*34·02*	*27·38*	2·12	63·3	0·14	45·4	*8·23*	,,	100–50			
		30	—	−0·78	*34·05*	*27·40*	2·15	63·3	0·17	42·0	—	,,	250–100			
		50	—	−0·85	*34·07*	*27·42*	2·13	57·5	0·17	47·1	*7·87*	,,	500–250			
		75	—	−0·91	*34·07*	*27·42*	2·18	55·8	0·20	52·1	—	,,	750–500			
		100	—	−1·03	*34·09*	*27·43*	2·22	54·1	0·14	56·3	*7·87*	,,	1000–750			
		150	—	−1·30	*34·16*	*27·50*	2·18	46·6	0·14	64·7	*4·03*	,,	1500–1000	—	2312	
		200	—	−0·96	*34·20*	*27·52*	2·39	50·6	0·09	67·2	*7·40*	N 100 H	0–1	2322	2350	
		300	—	1·79	*34·43*	*27·56*	2·36	51·8	0·00	73·9	*4·62*	N 70 B	} 155–0	2335	2355	KT
		400	—	2·10	*34·52*	*27·60*	2·46	59·2	0·00	81·5	*4·25*	N 100 B				
		490[2]	490	2·25	*34·58*	*27·64*	2·39	60·4	0·00	87·4	*3·56*					
		590[2]	586	2·15	*34·67*	*27·72*	2·43	55·3	0·00	94·1	*3·69*					
		790[2]	—	2·10	*34·70*	*27·75*	2·36	57·5	—	96·6	*3·86*					
		980[2]	978	2·00	*34·78*	*27·82*	2·25	52·3	—	91·6	*4·12*					
		1200[1]	1198	1·84	*34·69*	*27·75*	2·18	59·8	—	96·6	*4·10*					
		1480[1]	1481	1·57	*34·69*	*27·77*	2·12	55·8	—	109	*4·24*					
		1970[1]	—	1·14	*34·69*	*27·80*	2·18	57·5	—	123	*4·31*					
		2940[2]	2937	0·78	*34·67*	*27·82*	2·33	55·8	—	146	*4·27*					
2742	6	0	—	−0·71	*34·14*	*27·47*	—	—	—	—	—	N 100 B	350–250	1020	1111	Depth estimated
												BT	0–277			
2743	6	0	—	−1·43	*34·25*	*27·58*	1·96	66·5	0·17	82·4	*7·86*	N 50 V	100–0	2005		
		10	—	−1·53	*34·23*	*27·57*	1·94	72·3	0·29	82·4	—	N 70 V	50–0			
		20	—	−1·53	*34·22*	*27·55*	1·99	69·2	0·29	84·0	*7·89*	,,	100–50			
		30	—	−1·53	*34·22*	*27·55*	—	69·2	0·26	82·4	—	,,	250–100			
		50	—	−1·58	*34·23*	*27·57*	1·94	72·3	0·20	84·9	*7·60*	,,	500–250			
		75	—	−1·63	*34·20*	*27·54*	2·01	69·2	0·17	86·6	—	,,	750–500			
		100	—	−1·57	*34·20*	*27·54*	1·99	69·2	0·27	86·6	*7·25*	,,	1000–750			
		150	—	0·32	*34·22*	*27·47*	2·15	66·4	0·09	99·2	*5·46*	,,	1500–1000	—	2252	
		200	—	1·27	*34·47*	*27·62*	2·23	66·4	0·03	110	*4·72*	N 100 H	0–1	2304	2320	
		300	—	1·51	*34·70*	*27·80*	2·17	66·4	0·00	114	*4·59*	N 70 B	} 97–0	2312	2334	KT
		400	—	1·42	*34·67*	*27·77*	2·27	66·4	0·00	124	*4·65*	N 100 B				
		480[2]	482	1·43	*34·69*	*27·78*	2·22	63·5	0·00	131	*4·52*					
		580[2]	580	1·32	*34·69*	*27·79*	2·03	44·2	0·00	143	*4·38*					
		770[2]	771	1·18	*34·69*	*27·80*	1·97	42·2	—	130	*5·36*					
		970[1]	973	1·05	*34·65*	*27·78*	2·15	69·2	—	163	*4·44*					
		1170[1]	1170	0·90	*34·67*	*27·81*	2·03	66·5	—	165	*4·41*					
		1470[1]	1472	0·75	*34·67*	*27·82*	2·15	60·7	—	158	*4·53*					
		1950[1]	—	0·57	*34·67*	*27·83*	2·01	72·3	—	163	*4·53*					
		2430[1]	2427	0·37	*34·67*	*27·84*	2·01	66·5	—	165	*4·58*					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. °C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2744	60° 31′ S, 150° 25′ W	1950 17 xi	0900	3286*	W	7–10	W	2	—	—	bc	984·0	−0·6	−3·3
2745	60° 06′ S, 151° 58′ W	17 xi	2215	2714*	WNW	4–6	—	—	WNW	2	omf	970·7	−1·7	−1·7
2746	59° 45′ S, 153° 45′ W	18 xi	0900	2917*	S	17–21	S	4	N	4	os	970·2	−0·6	−0·6
2747	59° 39′ S, 154° 51′ W	18 xi	1512	—	WSW	4–6	W	1	WNW	4	BC	975·5	−2·2	−2·8
2748	59° 28′ S, 156° 05′ W	18 xi	2200	3129*	SSW	7–10	SW	3	W	4	c	978·2	−2·8	−3·3
2749	58° 51′ S, 158° 15′ W	19 xi	0900	3811*	W × N	22–33	W × N	5	W	5	bcs	980·0	−0·6	−1·1
2750	58° 52′ S, 158° 55′ W	19 xi	1500	4007*	W	22–27	W	5	W	5	bc	979·0	0·0	−0·6
2751	59° 02′ S, 160° 06′ W	19 xi	2200	3864*	SW × S	17–27	SW	4	SW	5	bc	981·3	−3·9	−3·9
2752	59° 09′ S, 162° 00′ W	20 xi	0905	—	W × S	28–33	W × S	6	W	6	osq	995·6	0·0	0·0
2753	59° 15′ S, 162° 50′ W	20 xi	1500	—	WSW	22–33	W × S	6	W	5	osq	998·2	0·0	0·0
2754	59° 29′ S, 164° 32′ W	20 xi	2200	4857*	NW × W	7–10	WNW	3	W	4	osq	995·4	0·6	0·0
2755	59° 48′ S, 166° 51′ W	21 xi	0900	4289*	W	7–10	W	3	W	3	bc	988·9	2·8	2·2
2756	60° 13′ S, 167° 48′ W	21 xi	1505	4528*	W	11–16	W	3	W	2	c	991·1	3·3	1·7
2757	60° 48′ S, 169° 02′ W	21 xi	2200	3806*	WNW	7–10	NW	3	NW	3	c	990·1	2·2	1·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_3	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks;
2744	7	0	—	−1·22	*34·20*	*27·53*	—	—	—	—	—	N 50 V	100–0	0916	0920	Near pack ice
												N 100 H	0–1	0930	0945	
												N 70 B	80–0	0938	0957	KT
												N 100 B				
												BT	0–277			
2745	8	0	—	−1·12	*34·18*	*27·52*	—	—	—	—	—	N 50 V	100–0	**2218**	**2225**	Near pack ice
												N 100 H	0–1	**2240**	**2304**	
												N 70 B	159–0	**2250**	**2315**	KT
												N 100 B				
												BT	0–277			
2746	8	0	—	−0·93	*34·09*	*27·43*	—	—	—	—	—	N 50 V	100–0	0913	0920	Great stray on wire
												N 100 H	0–1	0932	0955	
												N 70 B	132–0	0942	1008	KT
												N 100 B				
												BT	0–277			
2747	8	0	—	−1·12	*34·13*	*27·47*	—	—	—	—	—	N 70 B	148–0	1518	1540	KT
												N 100 B				
2748	8	0	—	0·53	*33·84*	*27·16*	—	—	—	—	—	N 50 V	100–0	**2209**	**2213**	
												N 100 H	0–1	**2229**	**2251**	
												N 100 B	150–0	**2247**	**2308**	KT
												BT	0–277			
2749	8	0	—	0·58	*33·84*	*27·16*	—	—	—	—	—	N 50 V	100–0	0913	0920	Great stray on wire
												N 100 H	0–1	0934	1000	
												N 70 B	117–0	0945	1007	KT
												N 100 B				
												BT	0–277			
2750	9	—	—	—	—	—	—	—	—	—	—	N 70 B	168–0	1518	1538	KT
												N 100 B				
2751	9	0	—	1·48	*33·82*	*27·09*	—	—	—	—	—	N 50 V	100–0	**2218**	**2226**	
												N 100 H	0–1	**2234**	**2259**	
												N 70 B	166–0	**2250**	**2311**	KT
												N 100 B				
												BT	0–277			
2752	10	0	—	1·31	*34·00*	*27·24*	—	—	—	—	—	N 70 B	64–0	0943	1000	KT
												N 100 H				
												BT	0–200			
2753	10	0	—	1·25	*34·00*	*27·25*	—	—	—	—	—	N 70 B	75–0	1517	1538	KT
												N 100 B				
2754	10	0	—	1·11	*34·04*	*27·29*	—	—	—	—	—	N 50 V	100–0	**2212**	**2218**	Zone −13 hrs
												N 100 H	0–1	**2230**	**2250**	
												N 70 B	166–0	**2246**	**2306**	KT
												N 100 B				
												BT	0–277			
2755	11	0	—	1·56	*34·04*	*27·25*	—	—	—	—	—	N 50 V	100–0	0910	0916	
												N 100 H	0–1	0929	0950	
												N 70 B	141–0	0939	1009	KT
												N 100 B				
												BT	0–277			
2756	11	0	—	1·67	*33·98*	*27·21*	—	—	—	—	—	N 70 B	128–0	1514	1535	KT
												N 100 B				
2757	11	0	—	−0·28	*33·89*	*27·24*	—	—	—	—	—	N 50 V	100–0	**2203**	**2210**	
												N 100 H	0–1	**2221**	**2244**	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2757 *cont.*	60° 48′ S, 169° 02′ W	1950 21 xi												
2758	61° 50′ S, 171° 08′ W	22 xi	0900	3561*	NW	11–16	NW	3	NW	2	Oms	990·7	0·6	0·0
2759	62° 12′ S, 172° 12′ W	22 xi	1440	3191*	N×W	7–10	—	—	—	—	omd	998·3	1·7	1·1
2760	61° 40′ S, 172° 17′ W	22 xi	2200	3334*	N	4–6	N	2	N	2	Ocm	992·5	0·6	0·6
2761	61° 25′ S, 174° 34′ W	23 xi	0900	—	NW	17–21	NW	4	NW	4	bc	986·2	1·7	1·1
2762	61° 09′ S, 175° 40′ W	23 xi	1500	3978*	NW	17–21	NW	4	NW	4	bc	982·1	2·2	1·7
2763	61° 09′ S, 177° 58′ W	23 xi	2200	4065*	SW	7–10	SW	2	W	3	o	980·2	−0·6	−1·1
2764	61° 45′ S, 179° 20′ E	24 xi	0900	3970*	WSW	11–16	WSW	2	SW	3	Os	977·3	−0·6	−1·1
2765	62° 04′ S, 178° 08′ E	24 xi	1500	—	W×S	17–21	W	4	W	4	O	973·1	−0·6	−1·1
2766	62° 15′ S, 176° 50′ E	24 xi	2155	4071*	W	11–16	W	3	W	3	o	971·4	−1·1	−1·7
2767	62° 37′ S, 175° 20′ E	25 xi	0900	—	SW	22–27	SW	5	SW	5	osq	973·8	−0·6	−1·1
2768	63° 00′ S, 175° 05′ E	25 xi	1445	4095*	S	17–21	S	3	S	2	osq	978·5	−1·1	−1·1

Station	Age of moon (days)	Hydrological observations: Depth (metres)	Depth by thermometer	Temp. °C.	S °/₀₀	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Biological observations: Gear	Depth (metres)	Time: From	To	Remarks
2757 *cont.*	11											N 70 B	110–0	**2230**	**2250**	KT
												N 100 B				
												BT	0–277			
2758	12	0	—	−0·60	*33·98*	*27·34*	—	—	—	—	—	N 50 V	100–0	0918	0925	
												N 100 H	0–1	0936	0952	
												N 70 B	99–0	0944	1005	KT
												N 100 B				
												BT	0–277			
2759	12	0	—	−0·60	*33·75*	*27·15*	—	—	—	—	—	N 70 B	121–0	1449	1511	KT. In lead in pack ice
												N 100 B				
2760	12	0	—	−0·83	*33·84*	*27·23*	—	—	—	—	—	N 50 V	100–0	**2210**	**2218**	
												N 100 H	0–1	**2231**	**2255**	
												N 70 B	142–0	**2247**	**2310**	KT
												N 100 B				
												BT	0–277			
2761	13	0	—	0·97	*34·02*	*27·28*	—	—	—	—	—	N 50 V	100–0	0913	0919	
												N 100 H	0–1	0926	0950	
												N 70 B	139–0	0937	1002	KT
												N 100 B				
												BT	0–277			
2762	13	0	—	1·11	*33·95*	*27·22*	—	—	—	—	—	N 70 B	117–0	1516	1538	KT
												N 100 B				
2763	13	0	—	0·28	*33·84*	*27·18*	—	—	—	—	—	N 50 V	100–0	**2207**	**2210**	Zone −12 hrs
												N 100 H	0–1	**2221**	**2241**	
												N 70 B	157–0	**2230**	**2251**	KT
												N 100 B				
												BT	0–277			
2764	14	0	—	0·20	*33·78*	*27·14*	—	—	—	—	—	N 50 V	100–0	0913	0917	
												N 100 H	0–1	0929	0954	
												N 70 B	183–0	0941	1006	KT
												N 100 B				
												BT	0–277			
2765	14	0	—	−0·20	*33·68*	*27·07*	—	—	—	—	—	N 70 B	131–0	1530	1550	KT
												N 100 B				
2766	14	0	—	−0·69	*33·66*	*27·07*	—	—	—	—	—	N 50 V	100–0	**2214**	**2220**	Last 20 m. on surface
												N 100 H	0–1	**2227**	**2250**	
												N 70 B	157–0	**2239**	**2300**	KT
												BT	0–277			
2767	15	0	—	1·60	*34·00*	*27·22*	—	—	—	—	—	N 50 V	100–0	0914	0920	
												N 100 H	0–1	0927	0947	
												N 100 B	128–0	0936	0957	KT
												BT	0–277			
2768	15	0	—	0·56	*34·04*	*27·32*	2·29	40·0	0·20	42·0	*7·85*	N 50 V	100–0	1456	—	In lee of drifting pack ice
		10	—	0·56	*34·00*	*27·29*	2·60	51·6	0·20	45·7	—	N 70 V	50–0			
		20	—	0·50	*34·02*	*27·31*	2·15	58·2	0·26	45·7	*7·93*	,,	100–50			
		30	—	0·34	*34·00*	*27·30*	2·49	61·2	0·23	46·2	—	,,	250–100			
		50	—	0·23	*34·05*	*27·35*	2·43	44·5	0·20	49·5	*7·83*	,,	500–250			
		75	—	−0·23	*34·02*	*27·35*	2·98	42·2	0·23	55·4	—	,,	750–500	—	—	Heavy stray on wire
		100	—	−0·34	*34·00*	*27·34*	2·53	58·2	0·23	55·4	*7·95*	,,	1000–750	—	**2143**	Heavy stray on wire
		150	—	−0·26	*34·04*	*27·36*	2·39	53·8	0·23	59·2	*8·06*	N 100 H	0–1	**2150**	**2207**	
		200	—	1·18	*34·27*	*27·47*	2·77	51·6	0·03	73·0	*5·53*	N 70 B	82–0	**2154**	**2215**	KT
		300	—	1·81	*34·40*	*27·52*	2·77	57·5	0·00	79·0	*4·60*	N 100 B				
		400	—	2·21	*34·49*	*27·56*	2·63	62·6	0·00	90·6	*4·26*					
		500	—	2·14	*34·58*	*27·65*	3·12	59·1	0·00	93·1	*4·22*					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
2768 *cont.*	63° 00′ S, 175° 05′ E	1950 25 xi												
2769	59° 07′ S, 174° 55′ E	26–27 xi	2000	5174*	WSW	11–16	WSW	3	WSW	3–4	O	996·7	0·6	0·6
2770	56° 16′ S, 174° 22′ E	27–28 xi	2000	5448*	NW	7–16	NW	2	NW	3	oc	999·3	6·7	6·1
2771	53° 50′ S, 173° 26′ E	28 xi	2000	3592*	N × W	33–22	N × W	5–6	N × W	6	oqR	989·2	7·2	6·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks;
2768 *cont.*	15	590[1]	588	2·25	34·65	27·69	2·60	18·9	0·00	109	4·00					
		790[1]	—	2·18	34·65	27·69	2·36	55·3	0·00	101	4·15					
		980[1]	977	2·08	34·67	27·72	2·46	22·6	0·00	119	4·36					
		1170[1]	1170	1·91	34·69	27·75	2·25	29·1	0·00	118	4·32					
2769	16	0	—	3·48	34·02	27·08	1·63	43·5	0·17	6·7	7·54	**N 50 V**	100–0	2006		
		10	—	3·52	33·98	27·05	1·59	51·5	0·17	5·0	—	**N 70 V**	50–0			
		20	—	3·52	33·96	27·03	1·59	51·5	0·20	5·0	3·30	,,	100–50			
		30	—	3·50	33·96	27·03	1·59	45·2	0·17	5·0	—	,,	250–100			
		50	—	3·50	33·96	27·03	1·61	28·1	0·17	5·0	7·52	,,	500–250			
		75	—	3·40	33·96	27·04	1·68	51·7	0·17	6·7	—	,,	750–500			
		100	—	3·27	33·98	27·07	1·77	52·8	0·17	5·0	7·45	,,	1000–0	—	—	Net failed to close
		150	—	3·19	34·00	27·09	1·80	57·0	0·23	13·4	4·74	,,	1000–750			
		200	—	3·09	34·00	27·10	1·80	50·6	0·20	13·4	6·03	,,	1500–1000	—	**0042**	
		300	—	2·74	34·00	27·13	1·90	52·3	0·00	15·9	4·78	**N 100 H**	0–1	**0048**	**0107**	
		400	—	2·84	34·11	27·21	2·04	59·1	0·00	27·7	5·00	**N 70 B**	99–0	**0057**	**0118**	KT
		500	—	3·05	34·23	27·29	2·22	58·7	0·00	39·5	5·23	**N 100 B**				
		570[2]	574	2·82	34·29	27·35	2·29	72·8	0·00	43·7	5·07	**BT**	0–277			
		750[2]	—	2·69	34·38	27·44	2·36	69·8	0·00	62·2	4·45					
		920[2]	921	2·47	34·49	27·54	2·39	64·1	0·00	75·6	4·02					
		1110[2]	1108	2·41	34·56	27·61	2·29	67·0	—	82·2	3·92					
		1410[2]	1411	2·29	34·63	27·68	2·29	61·2	—	89·0	3·98					
		1830[1]	1826	2·03	34·69	27·74	2·18	64·1	—	92·3	4·07					
		2810[1]	2813	1·38	34·69	27·79	2·18	64·1	—	116	4·21					
		3770[1]	3767	0·98	34·67	27·80	2·25	58·2	—	128	4·41					
		4740[1]	4735	0·92	34·67	27·81	2·15	57·6	—	133	4·33					
2770	17	0	—	5·23	33·98	26·87	1·54	41·4	0·23	7·6	7·27	**N 50 V**	100–0	2012		
		10	—	5·21	33·95	26·84	1·54	43·5	0·20	7·6	—	**N 70 V**	50–0			
		20	—	5·15	33·93	26·83	1·54	28·3	0·17	6·7	7·28	,,	100–50			
		30	—	5·13	33·96	26·86	1·54	33·4	0·23	5·9	—	,,	250–100			
		50	—	5·14	33·96	26·86	1·45	28·3	0·17	6·7	7·25	,,	500–250			
		75	—	5·46	34·02	26·87	1·49	31·3	0·17	8·4	—	,,	750–500			
		100	—	5·30	34·04	26·90	1·58	45·6	0·23	9·2	7·02	,,	1000–750	—	**0012**	
		150	—	4·69	34·05	26·98	1·66	55·7	0·17	12·6	6·62	**N 100 H**	0–1	**0058**	**0113**	
		200	—	5·04	34·16	27·03	1·78	62·7	0·00	15·1	6·21	**N 70 B**	143–0	**0101**	**0122**	KT
		300	—	4·40	34·14	27·09	1·87	60·0	0·00	16·8	6·35	**N 100 B**				
		400	—	4·19	34·14	27·11	2·03	74·8	0·00	24·4	5·64					
		500	—	3·82	34·22	27·20	2·15	69·9	0·00	30·3	5·32					
		590[2]	590	3·38	34·27	27·29	2·18	86·3	0·00	39·5	4·98					
		780[2]	779	2·85	34·36	27·41	2·39	69·9	—	61·3	4·45					
		960[3]	957	2·60	34·45	27·50	2·42	73·4	—	75·6	4·27					
		1160[3]	1155	2·47	34·54	27·59	2·39	86·3	—	86·0	4·11					
		1450[3]	1447	2·34	34·60	27·64	2·35	83·2	—	89·0	4·04					
		1590[1]	1591	2·26	34·63	27·68	2·25	71·3	—	96·6	4·01					
		2480[1]	2483	1·76	34·67	27·75	2·18	55·7	—	121	4·08					
		3370[1]	3369	1·19	34·67	27·79	2·15	52·1	—	139	4·23					
		4320[1]	4322	0·93	34·67	27·81	2·25	54·2	—	163	4·39					
2771	18	0	—	6·39	34·04	26·76	1·46	23·6	0·20	7·6	7·02	**N 100 B**	104–0	**2243**	**2305**	KT
		10	—	6·41	33·96	26·70	1·37	27·2	0·23	8·4	—					
		20	—	6·38	33·96	26·71	1·41	32·7	0·23	10·1	7·02					
		30	—	6·36	33·96	26·71	1·30	31·4	0·26	5·0	—					
		50	—	5·98	33·98	26·78	1·34	25·0	0·17	9·2	7·04					
		75	—	5·91	34·02	26·81	1·34	38·6	0·20	10·9	—					
		100	—	6·50	34·11	26·81	1·34	41·4	0·09	10·9	6·74					
		150	—	6·81	34·27	26·89	1·40	41·4	0·00	9·2	6·61					
		200	—	6·01	34·13	26·88	1·47	40·0	0·00	12·6	6·47					
		300	—	5·64	34·20	26·98	1·66	50·8	—	17·6	6·09					
		400	—	4·64	34·07	27·00	1·68	46·5	—	17·6	6·55					
		500[1]	500	4·22	34·14	27·11	1·82	60·0	—	25·2	5·62					
		650[1]	—	3·62	34·14	27·17	2·06	61·3	—	37·0	5·00					
		800[1]	798	3·36	34·29	27·30	2·15	60·8	—	44·5	4·63					
		940[1]	940	2·87	34·38	27·43	2·29	59·3	—	54·6	4·28					
		1180[1]	1178	2·60	34·47	27·52	2·39	75·0	—	71·4	3·92					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
2772	49° 20′ S, 171° 59′ E	1950 1 xii	0245 0330	143* 140*	W —	17–21 —	W —	4 —	W —	4 —	bc —	998·2 —	7·8 —	6·7 —
2773	56° 20′ S, 153° 42′ E	15 xii	1300	3661*	NNE	17–21	NNE	3	NE	5	ogmd	985·1	4·4	4·4
2774	56° 09′ S, 153° 40′ E	15 xii	1715	—	NE	4–6	NE	2	N	5	odm	980·1	4·4	4·4
2775	56° 00′ S, 153° 35′ E	15 xii	1730	3641*	NE	4–6	NE	2	N	5	odm	978·2	5·0	5·0
2776	55° 51′ S, 153° 30′ E	15 xii	1915	—	Var.	4–6	—	—	Conf.	5	odm	976·2	6·1	6·1
2777	55° 40′ S, 153° 28′ E	15 xii	2100	3795*	W × S	28–33	W'ly	4	W	5	odmQ	978·3	5·0	5·0
2778	33° 10′ S, 124° 58′ E	1951 8 i	1950	51*	ENE	7–10	NE	2	ENE	3	b	1014·1	20·0	18·3
2779	33° 34′ S, 125° 00′ E	8–9 i	2330	66*	E × N	7–10	E × N	2	E'ly	3	b	1015·2	19·4	18·9
2780	34° 30′ S, 124° 58′ E	9 i	0600	3694*	E × N	11–16	E × N	3	SW	4	b	1014·0	20·6	20·0

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
2772	21	—	—	—	—	—	—	—	—	—	—	**DC**	140	**0333**	**0336**	
		—	—	—	—	—	—	—	—	—	—	**DLH**	140	**0410**	**0416**	
2773	6	0	—	2·69	*33·75*	*26·94*	1·49	37·4	0·23	20·2	*7·76*	**BT**	0–277	—	—	Zone −11 hrs
		10	—	2·69	*33·75*	*26·94*	1·66	43·0	0·32	20·2	—					
		20	—	2·69	*33·75*	*26·94*	1·59	52·5	0·29	19·3	*7·78*					
		30	—	2·69	*33·77*	*26·95*	1·75	45·5	0·35	19·3	—					
		50	—	1·92	*33·86*	*27·08*	1·70	44·1	0·38	22·7	*7·74*					
		75	—	1·19	*33·84*	*27·12*	1·87	55·2	0·32	30·2	—					
		100	—	0·56	*34·05*	*27·33*	1·89	62·1	0·20	42·0	*6·99*					
		150	—	0·93	*34·23*	*27·46*	2·18	64·9	0·09	58·8	*5·91*					
		200	—	1·63	*34·29*	*27·45*	2·18	73·8	0·03	71·4	*4·95*					
		300	—	2·15	*34·51*	*27·59*	2·27	51·7	0·00	88·2	*4·35*					
		400	—	2·15	*34·60*	*27·66*	2·04	60·0	0·00	94·0	*4·20*					
		500	—	2·16	*34·61*	*27·68*	2·02	55·8	0·00	95·0	*4·25*					
		590[1]	586	2·16	*34·63*	*27·69*	1·94	58·6	—	107	*3·97*					
		780[1]	782	2·02	*34·74*	*27·79*	2·04	54·5	—	107	*4·03*					
		980[1]	—	1·91	*34·74*	*27·80*	1·85	55·2	—	119	*3·29*					
		1170[1]	1173	1·81	*34·70*	*27·77*	1·89	62·1	—	131	*4·02*					
		1480[1]	1479	1·57	*34·70*	*27·79*	1·75	55·2	—	131	*4·23*					
2774	6	—	—	—	—	—	—	—	—	—	—	**BT**	0–277			
2775	6	—	—	—	—	—	—	—	—	—	—	**BT**	0–277	—	—	Zone −10 hrs
2776	6	—	—	—	—		—	—	—	—	—	**BT**	0–277			
2777	6	0	—	5·11	*33·80*	*26·73*	1·39	26·2	0·35	4·2	*7·17*	**BT**	0–277			
		50	—	5·11	*33·80*	*26·73*	1·42	29·6	0·32	3·4	*7·20*					
		75	—	5·06	*33·82*	*26·76*	1·42	31·6	0·38	1·7	—					
		100	—	4·92	*33·80*	*26·76*	1·28	29·0	0·38	1·7	*4·68*					
		150	—	3·38	*33·93*	*27·02*	1·66	38·1	0·23	11·8	*7·21*					
		200	—	3·57	*34·07*	*27·11*	1·82	31·7	0·09	16·8	*6·47*					
		300	—	3·21	*34·20*	*27·25*	1·94	58·4	0·03	31·9	*5·78*					
		400	—	2·71	*34·31*	*27·38*	2·13	53·6	0·00	39·5	*5·45*					
		500	—	2·72	*34·42*	*27·46*	2·22	64·9	0·00	47·1	*5·02*					
		580[1]	581	2·60	*34·47*	*27·52*	2·22	56·5	—	57·2	*4·40*					
		790[2]	785	2·49	*34·54*	*27·59*	2·27	53·8	—	75·7	*4·08*					
		990[2]	—	2·37	*34·63*	*27·67*	2·32	52·4	—	80·7	*3·83*					
		1180[2]	1184	2·27	*34·69*	*27·72*	2·25	49·6	—	89·1	*3·83*					
2778	0	0	—	19·71	35·75	25·42	0·10	—	—	—	5·46	**DC**	51	**2027**	**2028**	Zone −8 hrs
		25	—	19·57	35·79	25·49	0·10	—	—	—	5·46					
		50	—	19·42	35·81	25·55	0·10	—	—	—	5·46					
2779	0	0	—	19·24	35·77	25·57	0·03	—	—	—	5·44	**DC**	65	**0003**	**0004**	
		25	—	19·12	35·71	25·55	0·00	—	—	—	5·53					
		50	—	18·81	35·79	25·69	0·03	—	—	—	5·50					
2780	1	0	—	18·48	35·66	25·68	0·06	—	—	—	5·56	**DC**	3694	**0915**	**0947**	
		25	—	18·31	35·62	25·69	0·10	—	—	—	5·63					
		50	—	18·11	35·64	25·75	0·06	—	—	—	5·56					
		75	—	16·01	35·52	26·16	0·10	—	—	—	5·96					
		100	—	14·57	35·41	26·40	0·13	—	—	—	6·00					
		150	—	13·37	35·21	26·50	0·16	—	—	—	5·91					
		200	—	12·77	35·07	26·51	0·29	—	—	—	5·81					
		300	—	11·34	34·94	26·69	0·45	—	—	—	5·59					
		400	—	9·83	34·76	26·81	0·61	—	—	—	5·66					
		580[1]	583	8·38	34·51	26·85	0·81	—	—	—	5·21					
		780[1]	—	6·74	34·38	26·99	1·16	—	—	—	4·49					
		980[1]	981	4·43	34·33	27·22	1·48	—	—	—	4·08					
		1470[1]	1471	2·66	34·56	27·58	1·77	—	—	—	3·62					
		1960[1]	1962	2·27	34·69	27·72	2·06	—	—	—	3·76					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2781	35° 20′ S, 125° 02′ E	1951 9 i	1640	4857*	NE	11–16	NE	4	SW	4	bc	1012·3	20·0	19·4
2782	36° 10′ S, 125° 00′ E	9–10 i	2330	—	NE	7–10	NE	3	SW	3	o	1013·1	18·9	18·9
2783	36° 41′ S, 125° 00′ E	10 i	0410	5401*	NE	7–16	NE	3	SW	3	bco	1011·2	18·9	18·3
2784	37° 49′ S, 124° 44′ E	10 i	2040	5941*	WSW	17–21	WSW	4	WSW	4	o	1006·5	17·8	16·7
2785	39° 35′ S, 119° 29′ E	12 i	1125	4801*	SW	7–10	SW	2	SW	4	bc	1022·7	13·9	11·7
2786	40° 05′ S, 118° 00′ E	12 i	2115	5027*	—	0	—	0	SW	3	od	1024·1	12·2	11·1

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	To	
2781	1	0	—	18·35	35·57	25·64	0·13	—	—	—	2·42?					
		25	—	18·00	35·53	25·70	0·13	—	—	—	4·66					
		50	—	17·33	35·55	25·87	0·10	—	—	—	4·88					
		75	—	15·80	35·53	26·22	0·10	—	—	—	4·92					
		100	—	14·75	35·48	26·41	0·16	—	—	—	4·70					
		150	—	14·06	35·37	26·48	0·29	—	—	—	4·33					
		200	—	13·18	35·23	26·55	0·35	—	—	—	4·46					
		300	—	11·57	34·97	26·67	0·61	—	—	—	4·91					
		400	—	11·64?	35·05	26·71	0·61	—	—	—	4·55					
		580[1]	582	8·30	34·58	26·92	1·26	—	—	—	4·18					
		780[1]	—	6·19	34·43	27·10	1·68	—	—	—	3·79					
		980[1]	976	4·10	34·33	27·26	2·06	—	—	—	3·49					
		1470[1]	1470	2·68	34·56	27·58	2·16	—	—	—	3·00					
		1970[1]	1967	2·28	34·65	27·69	2·13	—	—	—	3·06					
2782	1	0	—	18·11	35·59	25·71	0·06	—	—	—	5·10					
		25	—	18·06	35·59	25·72	0·16	—	—	—	5·26					
		50	—	17·83	35·59	25·78	0·23	—	—	—	5·29					
		75	—	15·70	35·48	26·20	0·42	—	—	—	5·56					
		100	—	14·94	35·50	26·39	0·42	—	—	—	5·52					
		150	—	13·80	35·28	26·46	0·61	—	—	—	5·29					
		200	—	13·05	35·21	26·57	0·68	—	—	—	5·34					
		300	—	11·74	35·03	26·68	0·94	—	—	—	5·21					
		400	—	10·06	34·78	26·79	1·06	—	—	—	5·53					
		580[1]	580	8·59	34·63	26·91	1·19	—	—	—	5·11					
		720[1]	—	7·37	34·47	26·97	1·35	—	—	—	4·54					
		850[1]	854	5·74	34·40	27·13	1·94	—	—	—	4·31					
		1170[1]	1165	3·55	34·40	27·37	2·19	—	—	—	3·98					
		1420[1]	1418	2·76	34·52	27·55	2·13	—	—	—	3·53					
2783	2	—	—	—	—	—	—	—	—	—	—	**STK**	5401	0830	0832	
2784	2	0	—	16·33	35·34	25·95	0·06	—	—	—	5·60					
		25	—	15·74	35·26	26·03	0·16	—	—	—	5·59					
		50	—	15·31	35·25	26·11	0·23	—	—	—	3·45?					
		75	—	12·96	35·07	26·47	0·42	—	—	—	5·82					
		100	—	12·53	35·07	26·55	0·42	—	—	—	5·72					
		150	—	11·42	34·96	26·68	0·61	—	—	—	5·72					
		200	—	11·03	34·92	26·72	0·68	—	—	—	5·64					
		300	—	9·85	34·85	26·87	0·94	—	—	—	5·46					
		400	—	8·95	34·72	26·93	1·06	—	—	—	5·45					
		590[1]	590	8·54	34·65	26·93	1·19	—	—	—	4·70					
		790[1]	—	7·42	34·52	27·00	1·35	—	—	—	4·36					
		990[1]	987	5·28	34·38	27·18	1·90	—	—	—	3·90					
		1490[1]	1485	2·84	34·56	27·57	2·19	—	—	—	3·32					
		1990[1]	1986	2·36	34·70	27·73	2·13	—	—	—	3·19					
2785	4	0	—	13·80	34·78	26·08	—	—	—	—	—	**N 70 H**	0–1	1125	1135	
												,,	0–1	1143	1200	
2786	4	0	—	14·60	35·03	26·10	0·42	—	—	—	6·12					
		25	—	14·12	34·96	26·14	0·39	—	—	—	6·14					
		50	—	13·41	34·94	26·28	0·48	—	—	—	6·17					
		75	—	12·01	34·96	26·57	0·52	—	—	—	6·16					
		100	—	11·12	34·87	26·67	0·52	—	—	—	6·25					
		150	—	10·22	34·87	26·83	0·61	—	—	—	6·24					
		200	—	10·43	34·90	26·82	0·87	—	—	—	5·70					
		300	—	9·14	34·65	26·84	1·06	—	—	—	6·01					
		400	—	8·80	34·67	26·91	1·13	—	—	—	5·97					
		600[1]	601	8·43	34·58	26·90	1·23	—	—	—	5·34					
		800[1]	—	7·31	34·47	26·98	1·52	—	—	—	4·70					
		1010[1]	1008	5·15	34·34	27·16	1·87	—	—	—	4·33					
		1500[1]	1502	2·94	34·56	27·56	2·23	—	—	—	3·62					
		2000[1]	2002	2·48	34·70	27·72	2·16	—	—	—	3·74					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. °C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2787	38° 25′ S, 118° 06′ E	1951 13 i	0915	5517*	E	4–6	E	2	E	2	o	1023·5	15·0	13·3
2788	37° 34′ S, 118° 05′ E	13 i	1600	5461*	E	11–16	E	3	E	3–4	oc	1020·8	18·3	16·1
2789	36° 45′ S, 118° 02′ E	13–14 i	2330	4905*	E×N	7–10	E	3	E	4	Od	1018·4	16·7	15·6
2790	35° 54′ S, 118° 02′ E	14 i	0900	4170*	E×N	11–21	E×N	4	E'ly	3	c	1019·1	18·9	17·2
2791	35° 35′ S, 118° 03′ E	14 i	1225	2880*	E	11–21	E	4	E	4	bc	1017·7	20·6	18·9

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
2787	5	0	—	15·59	35·32	26·10	0·32	—	—	—	5·98					
		25	—	15·55	35·32	26·11	0·32	—	—	—	6·05					
		50	—	15·37	35·39	26·21	0·32	—	—	—	5·87					
		75	—	14·40	35·39	26·42	0·35	—	—	—	5·89					
		100	—	13·67	35·34	26·54	0·42	—	—	—	5·82					
		150	—	12·75	35·21	26·63	0·52	—	—	—	5·78					
		200	—	11·46	34·97	26·69	0·65	—	—	—	5·72					
		300	—	9·92	34·74	26·79	0·94	—	—	—	5·84					
		400	—	9·10	34·69	26·87	1·10	—	—	—	5·81					
		540[1]	539	8·53	34·61	26·92	1·19	—	—	—	5·36					
		700[1]	—	8·10	34·47	26·86	2·13	—	—	—	6·29?					
		970[2]	968	5·21	34·40	27·19	1·90	—	—	—	4·39					
		1010[1]	1006	4·44	34·38	27·27	1·94	—	—	—	4·06					
		1370[1]	1366	3·02	34·60	27·58	1·74	—	—	—	3·47					
2788	5	0	—	17·31	35·61	25·93	0·19	—	—	—	5·19					
		25	—	16·04	35·32	26·00	0·16	—	—	—	6·02					
		50	—	15·80	35·44	26·15	0·23	—	—	—	6·04					
		75	—	14·20	35·30	26·40	0·45	—	—	—	6·01					
		100	—	13·98	35·34	26·47	0·42	—	—	—	5·79					
		150	—	12·04	35·05	26·63	0·55	—	—	—	5·96					
		200	—	11·40	34·96	26·68	0·71	—	—	—	5·95					
		300	—	9·94	34·76	26·79	0·94	—	—	—	6·07					
		400	—	9·09	34·49	26·72	1·19	—	—	—	5·84					
		580[1]	584	8·51	34·52	26·84	1·26	—	—	—	5·22					
		780[1]	—	6·84	34·40	26·99	1·84	—	—	—	4·15					
		970[1]	968	4·77	34·31	27·17	2·19	—	—	—	4·02					
		1450[1]	1454	2·83	34·42	27·45	2·39	—	—	—	3·50					
		1950[1]	1947	2·41	34·61	27·66	2·29	—	—	—	3·56					
2789	5	0	—	17·79	35·82	25·97	0·13	—	—	—	5·65					
		25	—	17·59	35·73	25·95	0·48	—	—	—	5·65					
		50	—	17·58	35·77	25·98	0·29	—	—	—	5·71					
		75	—	16·08	35·68	26·26	0·23	—	—	—	5·81					
		100	—	15·16	35·61	26·43	0·29	—	—	—	5·75					
		150	—	14·74	35·55	26·47	0·39	—	—	—	5·77					
		200	—	14·06	35·43	26·52	0·39	—	—	—	5·71					
		300	—	11·97	35·08	26·67	0·65	—	—	—	5·96					
		400	—	10·14	34·83	26·81	0·90	—	—	—	5·96					
		540[1]	538	9·02	34·69	26·89	1·16	—	—	—	5·44					
		780[2]	784	8·07	34·58	26·96	1·42	—	—	—	5·08					
		980[2]	983	5·49	34·31	27·09	1·97	—	—	—	4·31					
		1480[2]	—	2·87	34·56	27·57	2·32	—	—	—	3·58					
		1970[2]	1974	2·37	34·69	27·71	2·39	—	—	—	3·74					
2790	6	0	—	18·36	35·61	25·67	0·55	—	—	—	5·56					
		25	—	18·36	35·57	25·64	0·48	—	—	—	5·60					
		50	—	17·66	35·57	25·81	0·42	—	—	—	5·99					
		75	—	14·89	35·46	26·37	0·39	—	—	—	5·92					
		100	—	13·74	35·32	26·50	0·42	—	—	—	5·84					
		150	—	12·95	35·26	26·63	0·65	—	—	—	5·79					
		200	—	12·07	35·08	26·65	0·84	—	—	—	5·81					
		300	—	10·57	34·88	26·78	1·13	—	—	—	5·78					
		400	—	9·08	34·67	26·87	1·32	—	—	—	5·74					
		590[1]	592	8·42	34·49	26·83	1·55	—	—	—	5·24					
		790[1]	—	6·55	34·40	27·03	1·94	—	—	—	4·33					
		990[1]	991	3·99	34·31	27·26	2·39	—	—	—	4·07					
		1480[1]	1476	2·87	34·47	27·50	2·52	—	—	—	3·55					
		1970[1]	1969	2·46	34·67	27·69	2·58	—	—	—	3·62					
2791	6	0	—	18·38	35·59	25·64	0·48	—	—	—	5·57					
		25	—	18·16	35·61	25·72	0·48	—	—	—	5·56					
		50	—	17·46	35·55	25·84	0·45	—	—	—	5·77					
		75	—	15·92	35·55	26·21	0·58	—	—	—	5·76					
		100	—	14·57	35·41	26·40	0·55	—	—	—	5·72					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2791 *cont.*	35° 35′ S, 118° 03′ E	1951 14 i												
2792	35° 25′ S, 118° 03′ E	14 i	1540	128*	E×N	11–16	E	3	E	3	od	1018·2	19·4	18·3
2793	35° 16′ S, 118° 02′ E	14 i	1730	71*	E×N	11–16	E	3	E	3	od	1018·1	19·4	18·9
2794	32° 03′ S, 109° 39′ E	16 i	2030	5283*	S×E	11–21	S	4	S	3	O	1010·2	18·9	17·8
2795	32° 13′ S, 111° 46′ E	17 i	1145	5042*	S'ly	7–10	S	2	S'ly	2	bc	1007·2	20·6	18·3
2796	32° 06′ S, 112° 41′ E	17 i	1930	5000*	SSW	11–16	SSW	2	SW	2	oc	1007·1	18·9	17·8

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2791 *cont.*	6	150	—	13·26	35·26	26·56	0·68	—	—	—	5·66					
		200	—	12·42	35·16	26·64	0·81	—	—	—	5·76					
		300	—	10·72	34·94	26·80	1·10	—	—	—	5·79					
		400	—	9·10	34·67	26·86	1·55	—	—	—	5·75					
		560[1]	558	8·46	34·61	26·93	1·61	—	—	—	4·40					
		750[1]	—	6·75	34·47	27·06	2·16	—	—	—	4·33					
		940[1]	939	4·18	34·38	27·30	2·35	—	—	—	4·18					
		1430[1]	1429	2·74	34·63	27·64	2·61	—	—	—	3·59					
		1920[1]	1919	2·29	34·70	27·73	2·61	—	—	—	3·71					
2792	6	0	—	19·42	35·82	25·56	0·32	—	—	—	5·39					
		25	—	19·26	35·79	25·57	0·23	—	—	—	5·43					
		50	—	18·71	35·70	25·64	0·29	—	—	—	5·55					
		75	—	17·46	35·81	26·04	0·32	—	—	—	5·51					
		100	—	16·90	35·70	26·09	0·39	—	—	—	4·97					
		125	—	16·59	35·77	26·22	0·35	—	—	—	5·50					
2793	6	0	—	19·56	35·70	25·43	0·48	—	—	—	5·36					
		25	—	19·56	35·70	25·43	0·65	—	—	—	5·38					
		50	—	18·62	35·70	25·67	0·39	—	—	—	5·43					
2794	8	0	—	19·75	35·75	25·41	0·13	—	—	—	5·44	**TYFB**	128–0	**2330**	**2347**	KT
		25	—	19·18	35·82	25·62	0·13	—	—	—	5·45					
		50	—	18·62	35·84	25·77	0·10	—	—	—	5·65					
		75	—	17·64	35·84	26·02	0·16	—	—	—	5·61					
		100	—	16·63	35·68	26·14	0·23	—	—	—	5·72					
		150	—	15·53	35·71	26·42	0·29	—	—	—	5·62					
		200	—	13·54	35·34	26·56	0·42	—	—	—	5·67					
		300	—	11·75	35·07	26·71	0·61	—	—	—	5·86					
		400	—	9·99	34·81	26·83	0·87	—	—	—	5·90					
		570[1]	569	8·93	34·61	26·85	1·06	—	—	—	5·51					
		770[1]	—	7·39	34·40	26·91	1·39	—	—	—	4·76					
		960[1]	957	4·64	34·31	27·19	1·87	—	—	—	4·27					
		1460[1]	1455	2·98	34·49	27·50	2·42	—	—	—	3·50					
		1950[1]	1952	2·44	34·58	27·62	2·35	—	—	—	3·55					
2795	9	0	—	19·85	35·70	25·35	0·19	—	—	—	5·35	**TYFB**	81–0	1413	1433	KT
		25	—	19·56	35·68	25·41	0·16	—	—	—	5·39					
		50	—	19·51	35·66	25·41	0·19	—	—	—	5·40					
		75	—	19·44	35·61	25·39	0·16	—	—	—	5·33					
		100	—	19·37	35·70	25·48	0·16	—	—	—	5·32					
		150	—	18·11	35·79	25·86	0·19	—	—	—	5·32					
		200	—	16·57	35·73	26·20	0·29	—	—	—	5·41					
		300	—	14·10	35·52	26·58	0·52	—	—	—	5·61					
		400	—	12·28	35·10	26·63	0·58	—	—	—	5·95					
		500[1]	503	10·10	34·74	26·75	0·97	—	—	—	5·57					
		670[1]	—	8·50	34·52	26·84	1·26	—	—	—	5·22					
		970[2]	965	4·85	34·40	27·23	2·03	—	—	—	4·36					
		1450[2]	1448	3·12	34·56	27·54	2·26	—	—	—	3·44					
		1940[2]	1943	2·42	34·58	27·62	2·32	—	—	—	3·46					
2796	9	0	—	19·99	35·84	25·42	0·10	—	—	—	5·38	**TYFB**	84–0	**2149**	**2208**	KT
		25	—	19·56	35·79	25·49	0·13	—	—	—	5·42					
		50	—	18·71	35·84	25·75	0·13	—	—	—	5·59					
		75	—	18·03	35·91	25·98	0·13	—	—	—	5·58					
		100	—	17·06	35·82	26·15	0·19	—	—	—	5·50					
		150	—	15·65	35·75	26·42	0·32	—	—	—	5·47					
		200	—	14·55	35·57	26·53	0·39	—	—	—	5·51					
		300	—	12·70	35·32	26·71	0·45	—	—	—	5·92					
		400	—	10·17	34·79	26·78	0·97	—	—	—	5·93					
		520[1]	522	9·43	34·70	26·84	1·06	—	—	—	5·48					
		690[1]	—	8·27	34·61	26·96	1·23	—	—	—	5·13					
		850[1]	854	6·01	34·47	27·15	1·81	—	—	—	4·38					
		1300[1]	1299	3·19	34·49	27·48	2·32	—	—	—	3·50					
		1760[1]	1764	2·54	34·63	27·65	3·61	—	—	—	3·58					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2797	32° 00′ S, 113° 33′ E	1951 18 i	0200	4835*	SSW	7–10	SSW	1	SW	4	o	1006·0	18·3	17·2
2798	31° 58′ S, 114° 33′ E	18 i	0930	2922*	SSW	11–16	SSW	3	SW	2	o	1008·1	19·4	18·3
2799	31° 56′ S, 114° 56′ E	18 i	1230	549*	SSW	7–10	SW	2	SW	2	oc	1009·3	20·6	18·3
2800	31° 56′ S, 115° 07′ E	18 i	1416	777*	SSW	7–10	SW	3	SW	3	bc	1009·0	21·1	18·9
2801	7·2 miles 111° from Rottnest Island High Lt., W.A.	18 i	1615	82*	SSW	17–21	SW	3	SW	3	bc	1009·1	21·1	18·9
2802	39° 53′ S, 90° 24′ E	10–11 ii	2000	3334*	S×W	7–16	S×W	3–4	S	4	oc	1019·2	12·8	12·8

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	To	
2797	10	0	—	19·86	35·88	25·48	0·48	—	—	—	5·37	**TYFB**	132–0	**0403**	**0425**	KT
		25	—	18·34	35·75	25·78	0·23	—	—	—	5·62					
		50	—	17·66	35·73	25·94	0·19	—	—	—	5·66					
		75	—	15·78	35·62	26·29	0·26	—	—	—	5·87					
		100	—	14·82	35·52	26·42	0·35	—	—	—	5·87					
		150	—	13·19	35·30	26·61	0·52	—	—	—	5·75					
		200	—	12·19	35·14	26·68	0·74	—	—	—	5·82					
		300	—	10·34	34·87	26·81	0·94	—	—	—	5·99					
		400	—	9·26	34·69	26·85	1·06	—	—	—	5·89					
		570[1]	567	8·58	34·65	26·93	1·26	—	—	—	5·53					
		770[1]	—	6·81	34·45	27·03	1·55	—	—	—	4·48					
		970[1]	966	4·18	34·38	27·30	1·97	—	—	—	4·08					
		1440[1]	1444	2·89	34·58	27·58	2·06	—	—	—	3·44					
		1940[1]	1943	2·33	34·69	27·71	2·26	—	—	—	3·49					
2798	10	0	—	21·32	35·88	25·09	0·48	—	—	—	5·28					
		25	—	20·11	35·86	25·41	0·23	—	—	—	5·31					
		50	—	18·59	35·77	25·73	0·16	—	—	—	5·47					
		75	—	17·69	35·75	25·94	0·19	—	—	—	5·65					
		100	—	17·28	35·77	26·06	0·19	—	—	—	5·56					
		150	—	16·13	35·62	26·21	0·39	—	—	—	5·54					
		200	—	15·12	35·50	26·35	0·35	—	—	—	5·56					
		300	—	12·36	35·12	26·63	0·65	—	—	—	5·62					
		400	—	10·23	34·81	26·79	0·81	—	—	—	6·00					
		540[1]	542	8·67	34·58	26·86	1·13	—	—	—	5·47					
		730[1]	—	5·99	34·49	27·17	1·90	—	—	—	4·46					
		920[1]	915	3·94	34·43	27·36	2·16	—	—	—	4·04					
		1420[1]	1419	2·91	34·60	27·59	2·19	—	—	—	3·55					
		1890[1]	1890	2·19	34·72	27·75	2·19	—	—	—	3·67					
2799	10	0	—	22·11	35·59	24·65	0·10	—	—	—	5·02					
		25	—	20·93	35·70	25·06	0·10	—	—	—	5·08					
		50	—	20·14	35·71	25·28	0·26	—	—	—	5·25					
		75	—	19·75	35·73	25·41	0·13	—	—	—	5·23					
		100	—	19·13	35·73	25·57	0·10	—	—	—	5·45					
		150	—	17·53	35·81	26·02	0·23	—	—	—	5·35					
		200	—	16·51	35·75	26·22	0·42	—	—	—	5·34					
		280[1]	276	14·68	35·46	26·41	0·61	—	—	—	5·24					
		360[1]	364	12·03	35·01	26·51	0·81	—	—	—	5·43					
		470[1]	473	9·39	34·72	26·85	1·10	—	—	—	5·52					
2800	10	0	—	21·61	35·64	24·83	0·19	—	—	—	5·23					
		25	—	20·86	35·70	25·08	0·29	—	—	—	5·21					
		50	—	20·62	35·77	25·20	0·16	—	—	—	5·16					
		75	—	20·23	35·75	25·29	0·39	—	—	—	5·12					
		100	—	20·07	35·75	25·33	0·23	—	—	—	5·12					
		150	—	19·99	35·70	25·31	0·35	—	—	—	5·05					
		200	—	18·38	35·81	25·81	0·35	—	—	—	5·10					
		300	—	13·32	35·39	26·65	0·81	—	—	—	5·57					
		380[1]	380	13·03	35·53	26·82	0·65	—	—	—	5·28					
		590[2]	590	8·17	34·60	26·95	1·48	—	—	—	5·27					
		700[2]	695	6·38	34·49	27·12	1·97	—	—	—	4·58					
2801	10	0	—	21·74	35·82	24·93	0·35	—	—	—	5·16					
		25	—	20·65	35·68	25·12	0·35	—	—	—	5·30					
		50	—	20·43	35·81	25·28	0·32	—	—	—	5·55					
		75	—	20·41	35·77	25·26	0·29	—	—	—	5·18					
2802	4	0	—	15·25	*34·90*	*25·86*	0·34	6·4	0·14	2·2	*6·06*	**NHP**	50–0	**2011**	—	Zone −6 hrs
		10	—	15·25	*34·92*	*25·87*	0·38	0·6	0·14	2·2	—	**N 50 V**	100–0			
		20	—	15·25	*34·90*	*25·86*	0·38	2·8	0·17	4·4	*6·10*	**N 70 V**	50–0			
		30	—	15·23	*34·90*	*25·87*	0·38	2·0	0·14	4·4	—	,,	100–50			
		50	—	13·02	*35·03*	*26·43*	0·54	4·4	0·20	5·1	*6·26*	,,	250–100			
		75	—	12·05	*35·03*	*26·62*	0·63	5·4	0·12	6·6	—	,,	500–250			
		100	—	11·73	*35·03*	*26·68*	0·67	14·8	0·03	8·8	*6·16*	,,	750–500	—	—	Considerable stray on wire

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2802 *cont.*	39° 53′ S, 90° 24′ E	1951 10–11 ii												
2803	42° 24′ S, 90° 25′ E	11 ii	2000	2315*	SW	7–10	SW	2	SW	3	0	1021·0	10·6	10·6
2804	45° 11′ S, 90° 36′ E	12–13 ii	2000	3299*	NW	17–21	NW	4	NW	4	0	1012·1	11·1	10·6
2805	48° 04′ S, 90° 50′ E	13–14 ii	2000	3550*	Lt. airs	1–3	—	0	Conf.	4	0	999·2	6·7	6·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2802 *cont.*	4	150	—	11·48	*35·03*	*26·73*	0·72	18·6	0·00	8·8	*6·06*	**N 70 V**	1000–750	—	—	Considerable stray on [wire
		200	—	11·22	*35·01*	*26·77*	0·75	18·4	0·00	9·5	*6·02*	,,	1500–1000	—	**2317**	
		300	—	11·01	*34·97*	*26·78*	0·72	19·8	0·00	7·3	*6·75*	**N 100 H**	0–1	**2326**	**2348**	
		400	—	10·88	*34·92*	*26·75*	0·70	20·5	0·00	5·9	*2·96*	**N 100 B**	146–0	**2343**	**0004**	KT
		470^{2}	471	10·79	*34·94*	*26·79*	0·72	20·9	—	8·8	*5·84*	**LH**	0–1			
		560^{2}	—	10·20	*34·87*	*26·83*	0·79	25·6	—	8·1	*5·66*					
		730^{2}	731	8·65	*34·61*	*26·90*	1·08	65·0	—	13·2	*5·19*					
		910^{2}	905	6·63	*34·45*	*27·05*	1·46	64·0	—	20·6	*4·62*					
		1090^{2}	1093	4·59	*34·33*	*27·21*	1·70	76·8	—	35·3	*4·54*					
		1380^{1}	1380	3·26	*34·45*	*27·44*	1·93	76·0	—	58·1	*4·10*					
		1860^{1}	1863	2·56	*34·58*	*27·61*	1·80	72·1	—	78·2	*3·89*					
		2330^{1}	2330	2·27	*34·69*	*27·72*	1·76	86·3	—	89·0	*4·14*					
		2820^{1}	2819	1·74	*34·69*	*27·76*	1·76	95·6	—	111	*4·26*					
2803	5	0	—	11·88	*34·60*	*26·32*	0·67	5·6	0·11	0·7	*3·99*	**NHP**	50–0	**2024**		
		10	—	11·88	*34·58*	*26·31*	0·66	7·3	0·12	0·7	—	**N 50 V**	100–0			
		20	—	11·69	*34·58*	*26·34*	0·67	6·0	0·14	2·2	*6·49*	**N 70 V**	50–0			
		30	—	11·64	*34·56*	*26·33*	0·66	9·8	0·15	1·5	—	,,	100–50			
		50	—	11·61	*34·56*	*26·34*	0·70	8·4	0·16	2·2	*6·51*	,,	250–100			
		75	—	11·37	*34·63*	*26·44*	0·70	9·4	0·18	3·7	—	,,	500–250			
		100	—	9·36	*34·51*	*26·69*	0·94	25·3	0·23	4·4	*6·41*	,,	750–500			
		150	—	9·43	*34·63*	*26·78*	0·92	26·3	0·04	6·6	*6·15*	,,	1000–750			
		200	—	9·79?	*34·63*	*26·72*	1·00	26·7	0·03	8·8	*5·90*	,,	1500–1000	—	**2304**	
		300	—	8·90	*34·63*	*26·87*	1·08	27·3	0·01	8·8	*6·01*	**N 100 H**	0–1	**2314**	**2335**	
		400	—	7·67	*34·65*	*27·06*	1·08	39·0	0·00	8·1	*6·41*	**N 70 B**	} 123–0	**2327**	**2348**	KT
		480^{2}	484	7·51	*34·42*	*26·90*	1·20	45·1	0·00	13·2	*5·42*	**N 100 B**				
		580^{2}	—	6·45	*34·42*	*27·05*	1·23	44·5	0·00	17·7	*5·08*					
		810^{1}	807	4·65	*34·34*	*27·22*	1·44	56·2	—	27·2	*4·97*					
		990^{1}	—	3·75	*34·33*	*27·29*	1·55	55·4	—	39·0	*4·50*					
		1180^{1}	1179	3·06	*34·42*	*27·43*	1·66	62·1	—	55·9	*4·18*					
		1470^{1}	1466	2·70	*34·58*	*27·60*	1·70	62·1	—	70·6	*3·89*					
		2000^{2}	—	2·41	*34·67*	*27·69*	1·74	61·0	—	78·0	*4·22*					
2804	6	0	—	10·43	*34·25*	*26·31*	0·86	19·0	0·23	1·5	*6·80*	**NHP**	50–0	**2006**		
		10	—	10·43	*34·25*	*26·31*	0·86	18·2	0·18	1·5	—	**N 50 V**	100–0	—	—	Great stray on wire.
		20	—	10·48	*34·25*	*26·30*	0·86	20·1	0·21	5·1	*4·36*	**N 70 V**	50–0			[Net torn, catch re-
		30	—	10·46	*34·31*	*26·35*	0·89	22·3	0·17	7·3	—	,,	100–50			[tained
		50	—	10·28	*34·31*	*26·39*	0·86	21·3	0·21	5·1	*6·67*	,,	250–100			
		75	—	9·94	*34·45*	*26·55*	0·88	23·8	0·32	5·9	—	,,	500–250			
		100	—	10·04	*34·69*	*26·72*	0·92	31·7	0·00	10·3	*4·41*	,,	750–500			
		150	—	9·66	*34·67*	*26·77*	1·01	31·0	0·00	9·5	*6·15*	,,	1000–700			
		200	—	9·00	*34·56*	*26·79*	1·02	33·8	0·03	10·3	*3·76*	,,	1500–1000	—	**2344**	
		300	—	8·27	*34·51*	*26·87*	1·13	34·9	0·00	11·0	*6·17*	**N 100 H**	0–1	**2355**	**0013**	
		400	—	7·45	*34·51*	*26·99*	1·30	51·6	0·00	13·2	*3·60*	**N 70 B**	} 73–0	**0003**	**0024**	KT
		500^{2}	496	6·73	*34·45*	*27·04*	1·52	66·1	0·00	18·4	*4·86*	**N 100 B**				
		600^{2}	596	5·63	*34·36*	*27·11*	1·71	66·1	—	24·2	*4·88*					
		800^{2}	—	4·11	*34·33*	*27·26*	1·87	89·5	—	36·0	*4·83*					
		1000^{2}	995	3·25	*34·36*	*27·37*	2·02	77·3	—	55·1	*4·53*					
		1200^{2}	1195	2·66	*34·45*	*27·50*	2·05	74·1	—	67·6	*4·12*					
		1480^{1}	1480	2·62	*34·60*	*27·62*	2·05	83·4	—	85·3	*4·19*					
		1800^{1}	1798	2·38	*34·63*	*27·67*	1·87	61·2	—	83·0	*4·28*					
		2370^{1}	2368	1·99	*34·72*	*27·77*	1·82	59·0	—	97·0	*4·41*					
2805	7	0	—	7·39	*33·96*	*26·57*	1·07	40·5	0·26	5·9?	*3·71*	**N 50 V**	100–0	**2041**	—	Net torn—catch re-
		10	—	7·39	*33·96*	*26·57*	1·10	40·5	0·23	0·7	—	**N 70 V**	50–0			tained
		20	—	7·39	*33·96*	*26·57*	1·13	41·5	0·24	2·2	*7·02*	,,	100–50			
		30	—	7·38	*33·96*	*26·57*	1·16	56·0	0·22	2·9	—	,,	250–100			
		50	—	7·12	*33·95*	*26·60*	1·21	43·4	0·24	3·7	*7·07*	,,	500–250			
		75	—	6·89	*33·95*	*26·63*	1·21	51·2	0·26	3·7	—	,,	750–500			
		100	—	7·09	*34·13*	*26·74*	1·27	52·2	0·32	3·7	*6·81*	,,	1000–750	—	**0016**	
		150	—	7·41	*34·33*	*26·85*	1·27	45·0	0·00	16·2	*6·74*	**N 100 H**	0–1	**0033**	**0053**	
		200	—	6·96	*34·31*	*26·90*	1·23	44·1	0·00	5·9?	*6·72*	**N 70 B**	} 88–0	**0044**	**0100**	KT. **N 100 B** fished
		300	—	6·83	*34·27*	*26·89*	1·29	45·3	0·00	12·5	*6·51*	**N 100 B**				on surface for 5 min.
		400	—	6·29	*34·27*	*26·96*	1·36	63·0	0·00	12·5	*6·38*					Due to hold-up when
		490^{2}	485	5·79	*34·33*	*27·06*	1·55	74·9	—	16·9	*5·39*					paying out

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Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2805 *cont.*	48° 04′ S, 90° 50′ E	1951 13–14 ii												
2806	50° 43′ S, 91° 03′ E	14–15 ii	2000	4001*	W	11–16	W	4	W	3	bcqh	997·2	3·9	2·8
2807	53° 23′ S, 91° 09′ E	15–16 ii	2000	4457*	N	28–33	N	5–4	N	5	oq	992·3	3·9	3·9
2808	56° 59′ S, 91° 32′ E	17 ii	0900	4203*	NW	17–21	NW	5	NW	4	bcq	976·1	1·7	1·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	TIME From	To	
2805 *cont.*	7	580[2]	579	4·85	*34·31*	*27·17*	1·76	65·0	—	22·1	*5·13*					
		780[2]	—	3·67	*34·33*	*27·30*	1·87	95·3	—	34·6	*4·80*					
		980[2]	975	2·88	*34·34*	*27·40*	2·02	83·0	—	45·6	*4·50*					
		1180[2]	1175	2·76	*34·34*	*27·41*	2·08	89·2	—	58·8	*4·15*					
		1420[1]	1420	2·49	*34·58*	*27·62*	1·99	85·8	—	63·2	*3·86*					
		1890[1]	1894	2·34	*34·70*	*27·73*	1·83	82·0	—	71·3	*4·22*					
		2380[1]	—	2·07	*34·72*	*27·76*	1·76	90·0	—	77·2	*4·05*					
		2860[1]	2860	1·56	*34·72*	*27·80*	1·82	81·0	—	88·2	*4·32*					
		3330[1]	3325	1·12	*34·70*	*27·82*	1·82	85·4	—	107	*4·36*					
2806	8	0	—	5·01	*33·82*	*26·76*	1·20	49·0	0·27	4·4	*7·42*	**NHP**	50–0	**2010**		
		10	—	5·01	*33·84*	*26·77*	1·23	49·5	0·29	4·4	—	**N 50 V**	100–0			
		20	—	4·94	*33·84*	*26·78*	1·26	52·1	0·27	4·4	*2·93*	**N 70 V**	50–0			
		30	—	4·83	*33·84*	*26·79*	1·29	59·2	0·32	4·4	—	,,	100–50			
		50	—	4·74	*33·84*	*26·81*	1·29	49·5	0·26	4·4	*7·53*	,,	250–100			
		75	—	4·63	*33·86*	*26·83*	1·35	50·3	0·23	4·4	—	,,	500–250			
		100	—	4·49	*33·86*	*26·84*	1·30	37·3	0·25	5·9	*2·82*	,,	750–500			
		150	—	2·96	*33·89*	*27·02*	1·46	54·1	0·37	8·8	*7·50*	,,	1000–750			
		200	—	2·35	*33·98*	*27·15*	1·64	67·3	0·04	17·6	*7·09*	,,	1500–1000	—	**2318**	
		300	—	2·28	*34·13*	*27·27*	1·87	63·5	0·02	30·8	*6·14*	**N 100 H**	0–1	**2355**	**0010**	
		400	—	2·29	*34·23*	*27·36*	1·96	74·0	0·00	39·7	*5·42*	**N 70 B**	160–0	**0000**	**0021**	KT
		500	—	2·27	*34·33*	*27·43*	1·96	76·6	0·00	51·4	*4·87*	**N 100 B**				
		590[2]	587	2·23	*34·38*	*27·48*	1·99	86·6	—	58·9	*4·49*					
		790[3]	788	2·35	*34·54*	*27·60*	2·02	65·8	—	66·2	*4·19*					
		980[3]	981	2·35	*34·60*	*27·64*	1·93	74·0	—	67·6	*4·13*					
		1190[3]	1191	2·30	*34·70*	*27·73*	1·81	68·5	—	69·1	*4·27*					
		1410[1]	1405	2·27	*34·70*	*27·74*	1·81	58·8	—	72·0	*4·28*					
		1860[1]	1860	2·00	*34·70*	*27·76*	1·72	66·8	—	76·5	*4·59*					
		2350[1]	—	1·63	*34·72*	*27·80*	1·72	85·6	—	85·3	*4·47*					
		2830[1]	2829	1·15	*34·72*	*27·83*	1·81	73·0	—	106	*4·59*					
2807	9	0	—	3·33	*34·00*	*27·08*	1·39	42·7	0·30	9·5	*7·65*	**NHP**	50–0	**2014**		
		10	—	3·33	*33·96*	*27·05*	1·43	33·3	0·30	8·1	—	,,	100–0	—	—	In lieu of **N 50 V**
		20	—	3·33	*33·96*	*27·05*	1·45	42·7	0·27	10·3	*7·66*	**N 70 V**	50–0	—	—	Great stray
		30	—	3·33	*33·96*	*27·05*	1·49	51·1	0·26	10·3	—	,,	100–50	—	—	Great stray
		50	—	3·31	*33·96*	*27·05*	1·49	40·8	0·26	14·0	*7·67*	,,	250–100	—	**2236**	Remainder of vertical
		75	—	2·51	*33·93*	*27·09*	1·39	44·5	0·31	12·5	—	**N 100 B**	33–0	**0022**	**0041**	KT nets abandoned on
		100	—	2·19	*33·93*	*27·12*	1·43	32·3	0·31	16·2	*7·82*					account of heavy
		150	—	1·68	*33·96*	*27·19*	1·62	39·8	0·23	22·8	*7·23*					weather
		200	—	2·18	*34·13*	*27·28*	2·22	54·0	0·00	30·1	*6·26*					
		300	—	2·26	*34·33*	*27·43*	1·87	44·6	0·00	48·5	—					
		400	—	2·38	*34·42*	*27·49*	1·96	54·1	0·00	58·8	*4·66*					
		490[1]	485	2·30	*34·49*	*27·56*	1·96	58·9	—	63·9	*3·00*					
		630[2]	627	2·21	*34·58*	*27·64*	1·93	62·4	—	70·6	*4·30*					
		790[1]	788	2·20	*34·70*	*27·74*	1·87	54·0	—	77·9	*4·37*					
		960[3]	960	1·99	*34·72*	*27·77*	1·84	51·3	—	76·4	*4·38*					
		1420[1]	1419	1·70	*34·70*	*27·78*	1·84	55·0	—	85·3	*4·53*					
		1890[1]	1889	1·27	*34·69*	*27·79*	1·73	48·5	—	92·6	*4·42*					
		2870[1]	2868	0·46	*34·69*	*27·84*	1·73	72·0	—	116	*4·49*					
		3860[1]	3857	0·08	*34·69*	*27·87*	1·73	56·0	—	115	*4·78*					
2808	11	0	—	1·16	*33·86*	*27·13*	1·17	54·1	0·33	1·6	*7·88*	**NHP**	50–0	0926		
		10	—	1·12	*33·86*	*27·13*	1·38	53·2	0·33	1·6	—	,,	100–0			
		20	—	1·10	*33·86*	*27·14*	1·46	53·2	0·32	13·2	*7·98*	**N 70 V**	50–0			
		30	—	1·10	*33·86*	*27·14*	1·49	47·8	0·35	11·8	—	,,	100–50			
		50	—	1·05	*33·87*	*27·16*	1·49	43·3	0·35	12·5	*7·84*	,,	250–100			
		75	—	0·19	*33·96*	*27·28*	1·71	51·3	0·34	22·1	—	,,	500–250			
		100	—	0·06	*34·14*	*27·44*	1·93	61·3	0·17	40·4	*6·65*	,,	750–500			
		150	—	0·92	*34·33*	*27·53*	1·99	71·3	0·00	51·5	*5·53*	,,	1000–750	—	1240	
		200	—	1·59	*34·45*	*27·58*	2·02	73·1	0·00	63·2	*4·76*	**BT**	0–277			
		300	—	1·89	*34·58*	*27·67*	2·05	62·2	0·00	67·6	*4·44*					
		400	—	1·90	*34·65*	*27·72*	1·99	68·6	0·00	70·6	*4·47*					
		500[1]	495	1·87	*34·69*	*27·75*	1·93	60·7	—	80·8	*4·38*					
		600[1]	601	1·84	*34·70*	*27·77*	1·90	66·0	—	79·4	*4·34*					
		800[1]	—	1·74	*34·70*	*27·78*	1·81	78·0	—	80·8	*4·64*					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2808 *cont.*	56° 59′ S, 91° 32′ E	1951 17 ii												
2809	57° 55′ S, 91° 40′ E	17 ii	2100	4640*	N	7–10	N	3	NW	4	ogs	978·3	1·1	1·1
2810	60° 33′ S, 92° 22′ E	18–19 ii	2000	4409*	Lt. airs	1–3	—	0	Conf.	2	bc	977·8	1·1	0·6
2811	62° 49′ S, 90° 57′ E	19–20 ii	2000	3917*	W	7–10	WNW	2	NW	3	o	985·0	1·1	0·6
2812	64° 53′ S, 89° 54′ E	20 ii	1630	3220*	N × E	11–16	N × E	2	N'ly	1	OS	983·3	−0·3	−0·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	To	
2808 *cont.*	11	990[1]	992	1·67	*34·70*	*27·78*	1·75	71·7	—	88·2	*4·59*					
		1480[1]	1480	1·16	*34·70*	*27·82*	1·84	77·8	—	97·0	*4·63*					
		1970[2]	1972	0·76	*34·70*	*27·85*	1·93	85·0	—	109	*4·59*					
		2950[2]	2954	0·19	*34·69*	*27·86*	1·93	65·1	—	112	*4·86*					
		3940[2]	3935	0·00	*34·69*	*27·87*	1·90	67·9	—	120	*4·89*					
2809	11	0	—	1·61	*33·77*	*27·03*	—	—	—	—	—	**BT**	0–270	**2110**	**2115**	
												N 100 H	0–1	**2125**	**2144**	
												N 70 B	} 81–0	**2135**	**2155**	KT
												N 100 B				
2810	12	0	—	1·39	*33·55*	*26·88*	1·26	39·6	0·34	19·1	*8·01*	**NHP**	50–0	**2007**		
		10	—	1·18	*33·55*	*26·89*	1·32	38·8	0·31	18·3	—	**N 50 V**	100–0			
		20	—	1·13	*33·55*	*26·90*	1·35	43·2	0·30	19·1	*8·04*	**N 70 V**	50–0			
		30	—	1·12	*33·58*	*26·93*	1·35	41·5	0·30	19·1	—	,,	100–50			
		50	—	0·08	*33·77*	*27·13*	1·64	47·8	0·26	30·8	*7·72*	,,	250–100			
		75	—	−0·94	*34·16*	*27·49*	1·87	54·0	0·21	52·2	—	,,	500–250			
		100	—	−0·66	*34·33*	*27·61*	1·93	72·0	0·18	55·2	*6·35*	,,	750–500			
		150	—	0·55	*34·52*	*27·71*	2·08	72·0	0·02	68·4	*5·23*	,,	1000–750			
		200	—	1·34	*34·60*	*27·72*	2·02	77·5	0·02	73·5	*4·70*	,,	1500–1000	—	**0056**	
		300	—	1·58	*34·65*	*27·74*	1·99	73·9	0·00	75·0	*4·75*	**N 100 H**	0–1	**0106**	**0130**	
		400	—	1·77	*34·69*	*27·76*	1·96	64·0	0·00	76·4	*4·62*	**N 70 B**	} 150–0	**0121**	**0141**	KT
		500[2]	502	1·68	*34·67*	*27·75*	1·93	74·5	0·00	80·8	*4·56*	**N 100 B**				
		600[2]	602	1·58	*34·69*	*27·77*	1·87	88·1	—	84·4	*4·59*	**BT**	0–277			
		1000[3]	995	1·26	*34·72*	*27·82*	1·84	88·1	—	88·3	*4·84*					
		1200[3]	1196	0·97	*34·70*	*27·83*	1·90	90·0	—	96·9	*4·94*					
		1490[1]	1492	0·83	*34·70*	*27·84*	1·87	84·8	—	106	*4·42*					
		2000[1]	2004	0·46	*34·69*	*27·84*	1·93	84·8	—	116	*4·56*					
		2500[1]	—	0·20	*34·69*	*27·86*	1·87	85·3	—	119	*4·89*					
		2990[1]	2990	0·06	*34·67*	*27·86*	1·96	87·3	—	120	*4·83*					
		3980[1]	3983	−0·12	*34·67*	*27·87*	1·90	59·3	—	113	*5·26*					
2811	13	0	—	1·18	*33·71*	*27·02*	1·11	51·2	0·36	18·0	*8·16*	**NHP**	50–0	**2014**		
		10	—	1·17	*33·69*	*27·00*	1·19	52·2	0·36	17·5	—	**N 50 V**	100–0			
		20	—	1·08	*33·71*	*27·03*	1·17	56·8	0·35	17·0	*8·22*	**N 70 V**	50–0			
		30	—	0·98	*33·71*	*27·03*	1·23	55·0	0·35	17·0	—	,,	100–50			
		50	—	−1·52	*34·22*	*27·55*	1·71	57·7	0·10	32·0	*8·24*	,,	250–100			
		75	—	−1·65	*34·33*	*27·64*	1·81	68·7	0·18	34·5	—	,,	500–250			
		100	—	−1·10	*34·42*	*27·70*	1·87	68·7	0·11	39·0	*6·62*	,,	750–500			
		150	—	0·28	*34·58*	*27·77*	1·93	92·6	0·00	48·5	*5·56*	,,	1000–725			
		200	—	0·69	*34·60*	*27·76*	1·93	81·9	0·00	51·0	*5·28*	,,	1500–1000	—	**2345**	
		300	—	1·01	*34·65*	*27·78*	1·93	69·1	0·00	53·5	*5·12*	**N 100 H**	0–1	**0024**	**0050**	
		400	—	1·16	*34·69*	*27·80*	1·93	71·1	—	58·0	*5·14*	**N 70 B**	} 91–0	**0038**	**0058**	KT
		490[3]	493	1·08	*34·70*	*27·83*	1·87	74·9	—	58·0	*4·78*	**N 100 B**				
		600[2]	598	1·09	*34·72*	*27·83*	1·87	75·8	—	62·0	*4·65*	**BT**	0–277			
		800[2]	802	0·95	*34·72*	*27·84*	1·87	81·1	—	66·0	*4·58*					
		990[2]	—	0·83	*34·72*	*27·85*	1·87	81·1	—	68·5	*4·74*					
		1190[2]	1192	0·69	*34·70*	*27·85*	1·87	74·8	—	71·5	*4·54*					
		1470[1]	1471	0·51	*34·70*	*27·86*	1·93	68·4	—	78·0	*4·63*					
		1970[1]	1970	0·22	*34·69*	*27·86*	1·93	75·8	—	83·0	*4·80*					
		2470[1]	—	0·02	*34·69*	*27·87*	1·84	84·0	—	81·0	*5·08*					
		2960[1]	2961	−0·09	*34·69*	*27·88*	1·87	66·8	—	80·0	*5·13*					
		3490[3]	3491	−0·15	*34·69*	*27·88*	1·87	70·3	—	80·0	*5·34*					
2812	14	0	—	−0·77	*33·17*	*26·68*	1·20	50·3	0·23	41·9	*8·37*	**NHP**	50–0	1642		
		10	—	−0·82	*33·19*	*26·70*	1·20	44·8	0·23	41·9	—	**N 50 V**	100–0			
		20	—	−1·12	*33·44*	*26·92*	1·32	64·9	0·17	45·6	*8·35*	**N 70 V**	50–0			
		30	—	−1·54	*34·23*	*27·57*	1·79	72·0	0·11	53·7	—	,,	100–50			
		50	—	−1·72	*34·38*	*27·70*	1·82	54·0	0·15	55·1	*7·52*	,,	250–100			
		75	—	−1·78	*34·40*	*27·71*	1·87	76·4	0·22	55·9	—	,,	500–250			
		100	—	−1·79	*34·38*	*27·70*	1·87	73·0	0·04	55·1	*7·57*	,,	750–500			
		150	—	−1·75	*34·40*	*27·71*	1·90	70·3	0·00	54·4	*7·54*	,,	1000–750			
		200	—	−1·43	*34·45*	*27·74*	1·94	74·0	0·00	60·3	*7·35*	,,	1500–1000			
		300	—	−0·21	*34·58*	*27·80*	1·99	95·4	0·04	76·4	*5·96*	,,	2000–1500	—	**2029**	
		400	—	0·68	*34·69*	*27·83*	1·99	85·6	0·00	88·9	*5·33*	**N 100 H**	0–1	**2132**	**2153**	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2812 *cont.*	64° 53′ S, 89° 54′ E	1951 20 ii												
2813	63° 55′ S, 93° 04′ E	21 ii	2100	3124*	W	1–3	W	1	—	0	bc	982·6	−1·1	−1·1
2814	63° 08′ S, 98° 14′ E	22 ii	2100	2890*	SE	7–10	SE	2	—	0	o	986·2	−3·3	−3·3
2815	64° 07′ S, 103° 07′ E	23 ii	2100	1725*	SW	4–6	SW	2	—	0	o	986·2	−6·1	−6·1
2816	62° 27′ S, 107° 43′ E	24 ii	2100	3967*	SW	4–6	—	—	N'ly	2	o	977·0	−1·1	−1·1
2817	37° 15′ S, 152° 08′ E	22 v	1300	4901*	SE	7–16	SE	2	SE	4	bcs	1025·0	15·6	13·9
2818	39° 21′ S, 155° 36′ E	23 v	1300	4716*	ENE	7–10	ENE	3	ENE	2–3	bc	1024·7	13·9	13·3

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2812 cont.	14	530[4]	529	0·91	*34·69*	*27·82*	2·05	86·7	0·00	95·6	—	N 70 B	88–0	2143	2204	KT
		620[2]	619	0·81	*34·72*	*27·85*	2·05	89·1	—	100	*4·94*	N 100 B				
		760[1]	761	0·69	*34·72*	*27·86*	2·02	83·7	—	107	*4·93*	BT	0–277			
		930[3]	926	0·59	*34·72*	*27·87*	2·02	86·7	—	112	*4·84*					
		1110[3]	1106	0·45	*34·70*	*27·87*	1·99	93·0	—	110	*4·73*					
		1410[1]	1409	0·20	*34·69*	*27·86*	1·99	74·8	—	120	*5·02*					
		1890[3]	1888	−0·02	*34·70*	*27·89*	1·96	85·4	—	123	*5·04*					
		2350[3]	2347	−0·16	*34·69*	*27·88*	1·96	81·0	—	115	*5·16*					
		2840[3]	2835	−0·21	*34·67*	*27·87*	1·96	93·0	—	115	*5·33*					
2813	15	0	—	0·50	*32·63*	*26·20*	—	—	—	—	—	N 100 H	0–1	2130	2150	
												N 70 B	90–0	2139	2200	KT
												N 100 B				
												BT	0–277			
2814	16	0	—	−0·44	*32·16*	*25·86*	—	—	—	—	—	N 100 H	0–1	2121	2141	
												N 70 B	77–0	2134	2155	KT
												N 100 B				
												BT	0–277			
2815	17	0	—	0·16	*33·58*	*26·98*	—	—	—	—	—	N 100 H	0–1	2136	2156	
												N 70 B	82–0	2146	2205	KT
												N 100 B				
												TYFB	183–0	2146	2320	KT
												BT	0–277			
2816	18	0	—	1·67	*33·69*	*26·97*	—	—	—	—	—	N 100 H	0–1	2117	2141	
												N 70 B	77–0	2130	2150	KT
												N 100 B				
												BT	0–277			
2817	16	0	—	20·70	35·55	25·01	—	—	—	4·8	*5·11*	N 50 V	100–0	1307	—	Great stray on wire
		10	—	20·70	35·56	25·02	—	—	—	1·6	—	N 70 V	50–0			during last 30 m.
		20	—	20·70	35·53	25·00	—	—	—	1·6	*5·05*	,,	100–50			Zone −10 hrs
		30	—	20·50	35·48	25·01	0·32	—	—	3·2	—	,,	250–100			
		50	—	20·28	35·46	25·06	0·32	—	—	6·4	*5·10*	,,	500–250			
		75	—	20·28	35·44	25·04	0·32	—	—	3·2	—	,,	750–500			
		100	—	20·24	35·66	25·22	0·48	—	—	46·2?	*5·07*	,,	1000–750			
		150	—	18·70	35·55	25·53	0·72	—	—	62·1?	*4·57*	,,	1500–1000	—	1614	
		200	—	17·97	35·55	25·72	0·66	—	—	6·4	*4·47*	N 100 H	0–1	1634	1700	
		300	—	15·69	35·43	26·16	1·00	—	—	3·2	*4·30*	N 70 B	102–0	1647	1714	KT
		400	—	13·04	35·13	26·50	1·36	—	—	7·2	*4·45*	N 100 B				
		480[2]	482	11·34	34·91	26·66	1·36	—	—	6·4	*4·20*					
		580[2]	578	10·09	34·78	26·78	1·45	—	—	6·4	*4·19*					
		780[2]	—	7·86	34·56	26·97	1·85	—	—	14·3	*4·14*					
		970[2]	966	6·17	34·48	27·14	2·26	—	—	23·9	*3·86*					
		1160[2]	1158	4·76	34·42	27·25	2·40	—	—	43·0	*3·67*					
		1480[1]	1480	3·39	34·54	27·51	2·71	—	—	78·0	*3·05*					
		1960[1]	1961	2·47	34·63	27·66	2·62	—	—	88·3	*3·11*					
		2440[1]	—	2·09	34·63	27·69	2·49	—	—	88·3	*3·47*					
		3410[1]	3405	1·37	34·68	27·79	2·62	—	—	121	*3·74*					
		4390[1]	4387	1·17	34·70	27·82	2·19	—	—	73·2	*3·74*					
2818	17	0	—	16·72	35·43	25·92	0·48	—	—	4·0	*5·81*	N 50 V	100–0	1321		
		10	—	16·71	35·42	25·93	0·54	—	—	2·4	—	N 70 V	50–0			
		20	—	16·66	35·49	25·99	0·61	—	—	4·8	*4·73*	,,	100–50			
		30	—	16·64	35·48	25·98	0·52	—	—	4·0	—	,,	250–100			
		50	—	16·64	35·50	26·00	0·45	—	—	3·2	*5·43*	,,	500–250			
		75	—	16·63	35·52	26·02	0·45	—	—	4·0	—	,,	750–500			
		100	—	16·65	35·44	25·95?	0·34	—	—	3·2	*5·36*	,,	1000–750			
		150	—	15·04	35·30	26·21	0·90	—	—	4·8	*4·54*	,,	1500–1000			
		200	—	13·68	35·25	26·47	1·04	—	—	8·7	*4·87*	,,	250–0	—	1601	Fished through deep
		300	—	11·54	34·98	26·68	1·04	—	—	4·8	*5·32*	N 100 H	0–1	1615	1640	[scattering layer
		400	—	11·26	34·84	26·62?	1·49	—	—	6·4	*4·74*	N 70 B	102–0	1628	1647	KT
		490[2]	492	9·03	34·67	26·87	1·63	—	—	6·4	*4·71*	N 100 B				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2818 *cont.*	39°21′ S, 155° 36′ E	1951 23 v												
2819	41° 25′ S, 159° 04′ E	24 v	1130	5090*	ENE	11–16	ENE	3	E	2	bc	1019·1	12·8	10·0
2820	43° 32′ S, 162° 31′ E	25 v	1100	4684*	NE	17–21	NE	4	NE	4	oc	1009·0	11·7	10·0
2821	45° 21′ S, 165° 23′ E	26 v	1000	4493*	NE	22–33	NE	5	NE	5	Oqp	999·9	11·7	11·1

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2818 *cont.*	17	590[2]	—	8·39	34·62	26·94	1·81	—	—	11·1	4·59	BT	0–277			
		790[2]	788	7·03	34·46	27·01	2·31	—	—	17·5	4·22					
		980[2]	983	5·60	34·40	27·15	2·51	—	—	30·2	4·00					
		1180[2]	1183	4·64	34·44	27·30	2·71	—	—	51·0	3·74					
		1490[1]	1487	3·31	34·48	27·46	2·76	—	—	78·0	3·27					
		1990[1]	—	2·39	34·54	27·60	2·67	—	—	89·1	3·40					
		2480[1]	2477	2·00	34·68	27·74	2·53	—	—	98·6	3·47					
		3470[1]	3471	1·29	34·70	27·81	2·60	—	—	129	3·67					
		4460[1]	4458	1·05	34·67	27·80	2·56	—	—	135	3·82					
2819	18	0	—	14·16	35·12	26·26	0·43	—	—	2·4	5·77	N 50 V	100–0	1141		
		10	—	13·78	35·00	26·25	0·63	—	—	4·0	—	N 70 V	50–0			
		20	—	13·88	35·11?	26·31?	0·54	—	—	4·8	5·75	,,	100–50			
		30	—	13·70	34·99	26·26	0·48	—	—	5·6	—	,,	250–100			
		50	—	13·70	35·02	26·29	0·48	—	—	4·8	5·87	,,	500–250			
		75	—	13·70	34·99	26·26	0·54	—	—	4·8	—	,,	750–500			
		100	—	12·58	35·08	26·55	0·90	—	—	6·4	5·07	,,	1000–750			
		150	—	11·21	34·98	26·74	1·09	—	—	6·4	5·41	,,	1500–950	—	1527	Considerable stray on
		200	—	10·68	34·86	26·74	1·22	—	—	6·4	5·41	N 100 H	0–1	1536	1556	[wire
		300	—	9·37	34·64	26·80	1·38	—	—	6·4	5·72	N 70 B	} 72–0	1544	1604	KT
		400	—	8·65	34·60	26·88	1·45	—	—	8·7	5·67	N 100 B				
		500	—	8·16	34·51	26·88	1·65	—	—	9·5	5·78					
		520[2]	517	8·14	34·56	26·93	1·70	—	—	8·7	5·46					
		710[2]	—	7·25	34·52	27·03	2·01	—	—	15·9	4·79					
		890[2]	894	5·90	34·42	27·12	2·40	—	—	27·1	4·29					
		1090[2]	1087	4·74	34·39	27·25	2·65	—	—	43·8	3·92					
		1370[2]	1373	3·57	34·41	27·38	2·89	—	—	70·0	3·52					
		2030[1]	2027	2·49	34·60	27·63	2·98	—	—	98·7	3·40					
		2480[1]	—	2·03	34·74	27·79	2·67	—	—	98·7	3·64					
		2930[1]	2932	1·66	34·74	27·81	2·80	—	—	119	3·81					
		3930[1]	3931	1·16	34·71	27·83	2·76	—	—	124	3·60					
		4920[1]	4919	1·12	34·74	27·85	2·80	—	—	134	3·80					
2820	19	0	—	12·50	34·78	26·34	0·59	—	—	2·4	5·99	N 50 V	100–0	1108	—	Zone −11 hrs
		10	—	12·50	34·81	26·37	0·68	—	—	1·6	—	N 70 V	50–0			
		20	—	12·50	34·76	26·32	0·75	—	—	4·0	5·93	,,	100–50			
		30	—	12·50	34·79	26·35	0·68	—	—	1·6	—	,,	250–100	—	1214	
		50	—	12·49	34·77	26·33	0·68	—	—	3·2	6·34	,,	500–250	1541		
		75	—	12·48	34·79	26·35	0·68	—	—	2·4	—	,,	750–500			
		100	—	11·56	34·97	26·67	1·04	—	—	3·2	5·50	,,	1000–710			
		150	—	10·80	34·84	26·71	1·13	—	—	11·1?	5·48	,,	1500–1000	—	1742	
		200	—	10·14	34·81	26·80	1·29	—	—	4·8	5·55	N 100 H	0–1	1751	1809	
		300	—	9·79	34·64	26·72	1·54	—	—	4·8	5·42	N 70 B	} 72–0	1757	1818	KT
		400	—	8·50	34·55	26·87	1·74	—	—	5·6	5·49	N 100 B				
		500	—	8·07	34·60	26·97	1·94	—	—	6·4	5·63					
		590[2]	588	7·84	34·55	26·97	1·99	—	—	8·7	4·84					
		790[2]	—	6·78	34·38	26·98	2·26	—	—	18·3	4·07					
		980[2]	978	5·11	34·38	27·20	2·53	—	—	31·8	3·75					
		1180[2]	1175	3·93	34·50	27·41	2·98	—	—	50·1	3·49					
		1620[1]	1618	2·75	34·59	27·60	3·16	—	—	82·7	3·55					
		1960[1]	1964	2·37	34·60	27·64	2·98	—	—	90·7	3·33					
		2460[1]	2458	2·01	34·66	27·72	2·98	—	—	102	—					
		3430[1]	3432	1·32	34·70	27·81	2·71	—	—	118	3·81					
		4410[2]	4407	1·15	34·70	27·82	2·94	—	—	124	3·74					
2821	20	0	—	13·13	35·07	26·43	0·45	—	—	13·5?	6·35	N 50 V	100–0	1012	—	Net torn
		10	—	13·07	35·02	26·42	0·52	—	—	2·4	—	N 70 V	50–0			
		20	—	13·09	35·05	26·42	0·45	—	—	3·2	6·05	,,	100–50			
		30	—	13·05	35·13	26·50?	0·45	—	—	4·0	—	,,	250–100			
		50	—	13·05	35·01	26·41	0·48	—	—	4·8	6·14	,,	500–250			
		75	—	12·86	35·03	26·46	0·48	—	—	3·2	—	,,	750–500	—	1223	
		100	—	12·64	34·97	26·47	0·50	—	—	3·2	6·08	N 100 B	162–0	1350	1410	KT
		150	—	11·02	34·92	26·73	1·06	—	—	5·6	5·45					
		200	—	10·48	34·85	26·77	1·29	—	—	8·7	5·21					
		300	—	9·33	34·69	26·84	1·42	—	—	7·9	5·57					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. °C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2821 *cont.*	45° 21′ S, 165° 23′ E	1951 26 v												
2822	46° 24·2′ S, 170° 00·5′ E	27 v	1440	63*	N'ly	7–10	N'ly	2	N'ly	2	bc	1001·3	10·6	9·4
			1600	63*	—	—	—	—	—	—	—	—	—	—
			1800	63*	—	—	—	—	—	—	—	—	—	—
2823	51° 41′ S, 179° 37′ E	3–4 vi	2000	5038*	WSW	4–6	—	0	Conf.	2	Om	998·6	6·7	6·7
2824	53° 41′ S, 176° 56′ W	3–4 vi	2000	5415*	SW	7–10	SW	3	SW	2	Ogd	990·2	7·2	6·7
2825	54° 43′ S, 173° 00′ W	4–5 vi	2000	5159*	WSW	11–16	SW	3	SW	3	c	995·0	4·4	1·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	To	
2821 *cont.*	20	400	—	8·61	34·54	26·84	1·67	—	—	8·7	5·67					
		500	—	8·13	34·60	26·96	1·83	—	—	15·9	5·68					
		570[2]	565	7·77	34·56	26·98	1·97	—	—	11·9	5·13					
		760[2]	755	6·70	34·47	27·06	2·26	—	—	27·0	4·22					
		940[2]	941	5·24	34·49	27·26	2·62	—	—	39·8	4·04					
		1430[2]	1432	3·12	34·60	27·57	2·90	—	—	84·4	3·51					
		1980[1]	1975	2·38	34·65	27·68	2·94	—	—	105	3·63					
		2960[1]	2963	1·46	34·73	27·82	2·85	—	—	122	3·67					
		3940[1]	3941	1·18	34·72	27·83	2·85	—	—	143	4·12					
2822	21	0	—	11·8	—	—	—	—	—	—	—	**BT**	0–60	—	—	Zone −12 hrs. Temperatures by bathythermograph
		50	—	12·4	—	—	—	—	—	—	—	**DC**	63	1452	1505	
		—	—	—	—	—	—	—	—	—	—	**OTL**	63–63	1600	**1800**	
2823	28	0	—	7·95	34·09	26·58	1·58	—	0·36	4·0	6·57	**N 50 V**	100–0	**2018**	—	Zone −12 hrs
		10	—	7·94	34·14	26·63	1·63	—	0·29	4·8	—	**NHP**	50–0			
		20	—	7·94	34·16	26·64	1·58	—	0·30	3·2	6·61	**N 70 V**	50–0			
		30	—	7·93	34·13	26·62	1·58	—	0·39	6·4	—	,,	100–50			
		50	—	7·93	34·13	26·62	1·58	—	0·34	4·0	6·61	,,	250–100			
		75	—	7·93	34·13	26·62	1·58	—	0·36	4·0	—	,,	500–250			
		100	—	7·92	34·13	26·62	1·60	—	0·36	2·4	6·61	,,	750–500			
		150	—	7·23	34·20	26·78	1·76	—	0·40	4·8	6·43	,,	1000–750			
		200	—	6·38	34·31	26·98	1·90	—	0·15	6·4	6·35	,,	1500–1000	—	**0008**	
		300	—	5·77	34·33	27·07	1·99	—	0·09	7·9	6·41	**N 100 H**	0–1	**0047**	**0106**	
		400	—	5·50	34·34	27·11	2·04	—	0·12	8·7	6·28	**N 70 B**	} 152–0			
		500	—	4·81	34·20	27·08	2·28	—	0·09	13·5	6·00	**N 100 B**		**0055**	**0115**	KT
		560[2]	564	4·67	34·23	27·13	2·26	—	0·00	26·2	5·22	**BT**	0–277			
		760[2]	—	3·83	34·28	27·25	2·55	—	—	34·2	4·59					
		950[2]	951	3·05	34·35	27·39	2·64	—	—	50·9	4·08					
		1160[2]	1157	2·67	34·49	27·52	2·98	—	—	65·3	3·76					
		1980[1]	1984	2·22	34·65	27·69	2·66	—	—	84·3	3·82					
		2470[1]	—	1·85	34·73	27·79	2·66	—	—	93·9	3·96					
		2960[1]	2959	1·57	34·77	27·84	2·62	—	—	103	4·03					
		3960[1]	3962	1·00	34·69	27·81	2·62	—	—	127	3·84					
		4950[1]	4952	0·90	34·72	27·85	2·80	—	—	127	3·87					
2824	29	0	—	8·80	34·25	26·58	1·36	—	0·37	3·2	6·46	**N 50 V**	100–0	**2015**	—	Zone +12 hrs
		10	—	8·80	34·23	26·56	1·47	—	0·50	4·0	—	**NHP**	50–0			
		20	—	8·80	34·23	26·57	1·42	—	0·42	3·2	6·47	**N 70 V**	50–0			
		30	—	8·80	34·23	26·57	1·45	—	0·40	6·4	—	,,	100–50			
		50	—	8·80	34·23	26·57	1·47	—	0·36	3·2	6·45	,,	250–100			
		75	—	8·80	34·25	26·58	1·42	—	0·37	2·4	—	,,	500–250			
		100	—	8·69	34·33	26·66	1·40	—	0·36	4·0	6·36	,,	750–500			
		150	—	6·84	34·33	26·93	1·81	—	0·00	4·8	6·22	,,	1000–750	—	**2237**	
		200	—	6·53	34·25	26·91	1·94	—	—	9·5	6·33	**N 100 H**	0–1	**2346**	**0006**	
		300	—	6·29	34·24	26·93	1·94	—	—	7·9	6·31	**N 70 B**	} 162–0			
		400	—	5·88	34·32	27·04	2·04	—	—	11·1	6·32	**N 100 B**		**2359**	**0020**	KT
		500	—	5·44	34·23	27·04	2·08	—	—	14·3	6·16	**BT**	0–277			
		600[2]	599	4·86	34·23	27·11	2·22	—	—	19·1	5·66					
		800[2]	—	4·28	34·31	27·23	2·62	—	—	31·8	4·81					
		1010[2]	1008	3·44	34·35	27·34	2·80	—	—	47·7	4·41					
		1190[2]	1185	3·06	34·40	27·42	2·80	—	—	63·6	4·13					
		1490[2]	1489	2·60	34·56	27·59	2·80	—	—	79·5	3·82					
		1990[1]	1991	2·32	34·65	27·68	2·80	—	—	92·3	3·61					
		2490[1]	—	1·99	34·70	27·76	2·53	—	—	103	3·90					
		2990[1]	2990	1·63	34·70	27·79	2·67	—	—	127	3·74					
		3970[1]	3973	1·10	34·69	27·80	2·62	—	—	148	4·25					
		4980[1]	4979	0·95	34·72	27·84	2·67	—	—	127	3·96					
2825	0	0	—	7·04	34·06	27·70	1·58	—	0·12	3·2	6·75	**N 50 V**	100–0	**2011**		
		10	—	7·06	34·07	27·70	1·74	—	0·12	3·2	—	**N 70 V**	50–0			
		20	—	7·06	34·09	27·71	1·70	—	0·08	3·2	6·76	,,	100–50			
		30	—	7·13	34·09	27·70	1·51	—	0·12	7·9	—	,,	250–100			
		50	—	7·07	34·08	27·71	1·54	—	0·12	3·2	6·81	,,	500–250			
		75	—	7·04	34·07	27·70	1·63	—	0·52	7·9	—	,,	750–500			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. °C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2825 *cont.*	54° 43′ S, 173° 00′ W	1951 4–5 vi												
2826	57° 45′ S, 165° 16′ W	6–7 vi	2000	4478*	N×W	11–16	N×W	3	N'ly	3	oc	1000·3	1·7	0·6
2827	58° 38′ S, 162° 42′ W	7 vi	1012	—	W×N	11–16	W	4	W	3	bc	990·2	1·7	0·6
2828	59° 28′ S, 160° 24′ W	7–8 vi	2000	3718*	Lt. airs	1–3	—	0	N'ly	2	oc	983·2	1·7	−0·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2825 *cont.*	0	100	—	6·92	34·05	27·70	1·81	—	0·38	6·4	6·76	N 70 V	1000–780			
		150	—	5·39	34·19	27·01	1·76	—	0·00	7·9	6·53	,,	1500–1000	—	2342	
		200	—	4·98	34·16	27·03	1·85	—	—	12·7	6·54	N 100 H	0–1	2348	0004	
		300	—	4·61	34·17	27·09	1·88	—	—	12·7	6·53	N 70 B	136–0	2356	0015	KT
		400	—	4·24	34·23	27·16	1·99	—	—	17·5	6·17	N 100 B				
		500	—	4·01	34·20	27·17	2·24	—	—	20·7	5·89	BT	0–277			
		600[2]	598	3·64	34·30	27·29	2·48	—	—	27·0	5·04					
		790[2]	—	3·08	34·33	27·36	2·62	—	—	52·5	4·58					
		980[2]	982	2·76	34·42	27·46	2·89	—	—	54·0	4·11					
		1190[2]	1188	2·64	34·58	27·61	2·71	—	—	66·8	3·84					
		1490[2]	1493	2·36	34·63	27·67	2·66	—	—	68·5	3·75					
		1990[1]	1992	2·15	34·77	27·80	2·53	—	—	79·5	3·92					
		2480[1]	—	1·79	34·76	27·81	2·42	—	—	82·5	4·02					
		2970[1]	2966	1·47	34·76	27·84	2·58	—	—	97·0	4·13					
		3980[1]	3982	0·96	34·71	27·84	2·40	—	—	118	4·07					
		4980[1]	4981	0·96	34·76	27·87	2·66	—	—	130	4·27					
2826	2	0	—	4·12	33·91	26·93	1·94	—	0·44	4·8	7·23	N 50 V	100–0	2018	—	Zone + 11 hrs
		10	—	4·12	33·91	26·93	1·99	—	0·41	4·8	—	N 70 V	50–0			
		20	—	4·12	33·91	26·93	2·08	—	0·41	4·8	7·23	,,	100–50			
		30	—	4·12	33·89	26·91	2·06	—	0·41	5·6	—	,,	250–100			
		50	—	4·12	33·91	26·93	2·15	—	0·46	6·4	7·27	,,	500–250			
		75	—	4·14	33·89	26·91	2·10	—	0·30	8·7	—	,,	750–500			
		100	—	4·12	33·89	26·91	2·10	—	0·32	7·2	7·22	,,	1000–750	—	0004	
		150	—	3·34	34·06	27·13	2·26	—	0·00	18·3	6·66	N 100 H	0–1	0014	0028	
		200	—	3·02	34·12	27·21	2·46	—	—	23·1	6·44	N 70 B	57–0	0019	0039	KT
		300	—	2·39	34·10	27·24	2·38	—	—	24·7	6·39	N 100 B				
		400	—	2·45	34·21	27·33	2·66	—	—	30·2	5·97	BT	0–277			
		500[2]	503	2·51	34·30	27·39	2·80	—	—	39·0	5·14					
		580[2]	—	2·51	34·33	27·42	2·89	—	—	50·1	—					
		730[2]	726	2·55	34·34	27·42	2·94	—	—	71·6	4·17					
		1000[3]	1001	2·39	34·61	27·66	2·94	—	—	71·6	4·02					
		1190[3]	1188	2·35	34·63	27·67	3·03	—	—	79·5	3·93					
		1470[1]	1473	2·23	34·69	27·72	2·64	—	—	82·8	4·01					
		1970[1]	—	1·85	34·74	27·80	2·60	—	—	91·5	4·09					
		2460[1]	2461	1·45	34·78	27·86?	2·58	—	—	102	4·07					
		2960[1]	2957	1·21	34·70	27·82	2·62	—	—	114	4·18					
		3950[1]	3949	0·86	34·73	27·86	2·58	—	—	129	4·29					
2827	3	0	—	2·2	33·82	27·04	—	—	—	—	—	BT	0–277	—	—	Temperatures by bathythermograph
		50	—	2·2												
		100	—	2·2												
		150	—	1·6												
		200	—	1·5												
		250	—	1·9												
2828	4	0	—	1·86	33·89	27·11	2·21	—	0·22	18·3	7·60	N 50 V	100–0	2018		
		10	—	1·85	33·84	27·07	2·44	—	0·20	18·3	—	N 70 V	50–0			
		20	—	1·85	33·82	27·06	2·62	—	0·32	19·1	7·64	,,	100–50			
		30	—	1·85	33·82	27·06	2·53	—	0·32	22·3	—	,,	250–100			
		50	—	1·85	33·86	27·08	2·60	—	0·34	21·5	7·67	,,	500–250			
		75	—	1·85	33·87	27·10	2·42	—	0·32	20·7	—	,,	750–500			
		100	—	1·81	33·82	27·07	2·55	—	0·34	19·9	7·65	,,	1000–750	—	2217	
		150	—	1·18	34·04	27·28	2·78	—	0·00	23·9	7·13	N 100 H	0–1	2358	0016	
		200	—	1·58	34·05	27·26	2·82	—	—	27·0	6·66	N 70 B	64–0	0006	0027	KT
		300	—	1·98	34·25	27·39	2·82	—	—	38·2	5·64	N 100 B				
		400	—	2·30	34·33	27·43	2·89	—	—	46·1	4·79	BT	0–277			
		470[2]	471	2·35	34·34	27·44	3·16	—	—	58·9	4·05					
		570[2]	—	2·37	34·54	27·60	3·12	—	—	58·9	3·86					
		1070[1]	1072	2·20	34·69	27·72	2·84	—	—	74·8	4·02					
		1140[2]	1143	2·14	34·74	27·78	2·82	—	—	74·8	3·83					
		1410[1]	1408	2·01	34·73	27·78	2·87	—	—	75·6	4·00					
		1900[1]	—	1·62	34·75	27·82	2·89	—	—	89·1	4·23					
		2390[1]	2391	1·31	34·74	27·84	2·84	—	—	107	4·36					
		2890[1]	2886	1·00	34·70	27·83	2·80	—	—	114	4·30					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2829	60° 31′ S, 157° 26′ W	1951 8 vi	1540	—	ENE	7–10	NE	2	NE	2	om	985·1	0·0	0·0
2830	60° 51′ S, 156° 26′ W	8–9 vi	2000	3434*	NE	7–10	NE	2	SW	3	OS	988·1	0·0	0·0
2831	62° 22′ S, 152° 14′ W	9–10 vi	2000	3394*	N	11–16	N	3	N	4	OMS	991·3	−0·6	−0·6
2832	63° 55′ S, 147° 28′ W	10–11 vi	2000	3983*	NW	4–6	—	0	N'ly	2	oc	1002·5	−1·1	−2·2
2833	65° 21′ S, 143° 05′ W	11–12 vi	2000	4413*	—	0	—	0	N'ly	1	b	1014·2	−4·4	−4·4

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
2829	4	0	—	0·1	33·83	27·18	—	—	—	—	—	**BT**	0–277	—	—	Temperatures by bathythermograph
		50	—	0·1												
		100	—	−0·2												
		150	—	0·5												
		200	—	1·0												
		250	—	1·6												
2830	4	0	—	−0·07	33·81	27·17	2·44	—	0·32	42·2	7·97	**N 50 V**	100–0	**2007**		
		30	—	−0·07	33·81	27·17	2·49	—	0·38	39·8	—	**N 70 V**	50–0			
		50	—	−0·17	33·89	27·24	2·44	—	0·34	40·6	7·95	,,	100–50			
		75	—	−0·20	33·93	27·27	2·46	—	0·26	46·9	—	,,	250–100			
		100	—	−0·14	34·08	27·39	2·44	—	0·20	49·3	7·38	,,	500–250			
		150	—	0·58	34·33	27·55	2·90	—	0·00	61·2	5·76	,,	750–500			
		200	—	0·86	34·40	27·59	2·92	—	—	65·2	5·28	,,	1000–750	—	**2259**	
		300	—	1·70	34·52	27·63	2·96	—	—	73·1	4·44	**N 100 H**	0–1	**0049**	**0110**	
		400	—	2·06	34·61	27·68	2·94	—	—	78·8	4·29	**N 70 B**	} 76–0	**0058**	**0118**	KT
		500[2]	500	2·08	34·69	27·74	2·74	—	—	78·0	3·94	**N 100 B**				
		600[2]	—	2·09	34·70	27·75	2·80	—	—	84·4	4·05	**BT**	0–277			
		800[2]	801	1·95	34·70	27·75	2·78	—	—	89·8	4·14					
		1000[2]	1002	1·77	34·69	27·76	2·71	—	—	95·5	4·15					
		1190[1]	1186	1·68	34·70	27·78	2·58	—	—	97·0	4·90					
		1490[1]	—	1·43	34·72	27·81	2·62	—	—	105	4·20					
		1980[1]	1977	1·03	34·71	27·84	2·64	—	—	119	4·19					
		2480[1]	2475	0·77	34·70	27·84	2·64	—	—	131	4·48					
		2970[1]	2968	0·78	34·72	27·86	2·71	—	—	137	4·49					
2831	5	0	—	−0·89	34·14	27·48	2·19	—	0·10	53·3	8·01	**N 50 V**	100–0	**2009**	—	Zone +10 hrs
		50	—	−0·89	34·15	27·49	2·31	—	0·15	54·9	—	**N 70 V**	50–0			
		75	—	−0·82	34·22	27·53	2·24	—	0·14	52·5	8·00	,,	100–50			
		100	—	−0·82	34·23	27·54	2·22	—	0·17	52·5	8·03	,,	250–100			
		150	—	0·49	34·60	27·77	2·62	—	0·00	80·4	4·89	,,	500–250	—	**2230**	Remainder of vertical
		200	—	1·09	34·64	27·78	2·87	—	—	86·8	4·33	**N 100 H**	0–1	**0055**	**0115**	[nets abandoned
		300	—	1·83	34·68	27·75?	2·80	—	—	93·1	4·22	**N 70 B**	} 130–0	**0107**	**0127**	KT as deeper nets
		400	—	1·25	34·69	27·79	2·71	—	—	99·5	4·38	**N 100 B**				repeatedly closed
		490[2]	493	1·14	34·72	27·83	2·71	—	—	102	4·14	**BT**	0–277			prematurely
		590[2]	—	1·11	34·74	27·85	2·62	—	—	103	4·27					
		800[2]	802	0·93	34·68	27·82	2·64	—	—	105	4·33					
		1010[2]	1009	0·85	34·70	27·83	2·71	—	—	108	4·40					
		1180[1]	1181	0·77	34·70	27·85	2·71	—	—	114	4·43					
		1480[1]	—	0·63	34·72	27·86	2·67	—	—	119	4·37					
		1990[1]	1988	0·37	34·69	27·85	2·60	—	—	127	4·56					
		2470[1]	2474	0·20	34·70	27·88	2·56	—	—	119	4·56					
		2990[1]	2988	0·18	34·67	27·85	2·51	—	—	118	4·68					
2832	6	0	—	−1·62	33·94	27·33	2·22	—	0·26	44·6	8·24	**N 50 V**	100–0	**2010**		
		50	—	−1·62	33·96	27·35	2·22	—	0·26	43·7	8·25	**N 70 V**	50–0			
		75	—	−1·62	33·98	27·37	2·28	—	0·26	46·1	—	,,	100–50			
		100	—	−1·62	33·98	27·37	2·33	—	0·22	46·1	8·27	,,	250–100			
		150	—	−1·11	34·07	27·43	2·42	—	0·17	51·7	7·32	,,	500–250			
		200	—	1·28	34·64	27·75	2·80	—	0·00	87·5	4·29	,,	750–500			
		300	—	1·33	34·64	27·76	2·90	—	—	95·4	4·09?	,,	1000–750			
		400	—	1·29	34·72	27·82	2·84	—	—	102	4·26	,,	1500–1000	—	**0035**	
		510[3]	510	1·05	34·70	27·83	2·76	—	—	98·6	3·97	**N 100 H**	0–1	**0100**	**0120**	
		600[3]	597	1·12	34·70	27·82	2·80	—	—	98·6	4·16	**N 70 B**	} 122–0	**0109**	**0130**	KT
		800[2]	802	0·95	34·70	27·83	2·71	—	—	102	4·09	**N 100 B**				
		990[2]	—	0·85	34·67	27·81	2·62	—	—	105	4·39	**BT**	0–277			
		1180[2]	1175	0·75	34·70	27·85	2·67	—	—	108	4·41					
		1500[1]	1498	0·61	34·68	27·84	2·67	—	—	111	4·57					
		2000[1]	—	0·44	34·70	27·87	2·71	—	—	124	4·73					
		2490[1]	2486	0·23	34·70	27·88	2·62	—	—	121	4·65					
		2980[3]	2984	0·14	34·69	27·86	2·60	—	—	108	4·89					
		3490[3]	3494	0·11	34·68	27·86	2·67	—	—	111	4·70					
2833	7	0	—	−1·55	34·00	27·38	2·24	—	0·06	51·7	8·29	**N 50 V**	100–0	**2010**		
		10	—	−1·33	34·00	27·37	2·26	—	0·14	50·1	8·26	**NHP**	50–0			

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2833 *cont.*	65° 21′ S, 143° 05′ W	1951 11–12 vi												
2834	66° 00′ S, 140° 51′ W	12 vi	1100	4257*	Lt airs	0–1	—	0	N	2	b	1015·0	−4·4	−4·4
2835	64° 17′ S, 131° 50′ W	13–14 vi	2000	4462*	Lt airs	0–1	—	0	NE	2	OMS	1018·1	−1·1	−1·1
2836	63° 41′ S, 125° 54′ W	14 vi	2000	4498*	WSW	11–16	WSW	3	N'ly	2	b	1020·6	−3·9	−3·9
2837	62° 43′ S, 118° 03′ W	15 vi	2000	4855*	W×N	11–21	W	3	W	3	oc	1014·1	−2·2	−2·2

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
2833	7	30	—	−1·27	34·02	27·39	2·22	—	0·17	49·3	—	N 70 V	50–0			
cont.		50	—	−1·27	33·96	27·34	2·22	—	0·18	48·5	8·26	,,	100–50			
		75	—	−1·19	33·97	27·35	2·26	—	0·20	49·3	—	,,	250–100			
		100	—	−1·19	33·96	27·34	2·35	—	0·16	49·3	8·20	,,	500–250			
		150	—	−1·12	34·05	27·41	2·31	—	0·17	62·8	8·07	,,	750–500			
		200	—	0·34	34·46	27·67	2·76	—	0·00	89·9	5·50	,,	1000–750			
		300	—	1·43	34·69	27·78	2·82	—	—	105	4·50	,,	1500–1000	—	0004	
		400	—	1·41	34·69	27·79	2·64	—	—	111	4·58	N 100 H	0–1	0141	0200	
		480[1]	482	1·33	34·70	27·81	2·62	—	—	111	4·36	N 70 B	90–0	0152	0212	KT
		610[1]	605	1·18	34·69	27·80	2·55	—	—	111	4·08	N 100 B				
		800[2]	—	1·02	34·69	27·81	2·58	—	—	127	4·14	BT	0–277			
		1000[2]	1002	0·96	34·70	27·83	2·62	—	—	135	4·18					
		1170[1]	1172	0·81	34·69	27·82	2·80	—	—	135	4·67					
		1500[1]	1496	0·71	34·69	27·83	2·60	—	—	143	4·28					
		2000[1]	—	0·54	34·69	27·84	2·51	—	—	142	4·57					
		2490[1]	2489	0·38	34·69	27·85	2·53	—	—	142	4·60					
		2990[2]	2987	0·18	34·69	27·86	2·26	—	—	146	4·41					
		3980[2]	3977	0·15	34·67	27·85	2·40	—	—	143	4·63					
2834	8	0	—	−1·9	33·91	27·32	—	—	—	—	—	N 100 B	172–0	1149	1208	KT. In new pancake ice
		50	—	−1·9	—	—	—	—	—	—	—	BT	0–277	—	—	Temperatures by
		100	—	−1·8												bathythermograph
		150	—	0·1												
		200	—	1·2												
		250	—	1·6												
2835	9	0	—	−1·74	33·82	27·24	2·35	—	0·34	41·3	8·14	N 50 V	100–0	2053	—	Zone +9 hrs. In ice
		50	—	−1·74	33·91	27·31	2·40	—	0·14	41·3	8·07	NHP	50–0			crystals and sludge
		75	—	−1·74	33·91	27·31	2·40	—	0·14	43·0	—	N 70 V	50–0			ice
		100	—	−1·74	33·91	27·31	2·35	—	0·10	40·5	8·06	,,	100–50			
		150	—	−1·33	33·91	27·30	2·40	—	0·10	43·0	7·91	,,	250–100			
		200	—	0·28	34·29	27·54	2·94	—	0·00	66·1	5·98	,,	500–250			
		300	—	1·60	34·54	27·66	2·80	—	—	76·4	4·44	,,	750–500			
		400	—	1·86	34·61	27·70	2·71	—	—	79·5	4·33	,,	1000–750			
		490[2]	492	1·84	34·69	27·75	2·58	—	—	85·2	4·02	,,	1500–1000	—	0015	
		590[2]	—	1·74	34·69	27·76	2·53	—	—	85·9	4·15	N 70 B	100–0	0039	0100	KT
		800[2]	799	1·62	34·69	27·77	2·62	—	—	92·3	4·06	N 100 B				
		990[2]	988	1·49	34·69	27·78	2·67	—	—	95·4	4·18	BT	0–277			
		1190[2]	1188	1·30	34·67	27·78	2·58	—	—	102	4·05					
		1490[1]	1492	1·09	34·69	27·81	2·62	—	—	111	4·20					
		1990[1]	—	0·82	34·70	27·83	2·74	—	—	119	4·50					
		2490[1]	2485	0·68	34·72	27·86	2·60	—	—	127	4·25					
		2990[1]	2985	0·43	34·69	27·85	2·60	—	—	134	4·34					
		3970[1]	3966	0·23	34·69	27·86	2·32	—	—	129	4·52					
2836	10	0	—	−0·2	34·06	27·38	—	—	—	—	—	N 50 V	100–0	2012	2021	Temperatures by
		50	—	0·1	—	—	—	—	—	—	—	N 100 H	0–1	2031	2051	bathythermograph
		100	—	0·1	—	—	—	—	—	—	—	N 70 B	104–0	2043	2103	KT
		150	—	0·1	—	—	—	—	—	—	—	N 100 B				
		200	—	0·9	—	—	—	—	—	—	—	BT	0–277			
		250	—	1·6												
2837	11	0	—	0·23	34·07	27·37	2·53	—	0·28	25·4	7·84	N 50 V	100–0	2011	-	
		30	—	0·20	34·04	27·34	2·53	—	0·28	23·9	—	N 70 V	50–0			
		50	—	0·24	34·02	27·33	2·40	—	0·28	22·2	—	,,	100–50			
		75	—	0·16	34·03	27·34	2·44	—	0·28	23·9	—	,,	250–100			
		100	—	0·33	34·04	27·33	2·55	—	0·28	25·4	—	,,	500–250			
		150	—	0·13	34·08	27·38	2·58	—	0·26	30·2	7·65	,,	750–500			
		200	—	0·18	34·11	27·40	2·58	—	0·26	31·8	7·66	,,	1000–750			
		300	—	1·56	34·29	27·45	2·71	—	0·00	52·5	5·57	,,	1500–1000	—	2306	
		400	—	2·01	34·43	27·54	2·94	—	—	60·5	4·74	N 100 H	0–1	2333	2353	
		480[2]	484	2·11	34·51	27·59	2·82	—	—	64·5	4·22	N 70 B	92–0	2342	0000	KT
		580[2]	—	2·22	34·60	27·65	2·90	—	—	76·4	3·97	N 100 B				
		780[2]	783	2·16	34·63	27·69	2·84	—	—	78·8	3·98	BT	0–277			
		980[2]	983	2·09	34·69	27·73	2·76	—	—	84·4	3·99					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2837 *cont.*	62° 43′ S, 118° 03′ W	1951 15 vi												
2838	61° 22′ S, 104° 01′ W	17–18 vi	2000	5194*	NW × W	22–33	NW	4	NW	4	oc	990·0	1·7	1·1
2839	60° 32′ S, 90° 23′ W	19–20 vi	2000	5020*	S	7–10	W	3	W	4	o	988·5	−1·1	−1·4
2840	59° 42·5′ S, 84° 18′ W	20 vi	2000	5164*	S × W	17–21	S × W	4	S	3	oc	990·6	−2·2	−2·2
2841	59° 01′ S, 77° 38′ W	21–22 vi	2000	5015*	W × S	17–27	N'ly	4	N'ly	4	oq	974·3	1·1	1·1

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2837 *cont.*	11	1180[2]	1182	1·98	34·72	27·77	2·67	—	—	87·5	4·10					
		1440[1]	1436	1·80	34·73	27·79	2·60	—	—	92·3	3·77					
		1920[1]	—	1·39	34·73	27·82	2·60	—	—	110	4·02					
		2400[1]	2397	1·11	34·73	27·84	2·62	—	—	119	4·23					
		3350[1]	3351	0·68	34·72	27·86	2·55	—	—	134	4·47					
		4370[1]	4374	0·36	34·69	27·85	2·40	—	—	137	4·37					
2838	13	0	—	0·76	34·08	27·34	2·31	—	0·38	19·1	7·62	**N 70 V**	50–0	**2018**	—	Zone +7 hrs
		100[2]	100	0·69	34·09	27·35	2·33	—	0·32	19·1	7·60	,,	100–50			
		150[2]	—	0·66	34·10	27·36	2·33	—	0·32	18·3	7·61	,,	250–100			
		200[2]	—	0·71	34·09	27·35	2·53	—	0·32	17·5	—	,,	500–250			
		290[2]	293	1·55	34·23	27·41	2·71	—	0·06	38·2	5·99	,,	750–500	—	**2338**	Remainder of vertical
		330[1]	330	1·75	34·26	27·42	2·71	—	0·00	42·2	5·49	**N 70 B**	180–0	**0032**	**0058**	KT [nets abandoned
		430[1]	—	1·98	34·38	27·50	2·94	—	—	52·5	4·73	**N 100 B**				on account of
		520[1]	520	2·19	34·50	27·57	2·84	—	—	59·7	4·21	**BT**	0–277			heavy weather
		720[1]	716	2·36	34·61	27·66	2·92	—	—	66·8	3·86					
		920[1]	916	2·25	34·64	27·69	2·90	—	—	71·6	3·80					
2839	15	0	—	2·20	34·06	27·23	2·31	—	0·22	14·3	7·45	**N 50 V**	100–0	**2022**	—	Zone +6 hrs
		10	—	2·20	34·09	27·25	2·35	—	0·26	14·3	—	**N 70 V**	50–0			
		20	—	2·18	34·05	27·22	2·31	—	0·28	14·3	7·43	,,	100–50			
		30	—	2·16	34·06	27·23	2·22	—	0·26	14·3	—	,,	250–100			
		50	—	2·16	34·05	27·22	2·17	—	0·26	13·5	7·45	,,	500–250			
		75	—	2·16	34·07	27·24	2·22	—	0·28	12·7	—	,,	750–500			
		100	—	2·16	34·06	27·23	2·28	—	0·26	12·7	7·46	,,	1000–750	—	**2358**	
		150	—	2·13	34·06	27·23	2·24	—	0·22	12·7	7·40	**N 100 H**	0–1	**0006**	**0025**	
		200	—	2·13	34·04	27·21	2·24	—	0·28	12·7	7·49	**N 70 B**	96–0	**0019**	**0040**	KT. **N 70** did not fish properly
		300	—	2·45	34·07	27·22	2·51	—	0·00	26·2	6·21	**N 100 B**				
		400	—	2·56	34·07	27·21	2·71	—	—	36·6	5·56	**BT**	0–277			
		490[2]	487	2·06	34·07	27·25	2·80	—	—	39·8	5·31					
		590[2]	—	2·43	34·36	27·45	2·80	—	—	47·7	4·66					
		780[2]	781	2·31	34·56	27·61	2·94	—	—	58·9	4·15					
		970[2]	970	2·33	34·61	27·66	2·80	—	—	66·8	3·94					
		1180[2]	1176	2·24	34·63	27·68	2·71	—	—	71·6	3·89					
		1410[1]	1406	2·13	34·74	27·78	2·60	—	—	76·4	3·72					
		1890[1]	—	1·85	34·72	27·78	2·62	—	—	87·5	4·04					
		2370[1]	2365	1·44	34·76	27·84	2·62	—	—	95·4	4·15					
		3350[1]	3347	0·90	34·72	27·85	2·64	—	—	111	4·48					
		4280[1]	4276	0·49	34·70	27·86	2·78	—	—	108	4·43					
2840	16	0	—	4·2	34·13	27·09	—	—	—	—	—	**N 50 V**	100–0	**2020**	**2029**	[bathythermograph Temperatures by
		50	—	4·2	—	—	—	—	—	—	—	**N 70 B**	73–0	**2043**	**2103**	KT
		100	—	4·2	—	—	—	—	—	—	—	**N 100 B**				
		150	—	4·2	—	—	—	—	—	—	—	**BT**	0–277			
		200	—	4·2												
		250	—	4·2												
2841	17	0	—	4·38	34·12	27·07	1·81	—	0·11	7·2	7·14	**N 70 V**	50–0	**2013**	—	Zone +5 hrs
		50	—	4·38	34·16	27·10	1·85	—	0·11	8·7	7·13	,,	100–50			
		75	—	4·37	34·16	27·10	1·92	—	0·11	8·7	—	,,	250–100			
		100	—	4·36	34·16	27·10	2·08	—	0·09	9·5	7·13	,,	500–250			
		150	—	4·36	34·16	27·10	1·99	—	0·09	11·1	7·09	,,	750–500			
		200	—	4·38	34·16	27·10	1·97	—	0·11	11·1	7·14	,,	1000–750	—	**2307**	
		300	—	4·40	34·14	27·09	1·94	—	0·09	11·9	7·13	**N 100 B**	122–0	**0017**	**0036**	KT
		400	—	4·24	34·16	27·12	2·06	—	0·00	11·9	6·75	**BT**	0–227			
		500	—	3·80	34·13	27·13	2·31	—	—	16·7	6·50					
		580[2]	583	3·68	34·24	27·23	2·48	—	—	22·2	5·76					
		780[2]	780	3·23	34·27	27·31	2·69	—	—	35·0	4·96					
		980[2]	980	2·90	34·42	27·44	2·80	—	—	51·7	4·33					
		1190[2]	1186	2·58	34·49	27·53	2·96	—	—	62·0	4·03					
		1440[1]	1444	2·42	34·58	27·62	2·82	—	—	74·8	3·68					
		1920[1]	1919	2·10	34·66	27·71	2·69	—	—	95·4	3·51					
		2860[1]	2863	1·47	34·70	27·80	2·71	—	—	108	4·04					
		3850[1]	3845	0·85	34·70	27·84	2·80	—	—	135	4·29					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2842	63° 30′ S, 77° 13′ W	1951 23 vi	2000	4188*	SW	7–10	SW	3	SW	3	OCSP	1008·0	−1·7	−1·9
2843	63° 59′ S 77° 14′ W	24 vi	0915	4151*	W × N	17–27	—	—	W'ly	4	oc	1001·3	−1·1	−1·7
2844	60° 11 S, 70° 08′ W	25 vi	1600	4170*	SW × S	17–21	SW × S	5	SW	4	bc	1006·5	−1·1	−1·7
2845	57° 40′ S, 65° 02′ W	26 vi	2000	3561*	WNW	22–33	WNW	5	WNW	5	oq	988·1	3·9	3·3

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2842	19	0	—	−1·44	33·88	27·28	2·26	—	0·28	19·1	8·22	N 50 V	100–0	2012		
		10	—	−1·44	33·85	27·26	2·26	—	0·28	19·1	—	NHP	50–0			
		20	—	−1·44	33·93	27·32	2·24	—	0·28	23·9	8·32	N 70 V	50–0			
		30	—	−1·42	33·88	27·28	2·22	—	0·32	27·0	—	,,	100–50			
		50	—	−1·05	33·91	27·29	2·22	—	0·28	20·7	8·25	,,	250–100			
		75	—	−0·92	33·92	27·29	2·19	—	0·32	20·7	—	,,	500–250			
		100	—	−0·51	33·94	27·29	2·26	—	0·32	22·2	7·97	,,	750–500			
		150	—	0·08	33·99	27·32	2·31	—	0·17	27·0	7·51	,,	1000–750			
		200	—	0·84	34·07	27·33	2·55	—	0·00	37·4	6·73	,,	1500–1000	—	2252	
		300	—	1·88	34·29	27·43	2·71	—	—	55·7	5·22	N 100 H	0–1	2304	2324	
		400	—	2·20	34·41	27·49	2·87	—	—	66·8	4·50	N 70 B	98–0	2315	2336	KT
		480[2]	483	2·04	34·51	27·60	2·80	—	—	71·6	4·18	N 100 B				
		590[2]	590	2·15	34·52	27·60	2·76	—	—	76·4	4·05	BT	0–277			
		780[2]	784	2·15	34·64	27·69	2·71	—	—	81·1	4·03					
		980[2]	—	2·10	34·70	27·75	2·62	—	—	85·9	4·19					
		1180[2]	1178	1·97	34·76	27·80	2·42	—	—	92·3	4·23					
		1490[1]	1490	1·73	34·74	27·81	2·38	—	—	98·6	4·15					
		1990[1]	—	1·38	34·74	27·84	2·48	—	—	118	4·21					
		2490[1]	2491	1·01	34·72	27·84	2·56	—	—	124	4·38					
		2980[1]	2980	0·80	34·72	27·85	2·62	—	—	137	4·36					
		3970[1]	3974	0·46	34·69	27·84	2·71	—	—	154	4·71					
2843	20	0	—	−1·7	33·73	27·16	—	—	—	—	—	N 100 B	142–0	0950	1010	KT. In young pancake ice
		50	—	−1·6	—	—	—	—	—	—	—	BT	0–277	—	—	Temperatures by
		100	—	−0·7												bathythermograph
		150	—	−0·4												
		200	—	1·2												
		250	—	1·7												
2844	21	0	—	1·94	34·04	27·23	2·17	—	0·22	16·1	7·60	N 50 V	100–0	1612		
		50	—	1·85	34·09	27·27	2·17	—	0·22	16·1	7·57	N 70 V	50–0			
		75	—	1·85	34·05	27·24	2·17	—	0·22	18·5	—	,,	100–50			
		100	—	1·85	34·04	27·23	2·19	—	0·22	19·3	7·64	,,	250–100			
		150	—	1·83	34·04	27·23	2·22	—	0·22	20·9	7·59	,,	500–250			
		200	—	1·90	34·05	27·24	2·26	—	0·18	20·1	7·55	,,	750–500			
		300	—	1·62	34·10	27·30	2·44	—	0·00	32·2	6·91	,,	1000–750			
		400	—	1·69	34·16	27·34	2·60	—	—	38·6	6·38	,,	1500–1000	—	2043	
		490[2]	487	2·32	34·29	27·40	2·90	—	—	45·8	5·15	N 100 H	0–1	2049	2110	
		800[2]	797	2·35	34·52	27·58	2·80	—	—	70·1	3·87	N 70 B	90–0	2104	2119	KT
		990[2]	986	2·34	34·54	27·60	2·80	—	—	74·1	3·54	N 100 B				
		1200[2]	1199	2·22	34·65	27·69	2·80	—	—	78·9	3·93	BT	0–277			
		1480[1]	1480	2·06	34·70	27·74	2·69	—	—	85·4	—					
		1970[1]	—	1·73	34·71	27·78	2·51	—	—	98·3	4·16					
		2450[1]	2448	1·45	34·72	27·81	2·56	—	—	110	4·31					
		2930[1]	2926	1·09	34·70	27·82	2·71	—	—	116	4·29					
		3910[1]	3906	0·59	—	—	—	—	—	—	4·61					
2845	22	0	—	3·95	34·10	27·10	1·97	—	0·18	8·8	7·31	N 70 V	50–0	2046		
		50	—	3·95	34·11	27·11	1·94	—	0·18	8·8	7·27	,,	100–50			
		75	—	3·95	34·13	27·12	1·90	—	0·18	8·8	—	,,	250–100	—	2128	Remainder of vertical
		100	—	3·95	34·09	27·09	1·92	—	0·18	10·5	7·31	N 100 B	162–0	2324	2344	KT nets abandoned
		150	—	3·95	34·09	27·09	1·92	—	0·18	10·5	7·26	BT	0–277			on account of
		200	—	3·95	34·07	27·08	2·01	—	0·20	10·5	7·27					heavy weather
		300	—	3·87	34·08	27·10	1·99	—	0·12	10·5	7·09					
		400	—	3·36	34·09	27·15	2·22	—	0·22	12·1	7·33					
		500	—	3·52	34·09	27·13	2·26	—	0·00	12·9	6·91					
		580[2]	582	3·45	34·18	27·22	2·26	—	0·00	19·3	5·86					
		770[2]	765	3·48	34·28	27·28	2·64	—	—	33·0	4·82					
		960[2]	958	2·84	34·36	27·41	2·90	—	—	45·8	4·57					
		1170[2]	1169	2·65	34·45	27·50	2·84	—	—	58·8	4·12					
		1400[1]	1399	2·39	34·57	27·62	2·80	—	—	69·3	3·86					
		1830[1]	1831	2·25	34·63	27·68	2·76	—	—	78·9	3·93					
		2280[1]	2278	1·92	34·70	27·76	2·62	—	—	90·2	4·03					
		2740[1]	2739	1·55	34·70	27·79	2·71	—	—	99·9	4·17					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2846	52° 25′ S, 58° 22′ W	1951 28 vi	1600	141*	SW	17–21	SW	4	SW	4	bc	1022·4	5·0	3·9
2847	Sparrow Cove, Port William, Falkland Islands (51° 39·5′ S, 57° 48·5′ W)	1 vii	1100	9	W	11–16	—	1	—	—	bc	1012·5	1·7	1·1
2848	52° 35′ S, 54° 51′ W	5–6 vii	2000	1878*	S × W	11–16	S × W	4	S	5	oc	1008·2	−0·8	−1·1
2849	53° 40′ S, 51° 05′ W	6 vii	2030	2202*	SW	7–10	S'ly	2	S'ly	2	o	1019·2	−1·7	−2·8
2850	54° 47′ S, 46° 55′ W	7–8 vii	2000	4764*	SW × W	11–16	SW	3–4	SW	3	bc	1017·2	1·9	0·6
2851	56° 05′ S, 42° 24′ W	8 vii	2000	3795*	NW × W	4–6	W	2	—	—	oc	1026·9	−1·7	−1·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2846	22	0	—	6·1	33·78	26·60	—	—	—	—	—	**DLH**	141	**1700**	**1715**	Zone +4 hrs. Temperatures by bathythermograph
		50	—	6·0	—	—	—	—	—	—	—	**BT**	0–140			
		100	—	6·0												
		125	—	6·1												
2847	26	—	—	—	—	—	—	—	—	—	—	**DRS**	9	1112	1117	
												DRS	9	1132	1145	
												Sh. Coll.	—	1200	1430	
2848	1	0	—	4·44	34·13	27·06	1·40	—	0·10	10·6	6·98	**N 70 V**	50–0	**2020**		
		50	—	4·44	34·11	27·05	1·44	—	0·14	9·8	6·94	,,	100–50			
		75	—	4·43	34·11	27·06	1·40	—	0·10	9·8	—	,,	250–100			
		100	—	4·43	34·10	27·05	1·49	—	0·08	6·8	6·97	,,	500–250			
		150	—	4·44	34·09	27·03	1·55	—	0·08	8·3	6·92	,,	750–500	—	**2227**	
		200	—	4·47	34·08	27·03	1·52	—	0·10	10·6	6·99	**N 100 H**	0–1	**0017**	**0037**	
		300	—	4·64	34·13	27·04	1·64	—	0·04	12·1	6·65	**N 70 B**	74–0	**0029**	**0050**	KT
		400	—	4·42	34·18	27·12	1·74	—	0·00	17·4	6·41	**N 100 B**				
		500	—	4·08	34·18	27·15	1·83	—	—	18·1	6·02	**BT**	0–277			
		590[1]	593	3·88	34·22	27·19	1·92	—	—	24·2	5·38					
		790[1]	—	3·53	34·32	27·32	2·03	—	—	31·8	4·68					
		990[1]	985	3·01	34·39	27·43	2·20	—	—	46·8	4·26					
		1180[1]	1180	2·66	34·45	27·50	2·32	—	—	62·7	3·87					
		1480[1]	1482	2·35	34·56	27·61	2·20	—	—	71·0	3·70					
2849	3	0	—	4·18	34·06	27·04	1·33	—	0·15	10·6	7·01	**N 70 V**	50–0	**2043**		
		50	—	4·18	34·11	27·08	1·41	—	0·15	11·3	6·98	,,	100–50			
		75	—	4·18	34·07	27·05	1·52	—	0·15	9·8	—	,,	250–100			
		100	—	4·18	34·07	27·05	1·46	—	0·17	9·1	7·00	,,	500–250			
		150	—	4·18	34·07	27·05	1·43	—	0·18	11·3	6·99	,,	750–500			
		200	—	4·19	34·07	27·05	1·50	—	0·17	9·8	6·86	,,	1000–750	—	**2315**	
		300	—	4·12	34·10	27·08	1·61	—	0·00	14·3	6·56	**N 100 H**	0–1	**2325**	**2340**	
		400	—	3·80	34·15	27·15	1·77	—	0·00	20·4	6·17	**N 70 B**	132–0	**2334**	**2355**	KT
		490[2]	494	3·66	34·15	27·18	1·89	—	0·00	23·4	5·81	**N 100 B**				
		590[2]	593	3·45	34·21	27·24	1·95	—	0·00	27·2	5·43	**BT**	0–277			
		760[1]	756	3·02	34·34	27·38	2·11	—	—	45·3	4·56					
		950[1]	—	2·73	34·43	27·48	2·20	—	—	60·4	3·98					
		1130[1]	1126	2·48	34·52	27·57	2·26	—	—	71·0	3·88					
		1390[1]	1386	2·35	34·61	27·66	2·20	—	—	80·1	3·65					
		1860[1]	1862	2·14	34·67	27·72	2·17	—	—	88·4	3·78					
2850	4	0	—	3·34	34·05	27·12	1·40	—	0·10	12·1	6·93	**N 70 V**	50–0	**2017**	—	Zone +3 hrs
		50	—	3·28	34·05	27·12	1·58	—	0·10	11·3	6·91	,,	100–50			
		75	—	3·28	34·11	27·17	1·46	—	0·10	11·3	—	,,	250–100			
		100	—	3·28	34·11	27·17	1·52	—	0·04	11·3	6·92	,,	500–250			
		150	—	3·40	34·11	27·16	1·66	—	0·00	18·1	6·14	,,	750–500			
		200	—	3·07	34·11	27·19	1·72	—	—	21·9	6·02	,,	1000–750			
		300	—	2·93	34·23	27·30	1·98	—	—	37·8	5·08	,,	1500–1000	—	**2329**	
		400	—	2·71	34·32	27·39	2·11	—	—	46·1	4·69	**N 100 H**	0–1	**2337**	**2354**	
		500[2]	495	2·61	34·43	27·49	2·11	—	—	54·4	4·21	**N 70 B**	157–0	**2348**	**0007**	KT
		610[2]	605	2·53	34·50	27·55	2·14	—	—	61·9	4·01	**N 100 B**				
		790[1]	793	2·34	34·56	27·61	2·14	—	—	72·6	3·79	**BT**	0–277			
		980[1]	—	2·19	34·63	27·68	2·05	—	—	73·3	3·71					
		1170[1]	1168	2·16	34·64	27·70	2·05	—	—	81·6	3·84					
		1470[1]	1474	1·96	34·69	27·74	2·05	—	—	86·2	3·87					
		1940[1]	1943	1·78	34·73	27·80	1·92	—	—	93·6	3·97					
2851	5	0	—	−0·12	34·07	27·39	1·66	—	0·15	38·5	7·62	**N 70 V**	50–0	**2017**		
		50	—	−0·12	34·11	27·42	1·74	—	0·20	43·1	7·65	,,	100–50			
		75	—	−0·02	34·16	27·45	1·84	—	0·08	45·3	—	,,	250–100			
		100	—	0·00	34·15	27·44	1·86	—	0·06	45·3	7·11	,,	500–250			
		150	—	0·89	34·34	27·55	2·00	—	0·00	54·4	5·69	,,	750–500			
		200	—	1·08	34·38	27·57	2·12	—	0·00	61·2	5·24	,,	1000–750			
		300	—	1·40	34·50	27·63	2·16	—	0·00	71·0	4·70	,,	1500–1000	—	**2315**	
		400	—	1·80	34·61	27·70	2·22	—	—	74·1	4·27	**N 100 H**	0–1	**2330**	**2347**	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2851 *cont.*	56° 05′ S, 42° 24′ W	1951 8 vii												
2852	57° 35′ S, 37° 20′ W	9 vii	2000	3402*	W	22–33	W	4	W	4–5	o	1019·1	−0·6	−0·6
2853	58° 01′ S, 33° 03′ W	10 vii	2000	3884*	W	4–10	W	2	W	2	od	1017·8	−0·6	−0·6
2854	57° 33′ S, 31° 12′ W	11 vii	1000	3361*	W'ly	4–10	W'ly	2	W	2	os	1014·6	−1·1	−1·1
2855	57° 15′ S, 28° 50′ W	11 vii	2000	3367*	NNW	17–21	NW	4	NW	4–3	oc	1013·1	−2·2	−2·5
2856	57° 05·3′ S, 26° 50·2′ W Off Vindication Island, South Sandwich Islands. In fringe of pack ice edge	12 vii	1000	673*	W × N	17–21	W	3	WNW	3	O	1007·3	−2·2	−2·2
2857	56° 25′ S, 26° 00′ W	12 vii	2000	4691*	W	22–27	W	5	W	3	Cps	1004·7	−1·1	−1·4

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2851 *cont.*	5	500[2]	497	1·67	34·62	27·72	2·16	—	—	79·3	4·25	N 70 B	78–0	2336	2357	KT
		600[2]	595	1·69	34·67	27·75	2·16	—	—	80·1	4·29	N 100 B				
		770[1]	774	1·63	34·71	27·79	2·16	—	—	83·9	4·29	BT	0–277			
		970[1]	—	1·49	34·72	27·81	2·09	—	—	90·6	4·21					
		1170[1]	1165	1·25	34·70	27·81	2·16	—	—	96·7	4·39					
		1460[1]	1457	1·01	34·72	27·84	2·09	—	—	103	4·43					
		1950[1]	1948	0·58	34·70	27·86	2·03	—	—	106	4·48					
2852	6	0	—	−0·78	34·11	27·45	1·78	—	0·26	57·4	7·80	N 70 V	50–0	2017		
		50	—	−0·77	34·14	27·48	1·75	—	0·26	55·9	7·74	,,	100–50			
		75	—	−0·78	34·14	27·48	1·74	—	0·26	55·2	—	,,	250–100			
		100	—	−0·64	34·20	27·51	1·78	—	0·26	56·6	7·47	,,	500–250			
		150	—	0·53	34·42	27·62	2·11	—	0·08	68·0	5·73	,,	750–500			
		200	—	0·53	34·42	27·62	2·11	—	0·00	71·8	5·62	,,	1000–750			
		300	—	1·13	34·58	27·72	2·17	—	—	76·3	4·86	,,	1500–1000	—	2303	
		400	—	1·41	34·63	27·74	2·14	—	—	80·1	4·55	N 100 H	0–1	2315	2332	
		490[2]	492	1·29	34·64	27·76	2·12	—	—	84·7	4·62	N 70 B	84–0	2324	2344	KT
		600[2]	604	0·99	34·63	27·77	2·12	—	—	86·2	4·61	N 100 B				
		790[1]	789	0·84	34·69	27·82	2·09	—	—	89·2	4·66	BT	0–277			
		990[1]	—	0·72	34·67	27·82	2·14	—	—	92·1	4·68					
		1180[1]	1184	0·56	34·73	27·88	2·14	—	—	98·2	4·63					
		1480[1]	1481	0·41	34·69	27·85	2·14	—	—	103	4·60					
		1980[1]	1983	0·23	34·65	27·83	2·20	—	—	103	4·78					
2853	7	0	—	−1·45	34·08	27·45	1·67	—	0·26	55·2	7·94	N 50 V	100–0	2016	—	Zone +2 hrs
		50	—	−1·52	34·11	27·47	1·72	—	0·26	54·4	7·97	N 70 V	50–0			
		75	—	−1·51	34·11	27·47	1·74	—	0·26	55·2	—	,,	100–50			
		100	—	−1·51	34·18	27·53	1·80	—	0·26	56·6	7·94	,,	250–100			
		150	—	−0·77	34·31	27·61	1·88	—	0·11	65·0	6·99	,,	500–250			
		200	—	−0·10	34·55	27·77	2·05	—	0·00	77·1	5·56	,,	750–500			
		300	—	0·31	34·65	27·82	2·09	—	—	83·9	5·14	,,	1000–750			
		400	—	0·61	34·69	27·84	2·14	—	—	86·2	4·93	,,	1500–0	—	2305	Net failed to close
		500[2]	499	0·56	34·71	27·87	2·12	—	—	89·9	4·70	N 100 H	0–1	2313	2339	
		590[2]	—	0·41	34·71	27·88	2·06	—	—	89·9	4·74	N 70 B	76–0	2325	2346	KT
		780[2]	782	0·40	34·67	27·84	2·12	—	—	92·8	4·64	N 100 B				
		990[1]	986	0·40	34·75	27·91	2·14	—	—	94·4	4·62	BT	0–277			
		1190[1]	—	0·32	34·72	27·88	2·09	—	—	99·6	4·63					
		1480[1]	1480	0·29	34·74	27·90	2·09	—	—	101	4·65					
		1960[2]	1962	0·13	34·70	27·88	2·14	—	—	104	4·91					
2854	8	0	—	−0·3	34·08	27·41	—	—	—	—	—	N 50 V	100–0	1017	1025	Temperatures by
		50	—	−0·3	—	—	—	—	—	—	—	N 100 H	0–1	1036	1053	bathythermograph
		100	—	−0·2	—	—	—	—	—	—	—	N 70 B	130–0	1046	1108	KT
		150	—	0·3	—	—	—	—	—	—	—	N 100 B				
		200	—	1·2	—	—	—	—	—	—	—	BT	0–277			
		250	—	1·4												
2855	8	0	—	−1·7	33·95	27·34	—	—	—	—	—	N 50 V	100–0	2010	2019	Temperatures by
		50	—	−1·6	—	—	—	—	—	—	—	N 100 H	0–1	2030	2052	bathythermograph
		100	—	−0·8	—	—	—	—	—	—	—	N 70 B	130–0	2043	2103	KT. **N 70 B** may not
		150	—	−0·1	—	—	—	—	—	—	—	N 100 B				have fished properly
		200	—	−0·2	—	—	—	—	—	—	—	BT	0–277			
		250	—	0·1												
2856	9	0	—	−1·3	33·53	26·99	—	—	—	—	—	N 100 B	90–0	1035	1055	KT. Temperatures by
		50	—	−1·3	—	—	—	—	—	—	—	BT	0–277			bathythermograph
		100	—	−1·3												
		150	—	0·2												
		200	—	0·8												
		250	—	0·8												
2857	9	0	—	−1·6	33·78	27·21	—	—	—	—	—	N 50 V	100–0	2027	2036	Temperatures by
		50	—	−1·4	—	—	—	—	—	—	—	N 100 H	0–1	2046	2105	bathythermograph
		100	—	−1·1	—	—	—	—	—	—	—	N 100 B	72–0	2054	2114	KT
		150	—	−0·3	—	—	—	—	—	—	—	BT	0–277			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2857 *cont.*	56° 25′ S, 26° 00′ W	1951 12 vii												
2858	56° 14′ S, 23° 14′ W	13 vii	1000	4038*	W	17–21	W	4	W	3	oc	999·9	−2·5	−2·8
2859	56° 12′ S, 20° 57′ W	13 vii	2000	4711*	W	22–27	W	5	W	4	oc	997·2	−2·8	−3·1
2860	56° 15′ S, 18° 44′ W	14 vii	1000	4347*	SW	28–33	SW	5–6	SW	5	Osq	1000·3	−7·8	—
2861	56° 24′ S, 16° 24′ W	14 vii	2000	4513*	SW	11–21	SW	4	SW	4	bc	1006·2	−2·8	−3·6
2862	56° 38′ S, 13° 28′ W	15 vii	1000	—	W × N	28–33	W	5	W	5	bc	1003·1	0·3	0·0
2863	57° 16′ S, 11° 03′ W	15 vii	2000	—	NW	22–33	NW	4–5	NW	5	bc	998·1	−0·6	−0·8
2864	57° 26′ S, 10° 21′ W	16 vii	0900	—	NW	22–27	NW	5	NW	5	ogd	981·0	0·0	0·0
2865	43° 52′ S, 09° 44′ E	22 vii	0905	4550*	WSW	11–16	WSW	3	WSW	4	oc	1005·0	6·7	6·7

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermo-meter	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Mg.—atom m.³ Nitrate + Nitrite N_2	Mg.—atom m.³ Nitrite N_2	Mg.—atom m.³ Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	TIME To	
2857 *cont.*	9	200	—	0·4												
		250	—	0·7												
2858	10	0	—	−1·4	33·86	27·25	—	—	—	—	—	**N 100 H**	0–1	1025	1044	
		50	—	−1·3	—	—	—	—	—	—	—	**N 70 B**	74–0	1033	1054	KT. Temperatures by bathythermograph
		100	—	−1·2	—	—	—	—	—	—	—	**N 100 B**				
		150	—	−0·3	—	—	—	—	—	—	—	**BT**	0–277			
		200	—	0·4												
		250	—	0·4												
2859	10	0	—	−0·4	33·91	27·27	—	—	—	—	—	**N 100 H**	0–1	**2026**	**2046**	
		50	—	−0·4	—	—	—	—	—	—	—	**N 70 B**	148–0	**2035**	**2056**	KT. Temperatures by bathythermograph
		100	—	−0·3	—	—	—	—	—	—	—	**N 100 B**				
		150	—	0·7	—	—	—	—	—	—	—	**BT**	0–277			
		200	—	1·5												
		250	—	1·6												
2860	11	0	—	0·0	33·87	27·21	—	—	—	—	—	**N 70 B**	124–0	1040	1100	KT. Zone +1 hr. Temperatures by bathythermograph
		50	—	0·0	—	—	—	—	—	—	—	**N 100 B**				
		100	—	0·1	—	—	—	—	—	—	—	**BT**	0–277			
		150	—	0·3												
		200	—	0·9												
		250	—	1·1												
2861	11	0	—	0·2	33·86	27·19	—	—	—	—	—	**N 70 B**	102–0	**2037**	**2059**	KT. Temperatures by bathythermograph
		50	—	0·2	—	—	—	—	—	—	—	**N 100 B**				
		100	—	0·3	—	—	—	—	—	—	—	**BT**	0–277			
		150	—	0·3												
		200	—	1·2												
		250	—	1·6												
2862	12	0	—	−0·4	33·85	27·21	—	—	—	—	—	**N 100 B**	57–0	1030	1050	KT. Temperatures by bathythermograph
		50	—	−0·4	—	—	—	—	—	—	—	**BT**	0–277			
		100	—	−0·4												
		150	—	0·5												
		200	—	1·2												
		250	—	1·6												
2863	12	0	—	−0·9	33·89	27·27	—	—	—	—	—	**N 100 H**	0–1	**2027**	**2046**	
		50	—	−0·8	—	—	—	—	—	—	—	**N 100 B**	124–0	**2037**	**2058**	KT. Temperatures by bathythermograph
		100	—	−0·8	—	—	—	—	—	—	—	**BT**	0–277			
		150	—	0·3												
		200	—	1·2												
		250	—	1·6												
2864	13	0	—	−1·70	33·82	27·24	1·40	—	0·34	32·4	8·00	**N 70 V**	50–0	0929		
		50	—	−1·75	33·82	27·24	1·49	—	0·38	32·4	7·99	,,	100–50			
		75	—	−1·77	33·80	27·22	1·55	—	0·34	32·4	—	,,	250–100			
		100	—	−1·64	33·86	27·26	1·67	—	0·38	38·5	7·89	,,	500–0	—	—	Net failed to close
		150	—	0·20	34·25	27·51	1·91	—	0·00	58·9	6·01	,,	500–250			
		200	—	1·23	34·47	27·63	2·17	—	0·00	68·7	4·73	,,	750–0	—	—	Net failed to close
		300	—	1·60	34·55	27·67	2·12	—	—	76·3	4·31	,,	750–500	—	1240	
		400	—	1·60	34·66	27·75	2·12	—	—	85·4	4·33	**N 100 H**	0–1	1248	1313	
		490[2]	494	1·50	34·70	27·79	2·11	—	—	86·9	4·03	**N 100 B**	132–0	1300	1322	KT
		700[2]	695	1·43	34·70	27·80	1·92	—	—	94·4	4·02	**BT**	0–277			
		890[2]	891	1·22	34·70	27·82	1·92	—	—	94·4	4·01					
		1180[1]	1176	0·73	34·67	27·82	2·08	—	—	106	4·45					
		1460[1]	1462	0·56	34·64	27·81	2·05	—	—	112	4·46					
		1950[1]	1952	0·30	34·65	27·82	2·08	—	—	118	4·72					
		2450[1]	2445	0·12	34·65	27·83	2·17	—	—	121	4·83					
2865	18	—	—	—	—	—	—	—	—	—	—	**N 100 B**	750–0	1112	1155	[Zone −1 hr Depth estimated.
												N 70 B	1750–750	1112	1200	Depth estimated
												N 100 B				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2866	41° 21′ S, 12° 06′ E	1951 23 vii	0900	4558*	S	22–27	S	4	S	3	od	1006·0	7·8	7·8
2867	33° 12′ S, 33° 50′ E	17–18 viii	2000	3003*	NE × N	17–21	NE	4	NE	4	bc	1016·8	19·4	18·3
2868	38° 08′ S, 38° 17′ E	19–20 viii	2000	5444*	NE × N	11–21	NE	3	NE	4	Odi	1019·1	17·2	16·7
2869	42° 58′ S, 43° 31′ E	21 viii	2000	3019*	Lt airs	1–3	—	0	—	0	bc	1025·4	7·2	6·7
2870	48° 00′ S, 48° 57′ E	23–24 viii	2000	3795*	NNW	22–33	NNW	5	NW	4	oc	1020·8	2·8	2·2

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	TIME To	
2866	19	—	—	—	—	—	—	—	—	—	—	**N 70 B**	2600–1300	1100	1215	Depth estimated
2867	14	0	—	18·86	35·48	25·44	0·13	—	0·08	3·1	5·65	**N 50 V**	100–0	**2020**	—	Zone −2 hrs
		10	—	18·83	35·50	25·46	0·15	—	0·08	3·1	—	**N 70 V**	50–0			
		20	—	18·74	35·51	25·49	0·20	—	0·08	3·1	5·25	,,	100–50			
		30	—	17·99	35·51	25·68	0·23	—	0·10	3·1	—	,,	250–100			
		50	—	17·87	35·57	25·76	0·23	—	—	3·1	5·26	,,	500–250			
		75	—	17·85	35·61	25·79	0·23	—	0·32	3·1	—	,,	750–500			
		100	—	17·85	35·61	25·79	0·23	—	0·32	3·1	5·15	,,	1000–750	—	**2233**	
		150	—	17·85	35·60	25·78	0·23	—	0·34	3·1	5·21	**N 100 H**	0–1	**0032**	**0047**	
		200	—	17·77	35·60	25·80	0·25	—	0·34	3·1	5·25	**N 70 B**				
		300	—	17·17	35·52	25·88	0·38	—	0·08	3·9	4·81	**N 100 B**	100–0	**0039**	**0058**	KT
		400	—	15·78	35·50	26·20	0·40	—	0·08	3·9	4·89					
		480[2]	480	14·62	35·37	26·36	0·59	—	0·06	6·2	4·44					
		580[2]	575	13·35	35·26	26·54	0·69	—	0·00	12·4	4·73					
		780[2]	779	11·14	34·94	26·72	0·88	—	—	12·4	4·65					
		990[2]	985	8·72	34·69	26·93	1·25	—	—	17·1	4·44					
		1170[1]	1171	6·02	34·46	27·14	1·65	—	—	33·3	4·21					
		1470[1]	1469	4·11	34·51	27·41	1·95	—	—	57·4	3·49					
		1960[1]	1961	2·92	34·68	27·66	2·11	—	—	72·9	3·58					
		2460[1]	2459	2·56	34·77	27·76	1·81	—	—	71·4	4·10					
2868	16	0	—	16·93	35·57	25·99	0·41	—	0·14	4·6	5·26	**NHP**	50–0	**2020**		
		50	—	16·93	35·57	25·99	0·45	—	0·10	3·9	5·27	**N 50 V**	100–0			
		75	—	16·91	35·57	25·99	0·45	—	0·18	4·6	—	**N 70 V**	50–0			
		100	—	16·92	35·53	25·95	0·46	—	0·14	3·9	5·31	,,	100–50			
		150	—	16·90	35·53	25·97	0·56	—	0·14	4·6	5·27	,,	250–100			
		200	—	16·72	35·53	26·00	0·50	—	0·14	3·9	5·16	,,	500–250			
		300	—	14·45	35·34	26·37	0·71	—	0·06	6·2	5·04	,,	750–500			
		400	—	12·97	35·16	26·54	0·86	—	0·00	6·2	5·07	,,	1000–750	—	**0002**	
		500	—	12·89	35·14	26·54	0·83	—	—	6·2	5·19?	**N 100 H**	0–1	**0038**	**0057**	
		590[2]	592	10·56	34·79	26·71	1·02	—	—	6·2	5·11	**N 70 B**	107–0	**0049**	**0110**	KT
		790[2]	786	8·62	34·63	26·91	1·44	—	—	17·8	4·46	**N 100 B**				
		990[2]	—	5·49	34·34	27·12	1·90	—	—	23·2	4·48					
		1190[2]	1186	4·29	34·38	27·29	2·18	—	—	35·7	4·10					
		1480[2]	1479	3·26	34·52	27·50	2·11	—	—	59·9	3·64					
		1940[1]	1935	2·76	34·66	27·66	1·91	—	—	60·5	3·56					
		2430[1]	—	2·55	34·74	27·74	1·68	—	—	62·0	4·06					
		2910[1]	2907	2·28	34·79	27·80	1·68	—	—	63·6	4·23					
		3870[1]	3874	1·25	34·70	27·81	1·78	—	—	97·7	3·98					
		4850[1]	4847	0·73	34·69	27·83	2·11	—	—	116	3·86					
2869	18	0	—	6·96	33·93	26·60	0·99	—	0·32	2·3	6·83	**N 50 V**	100–0	**2017**	—	Zone −3 hrs
		50	—	6·54	33·93	26·66	1·09	—	0·38	2·3	6·85	**N 70 V**	50–0			
		75	—	6·17	33·93	26·70	1·19	—	0·38	2·3	—	,,	100–50			
		100	—	5·78	33·93	26·75	1·19	—	0·34	3·1	6·72	,,	250–100			
		150	—	5·63	34·03	26·86	1·31	—	0·20	4·6	6·38	,,	500–250			
		200	—	5·80	34·14	26·93	1·45	—	0·00	7·7	5·90	,,	750–500			
		300	—	5·05	34·18	27·04	1·58	—	—	13·2	5·71	,,	1000–750			
		400	—	4·19	34·17	27·13	1·75	—	—	17·0	5·63	,,	1500–1000	—	**2247**	
		490[2]	491	3·59	34·22	27·22	1·75	—	—	20·9	5·35	**N 100 H**	0–1	**2257**	**2315**	
		590[2]	—	3·17	34·23	27·28	2·03	—	—	26·4	5·10	**N 70 B**	70–0	**2308**	**2329**	KT
		790[2]	791	2·80	34·32	27·37	2·01	—	—	39·5	4·52	**N 100 B**				
		990[1]	988	2·63	34·41	27·47	2·13	—	—	51·2	4·03					
		1190[1]	—	2·50	34·53	27·58	2·11	—	—	58·9	3·80					
		1490[1]	1486	2·41	34·65	27·68	1·95	—	—	63·5	3·93					
		1980[1]	1982	2·19	34·74	27·77	1·75	—	—	65·9	2·71?					
		2460[1]	2460	2·11	34·71	27·76	1·78	—	—	71·3	4·37					
2870	20	0	—	2·21	33·78	27·01	1·55	—	0·34	12·4	7·62	**N 70 V**	50–0	**2035**		
		10	—	2·21	33·80	27·02	1·58	—	0·34	11·6	—	,,	100–50			
		20	—	2·21	33·80	27·02	1·55	—	0·32	13·9	7·62	,,	250–100			
		30	—	2·21	33·81	27·03	1·62	—	0·32	13·2	—	,,	500–250	—	**2257**	Remainder of vertical nets abandoned on account of heavy weather

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2870 *cont.*	48° 00′ S, 48° 57′ E	1951 23–24 viii												
2871	50° 09′ S, 51° 23′ E	24–25 viii	2000	4438*	SW	17–21	SW	4	SW	4	Ois	1007·2	0·0	−1·1
2872	52° 30′ S, 54° 17′ E	25 viii	2000	2774*	W × S	17–21	W × S	4	W	4	Cq	1011·2	0·0	0·0
2873	54° 40′ S, 56° 56′ E	26 viii	2000	—	W × N	28–33	W	5	W	7	oqs	1008·2	−0·3	−0·6
2874	57° 30′ S, 60° 37′ E	27–28 viii	2000	4927*	WNW	17–33	WNW	4–5	WNW	5	Os_od_o	990·7	0·0	0·0

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_3	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2870 *cont.*	20	50	—	2.18	33.84	27.05	1.58	—	0.32	12.4	7.62	**N 100 B**	56–0	**0029**	**0050**	KT
		75	—	2.18	33.84	27.05	1.62	—	0.32	11.6	—					
		100	—	2.12	33.84	27.05	1.65	—	0.26	11.6	7.56					
		150	—	1.92	33.81	27.05	1.68	—	0.26	14.7	7.49					
		200	—	1.96	33.98	27.19	1.88	—	0.06	20.9	6.71					
		300	—	2.02	34.14	27.31	2.18	—	0.00	32.6	5.59					
		400	—	2.06	34.14	27.31	2.18	—	0.00	34.1	5.61					
		500	—	2.42	34.41	27.49	2.48	—	0.00	53.5	4.31					
		580[2]	579	2.30	34.43	27.52	2.34	—	0.00	57.4	4.04					
		780[2]	780	2.33	34.58	27.63	2.24	—	0.00	65.1	3.99					
		980[2]	977	2.35	34.62	27.66	2.24	—	—	68.2	4.10					
		1470[1]	1470	2.17	34.70	27.74	1.91	—	—	69.8	4.17					
		1980[1]	1975	1.79	34.72	27.78	1.95	—	—	77.5	4.37					
		2480[1]	2478	1.36	34.70	27.80	2.08	—	—	90.7	4.39					
2871	21	0	—	2.11	33.82	27.05	1.52	—	0.26	16.3	7.55	**N 50 V**	100–0	**2024**		
		50	—	2.11	33.82	27.05	1.62	—	0.32	16.3	7.61	**N 70 V**	50–0			
		75	—	2.09	33.80	27.03	1.68	—	0.32	16.3	—	,,	100–50			
		100	—	2.09	33.80	27.03	1.62	—	0.32	16.3	7.60	,,	250–100			
		150	—	2.07	33.83	27.05	1.62	—	0.28	16.3	7.54	,,	500–250			
		200	—	1.95	33.89	27.11	1.78	—	0.20	18.6	7.38	,,	750–500			
		300	—	1.99	34.14	27.31	2.19	—	0.00	36.4	5.65	,,	1000–750	—	**2244**	
		400	—	2.30	34.34	27.45	2.34	—	0.00	48.1	4.69	**N 100 H**	0–1	**0005**	**0020**	
		490[2]	485	2.27	34.41	27.49	2.34	—	—	54.3	4.22	**N 70 B**	142–0	**0014**	**0034**	KT
		590[2]	—	2.26	34.49	27.56	2.31	—	—	60.5	4.01	**N 100 B**				
		780[2]	775	2.30	34.55	27.60	2.31	—	—	66.7	3.41					
		1170[2]	1166	2.28	34.66	27.70	2.08	—	—	69.8	3.93					
		1440[1]	1435	2.16	34.70	27.75	2.04	—	—	72.1	4.14					
		1930[1]	—	1.77	34.73	27.80	1.98	—	—	77.5	4.37					
		2410[1]	2408	1.33	34.72	27.82	2.04	—	—	89.2	4.43					
		2910[1]	2907	0.90	34.69	27.82	2.14	—	—	105	4.51					
		3880[1]	3876	0.20	34.69	27.86	2.21	—	—	124	4.86					
2872	22	0	—	0.96	33.92	27.20	1.58	—	0.28	26.4	7.72	**N 70 V**	50–0	**2021**		
		50	—	0.96	33.93	27.21	1.72	—	0.28	26.4	7.76	,,	100–50			
		75	—	0.93	33.92	27.20	1.78	—	0.28	25.6	—	,,	250–100			
		100	—	0.93	33.92	27.21	1.78	—	0.28	26.4	7.72	,,	500–250			
		150	—	0.93	33.92	27.21	1.82	—	0.28	27.1	7.74	,,	750–500	—	**2320**	Remainder of vertical nets abandoned on account of worsening weather conditions
		200	—	1.09	34.02	27.28	1.95	—	0.16	32.6	6.84	**N 100 B**	88–0	**2338**	**2359**	KT
		300	—	1.59	34.30	27.46	2.31	—	0.00	51.2	5.17					
		400	—	1.89	34.40	27.52	2.31	—	0.00	59.7	4.52					
		490[2]	492	2.04	34.54	27.63	2.21	—	—	69.0	4.04					
		590[2]	—	2.07	34.59	27.66	2.38	—	—	71.3	3.98					
		790[2]	789	2.09	34.67	27.72	2.24	—	—	74.4	4.02					
		1140[1]	1144	1.96	34.69	27.74	2.11	—	—	76.0	4.12					
		1910[1]	1914	1.27	34.72	27.82	1.92	—	—	92.9	4.51					
		2380[1]	2384	0.82	34.69	27.82	2.11	—	—	108	4.53					
		2770[1]	2770*	0.53	—	—	—	—	—	—	—	—	—	—	—	* Bottle hit bottom—most samples contaminated
2873	23	0	—	—	—	—	—	—	—	—	—	**N 100 B**	62–0	**2029**	**2050**	KT. Zone −4 hrs
		50														
2874	24	0	—	−0.70	33.87	27.25	1.87	—	0.32	27.1	7.89	**N 70 V**	50–0	**2047**		
		20	—	−0.70	33.87	27.24	1.98	—	0.32	27.9	7.98	,,	100–50			
		50	—	−0.73	33.87	27.25	1.98	—	0.28	27.1	7.94	,,	250–100			
		75	—	−0.73	33.87	27.25	1.98	—	0.28	27.1	—	,,	500–250	—	—	Considerable stray on wire
		100	—	−0.75	33.87	27.25	2.05	—	0.28	27.9	7.88	,,	750–500			
		150	—	−0.45	33.96	27.31	2.08	—	0.22	32.6	7.47	,,	1000–750	—	**2335**	
		200	—	1.50	34.33	27.49	2.44	—	0.00	52.8	4.97	**N 100 B**	54–0	**0016**	**0037**	KT. 250 m. warp
		300	—	2.02	34.51	27.60	2.58	—	—	58.9	4.17					
		400	—	2.08	34.54	27.62	2.51	—	—	66.7	4.21					
		500	—	2.12	34.64	27.70	2.48	—	—	66.7	4.15					
		580[2]	584	2.03	34.68	27.74	2.44	—	—	71.3	4.04					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. °C. Dry bulb	Air Temp. °C. Wet bulb
2874 *cont.*	57° 30′ S, 60° 37′ E	1951 27–28 viii												
2875	59° 15′ S, 64° 08′ E	28–29 viii	2000	4427*	W	17–33	W	4	WNW	4–5	c	966·9	−1·1	−1·7
2876	56° 50′ S, 66° 12′ E	29 viii	2000	—	SW × W	22–27	SW	4	SW	5	c	967·0	−0·6	−1·1
2877	53° 49′ S, 68° 04′ E	30 viii	2000	—	W	17–21	W	4–5	W	4	o	984·6	1·7	1·1
2878	49° 52′ S, 69° 43′ E	1 ix	2000	117*	W	7–10	W	2	W	2	o	1003·7	2·8	2·2
2879	56° 50′ S, 80° 42′ E	9 ix	2000	—	WSW	28–33	WSW	4	WSW	4	ocqs	976·0	−7·8	−7·8
2880	54° 13′ S, 84° 45′ E	10 ix	2000	4438*	NW × W	17–33	NW	3	NW	4	Osq	987·6	−1·7	−1·4
2881	49° 53′ S, 91° 36′ E	12 ix	2000	3714*	SW	7–16	SW	2	SW	3	Os_0s_0	988·0	2·2	2·2

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2874 *cont.*	24	780[2]	—	1·99	34·69	27·74	2·21	—	—	69·8	4·12					
		980[2]	979	1·92	34·69	27·74	2·18	—	—	70·5	4·21					
		1180[2]	—	1·76	34·72	27·79	2·08	—	—	72·1	4·36					
		1470[2]	1472	1·50	34·72	27·81	2·14	—	—	79·8	4·37					
		1930[1]	1934	1·08	34·70	27·83	2·14	—	—	91·4	4·28					
		2430[1]	2427	0·72	34·67	27·82	2·21	—	—	101	4·39					
		3410[1]	3413	0·19	34·63	27·82	2·28	—	—	113	4·52					
		4420[1]	4421	−0·12	34·63	27·84	2·28	—	—	113	4·65					
2875	25	0	—	−1·65	33·79	27·21	1·70	—	0·34	27·1	7·98	**N 70 V**	50–0	**2035**	—	In fringe of ice-edge
		10	—	−1·71	33·79	27·22	1·90	—	0·34	27·1	—	,,	100–50			
		20	—	−1·71	33·79	27·22	1·87	—	0·34	27·9	8·02	,,	250–100			
		50	—	−1·71	33·78	27·21	1·87	—	0·34	28·7	7·99	,,	500–250			
		75	—	−1·71	33·79	27·22	1·87	—	0·34	27·9	—	,,	750–500			
		100	—	−1·71	33·80	27·22	1·87	—	0·34	27·9	7·97	,,	1000–750	—	**2230**	
		150	—	−0·50	34·05	27·38	2·11	—	0·17	40·3	6·68	**N 100 B**	102–0	**2348**	**0010**	KT. 230 m. warp
		200	—	1·58	34·42	27·55	2·38	—	0·00	60·5	4·47	**BT**	0–277			
		300	—	1·95	34·57	27·65	2·41	—	0·00	68·2	4·12					
		400	—	1·98	34·58	27·66	2·34	—	—	68·2	4·07					
		480[2]	481	1·92	34·63	27·71	2·34	—	—	71·3	3·14					
		570[2]	—	1·94	34·69	27·74	2·21	—	—	72·1	3·89					
		760[2]	756	1·86	34·69	27·75	2·10	—	—	76·0	4·10					
		940[2]	939	1·77	34·74	27·81	2·08	—	—	76·0	3·76					
		1130[2]	1134	1·58	34·74	27·82	2·10	—	—	77·5	4·38					
		1430[1]	1434	1·36	34·72	27·82	2·05	—	—	83·7	4·25					
		1910[1]	—	0·95	34·69	27·81	2·06	—	—	93·9	4·18					
		2390[1]	2389	0·63	34·69	27·83	2·16	—	—	105	4·60					
		2870[1]	2869	0·35	34·69	27·85	2·14	—	—	105	4·45					
		3810[1]	3810	−0·01	34·65	27·84	2·19	—	—	116	4·82					
2876	26	0	—	−0·15	33·94	27·28	—	—	—	—	—	**N 100 H**	0–1	**2022**	**2042**	KT. Temperature by bathythermograph
												N 100 B	80–0	**2029**	**2050**	
2877	27	0	—	1·13	33·97	27·23	—	—	—	—	—	**N 100 H**	0–1	**2017**	**2040**	
												N 100 B	77–0	**2027**	**2048**	KT
2878	29	0	—	3·11	33·87	27·00	—	—	—	—	—	**DC**	116	**2024**	**2026**	Zone −5 hrs
												DLH	116	**2048**	**2058**	Stop on arm parted. Catch rather poor
2879	8	0	—	−1·33	34·15	27·50	—	—	—	—	—	**N 70 B**	140–0	**2035**	**2105**	KT
												N 100 B				
2880	9	0	—	−0·02	34·05	27·36	1·90	—	0·17	35·6	7·78	**N 100 B**	126–0	**2030**	**2055**	KT
		100[3]	95	0·09	34·05	27·36	1·96	—	0·20	35·6	4·26?	**N 70 V**	50–0	**2140**		
		140[3]	—	−0·16	34·08	27·40	1·98	—	0·22	41·8	5·79	,,	100–50			
		190[3]	189	−0·07	34·22	27·49	2·21	—	0·20	49·6	6·91	,,	250–100			
		290[2]	291	1·56	34·61	27·71	2·24	—	0·00	71·3	4·31	,,	500–250	—	**2233**	Remainder of vertical nets abandoned after repeated trouble with wire
		380[2]	—	1·47	34·70	27·80	2·31	—	—	74·4	4·11					
		470[2]	473	1·29	34·70	27·81	2·18	—	—	76·0	3·30					
		580[2]	577	1·51	34·71	27·81	2·18	—	—	76·0	3·73					
		770[2]	772	1·68	34·76	27·82	2·05	—	—	81·4	2·88					
		980[1]	976	1·54	34·74	27·82	2·05	—	—	85·3	4·47					
		1460[1]	1461	1·14	34·72	27·83	2·11	—	—	100	4·54					
		1940[1]	1936	0·79	34·72	27·85	2·14	—	—	108	4·50					
		2930[1]	2927	0·25	34·70	27·87	2·28	—	—	118	4·81					
2881	11	0	—	7·24	34·40	26·93	1·02	—	0·10	5·4	6·51	**N 50 V**	100–0	**2015**	—	Zone −6 hrs
		100[3]	99	7·24	34·36	26·90	1·11	—	0·10	5·4	6·38	**N 70 V**	50–0			
		150[3]	146	7·32	34·33	26·86	1·12	—	0·08	7·0	6·27	,,	100–50			
		190[3]	192	7·34	34·34	26·87	1·17	—	0·08	7·0	6·33	,,	250–100			
		290[3]	289	7·37	34·34	26·86	1·17	—	0·06	7·0	6·31	,,	500–250			
		400[2]	398	7·14	34·45	26·98	1·42	—	0·00	12·4	4·33	,,	750–500			
		500[2]	—	5·95	34·38	27·09	1·63	—	—	15·5	4·99	,,	1000–750			
		600[2]	599	4·87	34·34	27·18	1·80	—	—	23·2	3·89	,,	1500–1000	—	**2306**	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2881 *cont.*	49° 53′ S, 91° 36′ E	1951 12 ix												
2882	44° 42′ S, 97° 47′ E	14 ix	2000	3471*	SW	11–21	SW	3	SW	3	bc	1013·7	6·7	5·6
2883	36° 11′ S, 109° 13′ E	18 ix	0930	—	SE	17–21	SE	3–4	SE	3	bc	1030·5	9·7	7·8
			0956	4760*	—	—	—	—	—	—	—	—	—	—
			1009	4753*										
2884	31° 29′ S, 107° 46′ E	4 x	0600	5304*	W	11–16	W	3	W	4	bc	1014·6	19·4	17·2
			1255	5299*	—	—	—	—	—	—	—	—	—	—
2885	30° 10′ S, 93° 48′ E	8 x	0600	2284*	W	7–10	W	3	W	2	bc	1023·2	17·2	13·9
			1125	2287*	—	—	—	—	—	—	—	—	—	—
2886	29° 58′ S, 90° 00′ E	9 x	1300	2485*	S'ly	4–6	S'ly	1	S'ly	2	bc	1026·5	16·7	11·7
2887	25° 51′ S, 90° 02′ E	10 x	2000	4502*	NW	4–10	NW	1	SSW	3	bc	1021·6	18·3	13·9
2888	22° 38′ S, 90° 02′ E	11–12 x	2000	5121*	SSW	7–10	SW	2	SW	2	b	1020·5	19·4	16·1

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_3	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	TIME To	
2881 *cont.*	11	800[2]	795	3·51	34·35	27·35	2·05	—	—	34·9	4·88	**N 100 H**	0–1	**2325**	**2345**	
		1130[1]	1133	2·77	34·49	27·52	2·14	—	—	54·3	4·02	**N 70 B**	100–0	**2334**	**2355**	KT. Small hole in **N 70 B**
		1430[1]	—	2·54	34·60	27·62	2·19	—	—	65·9	3·76	**N 100 B**				
		1930[1]	1934	2·32	34·76	27·77	2·08	—	—	69·8	4·02					
		2430[1]	2434	2·02	34·76	27·80	1·93	—	—	77·6	4·36					
		3410[1]	3411	1·07	34·72	27·84	2·08	—	—	110	4·28					
2882	13	0	—	9·36	34·51	26·69	—	—	—	—	—	**TYFB**	750–0	**2025**	**2210**	Depth estimated
2883	17	—	—	—	—	—	—	—	—	—	—	**XSR**	—	0956	—	Shot 1. Zone −7 hrs
		—	—	—	—	—	—	—	—	—	—	**XSR**	—	1009	—	Shot 2
2884	3	—	—	—	—	—	—	—	—	—	—	**STK**	5304	0700	1130	Core 1
		—	—	—	—	—	—	—	—	—	—	**XSR**	5299	1255		
2885	7	—	—	—	—	—	—	—	—	—	—	**STK**	2284	0728	0925	Small main core accidentally lost. Pilot cores retained
												XSR	—	0945	—	Zone −6 hrs
												STK	2287	1052	1232	Core 2
2886	8	0[3]	—	16·17	35·68	26·24	0·53	—	0·05	4·2	5·69	**N 50 V**	100–0	1313		
		25[3]	—	15·88	35·62	26·27	0·53	—	0·09	4·9	5·89	**N 70 V**	50–0			
		50[3]	—	15·49	35·62	26·36	0·66	—	0·03	9·9	5·69	,,	100–50			
		100[3]	—	14·77	35·57	26·48	0·53	—	0·05	5·6	5·57	,,	250–100			
		150[3]	149	13·24	35·35	26·63	0·86	—	0·03	11·3	5·30	,,	500–250			
		200[2]	200	12·67	35·25	26·66	0·96	—	0·00	7·0	5·41	,,	750–500			
		300[2]	—	11·62	35·07	26·73	1·09	—	0·00	8·5	5·50	,,	1000–750			
		390[2]	390	10·92	34·94	26·76	1·14	—	0·00	11·3	5·55	,,	1500–1000	—	1605	
		490[2]	494	10·22	34·89	26·85	1·21	—	—	14·1	5·46	**N 100 H**	0–1	1613	1627	
		590[2]	591	9·53	34·70	26·82	1·22	—	—	10·6	5·42	**N 70 B**	77–0	1617	1638	KT. **N 70 B** torn
		790[1]	793	7·84	34·55	26·97	1·62	—	—	16·9	4·92	**N 100 B**				
		990[1]	—	5·03	34·38	27·20	2·32	—	—	36·0	4·26					
		1190[1]	1190	3·71	34·51	27·45	2·62	—	—	64·9	3·57					
		1480[1]	1482	3·03	34·58	27·57	2·65	—	—	86·0	3·40					
		1980[1]	1980	2·37	34·63	27·67	2·71	—	—	104	3·61					
2887	9	0	—	19·95	35·58	25·24	0·61	—	0·05	7·0	5·33	**N 50 V**	100–0	**2008**		
		25	—	19·58	35·57	25·33	0·45	—	0·09	6·3	5·33	**N 70 V**	50–0			
		50	—	19·57	35·56	25·32	0·33	—	0·03	2·8?	5·36	,,	100–50			
		75	—	19·47	35·59	25·37	0·36	—	0·00	6·3	—	,,	250–100			
		100	—	19·19	35·66	25·49	0·38	—	0·00	3·5	5·29	,,	500–250			
		150	—	18·94	35·66	25·56	0·50	—	0·00	3·5	5·34	,,	750–500			
		200	—	18·03	35·79	25·88	0·33	—	0·00	4·2	5·27	,,	1000–750			
		300	—	15·44	35·59	26·34	0·53	—	0·00	5·6	5·35	,,	1500–1000	—	**2250**	
		400	—	12·32	35·12	26·64	0·86	—	0·00	4·2	5·48	**N 100 H**	0–1	**2326**	**2344**	
		480[2]	479	10·98	34·94	26·75	0·99	—	—	7·0	5·14	**N 70 B**	102–0	**2332**	**2354**	KT
		570[2]	—	9·80	34·77	26·82	1·16	—	—	4·2	5·31	**N 100 B**				
		760[2]	—	8·01	34·53	26·93	1·58	—	—	7·0	4·31					
		950[2]	946	5·31	34·43	27·21	2·38	—	—	32·4	3·83					
		1160[2]	1155	3·99	34·47	27·39	2·61	—	—	52·2	2·92					
		1400[1]	1402	3·31	34·53	27·51	2·58	—	—	69·1	3·07					
		1890[1]	—	2·48	34·63	27·66	2·51	—	—	84·6	3·26					
		2370[1]	2373	2·04	34·66	27·72	2·38	—	—	94·5	3·48					
		3330[1]	3334	1·43	34·68	27·78	2·41	—	—	103	3·93					
2888	10	0	—	20·49	35·35	24·92	0·43	—	0·05	4·2	5·22	**N 50 V**	100–0	**2009**		
		10	—	20·49	35·34	24·91	0·45	—	0·05	3·5	—	**NHP**	50–0			
		25	—	20·37	35·34	24·94	0·69	—	0·03	3·5	5·22	**N 70 V**	50–0			
		50	—	20·20	35·37	25·01	0·74	—	0·03	7·0	5·29	,,	100–50			
		75	—	19·94	35·41	25·11	0·86	—	0·03	9·2	—	,,	250–100			
		100	—	19·89	35·43	25·13	0·66	—	0·00	4·2	5·25	,,	500–250			
		150	—	19·34	35·66	25·46	0·76	—	0·00	5·6	5·05	,,	750–500			
		200	—	19·02	35·73	25·60	0·86	—	0·00	6·3	4·87	,,	1000–750			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2888 *cont.*	22° 38′ S, 90° 02′ E	1951 11–12 x												
2889	19° 35′ S, 90° 01′ E	12 x	2000	5190*	SE	7–10	SE	1	SE	2	bc	1020·3	21·1	18·3
2890	16° 37′ S, 90° 05·5′ E	13 x	2000	3389*	SE	11–21	SE	3	SE	3	bc	1019·8	24·4	18·3
2891	13° 37′ S, 90° 00′ E	14–15 x	2000	5292*	SE	17–21	SE	3	SE	3	bc	1016·1	25·0	22·8

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_3	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2888 *cont.*	10	300	—	16·14	35·73	26·30	0·89	—	0·00	7·0	5·06	**N 70 V**	1500–1000	—	**2303**	
		400	—	13·01	35·35	26·68	1·12	—	0·00	4·2	5·34	**N 100 H**	0–1	**0030**	**0046**	
		590[2]	586	9·92	34·85	26·86	1·35	—	—	5·6	4·99	**N 70 B**	} 92–0	**0037**	**0057**	KT
		780[2]	—	7·71	34·57	27·00	1·85	—	—	14·1	4·38	**N 100 B**				
		970[2]	970	4·96	34·54	27·34	2·68	—	—	45·1	3·11					
		1180[2]	1179	4·12	34·58	27·46	2·84	—	—	70·5	2·57					
		1480[1]	1481	3·29	34·58	27·55	2·71	—	—	84·6	2·93					
		1970[1]	—	2·44	34·67	27·69	2·64	—	—	95·9	3·11					
		2960[1]	2957	1·71	34·69	27·76	2·51	—	—	107	3·67					
		3950[1]	3947	1·15	34·69	27·80	2·64	—	—	113	3·92					
		4920[2]	4921	1·15	34·69	27·80	2·51	—	—	116	4·10					
2889	11	0	—	23·01	34·57	23·62	0·54	—	0·05	9·2?	5·04	**N 50 V**	100–0	**2007**		
		10	—	22·69	34·70	23·82	0·45	—	0·09	1·4	—	**N 70 V**	50–0			
		20	—	22·51	34·76	23·91	0·38	—	0·03	1·4	5·11	,,	100–50			
		30	—	22·39	34·81	23·99	0·54	—	0·03	1·4	—	,,	250–100			
		50	—	22·00	35·00	24·24	0·43	—	0·00	2·1	5·14	,,	500–250			
		75	—	21·57	35·14	24·46	0·41	—	0·00	1·4	—	,,	750–500			
		100	—	21·26	35·23	24·62	0·45	—	0·00	4·2	5·18	,,	1000–750			
		150	—	20·65	35·46	24·96	0·63	—	0·00	4·2	4·65	,,	1500–1000	—	**2232**	
		200	—	19·87	35·63	25·30	0·53	—	0·00	3·5	4·48	**N 100 H**	0–1	**2336**	**2350**	
		300	—	16·41	35·71	26·22	0·70	—	0·00	1·4	4·92	**N 70 B**	} 100–0	**2342**	**0002**	KT
		400	—	12·98	35·33	26·67	0·94	—	—	2·1	5·34	**N 100 B**				
		470[2]	473	11·17	35·03	26·79	1·23	—	—	2·1	5·50					
		570[2]	—	9·60	34·79	26·88	1·46	—	—	4·9	5·20					
		780[2]	777	6·37	34·72	27·30	2·42	—	—	27·5	3·95					
		960[2]	960	4·83	34·59	27·39	3·08	—	—	62·0	2·79					
		1180[2]	1178	4·02	34·59	27·48	3·04	—	—	77·5	2·80					
		1360[1]	1357	3·50	34·66	27·59	2·81	—	—	84·6	2·68					
		1830[1]	—	2·64	34·69	27·69	2·84	—	—	100	2·90					
		2770[1]	2773	1·70	34·70	27·78	2·81	—	—	111	3·55					
		3770[1]	3768	1·17	34·69	27·80	2·74	—	—	111	4·06					
		4770[1]	—	1·14	34·69	27·80	2·57	—	—	111	4·17					
2890	12	0	—	25·75	34·67	22·88	0·35	—	0·05	4·9	4·79	**N 50 V**	100–0	**2008**		
		25	—	25·72	34·65	22·87	0·35	—	0·05	4·2	4·70	**N 70 V**	50–0			
		50	—	25·74	34·65	22·87	0·28	—	0·03	4·9	4·78	,,	100–50			
		75	—	25·75	34·70	22·91	0·33	—	0·00	4·9	—	,,	250–100			
		100	—	25·52	34·70	22·98	0·38	—	0·00	4·9	4·67	,,	500–250			
		150	—	20·96	35·07	24·57	0·81	—	0·00	11·3	3·53	,,	750–500			
		200	—	18·92	35·28	25·27	0·88	—	—	11·3	3·55	,,	1000–750			
		300	—	15·31	35·38	26·21	1·04	—	—	18·3	4·05	,,	1500–1000	—	**2259**	
		400	—	11·89	35·15	26·75	0·88	—	—	12·7	5·34	**N 100 H**	0–1	**2311**	**2332**	
		490[2]	492	10·01	34·86	26·86	1·26	—	—	16·9	5·25	**N 70 B**	} 92–0	**2318**	**2339**	KT
		580[2]	577	8·12	34·60	26·96	1·76	—	—	21·8	4·66	**N 100 B**				
		780[3]	784	6·16	34·65	27·27	2·79	—	—	69·1	2·30					
		980[1]	984	5·41	34·66	27·38	2·62	—	—	77·5	2·04					
		1180[1]	—	4·65	34·65	27·45	2·62	—	—	87·4	2·15					
		1470[1]	1471	3·72	34·67	27·57	2·59	—	—	95·9	2·54					
		1980[1]	1975	2·55	34·69	27·70	2·72	—	—	107	3·11					
		2960[1]	2963	1·67	34·70	27·78	2·32	—	—	117	3·69					
2891	13	0	—	26·82	34·19	22·19	0·69	—	0·05	3·5	4·61	**N 50 V**	100–0	**2009**		
		20	—	26·82	34·22	22·20	0·36	—	0·00	7·0	4·70	**N 70 V**	50–0			
		30	—	26·82	34·22	22·20	0·33	—	0·00	6·3	—	,,	100–50			
		50	—	26·19	34·40	22·54	0·41	—	0·00	8·5	4·78	,,	250–100			
		75	—	25·87	34·40	22·64	0·41	—	0·00	7·0	—	,,	500–250			
		100	—	25·14	34·56	22·99	0·58	—	0·00	9·9	4·39	,,	750–500			
		150	—	20·40	34·67	24·42	1·57	—	—	14·8	2·49	,,	1000–750			
		200	—	16·33	34·66	25·43	1·75	—	—	22·6	2·47	,,	1500–1000	—	**0009**	
		300	—	13·19	34·95	26·34	1·80	—	—	24·0	2·89	**N 100 H**	0–1	**0025**	**0043**	
		400	—	10·58	34·81	26·73	1·98	—	—	25·4	3·09	**N 70 B**	} 100–0	**0030**	**0050**	KT
		460[3]	460	9·68	34·81	26·88	1·75	—	—	18·3	4·21	**N 100 B**				
		560[3]	—	8·35	34·61	26·94	2·12	—	—	26·8	3·54					
		790[1]	792	6·47	34·63	27·22	3·07	—	—	62·7	1·94					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2891 *cont.*	13° 37′ S, 90° 00′ E	1951 14–15 x												
2892	10° 51′ S, 89° 58′ E	15 x	2000	5444*	ESE	21–11	SE	3	SE	3–4	bcqr	1013·0	24·4	22·8
2893	07° 52′ S, 89° 50′ E	16–17 x	2000	5060*	ESE	11–16	SE	3	SE	3	bc	1011·4	27·2	25·0
2894	05° 02′ S, 89° 47′ E	17 x	2000	4908*	E	21–11	E	3	E	3	bc	1010·5	28·3	25·6

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³: P	Nitrate + Nitrite N_3	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: From	To	Remarks
2891 *cont.*	13	960[2]	959	5·49	34·63	27·35	3·17	—	—	83·2	1·90					
		1140[3]	1143	4·76	34·65	27·44	2·78	—	—	93·1	2·07					
		1560[1]	1555	3·45	34·65	27·58	2·65	—	—	100	2·50					
		1900[2]	1895	2·76	34·70	27·69	2·65	—	—	111	2·87					
		2900[2]	—	1·71	34·69	27·76	2·71	—	—	120	3·51					
		3900[2]	3897	1·11	34·70	27·82	2·71	—	—	121	4·03					
		4870[2]	4869	1·22	34·69	27·80	2·18	—	—	118	4·17					
2892	14	0	—	26·72	34·02	22·09	0·28	—	0·00	5·6	4·72	**N 50 V**	100–0	**2009**		
		20	—	26·72	34·02	22·09	0·33	—	0·00	4·2	4·74	**NHP**	50–0			
		30	—	26·74	34·04	22·10	0·38	—	0·00	8·5	—	**N 70 V**	50–0			
		50	—	26·78	34·05	22·09	0·26	—	0·00	6·3	4·74	,,	100–50			
		75	—	26·32	34·23	22·38	0·38	—	0·00	8·5	—	,,	250–100			
		100	—	24·21	34·40	23·14	0·81	—	0·00	11·3	3·45	,,	500–250			
		150	—	20·32	34·54	24·35	1·19	—	—	16·2	3·03	,,	750–500			
		200	—	16·05	34·55	25·41	1·58	—	—	24·0	2·79	,,	1000–750			
		300	—	11·31	34·66	26·47	2·28	—	—	33·8	2·06	,,	1500–1000	—	**2259**	
		400	—	10·03	34·78	26·79	2·51	—	—	33·8	2·25	**N 100 H**	0–1	**2328**	**2346**	
		480[2]	479	8·81	34·68	26·92	2·58	—	—	38·1	2·11	**N 70 B**	162–0	**2334**	**2354**	KT
		580[2]	—	7·78	34·67	27·07	2·67	—	—	52·2	1·81	**N 100 B**				
		780[2]	780	6·20	34·58	27·22	2·94	—	—	70·5	1·87					
		990[2]	988	5·09	34·58	27·35	2·97	—	—	87·4	2·00					
		1470[1]	1473	3·69	34·69	27·59	2·74	—	—	101	2·22					
		1960[1]	—	2·61	34·69	27·69	2·84	—	—	104	2·76					
		2940[1]	2940	1·64	34·69	27·77	2·54	—	—	117	3·55					
		3920[1]	3919	1·09	34·68	27·80	2·38	—	—	114	4·06					
		4900[1]	4898	1·23	34·69	27·81	2·48	—	—	117	3·92					
2893	15	0	—	28·04	34·42	21·96	0·35	—	0·00	5·6	4·61	**N 50 V**	100–0	**2010**		
		20	—	28·03	34·51	22·03	0·45	—	0·00	7·7	4·63	**N 70 V**	50–0			
		30	—	28·03	34·49	22·02	0·43	—	0·00	10·6	—	,,	100–50			
		50	—	28·01	34·41	21·96	0·28	—	0·00	7·7	4·60	,,	250–100			
		75	—	27·99	34·52	22·06	0·33	—	0·00	8·5	—	,,	500–250			
		100	—	26·08	35·15?	23·14	0·66	—	0·00	9·9	3·88	,,	750–500			
		150	—	16·54	34·60	25·33	1·92	—	—	24·0	2·52	,,	1000–750			
		200	—	12·78	34·62	26·16	2·28	—	—	38·8	2·36	,,	1500–1000	—	**2242**	
		300	—	10·88	34·90	26·74	2·80	—	—	35·2	1·74	**N 100 H**	0–1	**0003**	**0023**	
		400	—	9·86	34·90	26·92	2·73	—	—	33·8	2·11	**N 70 B**	92–0	**0010**	**0032**	KT
		490[2]	489	9·14	34·84	26·99	2·97	—	—	40·9	1·96	**N 100 B**				
		590[2]	—	8·32	34·83	27·11	2·84	—	—	55·0	1·70					
		790[2]	786	6·55	34·76	27·31	3·70	—	—	88·8	1·54					
		990[3]	991	5·31	34·70	27·43	3·63	—	—	110	1·83					
		1180[3]	1182	4·69	34·79	27·57	3·46	—	—	128	1·92					
		1470[1]	1469	3·75	34·78	27·66	2·94	—	—	134	2·15					
		1970[1]	—	2·64	34·78	27·77	2·87	—	—	155	2·72					
		2960[1]	2960	1·70	34·78	27·84	2·80	—	—	>160	3·41					
		3960[1]	3956	1·12	34·72	27·83	2·64	—	—	>160	3·92					
		4930[1]	4932	1·18	34·72	27·83	2·37	—	—	>160	4·17					
2894	16	0	—	28·57	34·24	21·65	0·18	—	0·00	8·5	4·61	**N 50 V**	100–0	**2010**		
		20	—	28·55	34·22	21·65	0·26	—	0·00	10·6	4·59	**N 70 V**	50–0			
		30	—	28·55	34·26	21·68	0·26	—	0·00	11·3	—	,,	100–50			
		50	—	28·32	34·65	22·04	0·33	—	0·00	7·0	4·56	,,	250–100			
		75	—	26·60	35·19	23·01	0·50	—	0·00	10·6	—	,,	500–250			
		100	—	24·13	35·30	23·85	1·04	—	0·00	9·2	3·06	,,	750–500			
		150	—	14·42	34·70	25·89	2·25	—	—	29·6	2·27	,,	1000–750			
		200	—	12·22	34·88	26·47	2·52	—	—	32·4	1·68	,,	1500–1000	—	**2227**	
		300	—	10·92	35·01	26·82	2·54	—	—	25·4	2·28	**N 100 H**	0–1	**2311**	**2330**	
		400	—	10·06	34·96	26·92	2·84	—	—	33·8	1·76	**N 70 B**	142–0	**2317**	**2338**	KT
		480[2]	484	9·24	34·92	27·03	3·24	—	—	40·2	1·64	**N 100 B**				
		580[2]	—	8·40	34·91	27·17	3·64	—	—	51·5	1·30					
		770[2]	771	6·96	34·86	27·33	3·30	—	—	75·4	1·36					
		970[2]	966	5·63	34·80	27·47	3·57	—	—	95·9	1·57					
		1170[2]	1170	5·00	34·80	27·54	3·37	—	—	110	1·76					
		1490[1]	1494	3·59	34·79	27·68	2·94	—	—	120	1·93					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force (knots)	SEA Direction	SEA Force	SWELL Direction	SWELL Force	Weather	Barometer (millibars)	Air Temp. ° C. Dry bulb	Air Temp. ° C. Wet bulb
2894 *cont.*	05° 02′ S, 89° 47′ E	1951 17 x												
2895	02° 00′ S, 89° 40′ E	18–19 x	2000	3279*	S	1–6	—	0	E'ly	2	Opr	1010·3	27·2	25·6
2896	01° 06·5′ N, 85° 36′ E	20 x	0600	4471*	S'ly	4–6	S'ly	1	S'ly	2	bc	1010·0	28·3	26·1
			1030	4462*	—	—	—	—	—	—	—	—	—	—
			1200	—	S	4–10	S	1	S'ly	2–3	bc	1009·5	29·4	26·7
			1545	4464*										
2897	05° 13′ N, 73° 31·2′ E	1 xi	1005	810*	WSW	11–16	W	2	W	1	bc	1013·8	26·1	24·4
2898	Aligau Island, Fadiffolu Atoll, Maldive Islands	2 xi	0800	—	W	7–10	W	1–2	—	0	oRR	1013·1	24·4	24·4
2899	06° 55′ N, 66° 56′ E	4 xi	1300	—	S'ly	4–6	SW'ly	2	—	0	bcpr	1012·0	25·6	24·4
			1500	4111*	—	—	—	—	—	—	—	—	—	—
			1945	3475*										
	06° 56′ N, 66° 54′ E (by stellar observations)		2000											
2900	11° 51′ N, 48° 07′ E	9 xi	1627	—	E'ly	4–6	—	0	—	0	b	1014·0	28·9	23·9
2901	11° 30′ N, 45° 28′ E	10 xi	0845	1730*	E	7–10	E	1–2	E	1	b	1016·0	28·9	23·9

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	TIME From	To	
2894 *cont.*	16	1950[1]	—	2·61	34·80	27·79	2·87	—	—	141	2·65					
		2410[1]	2405	2·03	34·79	27·83	2·84	—	—	155	3·14					
		3370[1]	3373	1·50	34·76	27·84	2·41	—	—	> 160	3·40					
		4360[1]	4356	1·12	34·74	27·85	2·58	—	—	> 160	4·01					
2895	17	0	—	28·25	34·21	21·74	0·36	—	0·00	12·7	4·57	**N 50 V**	100–0	**2006**	—	
		10	—	28·46	34·52	21·90	0·46	—	0·00	2·8	—	**N 70 V**	50–0			
		20	—	28·47	34·65	21·99	0·36	—	0·00	2·1	4·59	,,	100–50			
		30	—	28·33	34·67	22·06	0·43	—	0·00	7·0	—	,,	250–100			
		50	—	27·76	34·79	22·34	0·41	—	0·00	7·7	4·45	,,	500–250			
		75	—	27·33	34·79	22·48	0·59	—	0·00	9·2	—	,,	750–500	—	—	Great stray on wire
		100	—	26·12	34·97	23·00	1·35	—	0·00	9·9	3·74	,,	1000–750			
		150	—	14·57	35·07	26·13	2·77	—	—	25·4	1·66	,,	1500–1000	—	**2358**	Very great stray on wire
		200	—	13·23	35·08	26·42	2·58	—	—	23·3	2·01	**N 100 H**	0–1	**0010**	**0028**	
		300	—	11·61	35·08	26·74	2·68	—	—	28·2	2·21	**N 70 B**	} 54–0	**0016**	**0038**	KT
		400	—	10·30	34·93	26·86	3·24	—	—	33·8	1·86	**N 100 B**				
		480[2]	480	9·63	34·92	26·97	> 3·50	—	—	40·9	1·61					
		570[2]	569	8·97	34·92	27·08	> 3·50	—	—	52·2	1·34					
		770[2]	766	7·43	34·90	27·30	> 3·50	—	—	84·6	1·15					
		990[3]	993	6·58	34·86	27·38	> 3·50	—	—	97·3	1·25					
		1180[1]	1183	5·28	34·81	27·52	> 3·50	—	—	125	1·61					
		1470[1]	—	4·00	34·78	27·63	3·47	—	—	144	2·07					
		1960[1]	1957	2·63	34·74	27·74	3·20	—	—	> 160	2·83					
		2550[1]?	2551?	1·99	34·72	27·77	3·07	—	—	> 160	3·28					
		2970[1]	2969	1·68	34·69	27·76	3·40	—	—	> 160	3·34					
2896	19	—	—	—	—	—	—	—	—	—	—	**STK**	4462	1010	1245	No core in main tube— [pilot corers full
		—	—	—	—	—	—	—	—	—	—	**XSR**	—	1330		
		—	—	—	—	—	—	—	—	—	—	**STK**	4464	1448	**1748**	Core 3
2897	1	—	—	—	—	—	—	—	—	—	—	**DLH**	810	1055	1109	
2898	2	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**	—	0800	1000	Zone −5 hrs
2899	4	—	—	—	—	—	—	—	—	—	—	**STK**	4111	1345	1652	Core 4
		—	—	—	—	—	—	—	—	—	—	**STK**	3475	**1853**	**2115**	No core, but pilot tubes contained some material
2900	9	0	—	26·83	36·15	23·65	—	—	—	—	—	**N 70 H**	0–1	1625	1635	Zone −3 hrs
2901	10	0	—	28·41	36·44	23·36	0·33	—	—	1·5	4·58					
		10	—	28·41	36·45	23·37	0·33	—	—	1·5	4·58					
		20	—	28·40	36·45	23·38	0·33	—	—	4·6	4·60					
		30	—	28·41	36·40	23·34	0·47	—	—	3·1	4·91					
		40	—	22·23	35·92	24·87	—	—	—	—	—					
		50	—	19·34	35·72	25·50	1·86	—	—	15·5	< 0·17					
		75	—	17·23	35·58	25·93	2·13	—	—	20·2	0·39					
		100	—	16·72	35·62	26·08	2·16	—	—	20·2	0·38					
		150	—	15·62	35·74	26·42	2·22	—	—	21·7	< 0·21					
		200	—	14·95	35·78	26·60	2·10	—	—	26·4	< 0·46					
		300	—	14·60	35·99	26·83	2·10	—	—	27·9	0·45					
		400	—	15·93	36·63	27·03	1·97	—	—	32·6	0·64					
		490[2]	488	16·09	36·78	27·11	1·89	—	—	32·6	0·56					
		580[2]	582	15·64	36·76	27·20	1·83	—	—	37·2	0·60					
		790[1]	791	13·10	36·31	27·40	2·08	—	—	48·0	0·67					
		990[1]	985	12·03	36·23	27·56	1·94	—	—	55·8	0·42					
		1180[1]	1183	9·64	35·80	27·66	2·10	—	—	73·0	0·72					
		1500[2]	1502	5·87	35·25	27·79	2·30	—	—	109	0·80					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		SWELL		Weather	Barometer (millibars)	Air Temp. ° C.	
					Direction	Force (knots)	Direction	Force	Direction	Force			Dry bulb	Wet bulb
2902	11° 54′ N, 44° 20′ E	1951 10 xi	1730	757*	E	4–6	E	1	E	1	b	1013·2	27·8	24·4
2903	12° 22′ N, 43° 41′ E	10–11 xi	2300	318*	E'ly	7–16	E	2	E	2	b	1016·5	26·7	24·4
2904	12° 51′ N, 43° 12·5′ E	11 xi	0400	194*	SE	11–16	SE	3	SE	2	b	1014·2	28·3	24·4
2905	15° 08′ N, 42° 01′ E	11 xi	2000	543*	SE	11–16	SE	2	SE	2	b	1012·0	28·3	25·6
2906	21° 53′ N, 37° 41′ E	13 xi	2000	669*	ENE	7–16	ENE	2	NE	2	bc	1013·0	27·8	22·2
2907	25° 08·5′ N, 35° 40′ E	14 xi	2000	657*	NNW	4–6	NW	2	NW	2	b	1014·4	26·1	24·4
2908	33° 17′ N, 29° 55′ E	18 xi	0910	2758*	N	17–21	N	3	N	4	bc	1014·0	18·9	15·6
2909	33° 57′ N, 26° 04′ E	19 xi	0900	3018*	N'ly	1–3	N'ly	1	N'ly	2	b	1018·9	18·9	15·0
2910	34° 52′ N, 21° 20′ E	20 xi	0900	2836*	—	0	—	0	—	0	bc	1020·4	17·2	13·9
2911	35° 55′ N, 17° 29′ E	21 xi	0600	3956*	SSE	11–27	SSE	3	SE	3	bc	1015·6	19·4	16·7
	35° 54′ N, 17° 19′ E	—	1215	3888*	—	—	—	—	—	—	—	—	—	—

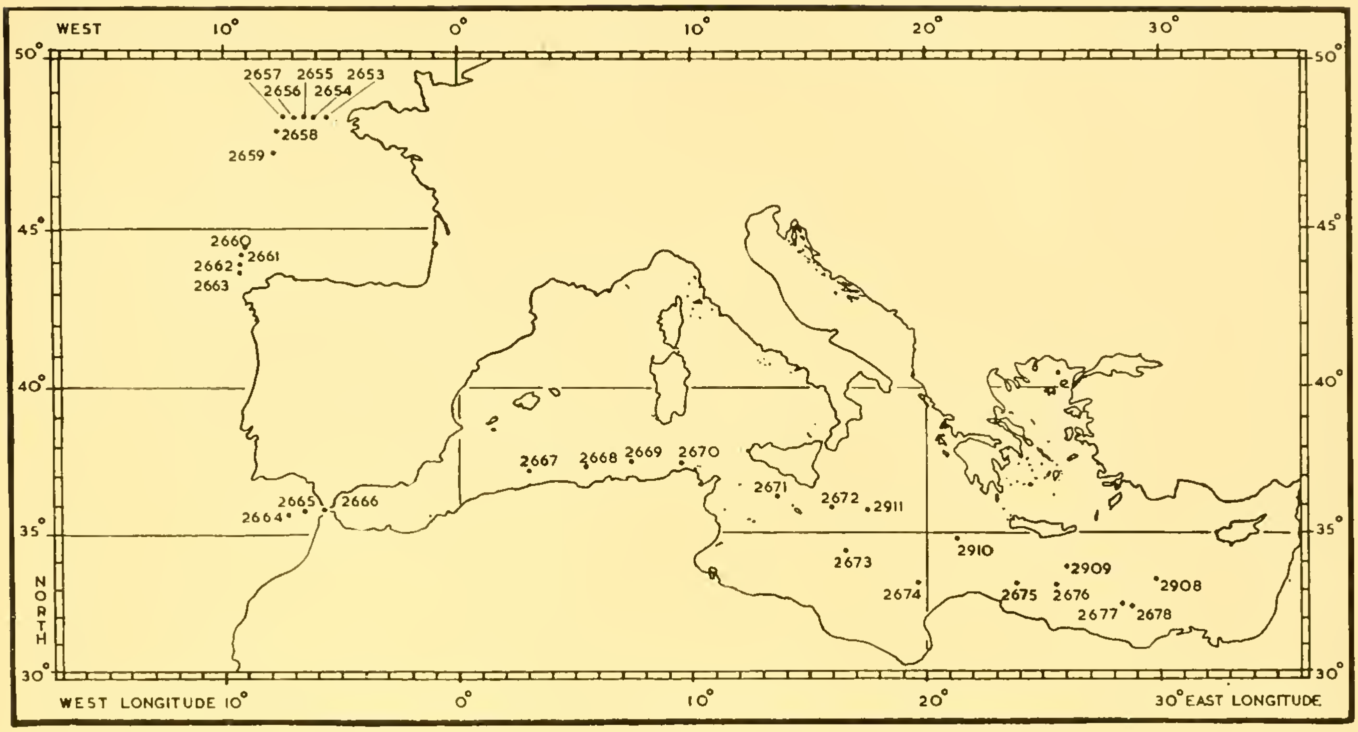
Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
2902	10	0	—	28·91	36·55	23·27	0·41	—	—	6·2	4·61					
		10	—	28·83	36·56	23·31	0·41	—	—	5·4	4·62					
		20	—	28·73	36·56	23·34	0·41	—	—	3·1	4·57					
		30	—	28·63	36·55	23·37	0·49	—	—	4·6	4·56					
		40	—	26·43	36·08	23·72	—	—	—	—	—					
		50	—	20·91	35·46	24·89	1·48	—	—	17·0	2·42					
		75	—	18·25	35·50	25·61	1·92	—	—	18·6	1·56					
		100	—	16·94	35·55	25·97	2·44	—	—	21·7	0·68					
		150	—	15·72	35·62	26·31	2·49	—	—	25·6	0·38					
		200	—	14·25	35·52	26·56	2·44	—	—	24·8	0·96					
		300	—	15·34	36·18	26·82	2·47	—	—	26·4	0·45					
		390[1]	389	15·71	36·51	26·99	2·22	—	—	37·2	0·50					
		490[1]	488	15·49	36·60	27·12	2·27	—	—	37·2	0·53					
		580[1]	580	13·27	36·20	27·29	2·41	—	—	48·1	0·39					
		740[1]	739	15·29	36·94	27·42	2·24	—	—	46·5	0·60					
2903	10	0	—	28·03	36·35	23·41	0·49	—	—	3·1	4·56					
		10	—	28·03	36·36	23·43	0·49	—	—	4·6	4·55					
		20	—	28·03	36·36	23·43	0·51	—	—	2·3	4·57					
		30	—	28·03	36·33	23·40	0·52	—	—	43·5?	4·56					
		40	—	28·01	36·27?	23·36	—	—	—	—	—					
		50	—	28·03	36·35	23·42	0·53	—	—	10·9	4·55					
		75	—	20·74	35·92	25·28	1·70	—	—	17·1	1·42					
		100	—	17·95	35·55	25·72	2·06	—	—	20·0	0·88					
		150	—	17·18	35·74	26·06	2·14	—	—	24·8	0·68					
		200	—	21·90	37·89	26·46	1·48	—	—	17·1	1·72					
		300	—	21·92	38·30	26·77	1·34	—	—	13·9	1·74					
2904	11	0	—	28·03	36·52	23·54	0·47	—	—	3·9	4·52					
		10	—	28·03	36·50	23·53	0·57	—	—	4·6	4·48					
		20	—	28·03	36·55	23·56	0·52	—	—	9·3	4·52					
		30	—	27·96	36·56	23·60	0·60	—	—	7·7	4·42					
		40	—	27·75	36·63	23·72	—	—	—	—	—					
		50	—	27·34	36·62	23·84	0·60	—	—	20·2	4·02					
		75	—	26·53	37·07	24·44	0·77	—	—	20·9	3·31					
		100	—	24·82	38·59	26·14	0·85	—	—	10·9	2·68					
		150	—	22·86	40·08	27·85	0·99	—	—	13·9	1·80					
		180	—	22·79	40·11	27·89	0·82	—	—	15·5	1·63					
2905	11	0	—	29·72	37·47	23·70	—	—	—	—	—	**N 70 B** **TYFB**	250–0	**2026**	**2057**	Depth estimated
2906	13	0	—	29·45	39·20	25·08	—	—	—	—	—	**N 70 B** **TYFB**	200–0	**2019**	**2053**	Depth estimated. Zone −2 hrs
2907	14	0	—	26·39	40·44	27·04	—	—	—	—	—	**N 70 B** **TYFB**	180–0	**2017**	**2047**	Depth estimated
2908	18	—	—	—	—	—	—	—	—	—	—	**XSR**	—	0920		
2909	19	—	—	—	—	—	—	—	—	—	—	**XSR**	—	0935		
2910	20	—	—	—	—	—	—	—	—	—	—	**XSR**	—	0920		
2911	21	—	—	—	—	—	—	—	—	—	—	**STK**	3956	0615	0900	Small core lost, but material in pilot tubes retained
		—	—	—	—	—	—	—	—	—	—	**XSR**	—	1100	—	Zone −1 hr

SUMMARIZED LIST OF STATIONS

The positions of all stations made by the R.R.S. 'Discovery II' between May 1950 and December 1951 are shown on the charts reproduced in Plates III–V. The following list indicates on which chart each of the stations is to be found.

Station	Date	Place	Plate
2653–2659	11. v–12. v. 1950	West of the English Channel	III A
2660–2663	13. v. 1950	Bay of Biscay	III A
2664–2666	16. v. 1950	Straits of Gibraltar	III A
2667–2678	18. v–31. v. 1950	Mediterranean	III A
2679–2682	7. vi–8. vi. 1950	Straits of Bab-el-Mandeb	IV (inset)
2683–2691	20. vi–30. vi. 1950	Indian Ocean (90° E.)	IV
2692–2697	5. vii–17. viii. 1950	Off West Australia	IV
2698–2705	20. viii–10. ix. 1950	Fremantle, W. Australia—Ice Edge 90° E.—Melbourne	IV, V
2706–2725	5. x–9. x. 1950	Off East Australia	III C
2726–2732	18. x–24. x. 1950	Tasman Sea	V
2733–2772	4. xi–1. xii. 1950	Wellington, New Zealand—Ice Edge in 150° W.—Dunedin	V
2773–2777	15. xii. 1950	Dunedin—Macquarie Islands—Melbourne	V
2778–2801	8. i. 1951–18. i. 1951	Off South and West Australia	III B
2802–2816	10. ii–24. ii. 1951	Fremantle—Ice Edge in 90° E	V
2817–2821	22. v–26. v. 1951	Tasman Sea	V
2822–2847	27. v.–1. vii. 1951	Dunedin—Ice Edge—Falkland Islands	V
2848–2866	5. vii–23. vii. 1951	Falkland Islands—Ice Edge—Simon's Town, South Africa	V
2867–2878	17. viii–1. ix. 1951	Durban, South Africa—Ice Edge—Kerguelen Islands	V
2879–2883	9. ix–18. ix. 1951	Kerguelen Islands to Fremantle	V
2884–2896	4. x–20. x. 1951	Fremantle—90° E. line—Colombo	IV
2897–2898	1. xi–2. xi. 1951	Maldive Islands	IV
2899–2900	4. xi–9. xi. 1951	Indian Ocean	IV
2901–2904	10. xi–11. xi. 1951	Straits of Bab-el-Mandeb	IV (inset)
2905–2907	11. xi–14. xi. 1951	Red Sea	IV
2908–2911	18. xi–21. xi. 1951	Mediterranean	III A

PLATES III—V


WEST
10°
0°
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20°
30°
50°
45°
40°
35°
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2657 2655 2653
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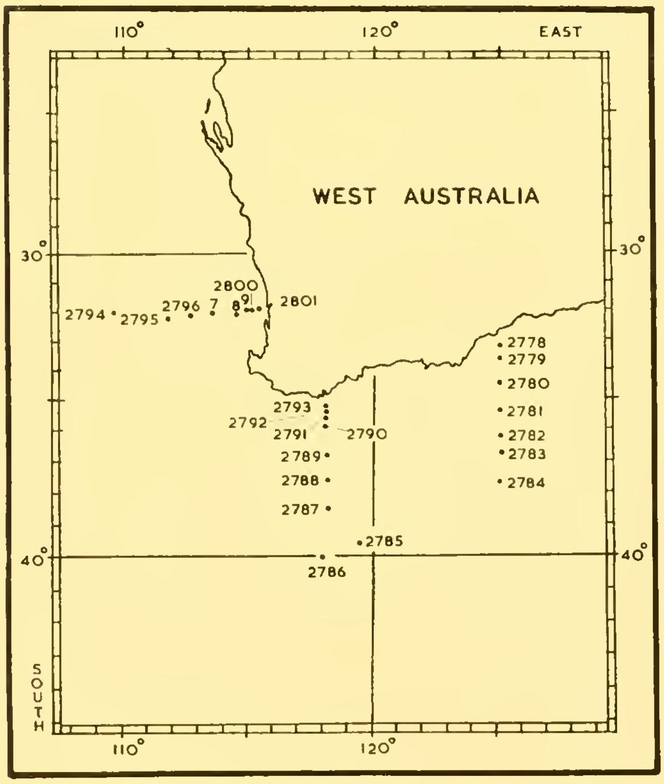
NORTH
WEST LONGITUDE 10°
30° EAST LONGITUDE

A


110°
120°
EAST
WEST AUSTRALIA
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40°
2800
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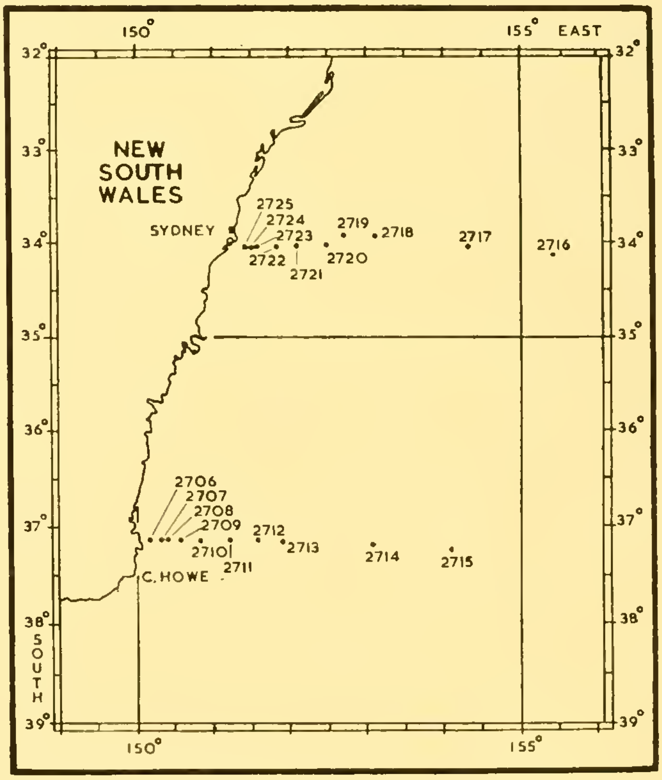
2786
SOUTH

B


150°
155°
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32°
33°
34°
35°
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SOUTH

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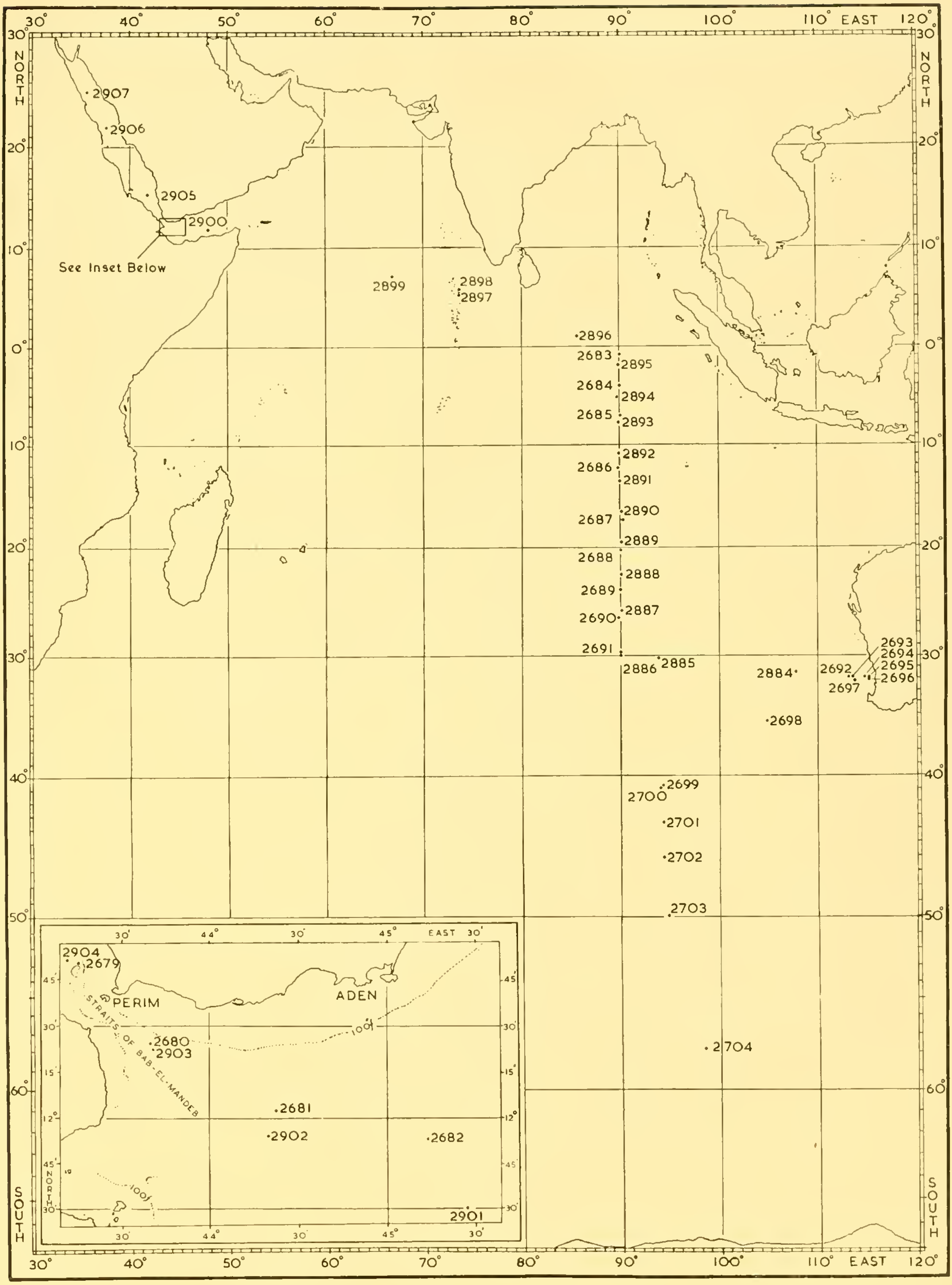
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PERIM
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STRAITS OF BAB-EL-MANDEB
2680
2903
2681
2902
2682
2901
EAST
NORTH
SOUTH


S. AFRICA
S. AMERICA
AUSTRALIA
30°
0°
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60°
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90°
120°
120°
150°
W 180° E
150°
65°
50°
35°
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