

never prominent; the secondary septa are very little projecting, but can usually be distinguished. The raised rims of the calices show much flattened spines, which correspond to the primary, secondary, and tertiary septa.

Funafuti; outer reef. Three specimens.

This species resembles *S. palmata* in form, but shows no sign of any anastomosis of its branches. The raised character of the whole edge of the calice separates the species from all previously described forms. In places the upper edge of the calice may be somewhat vaulted or even slightly acute, but the whole lip is never as large or distinct as it generally is even in *S. palmata*.

EXPLANATION OF PLATE LXII.

- Fig. 1. *Stylophora septata*, $\times \frac{2}{3}$, p. 996.
 Fig. 2. *Stylophora lobata*, $\times \frac{2}{3}$, p. 999.
 Fig. 3. *Stylophora rugosa*, $\times \frac{2}{3}$, p. 998.
 Fig. 4. *Stylophora compressa*, $\times \frac{2}{3}$, p. 997.

5. On some Crustaceans from the South Pacific.—Part III.
*Macrura*¹. By L. A. BORRADAILE, M.A., F.Z.S.,
 Lecturer in Natural Sciences at Selwyn College, Cambridge.

[Received November 15, 1898.]

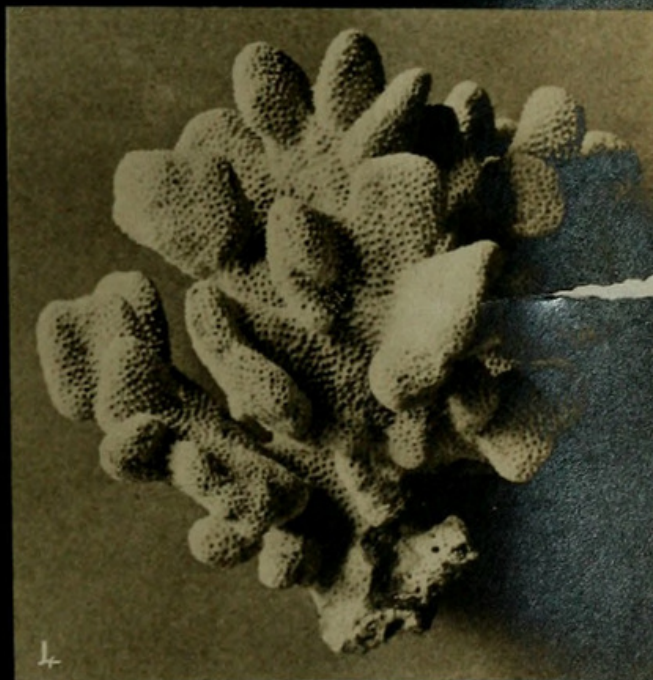
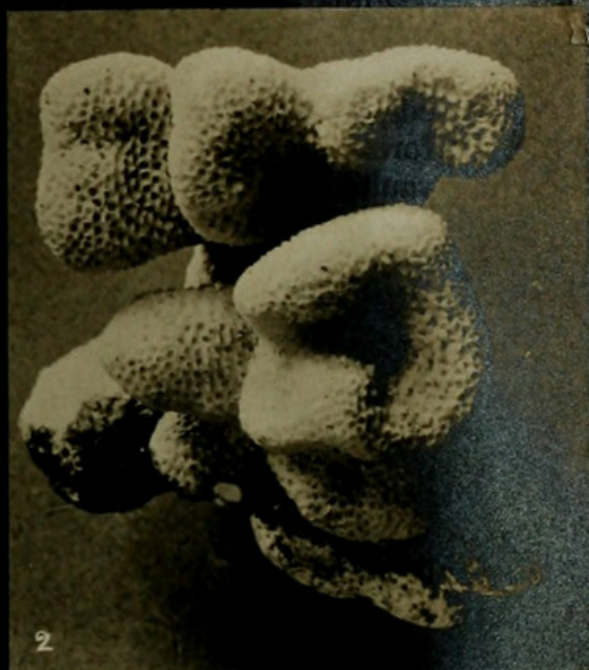
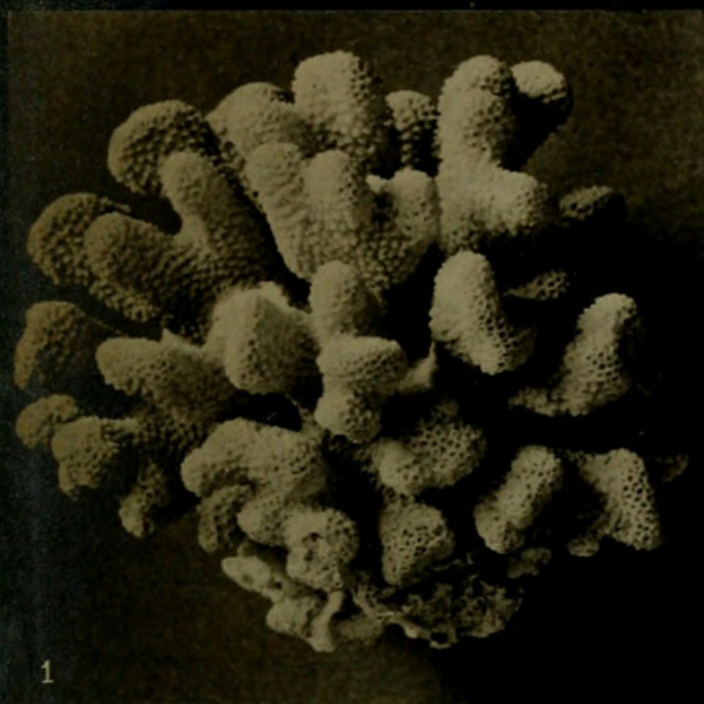
(Plates LXIII.–LXV.)

The specimens described in the present paper were collected by Mr. J. Stanley Gardiner in the Islands of Funafuti (Ellice Group), Rotuma, and Viti Levu, Fiji. Mr. Gardiner has very kindly furnished me with notes respecting several of them.

The Funafuti collection contained examples of the following species:—

1. ? *Periclimenes danæ* (Stimpson).
2. *Coralliocaris brevirostris* Borradaile.
3. *Palæmonella tridentata*, n. sp.
4. *Saron marmoratus* (Olivier).
5. *Athanas sulcatipes*, n. sp.
6. *Alpheus strenuus* Dana.
7. *Alpheus parvirostris* Dana.
8. *Alpheus collumianus* Stimpson.
9. *Alpheus lævis* Randall.
10. *Alpheus frontalis* Say.
11. *Alpheus prolificus* Bate.
12. *Alpheus funafutensis*, n. sp.
13. *Metabeteus minutus* Whitelegge.
14. *Callianidea typa* H. M.-Edwards.

¹ For Parts I. and II., see P. Z. S. 1898, pp. 32 and 457.



Photoprint by Bale & Danielsson Ltd



In the Rotuma collection were:—

1. *Metapencæus commensalis*, n. sp.
2. *Stenopus hispidus* (Olivier).
3. *Periclimenes spinigerus* (Ortmann).
4. *Periclimenes rotumanus* Borradaile.
5. *Conchodytes meleagrince* Peters.
6. *Saron marmoratus* (Olivier).
7. *Alpheus strenuus* Dana.
8. *Alpheus macrochirus* Richters.
9. *Alpheus lævis* Randall.
10. *Alpheus frontalis* Say.
11. *Alpheus pachychirus* Stimpson.
12. *Alpheus gracilipes* Stimpson.
13. *Paribacus antarcticus* (Rumph.).
14. *Panulirus penicillatus* (Olivier).
15. *Callianidea typa* H. M.-Edwards.

From Fiji are:—

1. *Caradina wycki* Hickson.
2. *Caradina vitiensis*, n. sp.
3. *Periclimenes vitiensis* Borradaile.
4. *Palæmon lar* Fabricius.
5. *Palæmon* sp.

I proceed to the consideration of the several species.

Tribe PENÆIDEA.

Family PENÆIDÆ.

Subfamily PARAPENÆINÆ.

Genus METAPENÆUS W.-Mason & Alcock, 1891.

1. METAPENÆUS COMMENSALIS, n. sp. (Plate LXIII. figs. 1-1b.)

Definition:—"A *Metapencæus* with the rostrum straight, bearing 8 teeth above and none below, fringed underneath with long hairs, and reaching to the middle of the second joint of the peduncle of the first antenna; carapace bearing a median spine at the base of the rostrum, and infraorbital, hepatic, and pterygostomian spines; first antenna with the penultimate joint of the peduncle longer than the last joint, flagella subequal(?), not so long as the last two joints of the peduncle(?); second antenna with the scale almost as long as the peduncle of the first antenna; third maxilliped reaching the end of the first joint of the peduncle of the first antenna; first pair of legs rather stout, with somewhat swollen chelæ, not reaching end of ante-penultimate joint of third maxilliped; second and third pairs more slender, with elongate chelæ, second reaching middle of penultimate joint of third maxilliped; third exceeding third maxilliped; fourth and fifth pairs subequal, reaching middle of wrist (carpopodite) of third pair; in all

the legs the carpus the longest joint; without a rudiment of the anterior arthrobranch on the fourth leg (?); with the right side of the petasma longer than the left; fifth and sixth abdominal segments with well-marked dorsal keel, fourth and fifth segments ending in two spines, sixth in one spine; telson elongate, triangular, ending in a point, and armed on each side with four spines, of which the last but one is the longest, while the most anterior is the smallest and the most distant from the rest."

Length of present specimen 42 mm. from tip of rostrum to end of telson.

The inner flagellum of the first antenna appears to be broken off near the tip on each side.

The systematic position of this species must remain somewhat doubtful till the collection of a series of specimens shall render it possible to decide the branchial formula. So far as could be ascertained without considerable injury to the single specimen, this is identical with that given by Wood-Mason and Alcock [Ann. Mag. N. H. (6) viii. p. 273 (1891)] for *M. coniger*, with the exception of the absence of the rudiment of an anterior arthrobranch on the fourth leg. This, however, is also wanting in *M. rectacutus* (Bate). The nearest ally of the new species would appear to be *M. philippinensis* (Bate) ['Challenger' Macrura, p. 261]; from which, however, it differs in having an additional tooth on the rostrum, in the length of that organ and of the antennal scale, in having the right, and not the left, side of the petasma the longer, and in the absence of the rudiment of an anterior arthrobranch on the seventh thoracic segment.

The living animal is almost transparent, with two or three bright pink bands. Its habits are most interesting. Mr. Gardiner found it living in the stomodæum of a green and yellow actinian, 14 cm. broad, allied to *Discosoma haddonii*. Also commensal in the same actinian was a small fish with bright red and yellow bands, identified by Mr. Boulenger as *Coris greenoughi*.

One male specimen from Rotuma.

Tribe STENOPIDEA.

Family STENOPIDÆ.

Genus STENOPUS Latreille, 1825.

2. *STENOPUS HISPIDUS* (Olivier), 1811. (Plate LXIII. figs. 2*a*, 2*b*.)

Palæmon hispidus, Olivier, Encycl. viii. p. 666 (1811).

Stenopus hispidus, Latreille, Desmarest's Consid. sur les Crust. p. 227 (1825); H. M.-Edwards, H. N. Crust. ii. p. 407 (1837); id. Cuvier's R. An. 3rd ed., Crust. p. 137, pl. l. fig. 2; Dana, U.S. Expl. Expd., Crust. i. p. 607, pl. xl. fig. 8 (1852); Bate, 'Challenger' Macrura, p. 211, pl. xxx. (1881).

The males of this species differ from the females in the form of

the first abdominal appendage. In the female this has the last joint longer than the preceding, narrow and acuminate, and the preceding joint usually without, sometimes with, one spine at the proximal end of the inner margin. In the male the same appendage has the last joint broad and not longer than the preceding, which is armed on its inner margin with one, usually with two or three spines. Further, in the male the first abdominal appendage is shorter relatively to the rest than in the female.

Five males and six females from Rotuma.

Tribe CARIDEA.

Family ATYIDÆ.

Subfamily ATYINÆ.

Genus CARADINA H. M.-Edwards, 1837.

3. CARADINA WYCKI (Hickson), 1888.

Atya wycki, Hickson, Ann. Mag. N. H. (6) ii. p. 357, pls. xiii. & xiv. (1888).

Caradina wycki, Thallwitz, Abh. Mus. Dresden, 1890-91, p. 27 (1891); de Man, Max Weber's Zool. Ergebn. ii. p. 386, pl. xxiv. figs. 29-29 k.

The single specimen of this species in the present collection has nineteen teeth on the upper border of the rostrum and eleven on the lower. It was taken in the Tamavua River, Viti Levu, Fiji.

4. CARADINA VITIENSIS, n. sp. (Plate LXIII. figs. 3, 3a.)

Definition.—"A *Caradina* with the rostrum straight, bearing 24 teeth above (none on the carapace) and 9 below, and reaching to somewhat beyond the middle of the second joint of the peduncle of the first antenna; carapace with an antennal spine and blunt pterygostomial angle; first antenna with the last joint of the peduncle about half the length of the preceding joint, and flagella subequal; second antenna with the scale longer than the peduncle of the first; third maxilliped as long as the peduncle of the first antenna; first pair of legs reaching the end of the first joint of the peduncle of the first antenna, with the fingers about equal in length to the palm; second pair of legs equal to the peduncle of the first antenna, with fingers considerably longer than the palm; and last three pairs of legs reaching the end of the second antennal scale."

Colour when living a pale, almost transparent green.

Length of the present specimen, from end of telson to tip of rostrum, 22 mm.

The telson of the single specimen has had the end broken off.

This species appears to be allied to *C. weberi* de Man [Max Weber's Zool. Ergebn. ii. p. 371, pl. xxii. fig. 23 (1892)], but differs from it in the larger number of teeth on the rostrum, the

greater stoutness of the second pair of chelæ, and the greater length of the last two pairs of legs.

One specimen from Suva, Tamavua River, Viti Levu, Fiji.

Family PONTONIIDÆ.

Genus PERICLIMENES Costa, 1844.

Periclimenes, Costa, Ann. Ac. Aspir. Nat. Nap. ii. (1844); Borradaile, Ann. Mag. N. H. (7) ii. p. 380 (1898).

Pelias, Roux, 1831; *Anchistia*, Dana, 1852; *Dennisia*, Norman, 1861.

The *Pelias migratorius* of Keller does not belong to this genus, but is synonymous with *Palæmonetes varians* (Leach).

5. PERICLIMENES SPINIGERUS (Ortmann), 1890.

Anchistia spinigera, Ortmann, Zool. Jahrb. v. Syst. 3, p. 511, pl. xxxvi. figs. 23, 23a (1890).

Periclimenes spinigerus, Borradaile, Ann. Mag. N. H. (7) ii. p. 383 (1898).

One specimen from Rotuma.

6. ? PERICLIMENES DANÆ (Stimpson), 1860. (Plate LXIII. figs. 4-4b.)

Anchistia danæ, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 39.

Periclimenes danæ, Borradaile, Ann. Mag. N. H. (7) ii. p. 382 (1898).

The collection contains a single specimen, which I have some hesitation in referring to this species.

The rostrum is straight, somewhat shallow, armed with seven teeth above and two below, and just reaches the end of the antennular peduncle. The carapace is armed with supraorbital, antennal, and hepatic spines. The eyes are large and project considerably on either side of the body. The first antenna is longer than the scale of the second by three-quarters of the length of its thicker flagellum. The slender inner flagellum is unfortunately broken short on both sides; it has the appearance, however, of having been *longer* than the outer one. The flagella of the second antenna are broken off. The scale is longer than the peduncle of the first antenna.

The third maxilliped reaches the end of the first joint of the antennular peduncle.

The first pair of legs exceed the thicker flagellum of the first antenna by about the length of the fingers. These are about as long as the palm. The second legs exceed the antennular peduncle by the wrist and chelæ, and the first legs by almost the whole chela. The distal end of their wrist is prolonged dorsally into a short spine, and the fingers are shorter than the hand. The fourth and fifth legs are subequal, and reach the end of the wrist of the first leg. The fifth pair are slender and attain the

end of the merus of the first leg. The telson is shorter than the uropods, and bears two long spines at the hind end.

The points of difference from Stimpson's description are:—

- (1) The presence of two spines below the rostrum, instead of three.
- (2) The inner flagellum of the first antenna is probably longer than the outer.

The specimen is 11 mm. long and has a somewhat immature appearance. It was taken among the seaweed of the reef at Funafuti.

7. *PERICLIMENES ROTUMANUS* Borradaile, 1898. (Plate LXIII. figs. 5-5b.)

Periclimenes rotumanus, Borradaile, Ann. Mag. N. H. (7) ii. p. 383 (1898).

The rostrum of this species is barely as long as the peduncle of the first antenna, and almost straight, and bears six teeth above and two below, the first of the former being situated on the carapace and the second just above the orbit. The carapace has the hepatic and antennal spines present. The thicker flagellum of the first antenna is about as long as the peduncle, the inner being more than twice as long as the outer. The scale of the second antenna is longer than the peduncle of the first, and the flagellum is longer than the body.

The third maxilliped reaches the end of the peduncle of the first antenna.

The merus of the second leg reaches the end of the first joint of the antennular peduncle, and the whole limb the end of the inner flagellum. The wrist bears a small spine above, and the merus one below, at the distal end. The wrist, palm, and fingers are subequal. The first legs nearly reach the end of the palm of the second. Their wrist is longer than the hand, and slightly longer than the merus. The fingers are about as long as the palm. The third pair of legs is broken off. The fourth and fifth are subequal and longer than the scale of the second antenna.

The endopodite and exopodite of the uropod are equal and outreach the telson. The latter is armed at the end with six spines, of which the outermost are the smallest and the intermediate the largest.

The length of the single specimen is 11 mm. It was taken in Rotuma.

8. *PERICLIMENES VITIENSIS* Borradaile, 1878. (Plate LXIV. figs. 6-6b.)

Periclimenes vitiensis, Borradaile, Ann. Mag. N. H. (7) ii. p. 383 (1898).

In this species the rostrum reaches almost to the end of the thicker flagellum of the first antenna. It is bent upwards at the free end and bears above six teeth, of which the first is situated above the orbit, and below four. The carapace is armed with

supraorbital, antennal, and hepatic spines, and with one in the dorsal median line, some little distance behind the rostrum. The pterygostomial angle is subrectangular. The slender flagellum of the first antenna of the present specimen is broken short on the right side and, I think, also on the left. On the latter side it is as long as the thicker flagellum, which is very stout and about equals the peduncle in length. The scale of the second antenna extends to the end of the rostrum, and the flagellum is about as long as the body.

The third maxilliped reaches the end of the penultimate joint of the antennular peduncle.

The wrist in the first pair of legs ends slightly beyond the scale of the second antenna and bears a spine on the inner side at its distal end. The fingers are about equal to the palm. The legs of the second pair are almost equal, and exceed those of the first by nearly the whole length of the hand; they are armed at the distal end of the merus with a spine below, and at that of the wrist with one on the inside. The third and fourth pairs of legs are subequal, reach the last third of the wrist of the second pair, and are armed with several slender spines on the underside of the propodite. The fifth pair reach halfway up the propodite of the fourth, and have their own propodite armed with a strong spine at the distal end on the underside and with two more slender ones proximally of this. The carpus in each leg of the last three pairs projects dorsally at the outer end as a blunt spine.

The endopodite and exopodite of the uropod are subequal and somewhat longer than the telson, which bears six spines at the hind end. Of these spines the outermost are the shortest, and the intermediate the longest.

The length of the single specimen is 20 mm. from the tip of the rostrum to the end of the telson.

This species is closely allied to *P. grandis* (Stimpson), but is separated by the shortness of the fourth pair of legs, and of the second as far as the end of the merus, and by its smaller size; and is therefore perhaps better regarded as distinct. If *P. petithouarsi* Miers (non Audouin) be rightly regarded as synonymous with *P. grandis* Stimpson, we may add as further differences the presence of six, instead of five, teeth on the dorsal border of the rostrum (excluding that on the carapace behind the rostrum in each case), and of four, instead of three, teeth on the inferior border. The rostrum, too, of Miers's species is "nearly straight," while that of *P. vitiensis* has a marked upward trend at the free end.

One female, with eggs, from Viti Levu, Fiji.

Genus CORALLIOCARIS Stimpson, 1860.

9. CORALLIOCARIS BREVIROSTRIS Borradaile, 1898. (Plate LXIV. figs. 7-7d.)

Coralliocaris brevirostris, Borradaile, Ann. Mag. N.H. (7) ii. p. 386 (1898).

This species has the rostrum unarmed and reaching only to the

middle of the first joint of the antennular peduncle. The carapace is short and unarmed. The first joint of the peduncle of the first antenna is longer than the second and third together, the second and third joints subequal. The inner and outer flagella are subequal and reach well beyond the fringe of the antennal scales. The scale of the second antenna is longer than the peduncle of the first.

The third maxilliped reaches the end of the first joint of the antennular peduncle.

The first leg exceeds the antennal scale by the hand and the last half of the wrist. The second legs are equal. The merus almost reaches the end of the antennal scale, and is armed distally with a spine at the lower and outer angle. The wrist is short and broad, and the hand longer than the carapace and fairly stout. The fingers are barely half the length of the palm, and the immovable finger has on the inner side a large swelling, indented by a notch, into which fits the single small tooth on the movable finger. The last three pairs are subequal, the third pair reaching the wrist of the second.

The exopodite of the uropod is slightly longer than the endopodite, and both are considerably longer than the telson. The latter is armed at the end with six spines, of which the two outermost are the smallest and the intermediate pair the longest.

The length of the single specimen is 19 mm.

Coralliocaris brevirostris is allied to *C. macrophthalma* (H. M.-Edw.), but may be distinguished from it by the following features:—

- (1) The rostrum reaches only the middle of the first joint of the antennular peduncle. In *C. macrophthalma* it reaches the beginning of the last joint.
- (2) The inner flagellum of the first antenna is longer than in *C. macrophthalma*.
- (3) The shape of the fingers of the second chela is different in the two species.

One female from Funafuti.

Genus CONCHODYTES Peters, 1851.

10. CONCHODYTES MELEAGRINÆ Peters, 1851.

Conchodytes meleagrinae, Peters, Ges. naturf. Freunde Berlin, 1851 (fide Heller); Ber. k. Ak. Wiss. Berlin, 1852, p. 594; Hilgendorf, Monatsber. k. Ak. Wiss. Berlin, 1878, p. 836; Borradaile, Ann. Mag. N. H. (7) ii. p. 390 (1898).

Pontonia meleagrinae, Bate, 'Challenger' Macrura, p. 707, pl. cxxiv. figs. 1, 2 (1888).

One male and one female from Rotuma.

Family PALÆMONIDÆ.

Genus PALÆMONELLA Dana, 1852.

11. PALÆMONELLA TRIDENTATA n. sp. (Plate LXIV. figs. 8-8c.)

Definition.—“A *Palæmonella* with the rostrum straight, slightly outreaching the antennular peduncle, and bearing 7 teeth above

(2 on the carapace) and 3 below; the carapace with hepatic and antennal spines; the first antenna having the first joint of its peduncle as long as the second and third joints together, and its flagella subequal and not so long as the second pair of legs; the second antenna with the peduncle shorter than the first joint of that of the second, the flagellum longer than the body, and the scale longer than the antennular peduncle; the third maxilliped reaching the end of the second joint of the antennular peduncle; the first pair of legs outreaching the rostrum by the wrist and hand; the legs of the second pair unequal, the right larger and outreaching the first pair by nearly the whole of the hand, bearing a spine below at the free end of the merus and one above at the free end of the wrist, with the fingers barely half the length of the palm; the legs of the last three pairs subequal, reaching beyond the end of the rostrum; and the endopodite and exopodite of the uropods equal, and longer than the telson, which ends in six spines, the outermost pair being the smallest and the intermediate the longest."

The length of the single specimen is 21 mm. from the end of the telson to the tip of the rostrum.

The animal when alive was colourless and almost transparent.

The species differs from *P. tenuipes* Dana in the following points:—

- (1) There are three teeth on the underside of the rostrum, instead of two.
- (2) The inner edges of the fingers of the second pair of chelæ are armed with teeth.
- (3) The distal end of the merus is rounded in profile, but provided with a large spine below at a short distance from the end. In *P. tenuipes* it is acute in profile and without the tooth.
- (4) The arrangement of teeth on the inner ramus of the mandible is different in the two species (fig. 8 d).

One specimen from Funafuti.

Genus *PALÆMON* Fabricius, 1798.

12. *PALÆMON* LAR Fabricius, 1798.

Palæmon lar, Fabricius, Entom. Syst., Suppl. p. 402 (1798); Ortmann, Zool. Jahrb. v. Syst. 5, p. 724 (1891); de Man, Max Weber's Zool. Ergebn. ii. p. 445 (1892).

Palæmon ornatus, Olivier, Encycl. viii. p. 660; H. M.-Edwards, H. N. Crust. ii. p. 396 (1837).

Bithynis lar, Bate, 'Challenger' Macrura, p. 789, pl. cxxix. fig. 1 (1888).

As de Man (*loc. cit.*) points out, the end of the telson is frequently worn or broken off in this species, so that the separation from it of forms with this structure truncated is unreliable.

Mr. Gardiner states that this species is very common in the upper waters of all the rivers of Fiji. In Taviuni it was formerly reserved as food for chiefs.

Eight males from Tamavua River, Viti Levu, Fiji.

13. *PALÆMON* sp.

One specimen from Tamavua River, Viti Levu, differing from *P. lar* in having three instead of one or two of the spines of the rostrum situate on the carapace. Second legs missing.

Family HIPPOLYTIDÆ.

Genus *SARON* Thallwitz, 1891.

14. *SARON MARMORATUS* (Olivier), 1811.

Palæmon marmoratus, Olivier, Encycl. viii. (fide H.M.-Edwards).

Alpheus marmoratus, Lamarck, Hist. Anim. sans Vert. v. p. 205.

Hippolyte marmoratus, H. M.-Edwards, H. N. Crust. ii. p. 379, pl. xxv. fig. 8 (1837).

Hippolyte marmorata, Randall, J. Ac. N. Sci. Philad. viii. 1, p. 142 (1839); de Man, Arch. Naturg. liii. 1, p. 533 (1887); Ortmann, Zool. Jahrb. v. Syst. 3, p. 497 (1890).

Hippolyte gibberosus, H. M.-Edwards, H. N. Crust. ii. p. 378 (1837); Atl. Cuv. R. An., Crust. pl. liii. fig. 4 (1849); Haswell, Cat. Austr. Crust. p. 185 (1882); Whitelegge, Funafuti Atoll, Crust. p. 146 (1897).

Hippolyte gibbosus, Dana, U.S. Expl. Exped., Crust. i. p. 565, pl. xxxvi. fig. 4 (1852); Streets, Bull. U. S. Nation. Mus. vii. p. 119 (1877).

Hippolyte gibberosa, de Man, Arch. Naturg. liii. 1, p. 533 (1888); Zool. Jahrb. ix. Syst. p. 761, fig. 68 (1897); Ortmann, Zool. Jahrb. v. Syst. 3, p. 497 (1890).

Hippolyte hemprichii, Heller, S.B. Ak. Wiss. Wien, 44, Abth. 1, p. 275, pl. iii. fig. 23 (1861); Verh. zool.-bot. Ges. Wien, xi. p. 29 (1861).

Saron gibberosus, Thallwitz, Zool. Anz. xiv. p. 99 (1891); Abh. Mus. Dresd. 1890-91, No. 3, p. 25; Ortmann, Semon's Forschungsreisen, v. 1, p. 16 (1894).

Randall (*loc. cit.*) first pointed out that the females of *S. marmoratus* differ from the males in the structure of the third maxillipeds, which in the male are considerably longer than the antennal scales and pointed at the tip, while in the female they never outreach the scales and are obliquely truncated at the end. Ortmann (Zool. Jahrb. *loc. cit.*) states that female *S. marmoratus* resemble *S. gibberosus* in every point save in the number of spines on the merus of the last three pairs of legs. The former species has, according to him, two spines on the legs of the third and fourth pairs and one on that of the fifth, while the latter has one spine on the legs of the third and fourth pairs and none on those of the fifth.

De Man (Zool. Jahrb. *loc. cit.*) goes further and shows that even these spines are extremely variable, and that specimens of *S. gibberosus* may be provided with as many of them as *S. marmoratus*. (The figures given on p. 1010 for the present collection will be seen to bear out this statement.) He thinks, however, that Ortmann's

females belonged to *S. gibberosus*, and that the true females of *S. marmoratus* will be found to possess the characteristic third maxillipeds of the male, at least in form if not in length. For this conclusion, however, there is no evidence whatever. The other authors make no reference to the sexual characters. In Mr. Gardiner's collection there are seventeen females and thirty males from Rotuma, all taken in the same localities and in the same position, namely, on the "reef-flat" and "rough-zone" of the outer reef. The males can be sharply divided into two groups, having the *marmoratus*- and *gibberosus*-characteristics respectively. The females, however, are all of the *gibberosus* type.

Taking into consideration the statements of Ortmann and de Man, these facts point, I think, to the conclusion that *Saron marmoratus* is a species with a dimorphic male, one form resembling the female, and the other differing from it in the length of the third maxilliped¹ and first pair of legs and in the form of the last joint of the third maxilliped. This appendage is well described and figured by de Man (Zool. Jahrb. *loc. cit.*).

Should the above surmise prove to be correct, the question will arise whether the dimorphism of the male be permanent or occur only at the breeding-season, as has been shown by Faxon [Am. Journ. Sci. xxvii. (1894)] to be the case for the males of *Cambarus*. On this point there is no direct evidence. The presence, in Mr. Gardiner's and other collections, of both forms of the male, taken at the same time, might seem rather to negative the latter suggestion; but in view of the fact that tropical marine forms tend to breed all the year round, the question must still remain open.

| Sex. | Number with 2 spines on merus of last leg. | Number with 1 spine. | Total. |
|---|--|----------------------------|----------|
| Females..... | 6 | 9 | 15 |
| <i>gibberosus</i> -males | 11 | 9 | 20 |
| <i>marmoratus</i> -males | 2 | 7 | 9 |
| | | | <hr/> 44 |
| Female with 3 spines on left side, 2 on right | | 1 | |
| Female " 2 " " 1 " | | 1 | |
| <i>marmoratus</i> } " 1 " " 2 " | | 1 | 3 |
| male } | | | <hr/> 47 |

Some interesting remarks on dimorphism in male Crustacea are contained in the Report on the Isopoda of the 'Lightning'

¹ According to Ortmann this difference in the length of the third maxilliped is not so marked in individuals from East Africa (Semon's Forschungsreisen, *loc. cit.*). His note, however, on this point is somewhat obscure, and it is quite possible that his specimens were *gibberosus*-males without a spine on the fifth merus.

expedition, by Messrs. Norman and Stebbing [Tr. Z. S. xii. p. 104 (1890)].

The colour in this species varies from mottled grey to green, but the colour-variations have no relation to those in form or length of the appendages.

The table on p. 1010 shows the variations in the spines on the legs of the last pair in the specimens from Rotuma.

The legs of the third and fourth pairs had two spines on the merus in every case save one. This was a female with only one spine on the left fourth leg. The specimen was among those with one spine on the legs of the fifth pair.

From Funafuti are two *marmoratus*-males with two spines on the merus of the last pair of legs, and two females with one spine.

Family ALPHEIDÆ.

Genus ATHANAS Leach, 1814.

15. ATHANAS SULCATIPES, n. sp. (Plate LXV. figs. 9-9 i.)

Definition.—"An *Athanas* with the rostrum straight, simple, sword-like, and reaching the end of the second joint of the antennular peduncle; the carapace armed with supra- and infraorbital spines only; the first antenna with the inner flagellum about twice as long as the outer; the second antenna with the peduncle somewhat longer than the first two joints of that of the first antenna, the flagellum about as long as the body, the scale slightly longer than the antennular peduncle and bearing a long fringe; the third maxillipeds slightly outreaching the antennal scale; the first pair of legs unequal, the larger in the male overlapping the antennal scale by the last third of its merus, which is large and deeply hollowed underneath, the wrist in the same limb being short, unarmed, and also hollow underneath, and the hand about as long as the two preceding joints, with the fingers shorter than the palm, apposed, and curved inwards. In the female the longer leg resembles that of the male, but is shorter and less robust. The smaller leg in the male is of the same form as the larger, save that the fingers are curved towards one another and enclose a gap, and reaches about halfway up the hand of the larger leg. In the female, on the other hand, the smaller leg is of a quite simple form, entirely unlike the larger, and reaches to about the end of the merus of the latter. The legs of the second pair have the wrist five-jointed, with the first joint larger than the second, third, and fourth together, the latter three joints equal, and the fifth longer than either of them, and reach, in the male, to the end of the merus of the longer leg of the first pair. The third pair of legs is nearly as long as the second, and the fourth and fifth are subequal, a little shorter than the third. The uropods have the endopodite and exopodite subequal and are somewhat longer than the telson, which ends in a fringe of hairs, and is provided with two pairs of spines on the upper surface."

The mouth-parts and other limbs are shown in figs. 9 *b-e*.

Length of largest male 9 mm., of largest female 8 mm.

This species is allied to *A. dimorphus* Ortmann, 1894, but is at once separated from it by the shape of the first pair of legs and the presence of the supraorbital spine.

Five females bearing eggs, and three males, from Funafuti.

Genus ALPHEUS Fabricius, 1778.

16. ALPHEUS STRENUUS Dana, 1852.

Alpheus strenuus, Dana, U.S. Expl. Exped., Crust. i. p. 543, pl. xxxiv. fig. 4 (1852); Ortmann, Zool. Jahrb. v. Syst. 3, p. 475 (1890); Coutière, Notes Leyd. Mus. xix. p. 199 (1897).

The specimens in the present collection are provided with a spine at the distal end of the merus of the great chela.

From Rotuma: three males and three females.

From Funafuti: four males and ten females.

17. ALPHEUS MACROCHIRUS Richters, 1880.

Alpheus macrochirus, Richters, Beit. Meeresf. Maur., Decapoden, p. 164, pl. xvii. figs. 31-33 (1880); Ortmann, Zool. Jahrb. v. Syst. 3, p. 485 (1890).

One specimen from Rotuma.

18. ALPHEUS PARVIROSTRIS Dana, 1852.

Alpheus parvirostris, Dana, U.S. Expl. Exped., Crust. i. p. 551, pl. xxxv. fig. 3 (1852); Ortmann, Zool. Jahrb. v. Syst. 3, p. 483 (1890).

One specimen from Funafuti.

19. ALPHEUS COLLUMIANUS Stimpson, 1860.

Alpheus collumianus, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 99; Ortmann, Zool. Jahrb. v. Syst. 3, p. 483, pl. xxxvi. fig. 15 *k, m* (1890).

One specimen from Funafuti.

20. ALPHEUS LÆVIS Randall, 1839.

Alpheus lævis, Randall, Journ. Ac. N. Sci. Philad. viii. p. 141 (1839); Dana, U.S. Expl. Exped., Crust. i. p. 556, pl. xxxv. fig. 8 (1852); Ortmann, Zool. Jahrb. v. Syst. 3, p. 487 (1890); Whitelegge, Funafuti Atoll, Crust. p. 146 (1897).

From Funafuti five specimens, two of them females with eggs.

From Rotuma sixteen specimens, five of them females with eggs.

21. ALPHEUS FRONTALIS Say, 1832.

Alpheus frontalis, Say, Journ. Ac. N. Sci. Philad. i. p. 245 (1832); H. M.-Edwards, H. N. Crust. ii. p. 356 (1837); Atlas to Cuvier's R. An. pl. liii. fig. 2 (1849); Ortmann, Zool. Jahrb. v. Syst. 3, p. 488 (1890).

From Rotuma five specimens; from Funafuti one.

22. *ALPHEUS PROLIFICUS* Bate, 1888.

Alpheus prolificus, Bate, 'Challenger' Macrura, p. 556, pl. xcix. fig. 4 (1888); Ortmann, Zool. Jahrb. v. Syst. 3, p. 484 (1890).

One specimen from Funafuti.

23. *ALPHEUS PACHYCHIRUS* Stimpson, 1860.

Alpheus pachychirus, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 99; Ortmann, Zool. Jahrb. v. Syst. 3, p. 489, pl. xxxvi. fig. 17 a, k (1890).

Three specimens from Rotuma.

24. *ALPHEUS GRACILIPES* Stimpson, 1860.

Alpheus gracilipes, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 31. One female from Rotuma.

25. *ALPHEUS FUNAFUTENSIS*, n. sp. (Plate LXV. figs. 10-10 h.)

Definition.—"An *Alpheus* with the rostrum arising from the anterior border of the carapace, continued backwards as a keel between the eyes, and not reaching the end of the first joint of the antennular peduncle; with the eye-covers unarmed; the scale at the base of the first antenna not so long as the first joint of the peduncle, the second joint of this peduncle somewhat longer than the first, nearly twice as long as the third; the second antenna with a rudimentary spine on the basal joint, and the scale longer than the peduncle of the first antenna, as long as that of the second; longer leg of the first pair notched above and below, with a longitudinal ridge on the outside and the fingers shorter than the palm, without a spine on the merus; smaller leg of the first pair simple in structure, with elongated fingers; legs of second pair longer than those of first, wrist with second joint slightly longer than first, which again is longer than fifth, and third and fourth joints short, subequal; merus of legs of third and fourth pairs with a spine; endopodite and exopodite of uropods subequal, somewhat longer than telson."

The mouth-parts and other limbs are shown in figs. 10 b-e.

When alive the specimens were of a green colour. Length of largest specimen 24 mm.

This species may be distinguished from *A. edwardsi* by the following characters:—

- (1) The scale of the basal joint of the first antenna is not so long as that joint.
- (2) The proportions of the joints in the wrist of the second pair of legs are different in the two species.
- (3) The merus is provided with a spine in the third and fourth pairs of legs.
- (4) The smaller leg of the first pair has the movable finger simple in both sexes.

Seven specimens from Funafuti; three of them females with eggs.

Genus *METABETÆUS*, nov.26. *METABETÆUS MINUTUS* (Whitelegge), 1897.

Betæus minutus, Whitelegge, Funafuti Atoll, Crust. p. 142, pl. vii. fig. 4 a, b (1897).

M. Coutière's researches [Bull. Mus. Paris, ii. p. 380 (1896)] necessitate, I think, the establishment of a new genus for this species. The following are the characters which together differentiate this proposed genus from those already diagnosed:—

- (1) Eyes not covered in front by the carapace.
- (2) Carapace with short, flat, triangular rostrum and minute ocular teeth.
- (3) Cornea lateral, eyestalks very broad and armed each with a spine above.
- (4) Outer flagellum of the first antenna bifid.
- (5) Palp of mandible two-jointed.
- (6) Branchial formula the same as that given by Bate for *Alpheus*.
- (7) First pair of legs simple, equal, with movable fingers as in *Betæus*.

The genus is allied to *Jousseauimea*, but is separated from it by the shape of the legs of the first pair, and by the presence of an arthrobranch on the first maxilliped. From *Alpheopsis* it is sundered by the presence of the arthrobranch, the spines on the eyestalks, and, seemingly, by the minute size of the ocular spines on the carapace.

Numerous specimens from Funafuti.

Tribe SCYLLARIDEA.

Family SCYLLARIDÆ.

Genus *PARIBACUS* Dana, 1852.27. *PARIBACUS ANTARCTICUS* (Rumph.).

Ibacus antarcticus (Rumph.), H. M.-Edwards, H. N. Crust. ii. p. 287 (1837).

Paribacus antarcticus, Dana, U.S. Expl. Exped., Crust. i. p. 517, pl. xxxvi. fig. 6 (1852).

Two males from Rotuma.

Family PALINURIDÆ.

Genus *PANULIRUS* Gray.28. *PANULIRUS PENICILLATUS* (Olivier), 1811.

Astacus penicillatus, Olivier, Encycl. Méth. vi. p. 343 (1811).

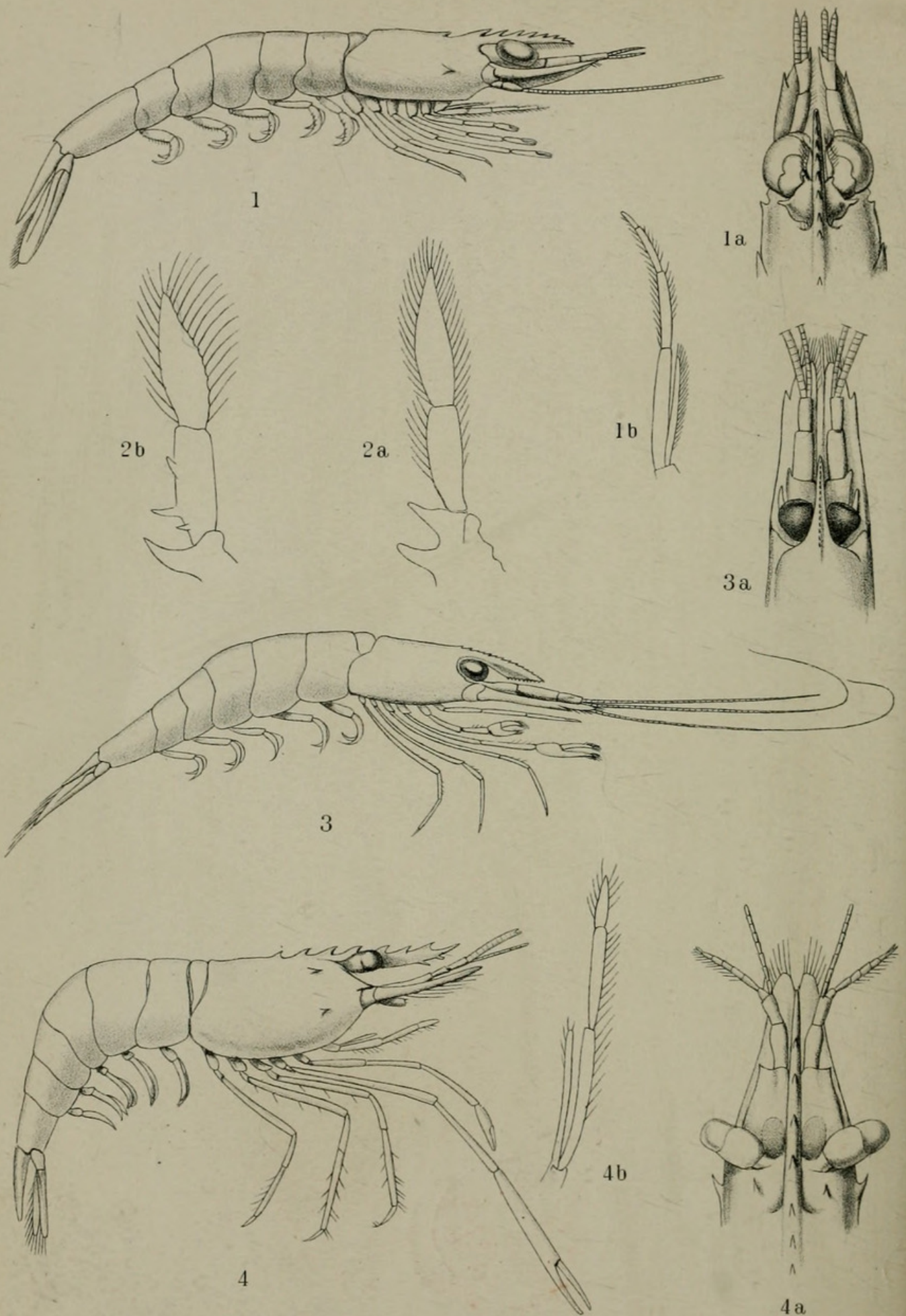
Palinurus penicillatus, H. M.-Edw. H. N. Crust. ii. p. 299 (1837).

Panulirus penicillatus, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 92; Bate, 'Challenger' Macrura, p. 52, pl. xii. fig. 2 (1888).

Senex penicillatus, Ortmann, Zool. Jahrb. vi. Syst. p. 28.

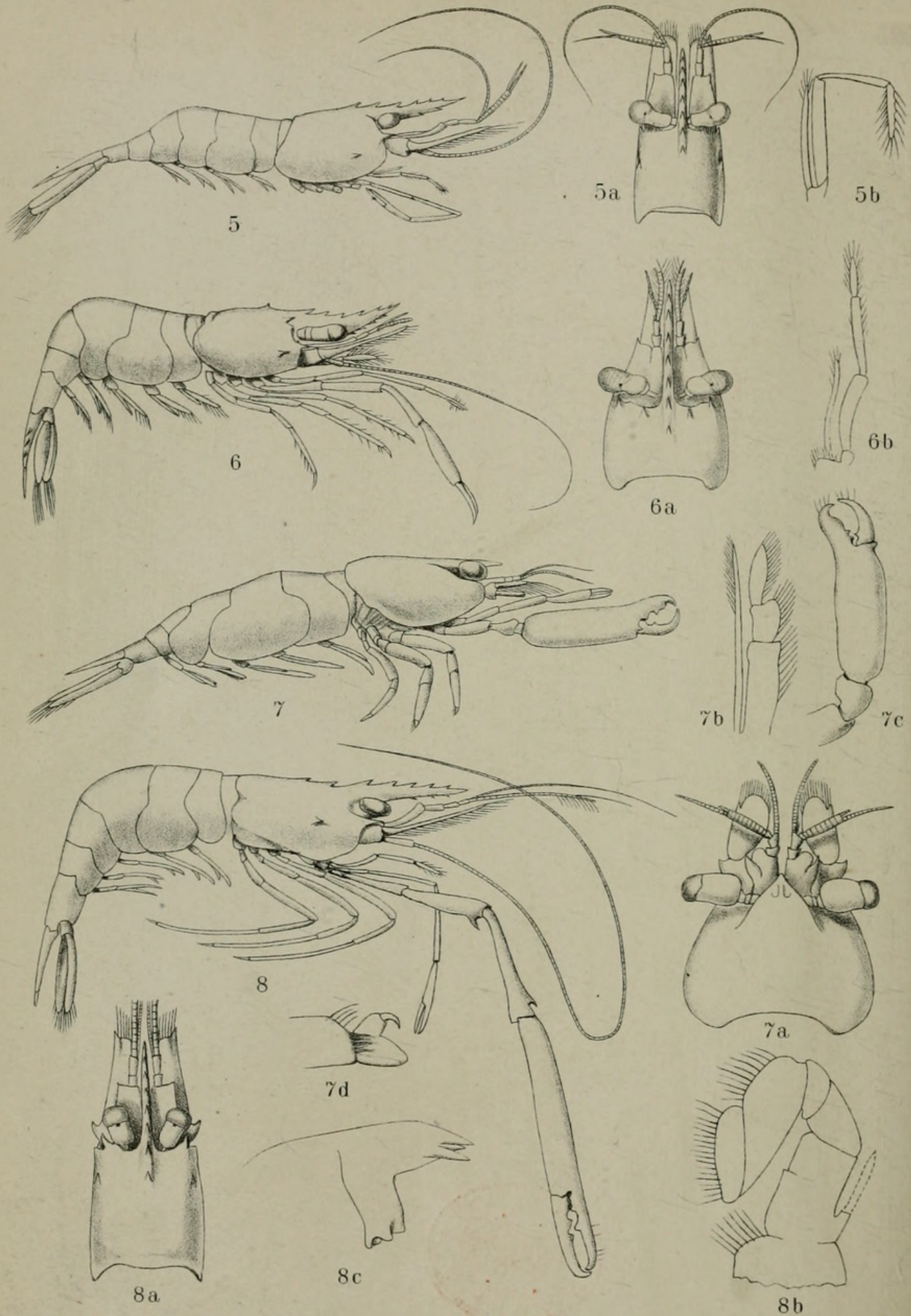
One female with eggs from Rotuma.





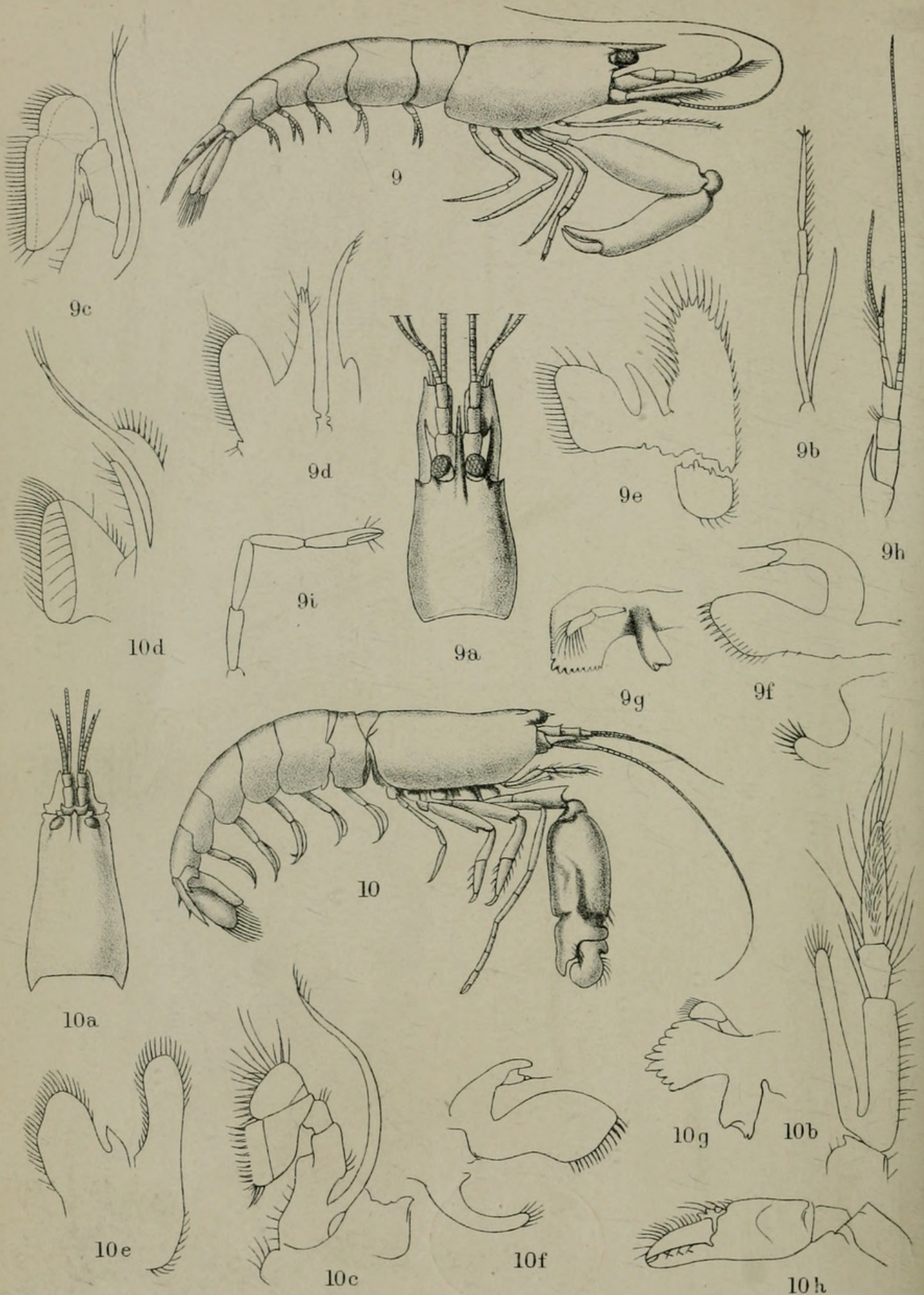
Edwin Wilson, del. ad. nat. lith. Cambridge.





Edwin Wilson, del. ad. nat. lith. Cambridge.





Edwin Wilson del. ad. nat. lith. Cambridge

Tribe THALASSINIDEA.

Family CALLIANASSIDÆ.

Genus CALLIANIDEA H. M.-Edwards, 1837.

29. CALLIANIDEA TYPÆ H. M.-Edwards, 1837.

Callianidea typæ, H. M.-Edwards, H. N. Crust. ii. p. 329, pl. xxv. bis, figs. 8-14 (1837).

From Rotuma six specimens ; from Funafuti six specimens.

EXPLANATION OF THE PLATES.

PLATE LXIII.

- Fig. 1. *Metapenæus commensalis*, n. sp., p. 1001, side view. $\times 1\frac{1}{2}$.
 1 a. " " head from above. $\times 2$.
 1 b. " " 3rd maxilliped.
 2 a. *Stenopus hispidus* (Olivier), p. 1002, 1st abdom. append. of ♀.
 2 b. " " 1st abdom. append. of ♂.
 3. *Caradina vitiensis*, n. sp., p. 1003, side view. $\times 4$.
 3 a. " " head from above.
 4. *Periclimenes danæ* (Stimpson), p. 1004, side view. $\times 8$.
 4 a. " " head from above. $\times 10$.
 4 b. " " 3rd maxilliped.
 5. *Periclimenes rotumanus*, Borradaile, p. 1005, side view. $\times 5$.
 5 a. " " head from above. $\times 5$.
 5 b. " " 3rd maxilliped.

PLATE LXIV.

- Fig. 6. *Periclimenes vitiensis*, Borradaile, p. 1005, side view. $\times 3$.
 6 a. " " head from above. $\times 3$.
 6 b. " " 3rd maxilliped.
 7. *Coralliocaris brevirostris*, Borradaile, p. 1006, side view. $\times 4$.
 7 a. " " head from above. $\times 4$.
 7 b. " " 3rd maxilliped.
 7 c. " " chela of 2nd pair.
 7 d. " " dactyle of 3rd leg.
 8. *Palæmonella tridentata*, n. sp., p. 1007, side view. $\times 4$.
 8 a. " " head from above. $\times 4$.
 8 b. " " 2nd maxilliped.
 8 c. " " mandible.

PLATE LXV.

- Fig. 9. *Athanas sulcatipes*, n. sp., p. 1011, ♂, side view. $\times 8$.
 9 a. " " head from above. $\times 8$.
 9 b. " " 3rd maxilliped.
 9 c. " " 2nd maxilliped.
 9 d. " " 1st maxilliped.
 9 e. " " 2nd maxilla.
 9 f. " " 1st maxilla.
 9 g. " " mandible.
 9 h. " " 1st antenna.
 9 i. " " smaller leg of 1st pair of ♀.
 10. *Alpheus funafutensis*, n. sp., p. 1013, side view. $\times 4$.
 10 a. " " head from above. $\times 4$.
 10 b. " " 3rd maxilliped.
 10 c. " " 2nd maxilliped.
 10 d. " " 1st maxilliped.
 10 e. " " 2nd maxilla.
 10 f. " " 1st maxilla.
 10 g. " " mandible.
 10 h. " " smaller leg of first pair.

6. Contributions to our Knowledge of the Plankton of the Faeroe Channel¹.—No. VII. A. General Data of the Stations. B. The Protozoa. C. The Medusæ. By G. HERBERT FOWLER, B.A., Ph.D., Assistant Professor of Zoology, University College, London.

[Received December 6, 1898.]

(Plate LXVI.)

A.—GENERAL DATA OF THE STATIONS.

In the table now exhibited (see p. 1019) will be found the chief details of the successive collecting stations of H.M.S. 'Research' in the Faeroe Channel, 1896 and 1897: Stations 11² to 18 being in the "Cold Area," between July 30 and Aug. 6, 1896; Station 19 in the "Warm Area," Aug. 7, 1896; Station 20 in the "Cold Area," July 7, 1897.

The physical conditions of the Channel have been fully dealt with in the Reports of the various exploring expeditions³ which have surveyed this classic district, of which it is not an exaggeration to say that the very beginnings of modern oceanography were made in its somewhat troubled waters.

DETERMINATION OF THE HORIZONS.

The horizons through which the Mesoplankton net remained open in 1896 were thus determined. In the first place, experimental hauls were made near the surface, to determine the number of fathoms through which the net must be towed at an approximately constant speed in order that the propeller (1) might open the net, (2) might shut it again. Of these experimental hauls, the contents of which were mostly not kept, the last one retained was 12*d*.

¹ Owing to the scanty leisure at my disposal, the series of papers under this title has been unavoidably disconnected.

The first three numbers dealt with some conspicuous and interesting species; the fourth, by Mr. I. C. Thompson, with the Copepoda; the fifth, by Mr. E. W. L. Holt, with the fish-larvæ; the sixth furnished a description of the special nets used for the Mesoplankton, and a short discussion of the general question of a midwater fauna. This and the future papers will discuss the organisms captured, group by group, and show their horizons by tables when necessary.

The references to previous papers of the series in the Society's Proceedings are:—No. I., 1896, p. 991; No. II., 1897, p. 523; No. III., 1897, p. 803; No. IV., 1898, p. 540; No. V., 1898, p. 550; No. VI., 1898, p. 567.

² Stations 1–10 were collecting-grounds in the neighbourhood of Kirkwall and do not concern the 'Research' cruises.

³ C. Wyville Thomson: 'Depths of the Sea.' London, 1873, 8vo (H.M.S. 'Lightning' and 'Porcupine').—T. H. Tizard and J. Murray: "Exploration of the Faeroe Channel in 1880." Proc. Roy. Soc. Edinb. xi. p. 638 (H.M. hired ship 'Knight Errant').—T. H. Tizard: "Soundings and Temperatures obtained in the Faeroe Channel during the Summer of 1882." Proc. Roy. Soc. xxxv. p. 202 (H.M.S. 'Triton').

The procedure was then as follows:—The net and machinery, weighted up to 100 lbs., were lowered overboard, and a number of fathoms run out, slightly greater than that of the sounding in the case of the lowest horizon; the angle made by the line when taut was approximately measured, and a calculation made from Traverse Tables in the ordinary way as to the depth which the net had reached. As I have pointed out already¹, this, the usual method, is most fallacious; for the towing-line does not form the hypotenuse of a right-angled triangle (as presupposed by this method), but an unknown catenary, which is practically uncalculable except

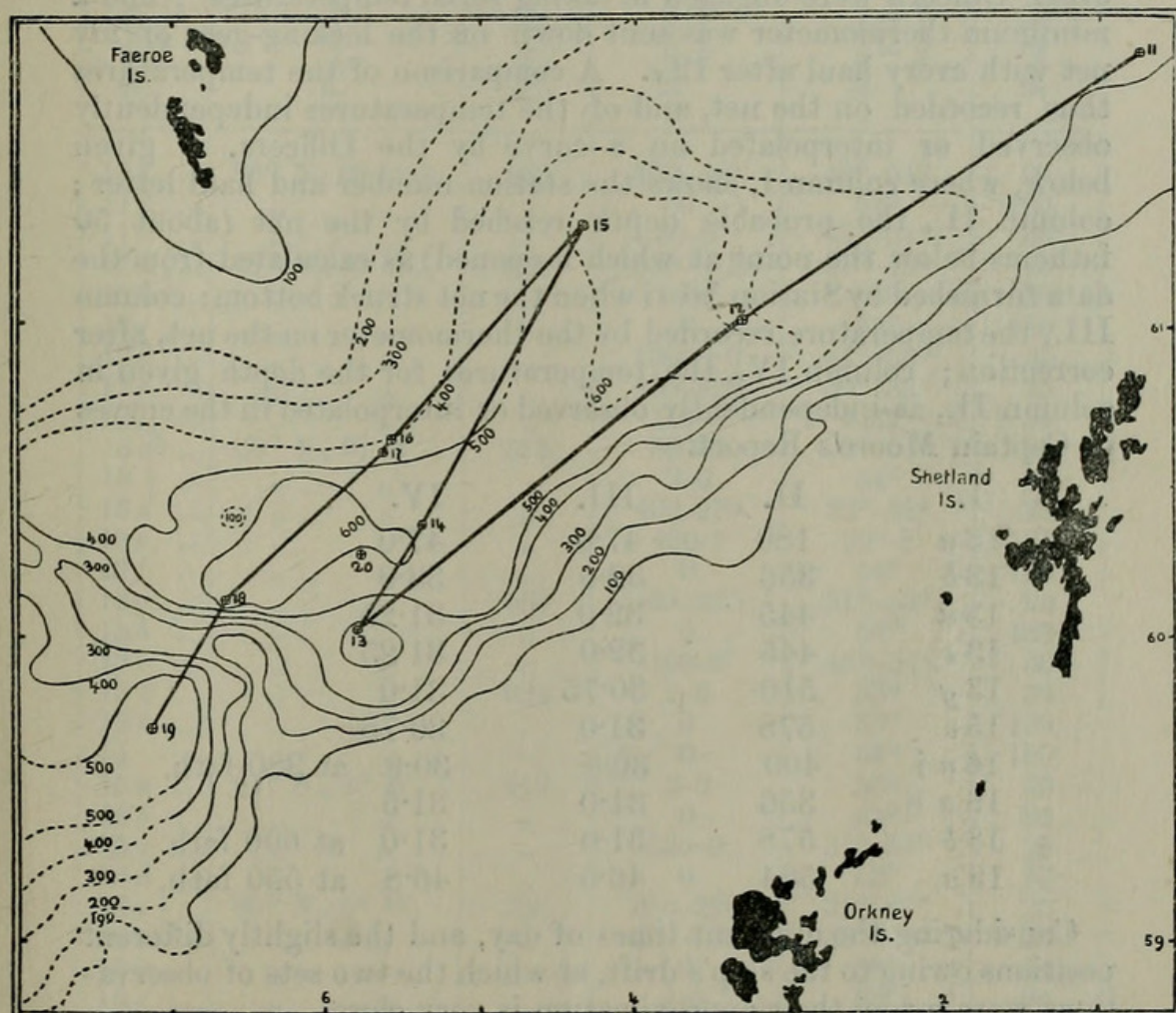


CHART OF THE FAEROE CHANNEL,

Showing the collecting-stations of H.M.S. 'Research' in 1896 and 1897. The contour-lines have been roughly plotted from the Admiralty Chart and from the soundings taken on these cruises: they are dotted where the soundings are far apart. (Station 20 (1897) is N. of Station 13.)

by tedious experiment in order to obtain the necessary data. The fallaciousness of this method was brought home to me by striking bottom at 398 fathoms (Station 16 a i) with 450 fathoms of warp out, though by quadrant and traverse tables the net should only have reached 300 fathoms. Fortunately all the details of the previous hauls had been kept; and as there was sufficient evidence, from

¹ Proc. Zool. Soc. 1898, p. 568.



Borradaile, L. A. 1898. "On some Crustaceans from the Pacific. Part III. Macrura." *Proceedings of the Zoological Society of London* 1898, 1000–1025.
<https://doi.org/10.1111/j.1096-3642.1898.tb03199.x>.

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