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DEPARTMENT OF AGRICULTURE AND TECHNICAL
INSTRUCTION FOR IRELAND.

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SCIENTIFIC INVESTIGATIONS,
1914.

The Decapoda Reptantia of the Coasts of Ireland.

PART I.

Palinura, Astacura and Anomura (except Paguridea.)

BY

C. M. SELBIE, B.Sc.

Plates I—XV.

This paper may be referred to as—

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- I.—MASSY, ANNE L.,—The Cephalopoda Dibranchiata of the Coasts of Ireland, pp. 39, pl. 3. [1909].
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Substance of Reports received from Clerks of Conservators relative to Salmon Fisheries, pp. 22, and
HOLT, E. W. L.,—Summary of Reports relative to Eel Fry, 1907–1908, pp. 6. [1909].
- X.—Title-page, Table of Contents and Index for 1907.

CORRIGENDA.

- Page 3, line 13, for "done" read "down."
- „ 3, „ 34, for "*voncolor*" read "*concolor*."
- „ 10, „ 26, for "mention" read "mentioned."
- „ 21, „ 1, for "POLYCHELUS" read
"POLYCHELES."
- „ 43, „ 33, for "trawels" read "trawlers."
- „ 69, bottom line, for "0-60" read "50-60."
- „ 104, line 10, after "shore collecting" insert "in
Ballynakill Harbour."

THE DECAPODA REPTANTIA OF THE COASTS OF IRELAND.

PART I.

PALINURA, ASTACURA, AND ANOMURA (EXCEPT PAGURIDEA).

BY

C. M. SELBIE, B.Sc.,
National Museum, Dublin.

Plates I–XV.

INTRODUCTION.

The present paper is a continuation of the account of the Irish Decapoda, begun by Mr. Stanley Kemp in "The Decapoda Natantia of the Coasts of Ireland" (*Fisheries, Ireland, Sci. Invest.*, 1908, I. [1910]), and I have tried to keep the scope of the work as nearly as possible the same, that is to say, every species discovered since the appearance of Bell's "British Stalk-eyed Crustacea" in 1853 has been described and figured. This paper includes the whole of the Palinura, Astacura, and Anomura, with the exception of the Paguridea. The latter will be dealt with in the next part, and a third paper will complete the account of the Reptantia with the Brachyura.

The classification adopted is that drawn up by Borradaile (1907), as slightly altered by Calman in the volume "Crustacea," in Lankester's "Treatise on Zoology."

The material on which the following account is based was nearly all taken by the Irish Fishery cruiser *Helga* since the year 1900. A few specimens taken within the Irish marine area by the Danish Fishery steamer *Thor* are also included. In the collection there are representatives of thirty-one species, four of which are new to science, eleven new to the British, and sixteen to the Irish marine fauna. The following is a list of those new to the Irish area in which those which are also new to British waters are marked with an asterisk:—

- | | |
|--|----------------------------------|
| * <i>Polycheles typhlops.</i> | * <i>Gastroptychus formosus.</i> |
| * <i>Polycheles sculptus.</i> | <i>Munida tenuimana.</i> |
| * <i>Polycheles nanus.</i> | * <i>Munidopsis tridentata.</i> |
| * <i>Polycheles granulatus.</i> | * <i>Munidopsis curvirostra.</i> |
| * <i>Eryonicus Faxoni.</i> | <i>Axius stirhynchus.</i> |
| <i>Nephropsis atlantica.</i> | * <i>Jaxea nocturna.</i> |
| * <i>Uroptychus rubrovittatus.</i> | <i>Callianassa Stebbingi.</i> |
| * <i>Uroptychus nitidus</i> , var.
<i>concolor.</i> | <i>Upogebia deltaura.</i> |

The majority of these were taken in the deep water off the south-west coast. *Jaxea nocturna*, however, was found in the Irish Sea between the Isle of Man and the coast of Co. Louth. It is a species found commonly in the northern part of the Adriatic, and only very rarely in other parts of the Mediterranean. The single specimen which was taken by the *Helga* in 1905 was the first adult individual to be found outside the Mediterranean. Since then another full-grown *Jaxea* has been found in British waters; it was taken by the Scottish Fishery Board steamer *Goldseeker* in Loch Fyne in 1908. The discovery of *Jaxea* within the British marine area has long been expected, as the peculiar *Trachelifer* larval form has been taken on many occasions in the Irish Sea, and on the west coast of Ireland and Scotland.

Three of the other species new to the Irish fauna, *Axius stirhynchus*, *Callianassa Stebbingi*, and *Upogebia deltaura*, are littoral and shallow water forms with a burrowing habit. It is probably this latter fact which has prevented their being included in earlier lists of Irish Decapoda. With the exception of these few forms the remainder of the species in the foregoing list were found in deep water off the west and south-west coasts.

The feature of the collection is the large number of specimens included in it belonging to the family Eryonidae, of which no examples had hitherto been taken within the British marine area. Four species of *Polycheles* and four of *Eryonicus* have been captured, three of the latter, *E. hibernicus*, *E. Scharffi*, and *E. Kempfi*, being new to science. Perhaps the most interesting specimen in the whole collection is a very young *Eryonicus*, only 7 mm. long, in which only the first two pairs of pereopods are developed, the rostrum has the form of a long median spine, and the abdomen is very small. The most striking fact, however, is the presence of exopodites on the pereopods and on the second and third maxillipedes. The specimen is, in fact, an *Eryonicus* in the *Mysis* stage of development.

Eryonicus differs from all the other species described in this paper in being a free-swimming form; all the others are true bottom-living forms.

There is also a new species of *Palinurus* in the collection. It is closely allied to the common species, *P. vulgaris*, and also to a South African species, *P. Gilchristi*. In many respects it is intermediate between these two forms, but I consider that its characters are sufficiently distinctive to give it specific rank. Eventually it may have to be reduced to a variety of *P. vulgaris*, on evidence based on the examination of a large number of specimens.

By far the greater part of the material was taken in the beam trawl, or in mosquito and sprat nets attached to the trawl as described in the introduction to Mr. Kemp's paper. The specimens of *Eryonicus* were nearly all taken in the midwater otter trawl, but in one or two instances they were found in

the beam trawl, in which case they must have been captured by the latter while it was being hauled to the surface.

Except in the case of very common species the actual records are given. The depths represent the soundings taken at the beginning and end of each haul, and the mean between these is to be regarded as the approximate depth at which the specimen was taken. Except in a few cases references are given only to the principal papers dealing with each species. Measurements of all specimens were taken from the tip of the rostrum to the end of the telson, when the abdomen is straightened out in macrurous fashion.

The following species are practically confined to the littoral and laminarian zones, that is, down to about twenty fathoms :—

Porcellana longicornis.
Porcellana platycheles.
Axius stirhynchus.
Callianassa Stebbingi.
Upogebia deltaura.

The following are also found in these zones, but they extend into deeper water as well :—

<i>Palinurus vulgaris.</i>	<i>Galathea squamifera.</i>
<i>Homarus vulgaris.</i>	<i>Galathea nexa.</i>
<i>Galathea intermedia.</i>	<i>Galathea strigosa.</i>

The species in the following list are all genuine deep-sea forms :—

<i>Polycheles typhlops.</i>	<i>Uroptychus nitidus</i> , var.
<i>Polycheles sculptus.</i>	<i>concolor.</i>
<i>Polycheles nanus.</i>	<i>Gastroptychus formosus.</i>
<i>Polycheles granulatus.</i>	<i>Munida tenuimana.</i>
<i>Nephropsis atlantica.</i>	<i>Munidopsis tridentata.</i>
<i>Uroptychus rubrovittatus.</i>	<i>Munidopsis curvirostra.</i>

The various species of *Polycheles* are nearly always found on a bottom of ooze. *Uroptychus nitidus* var. *concolor* and *Munidopsis tridentata* are usually found clinging to pieces of *Lophelia prolifera*.

The Reptantia treated of here include three species of great economic importance, *Homarus vulgaris*, *Palinurus vulgaris*, and *Nephrops norvegicus*. The Irish Lobster fishery is of increasing importance, as may be seen by the figures given on page 54. The number caught annually has increased steadily since 1903, with the exception of the years 1906 and 1910, and in 1912 the total reached more than half a million for the first time. By far the greatest numbers come from the west

and south coasts. Thus the total catch for 1912 was made up as follows:—

West coast	..	..	..	42·3%
South coast	..	..	..	25·9%
North coast	..	..	..	17·1%
East coast	..	..	..	14·6%

There is practically no fishery of *Palinurus vulgaris* in Ireland. It does not occur in anything like the same numbers as the Lobster, and it is not held in great estimation as an article of food in this country, whereas on the Continent it is greatly prized and preferred by many to the Lobster itself.*

Nephrops norvegicus, usually known in Ireland as the "prawn," occurs in immense numbers in the northern part of the Irish Sea, especially between the Isle of Man and the coast of Louth and Down. It is from this district that the greatest numbers are brought in by the trawlers.

Many of the Reptantia described in this paper are of importance as a source of food supply for fish of commercial value. Off the south of Iceland *Nephrops norvegicus* occurs in such large numbers that it forms the chief food of the cod. Some of the burrowing species such as *Callianassa Stebbingi*, *Axius stirhynchus*, and *Upogebia deltaura* are much more frequently found in the stomach of bottom-living fishes than taken in the trawl.

MONTHS in which ovigerous females were taken.

	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
<i>Polycheles typhlops</i>	x				
<i>Polycheles nanus</i>	x							
<i>Nephrops norvegicus</i>	x	x	.....	.....	.....	x	.....	x	.....	x	x	
<i>Nephropsis atlantica</i>	x	.....	.....	.....	.....	.....	x				
<i>Uroptychus nitidus</i> , <i>var. concolor.</i>	x			
<i>Galathea intermedia</i>	x	.....	x	.....	.....	x	x			
<i>Galathea nexa</i>	x	x	x	x	x	.....	x					
<i>Galathea strigosa</i>	x								
<i>Munida bamffica</i>	x										
<i>Munida tenuimana</i>	x				
<i>Munidopsis curvivostra</i>	x							
<i>Porcellana longicornis</i>	x								
<i>Axius stirhynchus</i>	x										
<i>Calocaris Macandreae</i>	x	.....	x		
<i>Jaxea nocturna</i>	x										

* See pp. 42, 43.

The Table printed above shows the months in which ovigerous females of the various species were taken. The Lobster, which may be found in the ovigerous condition at any time of the year, is not included.

The next table shows the distribution of those species which are found outside the Atlantic.

The third table shows the Atlantic distribution of each species. It will be seen that nine extend northwards beyond the Arctic Circle, and eighteen are found as far south as the Mediterranean.

A list of the papers to which references are given will be found at page 105, and an index to the genera and species at page 111.

I am glad to have this opportunity of expressing my indebtedness to Dr. Calman for his courtesy and patience in replying to my numerous inquiries, and also to the Rev. T. R. R. Stebbing, Dr. Allen of the Marine Biological Association, Dr. H. J. Hansen and Dr. Lundbeck of Copenhagen, and Prof. Steuer of Innsbruck, for the loan of specimens.

EXTRA-ATLANTIC DISTRIBUTION.

	Red Sea	Arabian Sea	Ceylon	Bay of Bengal and Andaman Sea	New Zealand	West Coast of America: San Diego to Ecuador
<i>Polycheles typhlops</i>	X	.....	X		
<i>Polycheles sculptus</i>	X	.....	.....	.....	X
<i>Polycheles nanus</i>	X
<i>Polycheles granulatus</i>	X	.....	.....	X
<i>Nephropsis atlantica</i>	X				
<i>Uroptychus nitidus</i> var. <i>concolor</i>	X	.....	X		
<i>Galathea strigosa</i>	?					
<i>Munidopsis tridentata</i>	X	X	X		
<i>Calocaris Macandreae</i>	?	?	?	

ATLANTIC

	West Coast of Ireland	South Coast of Ireland	Irish Sea	South Coast of England	East Coast of England	East Coast of Scotland	W. and N. Coast of Scotland and Shetlands	East Coast of North America
1. <i>Polycheles typhlops</i>	X							
2. <i>Polycheles sculptus</i>	X							X
3. <i>Polycheles nanus</i>	X	X	X	X	X	X	X	X
4. <i>Polycheles granulatus</i>	X							
5. <i>Eryonicus Faxoni</i>	X							
6. <i>Eryonicus hibernicus</i>	X							
7. <i>Eryonicus Kempfi</i>	X							
8. <i>Eryonicus Scharffi</i>	X							
9. <i>Palinurus vulgaris</i>	X	X	X	X	X		X	
10. <i>Palinurus Thomsoni</i>	X							
11. <i>Nephrops norvegicus</i>	X	X	X	X	X	X	X	
12. <i>Nephropsis atlantica</i>	X						X	
13. <i>Homarus vulgaris</i>	X	X	X	X	X	X	X	
14. <i>Uroptychus rubrovittatus</i>	X							
15. <i>Uroptychus nitidus, var. concolor</i>	X							
16. <i>Gastroptychus formosus</i>	X							
17. <i>Galathea intermedia</i>	X	X	X	X	X	X	X	
18. <i>Galathea squamifera</i>	X	X	X	X	X	X	X	
19. <i>Galathea strigosa</i>	X	X	X	X	X	X	X	
20. <i>Galathea nexa</i>	X	X	X	X	X	X	X	
21. <i>Munida bamffica</i>	X	X	X	X	X	X	X	
22. <i>Munida tenuimana</i>	X							
23. <i>Munidopsis tridentata</i>	X							
24. <i>Munidopsis curvirostra</i>	X							X
25. <i>Porcellana platycheles</i>	X	X	X	X	X	X	X	
26. <i>Porcellana longicornis</i>	X	X	X	X	X	X	X	
27. <i>Axius stirhynchus</i>	X		X	X				
28. <i>Calocaris Macandreae</i>	X		X	X	X	X	X	X
29. <i>Jaxea nocturna</i>			X				X	
30. <i>Callianassa Stebbingi</i>	X		X	X		X		
31. <i>Upogebia deltaura</i>	X	X		X		X		
32. <i>Upogebia stellata</i>				X	X	X		

DECAPODA REPTANTIA.

PALINURA.

The two tribes forming the Palinura may be separated as follows :—

Antennal scale present ; first four pairs or all five pairs of pereopods chelate ; pleopods present on first abdominal somite, .. ERYONIDEA.

Antennal scale absent ; none of the pereopods chelate, except occasionally the fifth pair in the female ; pleopods absent from the first abdominal somite, SCYLLARIDEA.

TRIBE ERYONIDEA.

FAMILY ERYONIDAE.

No specimens belonging to this family have previously been recorded from British waters. Attention was first drawn to these very peculiar Decapods by the *Challenger* expedition. The honour, however, of being the first to describe one of the group must be given to Heller, who in 1862 described and figured a small specimen of *Polycheles typhlops* from the Mediterranean. No one seems to have attached much importance to this description until after the discovery of several allied species by the *Challenger*. The capture of these specimens was amongst the most remarkable results achieved by the expedition, as the discovery of *Polycheles* and its allies was at least a partial fulfilment of the hopes of those who maintained that, owing to the uniformity of conditions existing at great depths, there might be found there organisms which had been regarded as extinct, for the nearest relatives of *Polycheles* and *Willemoesia* are the species of *Eryon* found in the Trias and Lower Cretaceous.

Two genera have been taken in Irish waters, *Polycheles* (including *Pentacheles*), and *Eryonicus*. *Willemoesia*, which is closely allied to *Polycheles*, is not yet known to occur within the boundaries of the Irish marine area.

The two genera are separable as follows :—

Carapace depressed, the lateral borders very sharply defined ; abdomen longer than carapace, *Polycheles*.

Carapace globular and inflated ; abdomen shorter than carapace, *Eryonicus*.

Polycheles, Heller.

Polycheles, Heller, 1862. *Polycheles*, Heller, 1863. *Polycheles*, Bate, 1888. *Pentacheles*, Bate, 1888. *Stereomastis*, Bate, 1888. *Polycheles*, Faxon, 1893. *Polycheles*, Faxon, 1895. *Polycheles*, Alcock, 1901. *Pentacheles*, Alcock, 1901. *Polycheles*, Stebbing, 1903. *Polycheles*, Bouvier, 1905. *Polycheles*, Kemp, 1912.

In his report on the Macrura of the *Challenger* Expedition Spence Bate distributes the species of this group among three genera, *Polycheles*, *Pentacheles*, and *Stereomastis*. In *Pentacheles* all five pairs of pereopods were chelate, and in *Polycheles* only the first four pairs. Faxon, however (1895), showed that this character was useless as some of the species included in *Pentacheles* had the fifth pereopods chelate in the female and simple in the male. *Stereomastis* was founded for the reception of these species in which "the mastigobranchial lash does not exist." After the examination of a large amount of material, Faxon was able to state that the epipodites of the thoracic legs were to be found in all grades of development, from large structures extending far up into the branchial chamber, to the merest rudiments. He therefore united the three genera in one, and has been followed by the majority of recent writers. Alcock, however, revived (1901) the genus *Pentacheles*, separating it from *Polycheles* by the following characters.

"Epipodite . . . of the external maxillipedes is represented at most by a papilla. Epipodites are present on the first four pairs of thoracic legs, but they are only membranous expansions of the base of the podobranch, and ascend little or not at all into the branchial chamber.—*Polycheles*.

External maxillipedes carry a functional epipodite, and the epipodites of the first four pairs of thoracic legs are independent plates, attached to the podobranchiae at the base only, and ascending into the branchial chamber in normal fashion.—*Pentacheles*."

But this was merely employing again the character which Faxon had shown to be useless for the distinction of *Stereomastis*. Moreover, Kemp has shown (1912) that Alcock's species *Pentacheles heathi* is a synonym of *Polycheles typhlops*. The characters given by Alcock, therefore, though doubtless holding good for Indian species, cannot be applied to the group as a whole. *Polycheles* is used in the present paper as including the three genera described by Spence Bate.

The carapace is nearly as long as the abdomen, and is very much flattened dorsally. The lateral edges are very well defined, and are lined with strong broad spines or teeth, the number of which varies with the species; the edges are slightly

convex or almost parallel. A distinct carina runs along the middle of the dorsal surface from the rostrum, marked by a single or double spine, to the posterior margin, which is concave. On the part of the carapace below the lateral margin there are two less distinct carinae, one running to the base of the antennae, and the other to the base of the chelipeds; both start from near the postero-lateral angle of the carapace. These three carinae all bear more or less well developed spines which are of great importance as specific characters. There is also usually a row of spines on the outer cardiac area running parallel to the posterior part of the lateral margin. The front edge of the carapace is excavated on either side into a deep sinus in which lies the fixed eyestalk.

The abdomen tapers rapidly to the telson, which always ends in a long narrow point. The abdominal terga bear median crests, which are sometimes developed into huge forward-curving spines. The pleura of the second segment are much larger than those of the other segments.

The eyestalks fill the sinuses in which they lie, and are opaque and dull except for a small circular area which is present at the posterior dorsal end in some species; this part is translucent and soft. The anterior end of the eyestalk, which may or may not bear a small spine, gives off a branch which passes outwards and downwards beneath the antero-lateral angle of the carapace; its tip is translucent like the dorsal area already mentioned.

The basal joint of the antennular peduncle is produced into an elongated and pointed scale on the inner side, and bears one or two spines at its outer angle. There is a narrow antennal scale. The outer antennular flagellum is always very short and slender, the inner one nearly equal in length to the antenna, which is usually slightly longer than the carapace. The renal tubercle is very well developed and presses against the base of the antennular peduncle, in which there is a rounded hollow for its reception.

The oral appendages are very uniform in the different species and are described in detail later.

All five pairs of thoracic legs are chelate in the female; in the male the last pair is more or less imperfectly chelate. The first pair is very long, often longer than carapace and abdomen, and the joints are all more or less flattened. The fingers are long and slender with strongly curved tips which cross when closed. The other pairs of legs become successively shorter and feebler backwards.

The pleopods are long and slender with a rod-like *appendix interna*. There is no transverse suture on the uropods.

There is no epipodite on the second maxillipedes; that on the third maxillipedes may be a mere papilla or of fair size. Epipodites and podobranchs are present on the first four pairs of thoracic legs and vary in size, sometimes reaching far up into the branchial chamber, sometimes hardly ascending into the

chamber at all. The arthrobranch on the third maxillipedes is never greatly developed, and it may be absent altogether.

Branchial formula :—

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs. . ep.	—	—	ep.	1+ep.	1+ep.	1+ep.	1+ep.	—
Arthrobranchs.	—	—	±1	2	2	2	2	—
Pleurobranchs..	—	—	—	—	1	1	1	1

Four species of *Polycheles* have been taken by the *Helga*, all of them new to the British fauna. *P. typhlops* has been taken frequently, and also several specimens of *P. sculptus*. Three specimens of *P. nanus*, belonging to the variety described as *P. Grimaldii* by Bouvier, were taken in the same haul as several specimens of *P. sculptus*. Finally, a single specimen of *P. granulatus* was taken. The species of this genus are good examples of the very wide range so often possessed by organisms living at great depths. Of the four species described here *P. typhlops*, *P. sculptus*, and *P. granulatus* have each been found in the Atlantic, Indian, and Pacific Oceans. They are nearly always captured on a bottom of Globigerina ooze and their long and slender chelipeds would appear to be well adapted for raking and sifting the ooze in the search for food.

A key for the separation of the four British species is given below.

- A. No spines on hind border of carapace ; teeth on lateral margins hardly decreasing at all in size posteriorly ; no ridge on the sixth abdominal tergum ; one spine on the outer angle of the basal joint of the antennular peduncle, *P. granulatus*.
- B. Spines on hind border of carapace ; teeth on lateral margins decreasing in size posteriorly ; a double ridge on the sixth tergum ; two spines on the outer angle of the basal joint of the antennular peduncle.
- a. Rostral spine single ; rows of tubercles on edges of terga, *P. typhlops*.
- b. Rostral spine double ; no rows of tubercles on edges of terga,
- I. Chelipeds slightly shorter than body ; ridge on sixth tergum very prominent, with jagged edges, *P. nanus*.
- II. Chelipeds much longer than body ; ridge on sixth tergum low, with smooth edges, *P. sculptus*.

Polycheles typhlops, Heller.

Pl. I, figs. 1-13.

- Polycheles typhlops*, Heller, 1862.
Polycheles typhlops, Heller, 1863.
Polycheles typhlops, Carus, 1885.
Polycheles Doderleini, Riggio, 1885.
Pentacheles Hextii, Alcock, 1894.
Polycheles typhlops, Adensamer, 1898.
Pentacheles Hextii, Alcock, 1901.
Polycheles typhlops, Senna, 1903.
Polycheles typhlops, Bouvier, 1905 (a).
Polycheles typhlops, Bouvier, 1905 (b).
Polycheles typhlops, Kemp, 1912.

The carapace is slightly shorter than the abdomen. Its dorsal surface is almost flat, and its lateral margins are very slightly convex. The frontal margin considered as a whole is slightly concave, and is divided into three lobes by the deep sinus at each side, in which the fixed and immovable eyestalk lies. The median lobe is bounded at either side by a strong spine. In the centre is the rostrum, formed by a single sharp spine pointing forwards and upwards. Below this there is a broader and blunter process in the median line. The outer border of each orbital sinus is furnished with three or four small teeth, which are more distinct in the female than in the male. At each antero-lateral angle of the carapace there is a strong curved spine, and from this there runs backwards a line of teeth along the lateral margin. These lateral spines decrease in size towards the posterior end, and the series is divided into three parts by the two branches of the cervical groove. The front part has usually seven spines, the middle four or five, and the hind part about twenty. The numbers however vary considerably. Senna gives them as 6 or 7, 4, 14 to 18, and Carus 7, 5, 20 to 23. The two sides of the same specimen even may show differences in the number of spines; in one of the specimens taken by the *Helga* the left side has 7, 5, 18, and the right, 8, 5, 20. The hind carapace margin is strongly concave, and is composed of a strong bar, the two halves of which meet at an obtuse angle in the centre. At this point there are two large forward-pointing spines, and two smaller ones further down on either side. The posterior extremities of this bar are firmly buckled to the first abdominal segment. From the middle of the hind margin to the rostrum there runs a raised carina along the whole length of the carapace. It is broken only at one point, where it is crossed by the cervical groove. It bears several distinct spines, some of which are double, and between these it is

covered with rough tubercles. In front of the cervical groove the spines, according to Senna, are arranged as follows

Rostrum + 1, 1, 1, 1, 2, 2,

in the male, and in the female either the same or,

Rostrum + 1, 1, 1, 2, 2.

In the specimens taken by the *Helga* these spines are not always well developed. It is especially difficult sometimes to say whether a spine is double or not. The one which lies just in front of the cervical groove is very often single, or has one half much larger than the other, or is altogether rudimentary. Behind the groove there are three double spines, but often some of these are very slightly developed. The arrangement of the carinal spines on some of the Irish specimens is as follows. (The semicolon marks the position of the cervical groove, and *r* signifies that the spine is rudimentary.)

Rostrum + 1, 1, 1, 2, $1\frac{1}{2}$; 2, *r*, 2.

Rostrum + 1, 1, 1, 2, *r*; *r*, *r*, 2.

Rostrum + 1, 1, 1, 1, 2, $1\frac{1}{2}$; *r*, *r*, 2.

Rostrum + 1, 1, 1, 2, $1\frac{1}{2}$; 2, 2, 2.

Rostrum + 1, 1, 1, 2, *r*; *r*, *r*, 2.

The cervical groove is situated almost exactly half-way between the rostrum and the hind margin of the carapace. It is well marked, and at a point rather nearer the median line than the margin it divides into two. The posterior branch cuts the margin almost at right angles, whereas the anterior, which is the fainter of the two, slants forwards, and meets the margin at an acute angle. From the hind branch of the cervical groove a low ridge furnished with about twelve to fourteen small teeth runs backwards parallel with the margin to the posterior end of the carapace. It is almost twice as far from the median carina as from the lateral margin. From the middle of the anterior branch of the cervical groove to the orbital sinus there is a curved row of four or five spines, which are not situated on a ridge. On the cervical groove itself, besides the two central spines forming part of the median carina, there is a single smaller spine on each side above the bifurcation, and three or four very small ones on the hind branch below it. Besides the larger spines, the position of which has been indicated, there are numerous very small ones scattered over the surface of the carapace; they are particularly plentiful about the borders of the cardiac region, and all of them are directed forwards.

On the lower surface of the carapace there are at each side two oblique carinae armed with small teeth. The external or upper of these submarginal ridges begins just opposite the base of the antenna and runs backwards towards the postero-lateral angle of the carapace. Its anterior end is marked by a large spine. The teeth are fairly large in the front portion, but they

die away about the middle, and the hind part is only faintly traceable. The internal submarginal carina runs from the posterior angle of the carapace forwards to a point opposite the base of the first pereopods. It is more definitely spiny than the other.

The tergum of the first abdominal somite is almost quite smooth, but on the second there is a well developed median spine, and on the third, fourth, and fifth there are large spines curving forwards. The sixth segment bears a low double keel which is broken up into six or seven tubercles.

The pleura of the first segment are the smallest, and those of the second the largest of the series. The others diminish in size and increase in sharpness from the third to the sixth.

The basal part of the telson has a median row of three or four tubercles. It tapers to a narrow but not very sharp point.

The pigmentless and immovable eyestalks fill the deep orbits in the front of the carapace. Each one gives off a tapering branch on the outer side, which extends beneath the anterolateral angle of the carapace. There is a short spine on the front of each eyestalk.

The inner flagella of the antennules are longer than the carapace; the outer are very short and much thinner than the others. The antennular scale extends far past the end of the peduncle, and ends in a sharp point; its inner margin is armed with teeth. The outer angle of the basal joint of the peduncle bears two prominent spines.

The narrow antennal scale does not reach the end of the peduncle. The flagellum is slightly shorter than the inner branch of the antennule. From the basal joint of the peduncle there projects on the inner side a short rounded process, the phymacerite or renal tubercle, the end of which lies in a hollow on the under side of the base of the antennule.

The cutting edge of the mandible bears about a dozen teeth, of which one at each end and one in the middle are larger than the others. There is a three-jointed palp.

The two lobes of the first maxillae are strongly incurved; they are very slender, and end in sharp bristles, which are stouter in the anterior one.

In the second maxillae the two lobes are not subdivided, but are long and slender, the inner larger than the outer; the scaphognathite is very large.

The first maxillipedes are very long and of unusual form. Fig. 7 shows the appearance of the anterior part without the epipodal lamella, which forms a prolongation backwards, so that the total length of the appendage is greater than that of the scaphognathite. The two lobes of the protopodite are represented by the parts *a* and *b*. From *b* there springs the long, slender endopodite, heavily fringed with setae, and having an imperfect joint slightly nearer the tip than the base. The exopodite, on the other hand, is very broad; in its distal part it divides into two curved plates which are curiously curled round

one another. That which is seen in profile in Fig. 7, *d*, partially encloses the other, *c*, which spreads out into a broad lamella from a very narrow base at *e*. On the anterior edge of the proximal protopodial lobe there are two rows of setae, one directed outwards, the other inwards; the former are plumose, the latter simple. The lobe *a* appears to be narrower in the figure than it really is, owing to foreshortening.

Neither the second nor the third maxillipedes have an exopodite. Both appendages are slender and pediform. In the second maxillipedes the carpus is long and much expanded; the dactyl ends in a spine. The third maxillipedes are very long and slender, and are unarmed except for the spines on the dactyl. The whole appendage is covered with long setae. There is a small epipodite.

In the female all five pairs of pereopods are chelate, but the last pair are not perfectly so, the dactyl being slightly longer than the projecting part of the propodite. In the male the first four pairs are chelate, but the fifth ends simply: In both sexes the tips of the fingers in the first and second pereopods cross one another and are strongly curved.

The first pereopods or chelipeds are slightly longer than the whole body from rostrum to tip of telson. They are remarkably slender and feeble. The ischium is very narrow at the proximal end, but expands distally, and this is also true of the carpus.

The merus is broad at the proximal end, narrows in the middle, and then widens again. The palm of the propodite is the stoutest part of the whole appendage, and is not so compressed as the ischium and merus. The fingers are very long and thin, and are sharply bent near the tip. The inner edge of each finger is furnished with a row of small plates set obliquely, and overlapping one another. The merus bears one or two spines at its upper distal end, and the carpus also has one in the same position. Sometimes the propodite bears a spine opposite the base of the dactyl. The upper margin of the merus is very minutely spinulose.

The other pereopods are very much shorter than the first, and diminish in size from the second to the fifth.

The first pair of pleopods are very different in the two sexes. Those of the female are fairly large and robust, passing the base of the fourth pereopods, and are heavily fringed with setae, which are of two kinds. There is a continuous fringe of slender pinnate setae along each margin, and in addition to these there is a much smaller number of simple hairs, which are much longer and thicker than the pinnate ones. The largest of all are to be found in a little group of four or five situated at the base of the distal joint.

The first pleopods in the male are quite devoid of hairs, with the exception of five or six on the proximal joint, and one at the extreme tip. Near the extremity there is a slight swelling on the inner side, which bears a group of little hooks. The appen-

dage is very slender, and is considerably shorter than in the female.

The succeeding pairs of pleopods are all well developed, and possess an *appendix interna*, and in the male the second pair have also an *appendix masculina*.

The uropods are large and broad, the exopodite more so than the endopodite. The margins are entire and fringed with long setae. In the endopodite there is a midrib extending to the tip, and in the exopodite two similar ribs, neither of which reach the margin.

Occasionally in the female there may be seen two spermatophores cemented firmly to the sternal surface between the coxae of the fourth and fifth pereopods. These are not unlike the spermatheca which is found in certain Decapods in the same position, and in *P. sculptus* they have erroneously been described as such (see Andrews, 1911).

Size:—Senna (1903) mentions three large females, taken in the Mediterranean, which measured 65, 70, and 90 mm. The largest specimens taken by the *Helga* are two females, each 80 mm. long. Another female measures 74 mm.

The following measurements are taken from a female from station S. R. 490.

Total length	..	..	..	80	mm.
Length of carapace	..	..	..	35	mm.
Length of abdomen	..	..	..	45	mm.
Breadth of carapace	..	..	..	23	mm.
Length of chelipeds	..	..	..	81	mm.
Length of ischium of chelipeds	..	..	..	13	mm.
Length of merus of chelipeds	..	..	..	26.5	mm.
Length of carpus of chelipeds	..	..	..	13.5	mm.
Length of propodite of chelipeds	..	..	..	27.5	mm.
Length of palm of chelipeds	..	..	..	12	mm.
Length of fingers of chelipeds	..	..	..	15.5	mm.
Length of second pereopods	..	..	..	32	mm.
Length of third pereopods	..	..	..	28	mm.
Length of fourth pereopods	..	..	..	26	mm.
Length of fifth pereopods	..	..	..	22	mm.
Length of antennules	..	..	..	43	mm.
Length of antennae	..	..	..	Broken.	

General Distribution:—The species was taken originally in the Mediterranean, and was described by Heller (1862 and 1863). It has since been recorded from Sicily (Heller, Reggio), Sardinia (Senna), the Adriatic, north coast of Africa, south coast of Asia Minor, and Crete (Adensamer). Under the name of *P. Agassizi* it has been recorded from several localities in West Indian waters (Milne Edwards), and Bouvier has shown that it is widely distributed in the eastern Atlantic. Kemp (1912)

has shown that Alcock's species *Pentacheles Hextii* is a synonym of *P. typhlops*, so that the range of the species is extended to the Indian Ocean.

Norman (1879) gives a description of two specimens of *Polycheles* taken by the *Porcupine*, one, a male, off the Portuguese coast, and the other, a female, on the Atlantic slope west of the English Channel (48° 13' N., 9° 11' W.). The male appears from the description to belong to *P. typhlops*, but the female certainly does not.*

Vertical Distribution :—Riggio records a Mediterranean specimen from about 55 fms., but usually the depths are very much greater. Senna's specimens were taken in 358–848 fms., and Adensamer's in 339–1122 fms. The depths at which the *Helga* has taken this species range from 208 to 728 fms.

Irish Distribution :—The species has not previously been recorded from British waters. All the specimens were found off the south-west coast.

Helga :—

- S. R. 171—5 XI '04.—52° 7' N., 11° 58' W., 337 fms. Trawl.—Two, 63–34 mm.
- S. R. 188—3 II '05.—51° 53' N., 11° 59' W., 320–372 fms., mud. Trawl. Temperature at 300 fms., 10·125° C., Salinity 35·5 ‰.—One, 70 mm.
- S. R. 321—1 V '06.—50° 56'–51° 0' 30" N., 11° 17' W., 480–208 fms., fine sand. Trawl.—One, 74 mm.
- S. R. 353—6 VIII '06.—50° 37'–50° 40' N., 11° 32' W., 250–542 fms., mud and sand. Trawl.—Temperature at 500 fms., 8·58° C., Salinity 35·46 ‰.—Seven, 80–30 mm.
- S. R. 482—29 VIII '07.—51° 6' N., 11° 26' W., 368 fms., fine sand. Trawl.—Three, 55–32 mm.
- S. R. 490—7 IX '07.—51° 57' 30" N., 12° 7' W., 470–491 fms., ooze. Trawl. Temperature at depth 6·68° C.—One, 80 mm.
- S. R. 502—11 IX '07.—50° 46' N., 11° 21' W., 447–515 fms. Trawl. Temperature at depth 8·8° C., Salinity 35·37 ‰.—Three, 50–30 mm.
- S. R. 504—12 IX '07.—50° 42' N., 11° 18' W., 627–728 fms., coral. Trawl.—One, 32 mm.
- S. R. 1242—14 VIII '11.—51° 27' N., 11° 55' W., 550–590 fms. Trawl.—One, 52 mm.
- S. R. 1693—20 VIII '13.—51° 30' N., 11° 51' W., 500–479 fms. Trawl.—One, 76 mm.

* Dr. Calman informs me that the female specimen has been seen by Mr. Kemp, and was referred by him to *P. sculptus*.

Polycheles sculptus, Smith.

Pl. II, figs. 1-9.

- Polycheles sculptus*, Smith, 1880 (a).
Polycheles sculptus, Smith, 1880 (b).
Pentacheles spinosus, Milne-Edwards, 1880.
Pentacheles sculptus, Smith, 1882.
Polycheles sculptus, Caullery, 1896.
Pentacheles sculptus, Alcock and Anderson, 1899.
Polycheles sculptus, Alcock, 1901.
Polycheles sculptus, Senna, 1903.
Polycheles sculptus, Stebbing, 1903.
Polycheles sculptus, Hansen, 1908.

The carapace is longer than the abdomen; its sides are almost parallel, but converge slightly in front and behind; the greatest breadth is just in front of the cervical groove. The latter is deeper than in *P. typhlops*. The rostrum is formed of two spines; there is a spine at the inner angle of the orbital sinuses, but not at the outer. The orbits are not of the same shape as in *P. typhlops*; their posterior part is not narrowed to a point, but is rounded. The margins of the sinus are not denticulate. The hind margin of the carapace is concave, and bears no spines except the two in the centre, which are the last of the median carina. The surface of the carapace is fairly smooth between the spines. The oblique line running forwards and outwards from the posterior cardiac region is without spines. The spiny armature of the carapace is more robust than in *typhlops* and is more constant in its arrangement. The spines of the median carina are arranged thus:—R + 1, 2, 1, ; 2, 2, 2. On the lateral margins there are six spines in the anterior part, three in the central, and seven behind. They diminish in size backwards, but are all larger than the corresponding spines in *P. typhlops*. There is a curved row of five small spines extending from the posterior end of the orbit to the cervical groove. There is also a ridge furnished with five or six spines between the median and lateral carinae; it is not quite parallel to the lateral margin, but curves slightly inwards. Of the two submarginal carinae the upper and outer one is very faint in its posterior part but becomes more distinct in front, and ends in a prominent tooth at the base of the antenna; the inner and lower one bears a row of well-developed teeth which decrease in size anteriorly.

The abdomen is broadest in its anterior part and tapers uniformly to the telson. The first five terga are all keeled in the median line. In the first segment the keel is not greatly developed, in the second it is larger, in the third and fourth it reaches a maximum, and in the fifth segment is slightly smaller. The dorsal median line of the sixth segment has a low unbroken double ridge. The basal part of the telson has sometimes a very small, blunt tubercle, but never anything like a well-developed spine. The first tergum has two spines at its lateral

extremities, one above and one below the point of attachment to the hind margin of the carapace. Each of the large median keels on the first five terga is in the form of a broad spine which curves forwards. The pleura of the first segment are very small. In the second segment they reach their greatest development; they overlap the pleura of the segment in front and also those behind. The pleura become successively narrower and shorter in the posterior segments. Each pleuron has a curved midrib which springs from the thickened pleurotergal suture. All the pairs of pleura are fringed with setae. On the terga of the second to fifth segments there is on each side an oblique furrow running from the postero-lateral angle towards the median keel.

The telson has a slight median ridge and tapers to a fine point. The eyestalks bear a small, blunt tubercle on the anterior margin. Occasionally it is almost absent, and apparently is not present in Indian specimens (Alcock, 1901). At the posterior end of the orbital sinus there is a small part which appears almost translucent, whereas the rest of the impacted eyestalk is hard and opaque. Smith (1882) suggests that this may represent an old corneal area, and that there was another one at the tip of the lateral process of the eyestalk.

The antennules are very like those of *P. typhlops*, but the scale is narrower and much longer than the peduncle, and has no teeth on its inner margin. The inner flagellum is very slightly longer than the antennae, and is also longer than the carapace. The outer flagellum is very short and slender, only slightly longer than the scale. There are two spines at the outer distal angle of the basal peduncular joint. The outer flagellum has a dense fringe of setae on its distal three-fourths.

The antennal scale is longer and more sharply pointed than in *P. typhlops*. It reaches almost to the tip of the peduncle and is furnished with setae on both edges, as are also the peduncular joints.

The mouth parts are practically identical in structure with those of *P. typhlops*.

The chelipeds vary from about two and a-half to three times the length of the carapace. All the joints are flattened, especially the merus and ischium. There are one or two spines on the proximal half of the upper border of the merus, and one at the distal end of the same joint; the lower margin is very minutely spinulose, sometimes almost smooth. The carpus has an upper and a lower distal spine. The lower border of the propodite is spinulose.

The other pairs of pereopods are similar to those of *P. typhlops*. The fifth are chelate in the female, while in the male the fixed finger is much shorter than the dactyl.

Neither the pleopods nor the uropods present any important differences from those of *P. typhlops*.

Size.—The largest specimen taken by the *Helga* is 75 mm. long. Alcock gives the length of one of his largest specimens

as 120 mm., and Smith's two largest measured 126 mm. and 124 mm.

The following measurements are taken from a male from station S. R. 944:—

Total length	68 mm.
Length of carapace	30 mm.
Length of abdomen	38 mm.
Breadth of carapace	32 mm.
Length of chelipeds	81 mm.
Length of ischium of chelipeds	11.5 mm.
Length of merus of chelipeds	26.5 mm.
Length of carpus of chelipeds	15.5 mm.
Length of propodite of chelipeds	25 mm.
Length of palm of chelipeds	10.5 mm.
Length of dactyl of chelipeds	14.5 mm.
Length of second pereopods	25 mm.
Length of third pereopods	22 mm.
Length of fourth pereopods	21 mm.
Length of fifth pereopods	15 mm.
Length of antennules	46 mm.
Length of antennae	45 mm.

General Distribution.—The species has been frequently taken in both the western and eastern Atlantic. It was first described by Smith from the east coast of the United States, and very soon after by Milne Edwards from the West Indies, under the name of *Pentacheles spinosus*. In the eastern Atlantic it has been taken as far north as Iceland (Hansen), and also in the Bay of Biscay (Caullery), and in the Mediterranean (Senna). Stebbing has recorded it from off Cape Natal and Alcock from the Arabian Sea. In the eastern Pacific Ocean it is represented by a var. *pacificus*, Faxon.

Vertical Distribution:—The *Helga* specimens were taken in depths of 610–982 fms. The species seems to occur most frequently between 500 fms. and 900 fms., but it has been taken in much greater depths than this, e.g., 1140–1508 fms. (Senna), and also in much shallower water, e.g., 250 fms. (Smith) and 440 fms. (Stebbing).

Irish Distribution:—This species has been taken at four stations, all on the west coast.

Helga:—

S. R. 331—9 v '06.—51° 12' N., 11° 55' W., 610–680 fms., ooze. Trawl.—One, 40 mm.

S. R. 335—12 v '06.—51° 12' 30"—51° 17' 30" N., 12° 18'—12° 16' W., 893–673 fms. Trawl.—One, 43 mm.

S. R. 506—12 ix '07.—50° 34' N. 11° 19' W., 661–672 fms. Trawl. Temperature at 600 fms, 8.22° C., Salinity 35.53 ‰.—Two, 75–44 mm.

S. R. 944.—17 v '10.—51° 22' N., 12° 41' W., 982 fms., ooze. Shrimp trawl.—Three, 68–56 mm.

Polychelus nanus (Smith).*Pentacheles nanus*, Smith, 1884.*Pentacheles nanus*, Smith, 1886.*Polycheles nanus*, Faxon, 1895.*Polycheles nanus*, Caullery, 1896.*Polycheles nanus*, Stebbing, 1908.*Polycheles nanus*, Hansen, 1908.**P. nanus**, var. **Grimaldii**, Bouvier.

Pl. I, figs. 14–15.

Polycheles Grimaldii, Bouvier, 1905 (b).

This species is closely allied to *P. sculptus* and both Faxon and Smith suggest that it may be merely a dwarf deep water variety of that species. It seems, however, to be distinguished by well-marked characters, which Smith, who has examined a large number of specimens, says are very constant. Hansen has also seen a large amount of material and is convinced that it forms a species quite distinct from *P. sculptus*.

The various spines and grooves are more robustly developed than in the last species. The sides of the carapace are slightly convex; the spines on the lateral margin are very slender and project almost at right angles; there are five or six in front, three in the central part, and seven behind. The frontal margin is concave considered as a whole, and is divided into three parts by the deep orbital sinuses. These are rounded posteriorly and do not narrow to a fine point as in *P. typhlops*. At the inner angle of each orbital sinus there is a small spine on the median lobe of the carapace in *P. Grimaldii* as described by Bouvier. As this, however, is the only difference between it and *P. nanus*, I have thought it best to give it merely the rank of a variety. Sometimes there is a blunt spine or process below the rostrum, but it is not so large as in *P. typhlops*, and is not a constant character. The rostrum is formed of two small spines. The median carina has its spines arranged as follows:—R + 1, 1, 2, 1; 2, 2, 2. The hind margin of the carapace has two small spines on each side beside the median ones. The carina which lies between the median line and the lateral margin has five prominent spines interspersed with smaller ones, and curves slightly inwards. The oblique line running outwards and forwards from the posterior cardiac region is well-marked and spiny. The submarginal carinae are well developed and furnished with distinct teeth.

The median carinal spines on the abdominal segments are longer and more strongly curved than in *P. sculptus*. The first segment, which is much narrower than the others, has two teeth on the lateral part of the tergum, one above and one below the point of attachment to the hind margin of the carapace; the carinal spine is not greatly developed. On the second segment the carinal spine is still quite low. In the next three segments, however, the median spines reach an enormous size and project

far over the preceding segments. The tergum of the sixth segment is marked by a double ridge, the edges of which are broken up into jagged teeth. On the basal part of the telson there is a sharp tooth with a very small tubercle on its posterior edge. The terga of the second to fifth segments have a deeply chiselled groove on each side, sloping upwards and forwards from the postero-lateral angle. The relative proportions of the pleura of the different segments are as in *P. sculptus*. In the present species, however, the lower edges of the pleura are minutely serrate. All the pleura are fringed with setae, as are also the telson and uropods.

The eyestalks have a small tubercle on the anterior edge, but sometimes it is very indistinct. At the posterior end of the orbital sinus there is a small translucent area on the eyestalk as there is in *P. sculptus*.

The basal joint of the antennular peduncle has two spines at its outer anterior angle. The outer flagellum is shorter than the peduncle and very slender. The inner flagellum is as long as the antennae, and longer than the carapace.

The chelipeds are extremely slender and compressed. They are much shorter than in *P. sculptus*. The merus bears a small spine on the proximal part of the upper margin, and also one at the distal extremity; the carpus also has a dorsal distal spine.

All five pairs of pereopods are chelate in both male and female.

The pleopods are similar to those of the species already described.

The three specimens taken by the *Helga* are all females, one of them ovigerous, and belong to the var. *Grimaldii*, Bouvier.

Size:—The largest specimen taken by the *Helga* measures 74 mm., exactly the same as Hansen's largest specimen. Faxon took an ovigerous female only 58 mm. long, so the size of the adult forms is considerably less than in *P. sculptus*.

The following measurements are taken from the large ovigerous specimen.

Length	74	mm.
Length of carapace	31	mm.
Length of abdomen	43	mm.
Breadth of carapace	23	mm.
Length of chelipeds	73	mm.
Length of ischium of chelipeds	14	mm.
Length of merus of chelipeds	22.5	mm.
Length of carpus of chelipeds	12	mm.
Length of propodite of chelipeds	23.5	mm.
Length of palm of chelipeds	10	mm.
Length of dactyl of chelipeds	13.5	mm.
Length of second pereopods	29	mm.
Length of third pereopods	26	mm.
Length of fourth pereopods	23	mm.
Length of fifth pereopods	20	mm.
Length of antennules	41	mm.
Length of antennae	33	mm.

General Distribution:—The species has a very wide range, being known from the east coast of North America between 35° N. and 41° N. (Smith), from Davis Straits, the west, south-west, and south of Iceland* (Hansen), from the Bay of Biscay (Caullery), Senegal (Bouvier), north-east of the Cape of Good Hope (Stebbing), and from the west coast of America between $0^{\circ} 31'$ S., and $7^{\circ} 30'$ N. (Faxon).

Irish Distribution:—The *Helga* has taken this species at one station only, and in the same haul there were several specimens of *P. sculptus*.

Helga:—

S. R. 944—17 v '10.— $51^{\circ} 22'$ N., $12^{\circ} 41'$ W., 982 fms., ooze.
Shrimp Trawl.—Three, 74–52 mm.

Vertical Distribution:—This species inhabits, as a rule, deeper water than *P. sculptus*. The greatest depth at which it has been taken is 1917 fms. (Smith), and the least, 355 fms. (Caullery). It appears to occur most commonly in about 800–1200 fms.

***Polycheles granulatus*, Faxon.**

Pl. III, figs. 1–11.

Polycheles granulatus, Faxon, 1893.

Pentacheles Beaumontii, Alcock, 1894.

Pentacheles Beaumontii, "Investigator," 1894.

Polycheles granulatus, Faxon, 1895.

Pentacheles Beaumontii, Alcock, 1901.

Polycheles dubius, Bouvier, 1905 (b).

Polycheles eryoniformis, Bouvier, 1905 (c).

? *Polycheles Beaumontii*, Stebbing, 1908.

This species differs from all the others taken by the *Helga* in the very great breadth of the carapace, in the granular surface of the latter, and in the poverty of the armature of spines.

The orbital sinuses are fairly narrow, and there is a spine at both the outer and the inner angle of each. The spine at the antero-lateral angle of the carapace is very long and sharp. There are two rostral spines. The edges of the carapace are convex; the spines with which they are furnished do not, as in the other species, diminish in size posteriorly; on the contrary, the last spines are as large as those in front. There are from seven to ten in front, three in the centre, and from twelve to fifteen behind the cervical groove. In the posterior half the edges of the carapace are tilted upwards. The cervical groove is not well marked, its anterior branch in particular being very indistinct, and there are no spines placed along it. There is no curved row of spines behind the orbit. The carina on the border

*I am indebted to Dr. Stephensen of the Copenhagen University Museum for the information that all Hansen's specimens of *P. nanus* possess the spine at the inner angle of the orbital sinus, which is the distinguishing character of the variety *Grimaldii*, Bouvier.

between the cardiac and branchial regions can be traced as a very faint curved ridge which fades away altogether in front. The hind margin is not so markedly concave as in the species already described, and is quite devoid of spines. The whole surface of the carapace is covered with very minute tubercles or granules. The median carina of the carapace is formed of a double row of large granules, and is furnished with very few spines. These are rather variable in number. In the *Helga* specimen there are three single spines between the rostrum and the cervical groove; in Alcock's specimen there is a single spine, a double, and another single; in Faxon's specimen two double spines and a single. In Bouvier's *P. eryoniformis*, which is probably a synonym of *P. granulatus*, there are two single spines in front of the cervical groove and two double ones behind it; none of the others have spines behind the groove. The submarginal carinae are very indistinct, the upper and outer one particularly so.

The abdominal segments are also granular. There are median carinae on the first five segments. The first three come to more or less sharp points which are directed forwards; the fourth is not produced to a point at all, and the fifth is reduced to a mere blunt ridge. The sixth segment is quite smooth. On the basal part of the telson there is a blunt tubercle, but no spine. On the second to fifth segments there is a groove sloping upwards and forwards from the postero-lateral angle of the tergum towards the median line. The pleura have smooth edges and are of the usual relative sizes.

There is a spine on the anterior end of the eyestalk.

The antennular scale is very broad; its inner edge is furnished with four or five teeth. The tip of the scale is bent inwards and upwards and ends in a long sharp point. There is a single spine at the outer angle of the basal peduncular joint.

The antennal scale is leaf-like, with a blunt tip, which does not quite reach the end of the peduncle. In Faxon's specimen the antennal scale is longer than the peduncle, in Alcock's "almost as long as the peduncle."

The oral appendages are very similar to those of *P. typhlops* and *P. sculptus*.

The chelipeds are considerably longer than the body and are compressed. The merus has a row of fairly prominent spinules on its lower edge; they decrease in size towards the distal end. At the latter there is a single curved spine on the dorsal side, which also bears a row of very minute spinules. The carpus has an upper and a lower distal spine. The propodite, which is slightly longer than the merus, has a spine at the base of the dactyl and both its edges are spinulose.

The other pairs of pereopods and the abdominal appendages present no points of difference from those of the three species already described.

Size.—The single specimen taken by the *Helga* measures

76 mm. Alcock's specimen was 80·5 mm. long, and Faxon's 99·5 mm. A specimen of *P. dubius* (= *granulatus*) taken at the Azores reached the length of 112 mm. (Bouvier).

The following are the dimensions of the single Irish specimen:

Length .. .. .	..	..	76 mm.
Length of carapace	..	..	36 mm.
Length of abdomen	..	..	40 mm.
Breadth of carapace	..	..	29·5 mm.
Length of chelipeds	..	..	92 mm.
Length of ischium of chelipeds	..	..	15 mm.
Length of merus of chelipeds	..	..	25·5 mm.
Length of carpus of chelipeds	..	..	18 mm.
Length of propodite of chelipeds	..	..	29 mm.
Length of palm of chelipeds	..	..	13·5 mm.
Length of dactyl of chelipeds	..	..	15·5 mm.
Length of second pereopods	..	..	31 mm.
Length of third pereopods	..	..	29 mm.
Length of fourth pereopods	..	..	25 mm.
Length of fifth pereopods	..	..	19 mm.
Length of antennules	..	..	58 mm.
Length of antennae	..	..	54 mm.

There seems to me to be no doubt that *P. Beaumontii*, Alcock, is merely a synonym of *P. granulatus*, Faxon. Alcock (1894) gives the following four distinctive characters for his species:—(1) Great breadth of carapace; (2) the diminutive size of antennular scale; (3) the deficient spinature of the median carina of the carapace; (4) the great length of the chelipeds. Of these, the first, third, and fourth are equally characteristic of Faxon's species, and as the latter writer points out (1895) the form of the antennules of Alcock's specimen must have been due to "malformation or mutilation." The figure of *P. Beaumontii* (*Investigator*, 1894) appears to support this view, and in his later description (1901) Alcock says:—"The antennular scale appears to have been of the broad type of *P. gibbus* and *P. Carpenteri*."

The Irish specimen is in many respects intermediate between *P. granulatus* and *P. Beaumontii*. *P. dubius* (Bouvier) is also clearly a synonym of *P. granulatus*; it appears to agree very closely with the *Helga* specimen. More doubtful is the case of *P. eryoniiformis*, Bouvier, in which there are faint ridges behind the orbits, and "carènes branchiales armées de fortes spinules" which are quite wanting in the other specimens.

Stebbing (1908) mentions specimens from about 40 miles N.E. of the Cape of Good Hope, which he doubtfully refers to *P. Beaumontii*; from his description, however, I do not think they can belong to that species. His specimens have two spines at the outer angle of the basal peduncular joint of the antennules, and also differ in other points.

General Distribution.—The species has been recorded from the

Gulf of Panama* (Faxon), from off Colombo (Alcock), from the Azores, Cape Verdes, south of Madeira and coast of Spain (Bouvier).

Irish Distribution.—Only a single specimen has been taken in Irish waters.

Helga.

S. R. 593—6 VIII '08. 50° 31' N., 11° 31' W., 670–770 fms., ooze. Trawl. Temperature at 650 fms., 7.75° C.; Salinity 35.53‰—One, 76 mm.

Vertical Distribution.—The greatest depth for the species is 1,076 fms. (S. of Madeira); the others range from 675 fms. (off Colombo) to 899 fms. (Gulf of Panama).

Eryonicus, Spence Bate.

Eryoneicus, Spence Bate, 1888. *Eryonicus*, Faxon, 1895.
Eryonicus, Alcock, 1901.

This genus was founded by Spence Bate on a very small specimen 13 mm. long, which was taken by the *Challenger* near the Canary Islands. He gave to this specimen the name of *E. coecus*, but, owing to the immaturity of the original of his description, it is difficult to refer adult specimens to the same species with certainty. Faxon, however, identified several specimens taken by the *Albatross* off the west coast of Central America as belonging to Bate's species. He gives a very complete and detailed account of these specimens, but it is very doubtful whether they really belong to *E. coecus*. Since then *Eryonicus* has been taken in several parts of the Atlantic, in the Mediterranean, and in the Indian and Pacific Oceans.

Though *Eryonicus* and *Polycheles* are distinguishable at a glance, yet examination shows that in very many points there is close approximation between the two genera. The chief characteristics which distinguish *Eryonicus* are (1) the extreme inflation of the carapace, which is sometimes almost spherical, and is larger than the abdomen; (2) the very peculiar form of the renal tubercle of the antennae which is produced to an extraordinary length, nearly equalling the peduncle itself, in the form of a slender cylindrical rod projecting inwards and forwards; (3) the shortness of the antennules and antennae which are less than half the length of the carapace; (4) the shortness of the chelipeds, (5) the almost membranous character of the integument.

The spiny armature of the carapace and abdomen is on the same plan as in *Polycheles*, the spines being usually confined to certain definite carinae. Sometimes, however, there are also spines scattered over the intercarinal surface of the carapace.

The eyestalks are of the same form as in *Polycheles*, but they do not so completely fill the orbital sinuses, nor is the outer lateral process so well developed, indeed in small specimens the latter

* *P. granulatus* has also been taken at a number of stations near the Hawaiian Islands (Rathbun, 1906.)

is sometimes hardly distinguishable. Usually there is a blunt conical tubercle on the front of the eyestalk and this may possibly represent the remains of the eye itself.

The oral appendages are similar to those of *Polycheles*.

The pereopods are also on the same plan as in the last genus, but the chelipeds are shorter and there are differences in the arrangement of the spines.

Except on the first abdominal segment, where they are modified in the usual manner in adults, and are small and slender in immature individuals, the pleopods are long and well developed. There is an *appendix interna* with distal hooklets on the endopodites.

The telson and uropods are very similar to those of *Polycheles*.

The branchiae are as described by Faxon, formed of a stem which gives off long delicate filaments which decrease in size towards the tip. In the specimens which I have examined the epipodite of the third maxillipedes is large and well developed, but those of the first four pairs of pereopods are very small and feeble. The branchial formula is as follows:—

	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	ep.	—	ep.	1+ep.	1+ep.	1+ep.	1+ep.	—
Arthrobranchs.	—	—	1?	2	2	2	2	—
Pleurobranchs.	—	—	—	—	1	1	1	1

I have been unable to find any trace of an arthrobranch on the third maxillipedes. In speaking of *Polycheles* Alcock says that this is sometimes very small and may be altogether absent, and it would seem as if the same were true of *Eryonicus* for Faxon mentions the arthrobranch in his description.

It has been suggested by more than one author that these interesting crustaceans are not adult forms, but are merely a stage in the development of *Polycheles*. This view was put forward by Spence Bate in his original description, and has been supported by some on the ground that no specimen has been found bearing ova, that the first pleopods are of an immature type, and that the whole aspect of the animal is that of a larval form. On the other hand, Faxon had in his collection a specimen measuring 62.5 mm., and another of 40 mm., and it is difficult to believe that animals of such large size should be merely larval forms, especially when we know that perfectly formed specimens of *Polycheles* have been found measuring no more than 30 mm. Moreover in Faxon's largest specimen he showed that the first pair of pleopods were developed with a broad expanded distal part just as in adult males of *Polycheles*. This individual had also an *appendix masculina* in addition to an *appendix interna* on the second pair of pleopods. Bouvier (1905 (b.)) has also described an adult male measuring 35 mm., the type specimen of *E. spinoculatus*. In one of the *Helga* specimens also the first pleopods are well developed and of the normal male type

This specimen is 34 mm. long. That no ovigerous female has yet been captured is not a serious difficulty when it is remembered that only about thirty-five specimens have been taken in all.

The *Helga* has captured ten specimens, including the types of three new species. Of these one, *E. hibernicus*, belongs to the division of the genus in which the carapace spines are confined to a few definite rows as in *E. coecus*, *E. Faxoni*, etc. The other two, *E. Scharffi* and *E. Kempfi*, belong to the group containing *E. spinulosus* and *E. Puritanii*, in which the spines are scattered over the whole of the carapace. Perhaps the most interesting of all the specimens taken by the *Helga* is a very small individual measuring only 7 mm., in which the rostrum has the form of a very long median spine, and only two pairs of thoracic legs are developed. On these, however, and on the second and third maxillipedes there are slender exopodites, so that it is really a young *Eryonicus* in the *Mysis* stage of development.

Eryonicus leads a free-swimming life at a considerable distance from the bottom. Most of the *Helga* specimens were taken by the midwater otter trawl. Others were taken by the beam trawl, but these must have been caught as the latter was being hauled to the surface. The great soundings at some of the stations where specimens have been taken may be very deceptive. Faxon mentions a case where the depth was 1168 fathoms, and where four specimens were caught less than 400 fathoms below the surface. Another of the *Albatross* specimens was taken by the trawl where the depth was only 384 fathoms. These facts would seem to show that *Eryonicus* sometimes comes to within a comparatively short distance of the surface.

Ten species are known so far and a key for the determination of these is given below.

Key to species of *Eryonicus*.

- | | |
|---|------------------------------|
| 1. a. Carapace spines almost entirely confined to definite rows, | 2 |
| b. Carapace spines not confined to definite rows but also scattered generally over surface, .. | 7 |
| 2. a. Two median spines on basal part of telson, | <i>E. coecus</i> , Sp. Bate. |
| b. One median spine on basal part of telson, | 3 |
| 3. a. Spines on anterior part of median row of carapace: <i>rostrum</i> +1, 1, 2, 1, 1, | 4 |
| b. Spines on anterior part of median rows of carapace: <i>rostrum</i> +1, 2, 1, 1, | 6 |
| 4. a. One spine on outside of basal joint of antennular peduncle, | <i>E. indicus</i> , Alcock. |
| b. Two spines on outside of basal joint of antennular peduncle, | 5 |

5. *a.* Abdominal median spines : 1, 1, 3, 3, 3, 2, 1,
E. spinoculatus, Bouvier.
b. Abdominal median spines : 1, 1, 2, 2, 2, 1, 1,
E. hibernicus, n. sp.
6. *a.* Spines on posterior part of median carapace
 carina : 2, 2, 1, 2, .. *E. Faxoni*, Bouvier.
b. Spines on posterior part of median carapace
 carina : *tubercle*, 2. Carapace broader than
 long, *E. Alberti*, Bouvier.
7. *a.* Tip of telson bears four very long and slender
 pinnate processes, .. *E. Puritanii*, Lo Bianco.
b. No such processes present, 8
8. *a.* Basal part of telson bears two median spines,
E. spinulosus, Faxon.
b. Basal part of telson bears one median spine, .. 9
9. *a.* Basal joint of antennular peduncle bears one
 external spine, *E. Scharffi*, n. sp.
b. Basal joint of antennular peduncle bears two
 external spines, *E. Kempfi*, n. sp.

***Eryoneicus Faxoni*, Bouvier.**

Pl. IV, figs. 1-5.

Eryoneicus Faxoni, Bouvier, 1905 (*a*).

Eryoneicus Faxoni, Bouvier, 1905 (*b*).

This species is in many ways very similar to that described by Faxon (1895) as *E. coecus*, Spence Bate, but it possesses several characters which at once serve to distinguish it.

It has the large and globular carapace characteristic of the genus. It is broadest in the branchial region and narrows considerably anteriorly; the posterior end is somewhat truncate but has rounded angles. When seen in profile the top of the carapace appears almost flat, ascending slightly from back to front, till it reaches a point three-fourths of the length from the hind margin, when it turns abruptly downwards, sloping very steeply, almost vertically, to the rostrum. *E. Faxoni* belongs to the division of the genus in which the spines on the carapace are almost entirely confined to definite rows running length-wise along the surface. Between these rows the carapace is devoid of spines, and has merely a few setae scattered over it. The rostrum is marked by a pair of small spines in the centre of the frontal margin between the orbital sinuses. The internal angle of each sinus is also marked by a spine sharper but not so thick as the rostral ones. The sinuses themselves are fairly deep and very broad, and do not become narrower backwards. Externally each is bounded by a sharp spine, which is the most anterior of a row extending along the whole lateral margin

of the carapace. These marginal spines are arranged as follows : in the front part there are six which are sharp and slightly curved forwards ; in the centre there are three very small, and in the hind part seven large spines, these latter thicker and blunter than the others ; they increase in size posteriorly. Along the median dorsal line there runs a series of prominent spines arranged thus :—

Rostrum + 1, 2, 1, 1, ; 2, 2, 1, 2,

(The semicolon denotes the position of the cervical groove.)

Between this median carina and the lateral margin on the posterior half of the carapace there is a row of six spines, the *branchial carina*, decreasing slightly in size anteriorly. These run parallel to the margin and are nearer it than to the median carina ; they extend from the hind margin to the cervical groove. There is a large single spine at the point of bifurcation of the cervical groove, one immediately in front of this, and also one external to it. Of the submarginal carinae the upper is minutely denticulate in its anterior third, and fades away behind this ; while the lower and shorter one is formed of eight or nine spines, the last three of which are small, but the others large and prominent. Between the orbital sinus and the lower part of the cervical groove there is a curved row of three or four very small spines.

The abdomen is shorter than the carapace and very much narrower ; it tapers slightly posteriorly. Each segment bears one or more large median dorsal spines arranged thus : 1, 3, 3, 3, 3, 1, 1, the last on the basal part of the telson. In the triple spines of the central segments the middle point is the largest and the front one is usually less erect than the others, sometimes almost horizontal. Besides these the abdominal segments bear other spines. On the sixth segment there is one at each edge of the tergum, and one projecting backwards horizontally from each postero-lateral angle. On the second, third, fourth, and fifth segments there is a spine at each edge of the tergum and also one on the middle of each pleuron. The pleura of the first segment are narrow and tapering. At each side of this segment there is a lateral extension which is buckled firmly to the hind part of the carapace. The second pleura are broad and expanded, with six or seven small spines on the lower margin. The pleura of the next three segments are all narrower than those of the second, and have each four or five marginal spines. The sixth pleura end in a single sharp point. They all bear setae at least on their posterior margin.

The telson is long and tapering, and has small spines on either margin and on two ridges running along the dorsal surface, besides the single large spine already mentioned. Its tip is prolonged into a sharp needle-like point.

The eyestalks are fixed and immovable in the orbital sinuses. Each bears in front a blunt conical process.

The basal joint of the antennular peduncle has two spines at the outer angle ; the third joint is much shorter than the second. The scale extends beyond the peduncle and tapers to a sharp point ; its inner edge bears two or three small teeth. The outer flagellum is very thin and less than half as long as the stout inner one.

The antennae are about equal in length to the larger flagella of the antennules. The scale is narrow and oval and fringed with plumose setae ; it reaches just beyond the peduncle. The renal tubercle is about equal in length to the whole peduncle.

The oral appendages are similar to those of *Polycheles*.

The chelipeds are nearly as long as the body without the telson, and are compressed in all their joints. The shape and relative lengths of the different joints are the same as in *Polycheles*. Both margins of the merus are spinulose, but the outer edge has only two or three spinules near the proximal end and a single curved distal spine, the inner having a row of very small spinules. The carpus has the usual upper and lower distal spines, and the propodite has one above the base of the dactyl.

The second pereopods are much shorter than the chelipeds, and are also compressed. The merus is long and stout and thickly covered with setae on both margins. It bears two large distal spines and also two near the middle. The carpus has a long proximal and two distal spines, and setae on the outer margin. The palm of the propodite is very slightly larger than the fingers.

The third and fourth pereopods are shorter than the second, and have no spines except a single one at the distal end of the merus and carpus.

The fifth are the shortest of all. They have no spines and are imperfectly chelate, the fixed finger of the propodite being represented by a very short blunt process.

The first pleopods are very small and extremely slender two-jointed appendages.

The succeeding pairs are long and well developed, and are fringed with long pinnate setae. An *appendix interna* is present furnished with a group of hooklets at the distal end.

The uropods are slightly shorter than the telson. Both the exopodite and endopodite have spinules and long setae on their margins.

Size.—The largest specimen taken by the *Helga* measures 35 mm. Bouvier gives the length of his as 30 mm.

The chief measurements of the largest specimen are as follows :—

Length	35 mm.
Length of carapace	18 mm.
Breadth of carapace	16 mm.
Length of abdomen	17 mm.
Length of antennules	10 mm.
Length of chelipeds	26 mm.

General Distribution.—The type specimen was taken by the *Talisman* off Cape Cantin, on the west coast of Morocco, and another individual of the species was captured by the *Princesse Alice* in the Mediterranean, south of Majorca.

Irish Distribution.—

Helga.—

S. R. 335—12 v '06.— $51^{\circ} 12' 30''$ – $51^{\circ} 17' 30''$ N., $12^{\circ} 8'$ – $12^{\circ} 16'$ W. 893–673 fms. Trawl.—One, ca. 18 mm.

S. R. 397—2 II '07.— $51^{\circ} 46'$ N., $12^{\circ} 5'$ W., 549–646 fms. Trawl.—One 13.5 mm.

S. R. 443—16-17 v '07.— $51^{\circ} 28'$ N., $12^{\circ} 5'$ W. Soundings 683 fms. Midwater otter tra 10–500 fms. Temp. at surface 11.65° C. Salinity 34.96 ‰.—One, 35 mm.

S. R. 449—19 v '07.— $50^{\circ} 28' 30''$ N., $11^{\circ} 39'$ W. Soundings 950 fms. Midwater otter trawl 0–700 fms.—One, 15 mm.

S. R. 806—15 VIII '09.—68 mls. W. $\frac{1}{4}$ N. of Tearaght Light. Soundings 634–651 fms., ooze. Midwater otter trawl 0–550 fms.—One, 24 mm.

I have referred these five specimens to Bouvier's species but the identification is open to doubt except in the case of the individual from station S. R. 443 which agrees exactly with the original description. The others are absolutely similar with the exception of the arrangement of the median abdominal spines. In the five specimens these are arranged as follows:—

S. R. 443	..	..	..	1,	3,	3,	3,	3,	1,	1.
S. R. 335	..	..	..	1,	2,	3,	3,	2,	1,	1.
S. R. 806	..	..	..	1,	1,	3,	3,	2,	1,	1.
S. R. 397	..	..	..	1,	1,	2,	2,	2,	1,	1.
S. R. 449	..	..	..	1,	1,	2,	2,	2,	1,	1.

It will be seen that with the exception of the last two, the arrangement of the spines is different in every case. I have placed them in such order as will best show that there is a distinct gradation from the first to the last. Moreover the specimens from stations S. R. 397 and S. R. 449, in which the spines are fewest are the smallest, so that the differences may be due, partly at least, to age.

Vertical Distribution.—As these organisms lead a free-swimming life at a considerable distance from the bottom it is very difficult to say exactly at what depth they were captured by the net. We may safely conclude that those specimens which were found in the trawl were caught as the latter was being hauled to the surface, and not on the bottom, but there is no means of knowing at what depth they entered the net.

Eryonicus hibernicus, n. sp.

Pl. V, figs. 1-2.

In general appearance this species closely resembles *E. Faxoni*, but is distinguished by certain well-marked characteristics. It has the spines of the carapace confined to definite rows, and not scattered thickly over the whole surface. The rostrum is double, and immediately below it there is a small median spine; the latter is not present in *E. Faxoni*. The whole surface of the carapace is more or less setiferous, being especially so about the rows of spines. The spines of the median carina are arranged as follows:—

Rostrum+1, 1, 2, 1, 1; 2, 2, 1, 2.

The carina between the cardiac and branchial regions is marked by five or six large spines. The lateral margin has six spines on the anterior part, three in the middle, and seven on the posterior part. The upper submarginal carina is faintly seen in its front part but dies out towards the hind margin. The lower submarginal carina is furnished with ten or twelve medium-sized spines. Behind the orbital sinus there are four small spines in a row, which curves towards the median line and ends in a large spine on the anterior branch of the cervical groove. There is a single spine at the point of bifurcation of the cervical groove, and also one on the space between the anterior and posterior branches. There is also a spine on the cardiac region between the median and branchial carinae, and finally, a spine on each side of the median line on the hind margin of the carapace.

The abdominal median spines are arranged as follows:—1, 1, 2, 2, 2, 1, 1, the last being on the basal part of the telson. The double spines on the third, fourth, and fifth segments are different in shape from those of other species. They are very broad and the lower portions of the two spines are united; they become separate only comparatively near the tip. On the second to fifth segments there is a spine at the lateral edge of the tergum, and also one on the pleuron. This latter spine in the sixth segment is situated at the upper posterior angle of the pleuron and projects over the base of the uropods. The pleura of the second segment are much broader than the others; they bear a row of teeth on their lower edge. The pleura of the other segments become successively narrower until in the sixth they end in a single sharp point. The pleura of the first segment are merely rudimentary as usual. The telson tapers to a sharp point, and bears small spines on either edge, and a double converging row of spinelets on its dorsal surface.

The eyestalks nearly fill the orbital sinuses; each bears a blunt tubercle in front, and has a fairly large lateral process developed which passes outwards and downwards beneath the antero-lateral angle of the carapace.

There are two spines at the outer angle of the basal peduncular joint of the antennules. The sharp narrow scale passes the end of the peduncle of which the ultimate joint is the smallest.

The antennae are similar to those of *E. Faxoni*.

The outer margin of the merus of the chelipeds has one large proximal spine, and one curved distal one. Except for these both margins are smooth. The carpus has an upper and a lower distal spine. The propodite is not spinulose; it bears a single spine at the base of the dactyl.

On the merus of the second pereopods there are two spines at the middle of the outer side, and two at the distal extremity. The carpus has one proximal, and three large and one or two small distal spines.

The third and fourth chelipeds have each a distal spine on the merus and the carpus.

All the pereopods are chelate except the fifth, in which the fixed finger of the propodite is represented by a short process not half as long as the dactyl.

The first pleopods are of the adult male type as seen in *Polycheles*. They have the same expanded distal part, with a group of hooklets on a small tubercle near the distal end of the inner margin.

The other pairs of pleopods are similar to those of *E. Faxoni*. There is no *appendix masculina* on the second pair.

The uropods bears small spines on the external margin. They are considerably shorter than the telson. At the outer angle of the basal part of the uropods there is a minute spine which is not present in *E. Faxoni* (see fig 2).

Fringes of setae are present on the edges of the pleura, and uropods, on the telson, the median carina of the abdominal segments, and on the pereopods, except the first pair.

In the single specimen taken by the *Helga* the length of the carapace is 18 mm., of the abdomen, 16 mm. The greatest breadth of the carapace is 14 mm.

Size.—The measurements of the single specimen are as follows:—

Length	..	..	..	..	..	34 mm.
Length of carapace			..	..	..	18 mm.
Breadth of carapace			..	..	..	14 mm.
Length of abdomen			..	..	..	16 mm.
Length of antennules			..	..	..	10 mm.
Length of chelipeds			..	..	..	20 mm.

Helga.—

S. R. 231—20 v '05. ca. 50 mls., N. by W. of Eagle Island, Co. Mayo, 55° 1' N., 10° 45' W. Soundings 1,200 fms. Midwater otter trawl, O—1,150 fms., One, 34 mm.

Eryonicus Scharffi, n. sp.

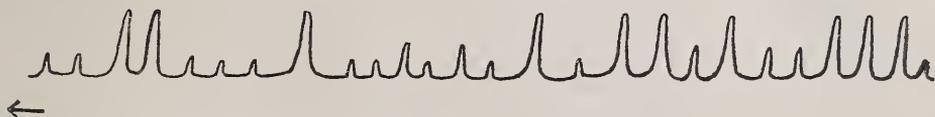
Pl. V, figs. 9-12.

The spines on the carapace are not confined to definite rows, but are also present on the surface between these. Two species of this sort have already been described, *E. spinulosus*, Faxon, from the Gulf of Panama, and *E. Puritanii*, Lo Bianco, from the Mediterranean, from both of which the present species is distinguished by several well-marked characteristics.

The ventral part of the carapace is more distinctly flattened than in the other species. The rostrum is marked by two long spines, and on either side of it the front of the carapace is produced into a horn-like process; these horns end in sharp spines and have also smaller spines on both edges. The arrangement of the spines on the median dorsal line is quite unlike that in any previously described species of *Eryonicus* :—

Rostrum + 2, 1, ; 2, 2, 1, 1, 2, 1, 2, 2.

It will be seen that there are only two spines between the rostrum and the cervical groove, one double and one single, while behind it there are no less than eight, five of which are double. The row of spines separating the cardiac from the branchial areas is very obscure, and is hardly distinguishable among the crowd of long, slender spines scattered over the carapace surface. The lateral margin has seven anterior spines on one side and eight on the other; in the central part there are four, of which the most posterior is smaller than the others; on the hind part there are ten large blunt spines interspersed with about fifteen or sixteen much smaller ones as in diagram :—



The orbital sinuses are shallow and wide.

The upper submarginal carina bears seven or eight large spines interspersed with a few smaller ones in its posterior third, but in front it becomes very faint, being marked by a few denticles, and ending in the usual spine at the base of the antenna. The lower submarginal carina is denticulate in front and bears five or six prominent spines posteriorly.

As already mentioned, the whole of the carapace surface, both above and below the lateral margin, is covered with spines which are not arranged in definite rows; they are largest towards the posterior end of the carapace, and are interspersed with setae, which are especially numerous on the lateral margin and on the median carina.

The median spines on the abdominal segments are arranged as follows :—2, 2, 2, 2, 2, 1, 1, the last being on the basal part of the telson. There are also other smaller spines present on each segment :—

First Segment.—Central double spine; and on each side two small spines on posterior margin.

Second Segment.—Central double spine ; one large spine at each side of tergum, and one large and one small on each side of posterior margin.

Third Segment.—Central double spine ; one at each side of tergum, one on each pleuron, and one small spine on each side of middle of posterior margin of tergum.

Fourth Segment.—Central double spine ; one at each side of tergum, two on each pleuron, and two small ones on each side on posterior margin of tergum.

Fifth Segment.—Central double spine ; one at each side of tergum, and two on each pleuron, near the posterior edge.

Sixth Segment.—Central single spine ; one at each side of tergum, and one at upper posterior angle of pleuron extending over base of uropods.

In the double spines the anterior point is the larger, and it is more or less erect, though often curving backwards near the tip ; the posterior halves are inclined at an angle of about forty-five degrees to the horizontal.

The pleura of the first segment are very small and narrow. Those of the second segment are broader than any of the others ; their lower margin is rounded and bears a row of small teeth. In the third and fourth segments the pleura taper slightly downwards, and are also furnished with teeth near their extremities. The fifth pleura are very narrow and end in a long spine in front of which are one or two teeth. In the sixth segment they are narrower still and taper to a needle-like point.

The telson bears a single large median spine near its base, and tapers to a sharp point. Its edges bear small spines, and are also fringed with setae. There are no spinules on the dorsal surface.

The median line of the abdominal segments bears a number of stiff setae scattered about the bases of the large spines.

The eyestalks bear a small tubercle on the anterior margin ; they do not completely fill the orbital sinuses.

The basal joint of the antennular peduncle has only a single spine at its outer anterior angle. The scale ends in a sharp inturned point and has six or seven spines on the inner edge.

The antennal scale is narrow and has a rounded tip ; it is fringed with setae, and reaches to the end of the peduncle.

The chelipeds are shorter than the body. The merus is spinulose on both margins, and has the usual distal spine. The carpus has an upper and a lower distal spine. The margin of the propodite is spinulose from the proximal end to the base of the dactyl, where there is a single spine. The basus bears a spine just below the beginning of the ischium.

The second pereopods are much stouter than the succeeding pairs, but shorter and slenderer than the chelipeds. The merus is slightly thicker in its distal portion than near the base ; slightly more than half-way to the distal end it bears three large and three or four small spines on its outer margin ; at

the distal end there are three larger spines. The carpus has on its outer margin one proximal, two central, and three distal spines, all of which are large; there are also two or three small distal spines. As usual the palm of the propodite is longer than the fingers, which have minutely serrate cutting edges and the tips of which cross one another. The propodite, carpus, and distal part of the merus bear setae on the outer edge.

In the third pereopods the dactyl is slightly larger than the fixed finger. The carpus has a single distal spine.

The fourth pereopods are shorter and feebler than the third, and the carpus has no distal spine.

In the very short and slender fifth pereopods the fixed finger is represented by a very small process of the propodite.

The pleopods are well-developed, biramous appendages, except the first pair, which are small and rudimentary.

The basal joint of the uropods bears a small spine at its outer angle. Both exopodite and endopodite are considerably shorter than the telson and are fringed with setae. The uropods have no spines on their margins.

Size.—The principal dimensions of the single specimen taken by the Helga are as follows:—

Length	..	..	..	..	26.5 mm.
Length of carapace	..	..	..	..	15.5 mm.
Length of abdomen	..	..	..	..	11 mm.
Breadth of carapace	..	..	..	..	14 mm.
Length of chelipeds	..	..	..	..	22 mm.

Irish Distribution :

Helga.—

S. R. 193—10 II '05.—40 mls., N. by W. of Eagle Island, Co. Mayo, 54° 50' N., 10° 30' W. Soundings 650 fms. Triangle net, O—630 fms. Surface temperature, 9.6° C. Salinity 35.41‰; at 480 fms., temperature 9.2° C., One, 26.5 mm.

Eryonicus Kempfi, n. sp.

Pl. V, figs. 3–8.

This species belongs to the division of the genus in which the carapace is more or less densely covered with spines, between, as well as on, the definite ridges. The spines, however, are not so thickly scattered as in *E. Scharffi*, and they are rather shorter than in that species. The inter-carinal spines are almost entirely absent on the submarginal part of the carapace, being represented merely by a small group near the posterior end. On the upper branchial, cardiac and gastric areas, however, they are present in large numbers, interspersed with setae. The carapace is very broad in its posterior half; in the branchial region its breadth is greater than the length from rostrum to hind margin. It narrows rapidly in front, and the anterior end is somewhat rounded as seen from above. In the cardiac region the surface

is almost flat. The frontal margin is produced into a horn on each side of the rostrum; each horn ends sharply in a short spine and also bears a few small spines on its sides. Immediately beneath the rostrum, which is formed of two spines, there is a single median spine directed downwards. The gastric surface slopes downwards very steeply, almost vertically, to the rostrum. The hind margin of the carapace is concave. The spines of the median carina are arranged thus:—

Rostrum + 1, 1, 1, 2, 1; 2, 2, 1, 2.

On the front part of the lateral margin there are seven or eight spines, in the middle five or six, and posteriorly, from seventeen to twenty. These latter increase in size towards the hind margin. The branchial carina consists of ten or eleven spines. The upper submarginal carina has six spines at the posterior end, practically disappears in the middle, but is continued anteriorly as a low ridge bearing a large number of spinules, and ending in a strong spine opposite the base of the antenna. The lower submarginal carina has twelve or thirteen spines, extending almost to the base of the chelipeds; they are not quite so large as those of the upper row. Along the edge of the upper part of the cervical groove there are three or four sharp spines. As already mentioned, the intercarinal spines are most plentiful above the branchial ridge, less common between the latter and the lateral margin, and practically disappear below this. The setae are most plentiful on the carinae.

The median spines on the abdominal segments are arranged as follows:—1, 3, 3, 3, 3, 1, 1, the last on the base of the telson. In addition to these the segments bear other spines. On the sixth there is one at each postero-lateral angle, and one at each edge of the tergum, and a very small one just in front of this. The fifth has one at each side of the tergum, with a smaller one in front of it, and one on the middle of each pleuron. On the second, third, and fourth segments there is likewise a spine at each lateral end of the tergum, and one on each pleuron, and on the second and third only, a single spine on the tergum, between the median line and the edge of the tergum.

The pleura of the first segment are very small and narrow; in the second segment they are broad and expanded, and on their lower margin they have a row of spinules. The third, fourth, and fifth pleura are narrowed, and have each five or six small spines at their extremities. In the sixth segment the pleura end in a single narrow tapering point.

The telson has a row of seven or eight spines along each margin, but none on its dorsal surface.

There is a short, blunt tubercle on the front of the eyestalk. The eyestalks do not quite fill the wide orbital sinuses.

The antennular scale ends in a narrow spine, not quite reaching the end of the peduncle. Its inner margin bears five or six spines, and also pinnate setae. At the outer angle of the basal peduncular joint there are two spines. The third joint is shorter

than the second. The inner flagellum is about two-thirds the length of the carapace.

The last three joints of the antennal peduncle have each a thick spine on the inner side. The renal tubercle is not as long as the peduncle. The scale is narrow and leaf-like, fringed with pinnate setae, and does not quite reach the tip of the peduncle. The flagella are slightly shorter than the inner branch of the antennules.

The chelipeds are shorter than the body. Both margins of the merus are spinulose. The outer margin has only five or six spinules, the inner many more, but these much smaller. At its distal end it bears two curved spines. The carpus has the usual upper and lower distal spines, and has also a row of minute spinules on its outer edge, as has also the palm of the propodite. At the base of the dactyl there is a single spine.

The merus of the second pereopods has a row of five or six long spines on the posterior margin, and four similar spines on the outer side. The carpus has also five spines on its posterior margin, and two at the distal end; it bears a heavy fringe of setae on the outer side.

The third and fourth pereopods are shorter than the last and very slender. They are devoid of setae except for a tuft at the end of the merus, and a similar one on the carpus.

The fifth pereopods are very slender and feeble, and are almost simple, the fixed finger being represented by a very short process of the propodite. They are fringed with setae throughout.

The first pair of pleopods are very small and feeble two-jointed structures.

The second to fifth pairs of pleopods are very long and slender, the distal portions being fringed with long pinnate setae. An *appendix interna*, with an inner distal group of hooklets, is present.

At the external angle of the basal part of the uropods there are two small spines on one side, but only one on the other. The outer margins of the uropods bear a few small spines. The exopodite is much broader than the endopodite. Both are very nearly as long as the telson.

Size.—The principal dimensions of the type specimen are as follows:—

Total length	..	..	..	..	25 mm.
Length of carapace	..	..	..	..	13 mm.
Length of abdomen	..	..	..	..	12 mm.
Breadth of carapace	..	..	..	..	15 mm.
Length of antennules	..	..	..	..	8.5 mm.
Length of chelipeds	..	..	..	..	18.5 mm.

Two specimens of this species have been taken by the *Helga*, both off the west coast.

Helga.

S. R. 332—10 v '06. 51° 12' N., 12° 2' 30" W., 680–735 fms., ooze. Trawl—One, 25 mm.

S. R. 752—16–17 v '09. 51° 48' N., 12° 11' 30" W. Soundings 523–595 fms., ooze. Midwater otter trawl, O–595 fms, Surface temperature 11.9° C. Salinity 35.32‰; at 10 fms., temperature 11.51° C. Salinity 35.34‰; at 50 fms., temperature 10.54° C. Salinity 35.32‰; at 100 fms., temperature 10.45° C. Salinity 35.34‰; at 200 fms., temperature 10.18° C. Salinity 35.32‰; at 500 fms., temperature 8.9° C. Salinity 35.43‰.—One, 22 mm.

Eryonicus sp. juv.

Pl. IV, figs. 6–9.

This very interesting specimen was taken by the midwater otter trawl off the south-west coast; at the same station a small *E. Faxoni* was taken, and it is possible that the present specimen belongs to the same species. It is a very immature individual, in which only the first two pairs of pereopods are developed, and these, as well as the second and third maxillipedes are furnished with exopodites. It is, in fact, a young *Eryonicus* in the *Mysis* stage of development, and the first that has been found, so far as I am aware.

The carapace is very much inflated, and is almost spherical. The rostrum is very long and slender; on each side of the base there is a small spine, probably representing the spine at the internal angle of the orbit of the adult. The median row of spines is well developed, and has the following arrangement:—

Rostrum + 1, 2, 1, 1, ; 2, 2, 1, 2.

The lateral margin is not at all clearly defined, and there is hardly a trace of branchial or submarginal carinae. There are four spines in a curved row behind the orbit, which is very wide and shallow. A few spines are present on the carapace besides those of the median carina. All the large spines on the carapace have setae springing from them. On the lower antero-lateral edge of the carapace there is a loop through which the tip of the second maxilla is visible. The edge of the loop is finely serrate.

The abdomen is very small and poorly developed. Each tergum bears a single feeble median spine, and there is a similar one on the basal part of the telson. The pleura are rounded, except in the sixth segment, where they end in a sharp point. A spine projects over the base of the uropods from the postero-lateral angle of the sixth segment. The telson is not fringed with setae.

The eyes do not nearly fill the very wide orbital sinuses. Besides the small part of the eye, which projects into the sinus, the larger posterior part can be seen as a dark yellow body, through the transparent carapace, and on the external side of this there is seen a bud or tubercle which represents the lateral process of the eyestalk of the adult.

The antennules are merely rudimentary and very short. No spine is developed at the outer angle of the basal peduncular joint, and the scale is represented by a short, blunt process.

The antennae are also very small. The scale is very feeble, but the renal tubercle is comparatively well-developed.

The first four pairs of oral appendages are similar to those of the adult.

The second and third maxillipedes have each a large exopodite, which is quite absent in full-grown specimens. In the second maxillipedes it is about two and a-half times as long as the endopodite, and in the third maxillipedes the two are about equal in length. The exopodite in both cases ends in a tuft of long setae.

There are only two pairs of pereiopods developed, but these are large and well formed. Each bears an exopodite ending in a group of long setae. These exopodites are formed of two joints, which are of equal length.

The first pereiopods are not relatively so long as in the adult, and the sutures between the various joints are not easily seen, especially in the proximal part of the limb. Near the distal end, and on the outer side of the merus, there are two strong spines. The carpus also bears two large spines, one proximal and one distal. The propodite is large and massive, the palm slightly shorter than the fingers. The exopodite is shorter than the propodite.

The second pereiopods have four very long spines on the merus, two near the middle, and two at the distal end. These spines are longer than the joint which bears them. The carpus has two spines of which the distal is the longer. The palm of the propodite is longer than the fingers. The exopodite is longer than the propodite.

The pleopods are formed, but are not functional as yet; they are very small and have no setae. There is a mere tubercle indicating the position of the *appendix interna*.

The uropods are shorter than the telson and are very feeble.

Size.—The specimen measured from tip of rostrum to end of telson, when the abdomen is straightened out, is only 7 m.m long.

The single specimen was taken at the following station:—

Helga.

S. R. 449—19 v '07. 50° 28' 30" N., 11° 39' W. soundings 950 fms. Midwater otter trawl, 0–700 fms. One, 7 mm.

TRIBE SCYLLARIDEA.

FAMILY *PALINURIDAE*.GENUS *Palinurus*, Fabricius.

The two Irish species may be separated thus:—

On the middle of the carapace there are two rows of large spines, parallel in front of the cervical groove, slightly converging behind it. Merus of first pereopods has four small teeth on proximal part of inner keel, and a large distal spine; on under side of propodite there is a small, sharp tooth near the distal end, *P. Thomsoni*.

Middle of carapace has no such rows of spines. Except for a distal spine the inner keel of the merus of the first pereopods is smooth. There is a very large and broad triangular tooth on under side of propodite, near the distal end, *P. vulgaris*.

Palinurus vulgaris, Latreille,

Pl. VI, fig. 3.

Palinurus vulgaris, Bell, 1853.

Palinurus vulgaris, Gruvel, 1912.

This species has been very fully described by Gruvel in his recent monograph on the *Palinuridae*, so that there is no need to repeat its characteristics here.

General Distribution.—The species reaches its maximum development as regards numbers in the Mediterranean and on the west coasts of Spain, Portugal, and Morocco. In the Mediterranean it is extremely abundant around Corsica and Sardinia, the Balearic Islands, and off the coast of Tunis and Tripoli. It also occurs in large numbers in the Adriatic and the Aegean. It is found at Madeira, and extends southwards as far as Cape Bojador (Gruvel). It extends northwards through the Bay of Biscay to the coasts of Britain, which form the northern limit to its range.

On the east coast of England* it is present only in small numbers, and becomes scarcer towards the north, ceasing altogether about Flamborough Head. It extends, however, along the whole west coast, being plentiful in the Bristol Channel and the Irish Sea. On the west of Scotland it is not common, but has been recorded from the Firth of Clyde, Loch

* For British distribution, see Ritchie, *Proc. Royal Phys. Soc., Edin.*, vol. XVIII, 1909-1910.

Fyne, Mull, Skye, North Uist and Sutherlandshire, the last four localities being represented by only one or two records each. It has been taken twice at the Orkneys.

Finally a single specimen has been found on the coast of Norway, near Bergen, but Appellöf (1906) regards this as a doubtful record.

Irish Distribution.—It is found all round the Irish coasts, but most plentifully in the south and west; in the north it is rare. It has been recorded from the following localities: South coast: Youghal (Bell), Cove (Humphreys), Derrynane, Valentia (Kinahan); west coast: Galway (Melville), Oranmore, Ballynakill, Aran; north coast: Magilligan (Kinahan); east coast: Larne Lough (Rankin), Dalkey Sound (Kinahan).

It is common at Inishbofin, Co. Galway.

On the Continent, and especially in France, Spain, and Portugal, *P. vulgaris*, the "Langouste," is of great commercial importance. It is fished on all the Atlantic and Mediterranean coasts of the countries named. The fishermen use boats fitted with large tanks in communication with the sea, and in these the animals may be kept alive for any length of time desirable. Some of the larger boats can carry eight or nine thousand living Langoustes. There is also a thriving industry connected with the species in Corsica, and on the Italian coasts. In Greek waters, on the other hand, it is not fished to any great extent, though occurring in large numbers. It is not held in great estimation in this country as an article of diet, and most of the specimens caught on the coasts of Devon and Cornwall are sent to Boulogne.

There is at present no regular fishery of *P. vulgaris* in Ireland, the pots used for the capture of lobsters being too small to admit full-grown "crayfish." The latter, when caught, are generally found clinging to the outside of the pot. They are also taken, not unfrequently, by trawls, and may often be seen exposed for sale in Dublin. I understand that it is proposed to use trammels for "crayfish" on the South coast. Trammels have been found very effective, especially if left in the water until the first fish caught in them become somewhat decomposed.

Palinurus Thomsoni, n. sp.

Pl. VI, figs. 1-2.

This species is at present represented by a single male specimen taken off the south-west coast of Ireland in 212-229 fms. It is closely related to *P. vulgaris*, Latrielle, and also to a South African species, *P. Gilchristi*, Stebbing:

On the median dorsal part of the carapace there are two rows of strong, well-developed spines. The rows begin at a point half-way between the rostrum and the cervical groove, and extend very nearly to the hind margin of the carapace. The part of each row which lies in front of the cervical groove consists of

three very large uniform spines, the tips of which point forwards, and almost overhang the base of the spine in front. Here the two rows are parallel, but behind the cervical groove they begin gradually to converge, and the spines to diminish in size. There are seven of these in each row behind the groove.

A somewhat similar arrangement of spines occurs in *P. Gilchristi*. Mr. Stebbing has very kindly lent me a specimen of this South African species for comparison with the Irish specimen.* I find that the dorsal rows are composed of much larger and stronger spines in the latter than in Mr. Stebbing's specimen; they are also more uniform in size and regular in arrangement.

The large supraorbital spines are more horizontal than in either *P. vulgaris* or *P. Gilchristi*, and the distance between the tips of these spines is greater than in the other two species. The distance from tip to tip is exactly half the length of the carapace, whereas in the other two species mentioned it is always markedly less than half. On the anterior margin of each of these spines there are four small teeth of uniform size. The posterior margin is smooth. Behind this large spine and also behind the suborbital spine there are diminishing rows of smaller spines, as in *P. vulgaris*.

The rest of the spiny armature of the carapace is more robust than in the specimen of *P. Gilchristi* which I have examined.

On the front edge of the epistome there are several small tubercles, in addition to the sharp central tooth and those at the external angles; they are not so large or so sharp as in *P. vulgaris*.

The pear-shaped body at the anterior end of the sternum bears two small tubercles.

The most important difference between this species and *P. Gilchristi* lies in the sculpture of the abdominal terga. On each of these from the second to the fifth there is a transverse furrow which is interrupted in the median line by a low flat ridge or carina; but in *P. Gilchristi* in addition to this, there is also on each of these segments an anterior furrow which is unbroken by the carina and which is heavily fringed with setae. In neither *P. Thomsoni* nor *P. vulgaris* is this second furrow present; there is at most a very faint depression on the second segment alone, and this bears only a few setae. The presence of this important furrow is not mentioned in the original description of *P. Gilchristi* (Stebbing 1900 (b)).

The spines of the abdominal pleura are quite as long and as sharp as in *P. vulgaris*. There is a sharp tooth on the anterior edge of the pleura of the second segment.

The first pair of legs are stouter and shorter than the succeeding pairs, but not very markedly so. On the inner side of the ischium there are two blunt tubercles. The inner crest of the merus

* Since writing the above, I have seen another specimen of *P. Gilchristi*, kindly sent to me by Dr. Calman. It agrees exactly with Mr. Stebbing's specimen.

bears four small sharp teeth on the proximal part of the joint, while at the distal end there is a much larger single tooth. The outer keel is quite smooth, and on the distal part of the upper keel there is a very faint granulation, but nothing comparable to the strong row of teeth present in *P. vulgaris*. Both the upper and outer keels end in sharp points. Near the distal end of the propodite there is on the under side a very minute, sharp tooth directed forwards.

The combined lengths of carpus and propodite in the fifth pair of legs are exactly equal to the combined lengths of these joints in the fourth pair.

The colour of the specimen (in alcohol) is as follows:—The abdomen is pale violet brown, mottled with pale yellow. The same violet brown colour is present on the carapace and extends half-way up the supra-orbital spines, the distal half of which is yellow; the extreme tip is a translucent golden brown. All the carapace spines are of this pale yellow tint and have translucent points. The sternum, legs, antennules, telson, and uropods are yellow; the antennae are marked with alternate bands of brown and whitish yellow.

The single specimen is a male, and measures 154 mm., from rostrum to end of telson.

I have great pleasure in naming the species in honour of my first instructor in Zoology, Prof. J. Arthur Thomson, of Aberdeen.

The record of the single specimen is as follows:—

Helga.

S. R. 1178—22 v '11. 58 mls. W. $\frac{1}{2}$ N. of Blackball Head.
51° 20' N., 11° 30' W., 212–229 fms., sand. Trawl—
One 154 mm.

As the three species, *P. Thomsoni*, *P. Gilchristi*, and *P. vulgaris*, are closely related it may be of use to give a summary of their characters in tabular form.

A. <i>Palinurus Thomsoni.</i>	B. <i>Palinurus Gölchristi.</i>	C. <i>Palinurus vulgaris.</i>
On the middle of the carapace there are two rows of large spines, parallel in front of cervical groove, slightly converging behind it. The spines are largest in front and diminish posteriorly.	As in <i>A.</i> , except that the spines are not so large or so uniformly arranged.	No such rows of spines.
A transverse furrow fringed with hairs on the second to fifth abdominal terga. Each furrow is broken by a low broad median carina.	A transverse furrow as in <i>A.</i> , broken by a narrow carina. In addition to this there is another unbroken transverse furrow on the anterior part of the tergum.	As in <i>A.</i>
On front margin of supra-orbital spines there are four uniform teeth.	Three or four teeth, of which that nearest the tip is the largest.	Four teeth; that nearest the tip much longer and sharper than others.
Distance between tips of supra-orbital spines is .5 of length of carapace.	.47---.42 of length of carapace.	.41 in specimen 4 inches long. .36 in specimen 7 inches long. .33 in large adult.
Merus of first pereopods has four small teeth on proximal part of inner keel, and a large distal spine.	4-6 small teeth, otherwise as in <i>A.</i>	Except for a distal tooth, inner keel is quite smooth.
Upper and outer keels of merus, smooth, except for very faint granulation on upper keel at distal end. Spine at end of each keel.	Upper and outer keels quite smooth, but with spine at extreme tip of each as in <i>A.</i>	Distal end of upper keel bears a row of prominent spines.
On under side of propodite there is a small, sharp tooth near the distal end.	As in <i>A.</i>	A very large and broad triangular tooth near distal end.
Pear-shaped body at apex of sternum bears two small tubercles.	Pear-shaped body smooth.	Pear-shaped body bears several rough tubercles.
Pleura long and sharp; those of the second segment have a spine on the anterior edge.	Blunter and shorter than in <i>A.</i> No spine on second segment.	As in <i>A.</i>

ASTACURA.

TRIBE NEPHROPSIDEA.

FAMILY NEPHROPSIDAE.

There are three genera occurring in Irish waters:—

A. Eyes small, without pigment; no antennal scale, *Nephropsis*.

B. Eyes large, well pigmented; antennal scale present.—

1. Eyes very large, reniform, broader than stalks; antennal scale foliaceous, .. *Nephrops*.

2. Eyes large, but not broader than stalks; antennal scale spine-like, *Homarus*.

GENUS *Nephrops*, Leach.

Nephrops norvegicus, Linne.

Nephrops norvegicus, Bell, 1853.

Nephrops norvegicus, Heller, 1863.

Nephrops norvegicus, Ortmann, 1892.

Nephrops norvegicus, Hansen, 1908.

This species, the Norway Lobster, or “Dublin Prawn,” is so well known that it is quite unnecessary to give a description of its characters here.

Size.—The largest specimen taken by the *Helga* is a male from the west coast; it measures 240 mm. from the tip of the rostrum to the end of the telson; carapace, 108 mm.; abdomen, 132 mm.; rostrum, 34 mm.; breadth of carapace, 44 mm. This individual was taken along with six others in the great depth of 337 fathoms.

The average length of adults is about 165–180 mm. for males, and 120–140 for females.

General Distribution.—The most northerly locality for the species is off the south coast of Iceland (Hansen), where it is so plentiful that it forms the chief food of the cod. It occurs on all the Scandinavian coasts (Sars, Meinert, etc.), on the coasts of Belgium and France (Van Beneden, Bonnier, Caullery), in the Mediterranean and Adriatic (Heller, Senna), and on the coast of Morocco (Milne Edwards). It is also present in great numbers on the coasts of England and Scotland, but it is not known to occur in the Hebrides, Shetlands or Faeroes (Hansen).

Irish Distribution.—It is found all round the Irish coasts, but it is specially plentiful in the Irish Sea between the Isle of Man and the coasts of Louth and Down. In this region several hundred specimens are frequently taken in one haul.

Vertical Distribution.—The species occurs in greatest numbers in depths of 10–40 fathoms in the Irish Sea; on the west coast it also extends into deep water down to more than 300 fathoms. The *Helga* took seven specimens, two of them very large, in 337 fathoms, the greatest recorded depth for the species, with the exception of one given by Senna (1903), from the west of Sicily, 416–450 fathoms.

GENUS **Nephropsis**, Wood Mason.

Nephropsis, Wood Mason, 1873. *Nephropsis*, Norman, 1882. *Nephropsis*, Alcock, 1901. *Nephropsis*, Stebbing, 1903.

The rostrum is fairly long, robust, usually furnished with lateral spines. Carapace more than half as long as the abdomen; cervical groove very distinct; telson quadrate.

The eyes are hidden beneath the rostrum; they lie close together, are very small, and devoid of pigment. The first joint of the antennular peduncle has no stylocerite; there is no antennal scale. First three pairs of legs chelate; first pair large and massive, very slightly unequal in both sexes; second pair slightly stouter than the succeeding pairs.

Nephropsis atlantica, Norman.

Pl. VII, figs. 1–13.

Nephropsis atlantica, Norman, 1882.

Nephropsis atlantica, Caullery, 1896.

Nephropsis atlantica, Alcock, 1901.

Nephropsis atlantica, Hansen, 1908.

The surface of the carapace is granular and bears a fairly dense coating of hair. The large rostrum, slightly upturned near the tip, is about half as long as the carapace; it bears a fringe of setae low down on either side. Normally it has two pairs of large lateral spines, but occasionally there are three pairs, and sometimes two on one, and only a single spine on the other side. At the base of the rostrum there are two large spines directed outwards and forwards, and behind these, two smaller ones. Between these two pairs there is a double divergent row of small teeth which decrease in size backwards. Enclosed by these, on the median line there is a blunt oval tubercle. At each side there is a large spine over the base of the antenna. There is a slight furrow running along the median line from the rostrum to the very prominent cervical groove; behind the latter it becomes much fainter, but can be traced to the posterior margin of the carapace, which is slightly concave. A distinct ridge divides the cardiac from the branchial area. From the posterior angle of the carapace there runs a very prominent ridge downwards and forwards parallel to the latero-ventral

margin till it meets the cervical groove. Starting from the same point and keeping parallel to this ridge, but between it and the margin, there is a shallow groove.

The abdomen is of almost uniform breadth throughout, narrowing very slightly about the fifth and sixth segments. From the second to the sixth segment there is a low median carina. The terga are all coated with a dense covering of setae. They are separated from the pleura by prominent curved ridges. On the first segment the pleura are very slightly developed, but in the other segments they are large. On the second to the fifth segments they taper rapidly downwards and are produced into very long sharp points. Both anterior and posterior edges are minutely serrate. Half way down the anterior border of the pleura of the second segment there is a single spine.* The pleura of the sixth segment are much blunter than the others. They have a sharp spine projecting backwards over the base of the uropods.

The telson is almost quadrate in outline, the posterior margin being very slightly convex. On its surface there are two ridges which diverge backwards and terminate at the external angles in sharp spines. It is covered with short scattered hairs and fringed with long setae on the posterior and lateral margins.

The eyes are devoid of pigment and are very small. They lie close together beneath the rostrum.

The first and third joints of the peduncle of the antennules are almost equal, the third being very slightly larger. The second is about half the length of the third. The outer flagellum is thicker and slightly shorter than the inner which is considerably less than twice the length of the peduncle.

The flagella of the antennae are extremely long, sometimes nearly two and a-half times the total length of the body. The peduncle is equal to that of the antennules. The opening of the renal tubercle is conspicuous on the lower side. The antennal peduncle is practically hairless, but that of the antennules bears heavy fringes of pinnate setae.

The mandibles are massive, and have no toothed edge. There is a three-jointed palp, the basal joint very small.

The first maxillae have a two-jointed palp, the distal joint very much more slender than the proximal, at the base of which there is a dense brush of setae. The inner edge of the upper endite bears rows of strong teeth, and the lower one spines and long pinnate setae.

In the second maxillae the palp is very long, extending beyond the tip of the scaphognathite.

The endopodite of the first maxillipedes is two-jointed, the first joint more than twice as long as the second. The exopodite is very long and slender, and its distal part is multiarticulate. The epipodite is large and foliaceous.

* In a male specimen taken in 610-680 fms., at station S. R. 331, each of the pleura from the second to the fifth segment has two large spines on the anterior border. In all other respects the specimen is quite normal.

In the second maxillipedes the merus is the longest joint. The propodite is short and inflated; the dactyl bears a few terminal spines. The exopodite is very long and slender; its peduncle reaches beyond the distal extremity of the merus, and its flagellum well beyond the tip of the dactyl, when the appendage is straightened out. The epipodite is rather slender.

The teeth on the crest of the ischium of the third maxillipedes are rather blunt. The merus is slightly shorter than the ischium. None of the joints are armed with large spines. The carpus, propodite, and dactyl are nearly equal in length. The exopodite is short, not reaching the distal end of the merus.

The chelipeds are massive, are densely setose, and have more or less rounded angles. They are slightly unequal. They are longer in the male than in the female. In the specimens taken by the *Helga* the chelipeds are .71 of the length of the body in the males, and only .59 in the females. The merus is very slightly shorter than the propodite, though Norman, in his original description of the species (1882), says the merus is the longest joint. At its distal end the merus bears two spines, one above and one below. It is thicker distally than at the proximal end. The carpus is short and stout and bears several spines, three on the inner side, one on the outer, and one below. Sometimes, however, only four spines are present. The propodite is the largest joint; it is quite unarmed and is very thickly covered with hair; the palm is slightly longer than the fingers, the tips of which cross when closed. The whole surface of the appendage is more or less granular. The setae are thickest on the carpus and propodite.

The second pair of legs are rather stouter than the next three, which are long and slender. The second and third pairs are chelate, and their coxae bear on the inner side large flattened lobes, which in the third pair end in a conspicuous hook at the outer side. These lobes are almost entirely absent in the female. The fourth legs are the longest; the fifth are a little shorter, and the third and second slightly shorter still.

In the male the first pleopods lie close together, and are pressed against the ventral surface. In adult specimens they reach as far as the base of the second legs. They consist of two joints, the first of which is very short. The second is expanded into a flattened blade, which is concave on the inner side, so that when pressed together the two pleopods form a tube. On the inner surface of each there are two rows of stiff setae, one on the margin, and the other springing from a low ridge that runs from the proximal into the concave distal part; the setae all point forwards.

In the female the first pleopods are very slender and short; the distal part is multiarticulate and is fringed with long pinnate hairs.

In the male the second pair of pleopods has a large *appendix masculina* attached to the endopodite. It usually lies closely pressed against the first pair. It is nearly as long as the pleopods

themselves, is much stouter, and ends in a group of long, sharp teeth.

The following pairs of pleopods are long and slender and bear fringes of long pinnate setae. A small and feeble *appendix interna* is present on the second to fifth segments, in the female, and third to fifth in the male. In the latter it is wanting on the second segment. It is never more than about half the length of the endopodite, and becomes smaller on the posterior segments.

The exopodites of the uropods have a transverse suture. Both exopodite and endopodite are strengthened by two ridges, one median and the other along the outer border. The latter ends in a sharp tooth. The base of the uropods also bears a spine pointing backwards. The hind margins of the uropods are fringed with long setae.

The branchial formula is as follows:—

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	ep.	ep.	1+ep.	1+ep.	1+ep.	1+ep.	1+ep.	—
Arthrobranchs.	—	—	2	2	2	2	2	—
Pleurobranchs.	—	—	—	—	1	1	1	1

In the females there is situated between the bases of the fourth pair of thoracic legs a structure corresponding to the thelycum of the Peneidae. So far as I know such an organ has not hitherto been described in this species.* It consists of two plates lying in contact on the sternal surface between the coxae of the last two pairs of legs. At the anterior end they coalesce and are rounded; at the posterior end, on the other hand, they diverge and end in narrow points beside the fifth coxae. The two plates are arched and rise steeply from the sternum on either side. Between them there is a deep groove which is widest posteriorly and gradually narrows towards the front. It leads to the minute opening into the interior of the spermatheca.

If one of the plates is removed it is found that the interior is filled with a whitish friable substance, in which I have succeeded in finding spermatozoa. The interior of the one plate is in communication with that of the other by the anterior portion where they are united.

There seems to be no doubt that the structure is a genuine spermatheca. It is not merely a body produced by the close adherence of two spermatophores, such as has been erroneously described as a spermatheca in some of the Eryonidae (Andrews, 1911), for in this case it is invariably present in females, and possesses perfect bilateral symmetry, two features which are wanting, for instance, in *Polycheles sculptus*, in which species spermatophores found adhering to females have been taken for a spermatheca.

* Since writing the above I have found this structure mentioned by Caullery (1896).

The coxae of the third pair of legs, which bear the large oval genital openings, are much swollen, and project inwards, so that they lie immediately in front of the spermatheca.

In a male specimen from station S.R. 477 there was found a spermatophore projecting from the genital orifice to a distance of 9 mm. It consists of a slightly convoluted cylindrical tube within which the spermatozoa are densely packed. The tube is embedded in a flattened translucent mass of a brownish-yellow colour. This is narrowed to a point at the anterior end.

The spermatozoa themselves are flask-shaped bodies which are surrounded, except at the tip, by a thick transparent envelope.

A specimen which was taken by the *Thor* at $49^{\circ} 23' \text{ N.L.}$, $12^{\circ} 13' \text{ W.L.}$, is peculiar in having some of the male characters united with those of the female. There is a spermatheca present exactly as in a normal female, and the first pair of pleopods are of the female type. On the coxae of the third pair of thoracic legs, however, there are flattened plates ending posteriorly in hooks as in male specimens. There are no genital openings on the third coxae, but there are on the fifth. Thus in the one individual we have the male genital openings and the male hooks on the third coxae, and also a spermatheca and first pleopods of the female type. The internal sexual organs are those of a normal male; no trace of ovaries is to be seen.

The hermaphroditism here is not so complete as in *Calocaris Macandreae*, where the first pleopods are of the male type, and both male and female genital openings are present (see p. 93.)

General Distribution.—The species was first described from a single specimen taken by the *Knight Errant* off the north of Scotland (Norman, 1882), and it was again taken in the same region, in the Faeroe Channel, by the *Michael Sars* in 1902. It has also been recorded from the Bay of Biscay (Caullery), from South Africa (Stebbing), and from the Arabian Sea (Alcock).

Two specimens have also been taken by the *Thor* off the south-west coast of Ireland, just outside the Irish marine area.

Irish Distribution.—The *Helga* has taken the species on several occasions, always off the south-west coast.

S. R. 327—8 v '06. $51^{\circ} 43' 30''$ — $51^{\circ} 38' \text{ N.}$, $12^{\circ} 15'$ — $12^{\circ} 18' \text{ W.}$, 550–800 fms. Trawl—One female, about 85 mm. (rostrum broken).

S. R. 331—9 v '06. $51^{\circ} 12' \text{ N.}$, $11^{\circ} 55' \text{ W.}$, 610–680 fms. Trawl—Five, three males, two females, 103–52 mm.

S. R. 333—10 v '06. $51^{\circ} 37' \text{ N.}$, $12^{\circ} 9' \text{ W.}$, 557–579 fms. Trawl—Temp. at 500 fms. 9.2° C. , Salinity 35.1‰ . —One female, 101 mm.

S. R. 334—10 v '06. $51^{\circ} 35' 30'' \text{ N.}$, $12^{\circ} 26' \text{ W.}$, 500–520 fms. Trawl—One male, 84 mm.

S. R. 363—10 VIII '06. $51^{\circ} 22' \text{ N.}$, 12° W. , 695–720 fms. Trawl—One female, 70 mm.

- S. R. 400—5 II '07. 51° 21' N., 11° 49' W., 525–600 fms.
Trawl—Two.
- S. R. 401—5 II '07. 51° 14' N., 11° 51' W., 600–660 fms.
Trawl. Temp. at 580 fms. 8·35° C., Salinity 35·5 ‰
—Two females, 75–73 mm.
- S. R. 477—28 VIII '07. 51° 15' N., 11° 47' W., 707–
710 fms. Trawl. Temp. 7·19° C.—Two males and
two females, one ovigerous, 94–84 mm.
- S. R. 484—30 VIII '07. 51° 35' N., 11° 57' W., 602–
610 fms. Trawl—One male, 84 mm.
- S. R. 506—12 IX '07. 50° 34' N., 11° 19' W., 661–
672 fms. Trawl. Temp. at 600 fms. 8·22° C.,
Salinity 35·53 ‰—Two males and two females,
79–70 mm.
- S. R. 593—6 VIII '08. 50° 31' N., 11° 31' W., 670–770 fms.
Trawl. Temp. at 650 fms. 7·75° C., Salinity
35·53 ‰—Four females, one ovigerous, 97 mm.

Vertical Distribution.—The depths at which this species has been found range from 350 fms. (Caullery) to 740 fms. (Alcock). It appears to reach its greatest frequency between 600 and 700 fms.

GENUS *Homarus*, H. Milne-Edwards.

Homarus vulgaris, Milne-Edwards.

Homarus vulgaris, Bell, 1853.

Homarus vulgaris, Heller, 1863.

Homarus vulgaris, Carus, 1885.

Size.—Though as a rule it is considerably smaller than the closely-allied American Lobster, the European species sometimes attains a very large size. The largest specimen of which I have been able to find a record is one measuring 20 inches from the rostrum to the telson; it was taken in Guernsey in 1873. A very large individual was taken in the Irish Sea in 1911; it measures 19 inches from rostrum to tip of telson and has the following additional dimensions:—

Length of carapace (including rostrum)	.. ..	219 mm. (8 $\frac{5}{8}$ ins.)
Breadth of carapace	.. ..	108 mm. (4 $\frac{1}{4}$ ins.)
Tip of longest cheliped to tip of telson	.. ..	784 mm. (31 ins.)
Length of crushing chela	.. ..	292 mm. (11 $\frac{1}{2}$ ins.)
Length of cutting chela	.. ..	273 mm. (10 $\frac{3}{4}$ in.)

General Distribution.—The northern limit of the range of the European Lobster is about Tromsö on the north-west coast of Norway; it is, however, much more plentiful on the south-west coast (Appellöf). It occurs commonly in Swedish and Danish waters (Goës, Meinert), and along all the coasts of the North Sea. It is found all round Britain, and extends southwards through the Bay of Biscay to the coast of Spain and

Portugal, and into the Mediterranean. It does not occur there in such large numbers as in Northern Europe, and is of less importance from an economic point of view than *Palinurus vulgaris*, the "Langouste." Its range is not bounded eastwards by the Adriatic as stated by Herrick (1911), as it extends into the Aegean (see Calman and D'Arcy Thompson, *Nature*, 1911).

Irish Distribution.—The Lobster is found on all the coasts of Ireland, and is the basis of a fishery which is growing in value and importance, as may be seen from the tables given below. In 1912 the total catch was more than half a million for the first time. The figures for England and Wales, and for Scotland, are given below in parallel columns for comparison. The greatest numbers are landed on the west and south coasts.

In the last half-century an extensive literature on the lobster has grown up, and experiments have been carried out in many countries with a view to devising some practical method of lobster-culture, which would counteract the serious depletion of the supply which has been brought about by over-fishing. I have thought it useful to give here references to a few of the most important papers dealing with the lobster and its fisheries.

1888, Ewart and Fulton; 1894, Ehrenbaum; 1895, E. J. Allen; 1896, E. J. Allen; 1896, F. H. Herrick; 1909, Appellöf; 1911, F. H. Herrick.

The most complete account of the European lobster is to be found in the paper by Appellöf (1909). Herrick's splendid monograph (1911) gives a most exhaustive and detailed account of the structure, relationship, habits, development, and fisheries of the American lobster; it also includes a large amount of information on the European species, and contains an almost complete bibliography of the literature of both.

NUMBER AND VALUE OF LOBSTERS LANDED IN IRELAND,
ENGLAND AND WALES, AND SCOTLAND FROM 1900 TO 1912.

	IRELAND		ENGLAND AND WALES		SCOTLAND	
	Number	Value £	Number	Value £	Number	Value £
1900	285,821	8,321	654,152	28,590	672,093	31,609
1901	244,854	7,351	650,491	28,735	790,310	36,621
1902	193,820	6,585	648,736	29,403	789,554	37,329
1903	176,656	6,120	549,351	25,431	1,195,788	34,568
1904	190,902	6,452	*546,001	*25,566	*747,121	*35,736
1905	234,592	7,362	585,789	26,712	1,239,317	36,320
1906	196,502	6,733	520,657	25,256	828,252	35,966
1907	323,030	10,088	495,781	23,802	725,421	35,505
1908	374,185	11,883	512,478	24,377	685,371	33,920
1909	420,830	11,361	546,823	26,288	688,526	33,688
1910	324,585	12,499	533,008	25,435	688,856	34,795
1911	493,465	16,722	570,272	27,436	640,797	32,091
1912	508,986	17,490	640,860	30,576	624,703	32,173

* Eleven months only.

ANOMURA.

TRIBE GALATHEIDEA.

The three families having representatives in Irish waters may be separated as follows :—

A.—Posterior half of abdomen bent under the first, but telson not tucked under last segment; telson broad, made up of separate plates suggestive of a tergum and pair of modified appendages; antennal peduncle four-jointed; no acicle; arthrobranchs normally placed, GALATHEIDAE, Dana.

B.—Abdomen bent as in Galatheidæ, but in addition the telson and uropods are tucked under the last abdominal segment; telson narrow, weak, and transversely fissured; antennal peduncle five-jointed; second joint usually with an acicle; arthrobranchs placed on side of thorax, .. UROPTYCHIDAE, Henderson.

C.—Cephalothorax very broad, almost circular in outline; abdomen bent and closely-pressed against sternum as in Brachyura; third maxillipedes have ischium much flattened, and merus with broad internal lobe; in the male a single pair of pleopods present, on the second segment; antennal peduncle four-jointed; no acicle; arthrobranchs normally placed, PORCELLANIDAE, Henderson.

FAMILY UROPTYCHIDAE.

Chirostylidae, Ortmann, 1892. Diptycinae, Milne-Edwards and Bouvier, 1900. Uroptychidae, Alcock, 1901.

The two genera included in the family may be separated as follows :—

Rostrum spiniform; lateral margins of carapace very obscure; no acicle on antennae; chelipeds often more than five times length of carapace and abdomen; walking legs very long, *Gastroptychus*.

Rostrum flat and triangular; lateral margins of carapace well defined; well developed triangular acicle; chelipeds long; walking legs moderately long, *Uroptychus*.

GENUS *Uroptychus*, Henderson.

Diptychus, Milne-Edwards, 1880. *Diptychus*, Bonnier, 1888. *Uroptychus*, Henderson, 1888. *Diptychus*, Milne-Edwards and Bouvier, 1894 (a). *Uroptychus*, Alcock, 1901. *Uroptychus*, Stebbing, 1903.

The two Irish species may be distinguished from one another by the following characters:—

Dorsal surface of carapace bearing numerous fine hairs, especially on branchial and hepatic areas; no movable spines on lower edge of propodite of walking legs; upper and lower surface of chelipeds covered with small scales, which bear each a row of long hairs, .. *U. rubrovittatus*.

Dorsal surface of carapace devoid of hairs, very smooth and shining, minutely punctate; lower edge of propodite of walking legs bears a row of movable spines; chelipeds quite smooth, without scales, and without hairs, except at the tips of the fingers,

U. nitidus, var. *concolor*.

***Uroptychus rubrovittatus* (Milne-Edwards).**

Pl. VIII, figs. 1-4.

Diptychus rubrovittatus, Milne-Edwards, 1881.

Diptychus rubrovittatus, Bonnier, 1888.

Uroptychus rubrovittatus, Caullery, 1896.

Diptychus rubrovittatus, Milne-Edwards and Bouvier, 1900.

Uroptychus rubrovittatus, Hansen, 1908.

The carapace is broadest in the branchial region; it is slightly narrower behind, and considerably so in front. The rostrum is large and triangular, with very slightly crenulated margins; it is slightly hollowed out on the upper surface. The carapace is arched from side to side, and is almost quite smooth; the cervical groove is represented by a faint crescent-shaped depression. There is a sparse covering of tufts of fine hairs which are most plentiful on the branchial and hepatic areas, and also occur on the upper surface of the rostrum. The posterior margin is slightly concave. The lateral margins have a row of very small tubercles which do not come to sharp points. There is an inward curved spine at each antero-lateral angle, and there is a smaller spine on the anterior margin above the base of each antenna. The *linea anomurica* is distinctly marked. The submarginal parts of the carapace bear a number of small and rather obscure tubercles, which, however, are absent from the central part.

The first abdominal segment is very narrow and almost entirely hidden by the carapace. The pleura of the second segment are poorly developed and its lateral margins are concave. In the third to sixth segments the pleura are well developed, and are fringed with setae. The terga are smooth and have a very sparse covering of setae. The abdominal segments are much broader in the female than in the male, and in the former the pleura completely enclose the space in which the ova are carried before hatching.

The telson is folded against the lower surface of the sixth abdominal segment. It is divided into a proximal and a distal portion by a transverse suture. Both are thin and feeble, but the proximal part is slightly calcified, while the distal part is wholly membranous and transparent. The lateral borders have each a deep sinus opposite the suture; the posterior margin is concave; the posterior angles are rounded; the lateral and posterior margins are fringed with fine setae. The telson as a whole is much narrower than the abdominal segments which precede it.

The eyes are small and reach only to the middle of the rostrum. The eyestalks are cylindrical, and the border between stalk and cornea is entire and straight. The eyes (in spirit) are of a bright reddish-brown colour.

The basal joint of the antennules is short, and bears a strong curved spine at its upper and outer extremity; this spine bears two or three small teeth on its margin. The second joint is roughly cylindrical, and the third is very much thickened distally. The upper flagellum consists of about a dozen joints, and the lower, which is much shorter and very slender, of three to five joints. There are no hairs springing from the distal end of the third peduncular joint as in some of the Galatheidea.

The peduncle of the antennae is five-jointed. The basal joint is short and broad, with the opening of the renal gland on its lower surface. The second joint bears a well developed scale, which tapers to a fine point; its inner border is entire, but the other is very slightly denticulate, and bordered with hairs. The third and fourth joints are short and thick, the fifth long and slightly thickened distally, bearing a thin flagellum which reaches beyond the merus of the chelipeds.

The third maxillipedes are long and pediform; the propodite is the longest individual joint. When extended they reach beyond the merus of the chelipeds. None of the joints bear spines, with the exception of the ischium, which has the usual *linea cristata*. The carpus is very short and broad. The propodite is as long as the merus and the carpus together; on its inner surface there is a broad obtuse process which reaches its greatest size in the proximal third of the joint. The inner surface of the dactyl, the distal two-thirds of the propodite, and the carpus bear dense fringes of setae. The peduncle of the exopodite reaches just beyond the middle of the merus; its flagellum is nearly as long as the peduncle.

The chelipeds are longer than the whole body of the animal. The first two joints are not much larger than those of the walking legs; the ischium is narrow, flattened, and quite short; the merus is very much thicker, and is practically cylindrical; the carpus is about as long as the merus and the ischium together, and becomes thicker at the distal end; the propodite is the longest and stoutest joint of the appendage, and is almost as long as the merus and carpus together; the dactyl is about half as long as the palm of the propodite. On the cutting edge of the dactyl there is a large prominence near the base. The tips of the fingers are incurved, and cross one another. The whole surface of the appendage is covered with a large number of scale-like protuberances arranged in longitudinal rows, and each bearing three or four setae pointing forwards. The scales are not always easy to see; they are most prominent on the lower surface of the merus, and decrease gradually till they disappear about the base of the dactyl. Two teeth are present at the anterior end of the lower side of the merus and also of the carpus.

The three pairs of walking legs which follow also bear scales furnished with hairs, but they are often very difficult to detect. The three pairs are sub-equal. The posterior margin of the dactyl bears a row of teeth, of which that at the tip is the largest.

The fifth pair of pereopods are very much reduced; they end in chelae covered with long setae. The sternum of the fifth pair is obsolete.

In the male the only pleopods present are those of the first and second pairs. In the female, on the other hand, only the appendages of the third and fourth segments are present; these are slender and three-jointed. The first and second pleopods of the male are similar to those of *U. nitidus* var. *concolor*.

The uropods are tucked underneath the sixth abdominal segment along with the telson. They are rather narrow, and have rounded posterior margins fringed with fine setae. There is no transverse suture on either endopodite or exopodite.

Size.—Hansen (1908) mentions some very large specimens which were taken by the *Thor* off the south of Iceland, a male and a female, measuring 33mm. and 40 mm., respectively. The usual size seems to be about a quarter or a third less than this.

General Distribution.—The species is known from the west coast of Africa as far south as Cape Bojador (Milne-Edwards), from the Canaries and Azores (Milne-Edwards and Bouvier), from the Spanish coast (Bonnier), and the Bay of Biscay (Caullery, Kemp). More recently it has been recorded by Hansen from the south of Iceland.

Irish Distribution.—So far as I know this species has not hitherto been correctly recorded from British or Irish waters. Calman (1896) gives "*Uroptychus rubrovittatus*" in the list of species from the south-west of Ireland, but I have had the opportunity of examining these specimens in the Irish National

Museum, and I find that all of them must be referred to *U. nitidus* var. *concolor*.

The *Helga* has taken this species on two occasions.

Helga.

S. R. 223.—12 v '05. 53° 7' N., 14° 50' W., 410–500 fms., coral. Trawl.—One, 17 mm.

S. R. 327.—8 v '06. 51° 43' 30"—51° 38' N., 12° 15'–12° 18' W., 550–800 fms., ooze. Trawl.—Three.

Vertical Distribution.—The species appears to occur most frequently in depths of 300–700 fathoms, but it has been taken in 160 fathoms on the one hand and 766 fathoms on the other.

***Uroptychus nitidus*, var. *concolor* (Milne-Edwards).**

Pl. VIII, figs. 5–10, Pl. IX, fig. 1.

Diptychus nitidus, var. *concolor*. Milne-Edwards and Bouvier, 1894 (b).

Uroptychus nitidus, var. *concolor*, Caullery, 1896.

Diptychus nitidus, var. *concolor*, Milne-Edwards and Bouvier, 1899.

Diptychus nitidus, var. *concolor*, Milne-Edwards and Bouvier, 1900.

In general appearance this species resembles *U. rubrovittatus*, but is distinguishable by well-marked characteristics.

The surface of the carapace and abdomen is quite smooth and glistening; it is sparsely punctate, but this can be seen only when the specimens are dry. The carapace is narrower than in the last species, and is devoid of hairs. The cervical groove is barely distinguishable. The lateral margins are slightly granular, with here and there a denticule. The antero-lateral spine curves slightly more inwards than in *U. rubrovittatus*. The tooth above the base of the antenna is blunt. The rostrum is narrower and rather longer than in *U. rubrovittatus*, and its margins are quite entire; it is quite free from setae. The basal part of the rostrum curves downwards, and the tip is elevated, so that when seen in profile it has quite a different appearance from that of the last species (Pl. VIII., figs. 2, 5.).

The abdomen resembles that of *U. rubrovittatus*, but is free from setae.

The eyes are large and oval; they reach beyond the middle of the rostrum, and almost to the end of the antennal peduncle. The stalks are slightly swollen just below the cornea, which is of an orange yellow colour (in spirit).

The antennules much resemble those of *U. rubrovittatus*. The curved process springing from the basal peduncular joint bears two large sharp teeth. The upper flagellum has fourteen joints, and the lower only four.

The scale of the antennae is narrower than in the last species, and on neither edge has it any setae or teeth. The slender flagellum does not reach the distal end of the merus of the chelipeds.

The third maxillipedes differ from those of *U. rubrovittatus* in having a groove on the outer surface of the merus. The teeth of the *linea cristata* are also longer and sharper.

The chelipeds differ greatly from those of the last described species in having no covering of setiferous scales. Setae are absent, except for the tufts at the end of the fingers. The ischium is short and slender; on its lower surface it bears two or three rows of fairly sharp tubercles which point forwards. The merus is a much longer and stouter joint, and its lower surface is furnished with three or four rows of similar but larger tubercles; the rows vary somewhat in distinctness. The merus is more or less cylindrical, but the two succeeding joints are slightly compressed. The carpus is considerably longer than the merus, and the propodite again is longer than the carpus. The carpus, the upper surface of the propodite, and merus are all quite smooth, and are sparsely and minutely punctate. On the lower surface of the propodite, however, there are five or six longitudinal rows of very minute tubercles; they are often very difficult to detect, and are most easily seen in dry specimens; they may be felt by passing the finger backwards along the joint. The dactyl is only about one-third as long as the propodite. Both fingers bear tufts of long setae which are most crowded near the tip. When closed the fingers are in contact for nearly the whole of their length. The inner edge of the dactyl bears near its base a formidable tooth or process which is almost rectangular, and is about a quarter of the whole length of the cutting surface. There is a slight depression in the inner edge of the other finger opposite this tooth; the edges of the latter are crenulated. The teeth on the cutting edges of the fingers are not sharp, but are rounded. The tips of the fingers curve towards one another, and cross when closed. The whole surface of the chelipeds is bright and glistening.

The next three pairs of pereopods are nearly equal, but the middle pair, the third pereopods, are the shortest. The merus in the second and fourth pereopods is flattened laterally, but in the third it is cylindrical. In the second and fourth the carpus is slightly thickened distally, but not in the third. The propodite is more slender in the second pereopods than in the next two pairs. In each case the dactyl is robust, strongly curved, and bears numerous teeth on its lower surface.

The lower side of the distal half of the propodite bears a row of long, mobile spines, and these, together with the teeth of the dactyl when bent back, form a very efficient subchela, which enables the animal to get a firm grip of the coral on which it lives. The teeth on the dactyl are broad, and not long and narrow as in *U. rubrovittatus*; there are usually ten or eleven.

The merus of these walking legs bears a very few long hairs ; on the carpus they are more numerous, especially on the dorsal side, except in the third pereopods where they are almost absent. The distal half of the propodite bears tufts of long hairs in all three pairs of appendages, and they are also present on both surfaces of the dactyl.

The fifth pereopods are very slender and reduced. They end in a chela, and the propodite and dactyl are covered with long plumose hairs.

In the first pleopods of the male the distal joint is expanded into a broad membranous lamella with incurved edges. Its inner surface bears a few short bristles.

The second pleopods of the male have a long cylindrical proximal joint, and a much shorter distal joint, which is greatly expanded and flattened. This part is partially divided into two lobes, both of which are fringed with stiff hairs. In one lobe these are much shorter than in the other, and the same lobe has its surface covered with short bristles. The opposite edge of the distal joint is curled downwards, and bears short, slender bristles on its inner edge. The lobe bearing the bristles represents the *appendix masculina*, which has become fused with the internal ramus of the pleopod. The external part is represented by a small, blunt process at the extremity of the proximal joint.

In the female, pleopods are present on the third and fourth abdominal segments only. They are very slender and serve for the attachment of ova. The latter are large and never numerous. One of the *Helga* specimens bears seven eggs and the other twenty. In ovigerous females the telson is not folded against the sixth abdominal segment, but is extended so that it rests on the surface of the thoracic sternum.

The uropods are similar to those of *U. rubrovittatus*.

Size.—The largest specimen taken by the *Helga* is an ovigerous female, measuring 27 mm. The chelipeds of the same specimen are 45 mm. long.

General Distribution.—The typical *U. nitidus* is confined to West Indian waters. The var. *concolor* is, on the other hand, widely spread. It has been found in many parts of the eastern Atlantic (Mine-Edwards, Bouvier, Caullery), on the west coasts of France, Spain, and Morocco, at the Azores and Cape Verdes. Its most northerly record is from the south-west of Iceland (Hansen). It is also recorded from South African waters (Stebbing), and from the Laccadive Islands and Bay of Bengal (Alcock).

The species is represented in the Pacific Ocean by a var. *occidentalis*, Faxon, which was taken by the *Albatross* in the Gulf of Panama.

Irish Distribution.—The species has previously been taken in Irish waters, viz., by the *Lord Bandon* expedition in

1888 off the south-west coast, but the specimens were recorded under the name of *U. rubrovittatus* (see p. 58).

The *Helga* has taken this species at three stations.

Helga.

S. R. 493.—8 IX '07. 51° 58' N., 12° 25' W., 533–570 fms.

Trawl.—One, 21 mm.

S. R. 494.—8 IX '07. 51° 59' N., 12° 32' W., 550–570 fms.

Trawl.—One, 27 mm.

S. R. 500.—11 IX '07. 50° 52' N., 11° 26' W., 625–666 fms.

Trawl.—One, 25 mm.

Vertical Distribution.—The species is most commonly found in depths ranging from 400 fathoms to 650 fathoms, but it has been found in 318 fathoms and in 808 fathoms.

GENUS *Gastroptychus*, Caullery.

Ptychogaster, Milne-Edwards, 1880. *Ptychogaster*, Henderson, 1888. *Chirostylus*, Ortmann, 1891–94. *Gastroptychus*, Caullery, 1896. *Ptychogaster*, Milne-Edwards and Bouvier, 1900. *Ptychogaster*, Alcock, 1901.

Gastroptychus formosus (Milne-Edwards).

Pl. IX, figs. 2–8, Pl. X, fig. 1.

Ptychogaster formosus, Filhol, 1886.

Ptychogaster formosus, Perrier, 1886.

Ptychogaster formosus, Milne-Edwards and Bouvier, 1894 (b).

Gastroptychus formosus, Caullery, 1896.

Ptychogaster formosus, Milne-Edwards and Bouvier, 1900

The carapace is much narrower in front than behind; its broadest part is a short distance behind the cervical groove. In front there is a narrow spiniform upturned rostrum, about twice the length of the eyestalks; its margins are entire. The gastric region of the carapace is inflated and sharply marked off from the surrounding parts. The carapace is furnished with a large number of spines. At each side of the base of the rostrum, above the eyes, there is a large spine; behind these, and much wider apart, is another pair of large spines; near the posterior edge of the gastric area there are two spines opposite the supra-orbital ones in front; on the centre of the gastric area there is a large unpaired spine, so that on this part of the carapace there is a ring of six large spines enclosing a single median one. Just behind the cervical groove there are two median spines, and farther back a similar pair, while a third pair is situated on the posterior margin of the carapace. On the hepatic region there are two large spines on each side, and between these and nearer the median line is another spine. There are rows of smaller spines on the branchial regions, running parallel to the lateral margin of the carapace. Between the spines the surface of the carapace is perfectly smooth. The cervical groove is

distinct in its central part, but becomes obscure at the sides.

The sternum becomes very narrow anteriorly, and is furnished with two or three large spines at the base of the chelipeds. It is divided by three deep, transverse furrows. The sternal plates of the last thoracic segment are atrophied, being represented merely by a patch at the base of each of the fifth pereopods. The *linea anomurica* is distinct, and is deepest in its posterior part. Below it the flanks of the carapace bear a number of small, irregularly-arranged spines.

The first two abdominal terga bear a transverse row of spines, some of which are much larger than others. The first abdominal segment is very narrow and its pleura are rudimentary. All the other segments are much broader and have well-developed pleura; the latter are largest and most sharply pointed in the second segment, and become successively smaller and blunter backwards. The third, fourth, and fifth terga are practically smooth; the sixth tergum, however, bears about a dozen spines arranged in two roughly crescentic rows, in addition to three on the posterior margin, which are pressed against the under surface of the thorax.

The terga bear very short setae on the smooth parts of their surface. The anterior edges of the pleura are furnished with setae, and in the second segment bear a few small teeth.

The telson and uropods are completely folded under the last part of the abdomen, which in its turn is bent on itself, so that the end of the sixth segment is pressed against the thoracic sternum. The telson is quite thin and membranous; it is slightly concave laterally and posteriorly, and is divided by a transverse suture.

The eyes reach the middle of the rostrum. The corneal part is wider than the cylindrical stalk.

The antennular peduncle extends well past the tip of the rostrum. The basal joint is thicker than the second and third; the opening of the otolith-chamber is elevated into a ridge fringed with bristles. The third joint is the longest; it is very slightly thickened distally. The internal flagellum is thick at the base, but tapers rapidly to a fine point; it is composed of about twenty joints and bears a heavy fringe of hairs. The outer flagellum is much shorter, is quite slender throughout, and is composed of very few joints.

The antennal peduncle is very slender and quite short; it extends just beyond the cornea of the eye. The flagellum is also short, being very slightly longer than the antennules. The peduncle is five-jointed and has a rudimentary scale. There is a slender spine at the distal end of the terminal joint.

The mandibles have a well developed three-jointed palp. The anterior four or five teeth on the cutting edge are much larger than those behind.

The exopodite of the first maxillae is represented by a mere rudiment; at the tip of the endopodite there are three or four sharp spines.

The second maxillae are normally developed.

The first maxillipedes have a rudimentary epipodite; the basal part of the exopodite is very much flattened.

The exopodite of the second maxillipedes is longer than the endopodite, and its peduncular portion is expanded.

The coxa of the third maxillipedes has a strong spine on the inner edge; the ischium has the usual *linea cristata*. There is a short spine near the distal end of the outer margin of the merus, and a longer and sharper one in the same position on the carpus. The propodite is long and massive, and bears a rounded protuberance near its extremity on the lower side. Neither the propodite nor the dactyl have any spines, but bear thick tufts of setae. The exopodite is very slender; its peduncle reaches the middle of the merus; the first joint of its flagellum is much longer than the succeeding ones.

The chelipeds are developed to an extraordinary extent, being between five and six times as long as the carapace and rostrum. They are slender and cylindrical and thickly covered with sharp spines which are arranged in longitudinal rows. There are six or seven rows on each joint. The longest joint is the merus, and the spines also reach their maximum development there; here and there among the spines there are long setae. The spines are similarly arranged on the carpus and the propodite. The carpus is slightly shorter than the latter. The dactyl is less than a third of the length of the propodite. The fingers bear only a few small spines; both margins are setiferous; on the inner edge, near the base of each finger, there is a blunt tubercle; the cutting edges bear isolated teeth which crowd more closely together towards the tip; the fingers end in sharp and curved claws which cross one another; the cutting edges do not come in contact with one another except in their distal half and where the two tubercles meet.

The next three pairs of pereopods are more slender than the chelipeds and are subequal in length. They are very much shorter than the chelipeds, reaching only to about the middle of the carpus of the latter. In the merus, which is the longest and stoutest joint, the spines are arranged as in the chelipeds. In the carpus the lower and outer edges are almost free from spines. The propodite is longer and thinner than the carpus, and bears a dorsal tuft of setae at its distal extremity; on the distal half of its lower margin there is a row of about a dozen mobile spines, interspersed with setae. The dactyl ends in a strong curved claw and also bears a row of about eight or nine spines on its lower surface; these spines increase in size distally.

The fifth pereopods are very small and feeble, and are carried bent on themselves in the manner usual in the group.

There are no pleopods on the first abdominal segment in the female, but they are present on the second to fifth segments. They are uniramous and two-jointed, bearing tufts of long setae at the extremity of each joint.

In the male the distal joint of the first pleopods is expanded

into a wide lamella, which has the edges slightly, and the tip very much, curled inwards.

In the second pair in the male the peduncular joint is long and robust. The distal joint is of peculiar structure, being slightly twisted into a spiral; near the tip there is a wide ear-shaped plate standing out almost at right angles to the axis of the joint. The rounded margin of this plate, which half encircles the joint, is densely covered with short bristles. It is much thicker at one side than the other, and the bristles all point towards the thick part. A few setae are present on the tip of the joint, and below the plate-like expansion there is a fringe of longer setae on the margin. The other pairs of pleopods are represented by mere rudiments in the male.

The uropods are thin membranous structures, and are folded under the abdomen with the telson. They have no transverse suture on either branch; their lateral and posterior edges are setiferous.

When alive the animal is bright scarlet, and the eyes have a bronze lustre.

Size.—The largest specimen taken by the *Helga* measures 44 mm., when the abdomen and telson are fully extended. Milne-Edwards and Bouvier mention specimens 52 mm. long.

General Distribution.—The species is known hitherto only from those regions with which the names of the *Travailleur*, *Talisman*, and *Caudan* are associated. It has been recorded from stations ranging from Rochefort, in the Bay of Biscay, to the Canaries. More recently it has been taken further north, two specimens having been captured by the *Huxley*, in the latitude of Brest, long. $8^{\circ} 13' W.$, (Kemp). The specimens taken by the *Helga* extend the range of the species still further in a northerly direction.

Irish Distribution.—

Helga.

CXX.—24 VIII '01. 77 mls. W.N.W. of Achill Head, Co. Mayo, 382 fms. Trawl.—One.

S. R. 223.—12 V '05. $53^{\circ} 7' N.$, $14^{\circ} 50' W.$, 410–500 fms., coral. Trawl.—Two, 44–34 mm.

Vertical Distribution.—The depths in which the species has been taken range from 382 fms. (*Helga*) to 929 fms. (*Caudan*). The other specimens were captured in over 444 fms. (*Huxley*), 517 fms., and 482 fms. (*Travailleur* and *Talisman*).

FAMILY GALATHEIDAE.

There are two sub-families:—

A.—Integument crisp; exopodite of the first maxillipedes terminates in a flagellum; eyes faceted and well pigmented, .. GALATHEINAE.

B.—Integument very strongly calcified and very thick; exopodite of first maxillipedes does not end in a flagellum; eyes opaque, not faceted, and devoid of pigment, .. MUNIDOPSINAE.

SUB-FAMILY *GALATHEINAE*.

A.—Rostrum broad and flattened, armed with teeth, *Galathea*.

B.—Rostrum spiniform; supra-orbital spines very long, *Munida*.

GENUS *Galathea*, Fabricius.

Galathea intermedia, Lilljeborg.

Pl. XI, figs. 1-12.

Galathea Andrewsii, Kinahan, 1857 (*d*).

Galathea Andrewsii, Kinahan, 1861.

Galathea intermedia, Bonnier, 1888.

The carapace is roughly pear-shaped. It ends in front in a large triangular rostrum, and is slightly concave on the hind margin. Its surface is traversed by grooves running from one side to the other; they are bordered by fringes of fine setae. The rostrum has four spines on each side but they are not all well developed; the last pair, especially, are very small. The central point is longer than any of the lateral spines. The rostrum is longer and narrower in the male than in the female. The lateral margins of the carapace bear each a row of spines, of which those at the antero-lateral angles are the largest. There is a short, transverse groove surmounted by two spines at the base of the rostrum, separating it from the gastric area. Below the lateral margin there is a distinct *linea anomurica*, and beneath the latter are a number of oblique grooves running forwards and downwards.

Each of the abdominal terga bears a single transverse furrow. The pleura point slightly forwards, and are of equal size from the second to the sixth segment; in the first segment they are much reduced and more or less hidden by the carapace.

The telson is bisected by a longitudinal groove, and further divided by lines running obliquely inward from the postero-lateral angles. Its dorsal surface bears minute scales from which spring groups of bristles and spines, all directed backwards.

The eyes are small, and the eyestalks cylindrical, and partly hidden by the rostrum.

The basal joint of the antennules bears two long pointed processes, from which spring a few bristles near the tip. On the upper surface of the joint there is a deep groove into which the distal portion of the appendage can be folded. When in

this position the antennules are protected by the massive basal joint below, and by the rostrum above. On the same joint there is the slit-like opening of the auditory sac. From the exterior margin of the latter there grow inwards a row of long hairs, which form a protective covering to the opening. The slit widens towards the proximal end, and is here partly covered by a rounded flap. The second and third peduncular joints are about equal in length.

The outer flagellum is very thick at the base, but tapers rapidly; it is composed of fifteen joints, and has a dense fringe of setae on its inner margin. The inner flagellum is composed of only six joints and is uniformly slender throughout.

The first, and largest, joint of the antennal peduncle has a sharp spine at the antero-interior angle; there is no trace of a scale. The flagellum is as long as the chelipeds in the female, but scarcely reaches to the middle of the propodite in the male.

The first two joints of the third maxillipedes are short and broad. A small epipodite is attached to the coxa. The exopodite has a long peduncle which extends beyond the merus; it narrows suddenly in its distal third; the flagellum has one long basal joint, the rest being made up of short joints, each of which bears two long setae. The ischium is shorter than the merus, its lower distal extremity ends in three teeth. The *linea cristata* bears about twenty-two teeth. On the inner side of the merus there are two large spines; one is situated at the distal end, and the other near the middle, but rather nearer the distal than the proximal extremity. Both ischium and merus bear fringes of long setae. The carpus is slightly swollen in its second half, and is of about the same length as the propodite. The dactyl is shorter than both.

In the young male the chelipeds are similar to those of the female; in the adult, however, they become developed to a relatively enormous size, being about twice the length of the body (with the abdomen in its natural folded position). The elongation is accompanied by great thickening, and the unwieldy appearance of the appendage is enhanced by the fact that the first three joints remain slender. The thickening begins at the proximal end of the merus. The largest joint is the propodite. The two chelipeds are unequal, sometimes the right, sometimes the left, being the larger. In the latter the distal part of the propodite is peculiarly modified; the fixed finger curves strongly outwards from the point of articulation of the dactyl, and meets the latter only at its tip. Opposite the curve there is a strong tubercle on the inner margin of the dactyl. The surface of the chelipeds is covered with scale-like tubercles, especially in adult males. The curve in the fixed finger does not seem to develop until the animal has attained maturity. Of two large males in the collection at my disposal, one has the curve and opposite tubercle very prominently developed, whereas in the other, which is only very slightly smaller, there is no trace of it, and the fingers are in contact throughout their entire length.

The spines on the chelipeds of the adult male are much reduced compared with those on the female or the young male.

The extreme tip of the chelipeds is characteristic of the species. Both fingers end in a broad, curved tooth which terminates the inner margin, and above this there is another smaller and sharper tooth in line with the outer margin.

The second, third, and fourth pereopods resemble one another closely, and are of much the same size; the merus and propodite are long, the other joints short. All three end simply.

The fifth pereopods are very feeble, and are usually carried folded on themselves, and half inside the branchial chamber. The merus and carpus are long and slender, the flexure taking place at their point of articulation. The appendage ends in a small chela, thickly covered with setae.

The pleopods are quite different in the two sexes.

In the male the first pair of pleopods consist of a slender peduncle, which is followed by a single lamellar joint of peculiar structure. It consists of a thin plate, the inner edge of which is curved, and is fringed with short bristles; the outer edge is not curved except near the distal end, where it is folded inwards, so as to form a flap, which bears some longer bristles. The second pleopods are longer than the first, and consist of a fairly stout peduncle, at the end of which there is a small blunt process of one joint which represents the exopodite. The endopodite slopes inwards and broadens out half-way to the tip, after which it narrows again; the distal half has a covering of short, stiff bristles. This portion probably represents the *appendix masculina* united to the endopodite. The third, fourth, and fifth pairs of pleopods have thin lamellar peduncles, which are straight on the outer side and curved on the inner; the latter bears a row of long plumose hairs from seven to fourteen in number. At the extremity of the exterior margin there is a short, blunt process representing the endopodite. Of this process Bonnier says: "à son extrémité distale . . . se trouve un rameau interne, d'un seul article et très réduit." In the large number of specimens collected by the *Helga* quite a number of males have this process composed of two joints. In the majority of cases those in which two joints are present are larger than those with one. Altogether fifteen males have only one joint, and eight have two. In some of the latter the second joint is much shorter than the first, while in others the two joints are equal. Probably the possession of one or of two joints depends upon age.

In the female the pleopods of the first segment are altogether absent. Those on the following segments are slender and three-jointed.

The borders of the uropods are furnished with fringes of long, pinnate setae, and also bear rows of large and small spines. The spines are best developed on the posterior edge of the endopodite. The surface also bears small groups of spines and bristles, all pointing backwards.

Epipodites are present on the chelipeds, but not on the other pereopods.

Branchial formula :—

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	ep.	—	ep.	ep.	—	—	—	—
Arthrobranchs.	—	—	2	2	2	2	2	—
Pleurobranchs.	—	—	—	—	1	1	1	1

Size.—This is by far the smallest of the British species of *Galathea*. Adult specimens usually measure from 12 mm. to 20 mm. The largest specimen taken by the *Helga* is an ovigerous female which is 21 mm. long.

General Distribution.—The species is found in all the seas of western Europe. Norway (Lilljeborg, G. O. Sars), Skagerrak and Kattegat (Meinert), Scotland (Norman, Kinahan, Henderson); North Sea (Hoek), Cornwall (Carrington), English Channel (Crawshay), Bay of Biscay (Bouvier), Spain (Göes), Mediterranean (Milne-Edwards), Madeira, Azores (Barrois).

Irish Distribution.—It is very plentiful all round the coast, and is often taken in very large numbers. A large proportion of the females taken by the *Helga* are ovigerous, especially those taken in March, April, and May.

Vertical Distribution.—It extends from the littoral zone down to considerable depths, the *Talisman* having taken a specimen in 123 fathoms. It occurs in greatest abundance in depths of 8–50 fathoms.

Galathea squamifera, Leach.

Galathea squamifera, Bell, 1853.

Galathea squamifera, Kinahan, 1861.

Galathea squamifera, Bonnier, 1888.

Both upper and lower surfaces of the chelipeds, and the upper surface of the rostrum are densely covered with scaly tubercles. The chelipeds are somewhat flattened, and bear long spines on the inner surface, except on the propodite, where the spines are on the outer margin.

The basal joint of the antennular peduncle has three sharp spines.

The ischium of the third maxillipedes is shorter than the merus. On the distal half of the inner margin of the merus there is a row of three or four small teeth, and beyond these, at the distal extremity, a single large spine.

The endopodites of the third, fourth, and fifth pairs of pleopods of the male are three-jointed.

The first three pairs of pereopods have epipodites.

Size.—It is usually considerably smaller than *G. strigosa*, 6–60 mm., being a common size for adults.

General Distribution.—The range is very much the same as that of *G. intermedia*. Norway (G. O. Sars, Loven), Kattegat (Meinert), Skagerrak (Stephensen), British and French coasts (Bell, Norman, Bonnier), Mediterranean and Adriatic (Heller), Azores and Cape Verde (Barrois).

Irish Distribution.—Common all round the coast, but not occurring in such large numbers as *G. intermedia*.

Vertical Distribution.—Commonest from tide-marks to about 3–4 fathoms, but occasionally it is found at depths of about 40–50 fathoms. The species migrates shorewards in spring, being found in large numbers under stones between tide-marks.

Galathea nexa, Embleton.

Galathea nexa, Embleton, Proc. Berwickshire Nat. Field Club, 18—.

Galathea nexa, Bell, 1853.

Galathea dispersa, Bate, 1859.

Galathea nexa, Kinahan, 1861.

Galathea dispersa, Kinahan, 1861.

Galathea nexa, Henderson, 1886.

Galathea dispersa, Henderson, 1886.

Galathea nexa, Bonnier, 1888.

Galathea dispersa, Bonnier, 1888.

Galathea nexa, Milne-Edwards and Bouvier, 1899.

Galathea dispersa, Milne-Edwards and Bouvier, 1899.

Galathea dispersa, Milne-Edwards and Bouvier, 1900.

Galathea nexa, Appellöf, 1906.

Galathea nexa, Hansen, 1908.

Galathea nexa, Kemp, 1910.

Galathea nexa, Crawshay, 1912.

Galathea dispersa, Crawshay, 1912.

The majority of recent writers on the Galatheidae have united *G. nexa* and *G. dispersa* as one species; this is done by Appellöf, Hansen, Kemp, and others, while Milne-Edwards, Bouvier, and Crawshay keep the two separate. The most detailed description is that given by Bonnier (1888). The character on which he chiefly relies for their separation is the number of spines on the inner margin of the merus of the third maxillipedes. In *nexa* there is a single large spine on the middle of the joint, and in *dispersa* a large spine in the same position, followed by a varying number of more distal and smaller spines, usually three or four. Bonnier's figure does not show this correctly, the drawing being out of proper perspective, so that the spines appear to be at the distal end of the joint. Milne-Edwards and Bouvier correct this (1899), and give a list of distinguishing characters, most of which are of very little value.

The specimens taken by the *Helga* all approach more or less closely to the *dispersa* type. One hundred and eighty-eight

specimens were taken, and in examining these I have found that there is very considerable variation in many of the characters on which Milne-Edwards and Bouvier base their distinctions. For instance, the spines on the sides of the rostrum vary in length and sharpness, and in those most nearly approaching the *nexa* type they are not blunter or thicker than in many of the *dispersa* type. The rostrum also varies in length, and it is often impossible to say whether it "almost reaches the extremity of the antennular peduncle" or "just passes the base of the last joint." It depends very much on the way in which the antennules are extended. Another character given by Milne-Edwards and Bouvier concerns the teeth or spines on the transverse furrow immediately behind the rostrum. They say that in *dispersa* "il y a au moins deux paires de saillies spiniformes ou d'épines," and in *nexa* "il n'y a pas de saillies, ou seulement une paire de saillies à peines distinctes," yet in many of the *Helga* specimens of undoubted *dispersa* form there are no teeth or spines on this line, and in others only a single pair. Again, in the great majority of the *Helga* specimens of the *dispersa* type the lateral margins of the carapace are distinctly convex, not "sensiblement droits."

The spines on the third maxillipedes show considerable variation. In some cases the large spine is followed by three or four smaller ones, in others by only one. In two large males from the west coast there is only one very small spine distal to the large one. These two specimens approach more nearly the *nexa* type than any of the others, and this lends support to Hansen's view that *nexa* has been founded on large male specimens of *dispersa*. Bonnier's description of *nexa* was taken from a single large male, and Milne-Edwards and Bouvier also saw only a single specimen, a male, whereas Appellöf and Hansen both had a large amount of material.

More recently Crawshay (1912) has separated the two forms by the character of a small group of three or four setae on the third maxillipedes close to the base of the large meral spine. In *nexa* these are simple, and in *dispersa* pinnate. They are pinnate in all the *Helga* specimens except the two large males mentioned before (from Ballynakill Harbour, Co. Galway), in which they are simple. These two also possess the strong spination and hispidation of the chelipeds of which Crawshay speaks, but the third maxillipedes bear a spine distal to the large central one, so that the characters of *nexa* and *dispersa* are here to some extent combined.

I am quite convinced, with Hansen, that the species *nexa* has been erroneously founded on very large male specimens of *dispersa*. The *dispersa* forms are very much commoner than the other, but the name *nexa* has priority and so must be used for the united species.

Size.—The largest specimen in the Irish collection is a male measuring 40 mm.

General Distribution.—The distribution of this is practically

the same as that of the two preceding species. It extends from West Finmark along the coasts of Norway and Denmark (Sars, Stephensen); it is found on all the coasts of Great Britain (Norman, Henderson, Kinahan, etc.), on the French and Spanish coasts (Milne-Edwards and Bouvier), in the Mediterranean and Adriatic (Heller-Hansen), and at the Azores and Canaries (Milne-Edwards and Bouvier). It has also been recorded from Iceland.

Irish Distribution.—The species is found all round the Irish coasts. It has been recorded from Dublin and Belfast (Kinahan, Thompson), from the south-west coast (Calman), Clare Island, Co. Mayo (Farran), and has been taken with very great frequency by the *Helga* in the Irish Sea, and on the south and west coasts. It was found plentifully at Ballynakill and Bofin Harbours and in Blacksod Bay.

Vertical Distribution.—*G. nexa* seems to be most plentiful at depths of about 25–40 fms., but it may be found from the shore line down to 260 fms. (Bonnier). The greatest depth at which it was taken by the *Helga* was 199 fms. On the west coast it was several times captured in more than 100 fms., and was very common at about 40 fms. On the east coast it occurs most plentifully in depths of about 20–30 fms.

***Galathea strigosa*, Linne.**

Galathea strigosa, Bell, 1853.

Galathea strigosa, Kinahan, 1861.

Galathea strigosa, Bonnier, 1888.

This may be distinguished from the other British species of *Galathea* by its large size, the great length of its chelipeds, furnished on both edges with strong spines, by the absence of epipodites on all the pereopods and by the form of the third maxillipedes.

Size.—Adult specimens may sometimes grow to a very large size. One specimen found in Cork Harbour is 102 mm. long, and individuals measuring 80–90 mm. are fairly common.

General Distribution.—This species extends along the coasts of the east Atlantic from the North Cape to the Canaries and Azores (Sars, Appellöf, Bouvier, Bonnier, etc.) It extends into the Mediterranean and Adriatic (Heller, Senna), and according to Heller has been found in the Red Sea.

Irish Distribution.—Found all round the coast.

Vertical Distribution.—It is frequently found under stones between tide-marks, but also extends to considerable depths. It is common in about 4–7 fathoms. One specimen was taken by the *Helga* in 37 fathoms off the Calf of Man, and Bonnier mentions a case in which it was taken in 328 fathoms.

GENUS *Munida*, Leach.

The two species occurring in Irish waters may be separated as follows :—

Cornea of eyes surrounded by circlet of hairs, some at least of which extend far out on the pigmented surface; the sternal plates are thickly covered by scale-like tubercles or ridges, which are bordered anteriorly with short setae, *M. bamffica*.

Circlet of hair at base of cornea absent or quite rudimentary; sternal plates smooth or with at most a very few setiferous ridges, *M. tenuimana*.

Munida bamffica (Pennant).

Pl. XI, figs. 13-14.

Munida Rondeletii, Bell, 1853.

Munida rugosa, G. O. Sars, 1882.

Munida Rondeletii, G. O. Sars, 1882.

Munida bamffica (*ex parte*), Milne-Edwards and Bouvier, 1894 (*a*).

Munida bamffica (*ex parte*), Milne-Edwards and Bouvier, 1899.

Munida bamffica (*ex parte*), Milne-Edwards and Bouvier, 1900.

Munida bamffica, Appellöf, 1906.

Munida rugosa, Appellöf, 1906.

Munida bamffica, Hansen, 1908.

A great deal of confusion exists with regard to this and the following species. Some writers have looked upon *M. bamffica*, *M. rugosa*, and *M. tenuimana* as constituting three separate species, others as two, and others again as a single species.

Bell (1853) changed the name of the present species to *M. Rondeletii* on quite insufficient grounds, and this name should not be retained at all. Sars, however, uses it (1882) in giving three species of the genus *Munida* as occurring in Norwegian waters, *M. Rondeletii*, Bell, *M. rugosa*, Fabr., and *M. tenuimana*, Sars. He separates these mainly by the size of the eyes, and the presence or absence of a circlet of hairs at the base of the cornea, and also by the spines on the fourth (in Sar's description the third) abdominal segment. Milne-Edwards and Bouvier, after examining the specimens taken by the *Hirondelle*, came to the conclusion that there is a single very variable species containing several varieties, and they adhere to this opinion after seeing the specimens taken by the *Travailleur* and *Talisman*. Appellöf, on the other hand, maintains with Sars that there are three distinct species, and gives a list of characters by which they may

be distinguished. Lastly, Hansen (1908) comes to the conclusion that *M. tenuimana* is a distinct species, but regards *M. bamffica* and *M. rugosa* as synonyms.

After examining carefully all the specimens of *Munida* taken by the *Helga*, I have come to the conclusion that Hansen's view of the species is the correct one. The specimens of *M. tenuimana* are at once separable from the rest by well-marked characteristics, but it is impossible to divide the others into *M. bamffica* and *M. rugosa*.

Appellöf gives the following characters as distinguishing marks between *M. bamffica* (= *Rondeletii*) and *M. rugosa*.

M. bamffica.

(a) Eye-bulb hardly broader than the stalk.

(b) Circlet of hairs more or less rudimentary.

(c) Hind margin of the carapace has one or two pairs of spines at the sides, the central part being quite unarmed.

(d) Fourth abdominal segment always without dorsal spines.

M. rugosa.

(a) Eye-bulb distinctly broader than the stalk.

(b) At least a few hairs extend far out on corneal surface.

(c) Hind margin of carapace normally has spines both at sides and in the centre.

(d) Fourth abdominal segment with two dorsal spines.

Some of the Irish specimens agree with nearly all the characters of *M. bamffica* given above, and some with those of *M. rugosa*, but between these there are individuals in which the characters of both are combined. For instance, two specimens from station S. R. 196 agree with *M. rugosa* in regard to the eye and the fringe of hairs round it, yet the hind margin of the carapace is practically devoid of spines, having merely a hint of one at each side, and there are no spines on the fourth abdominal segment. Appellöf admits that in young specimens of *M. rugosa* of less than 15 mm. these last spines may not be developed, but the Irish specimen is much larger than this, measuring 27 mm.

Of the ten adult specimens taken by the *Helga*, those from stations S. R. 194, S. R. 215, and S. R. 185 agree with Appellöf's characters of *M. rugosa* as regards the eyes, the circlet of hairs, the spines on the hind margin of the carapace and on the fourth abdominal segment. Those, on the other hand, from S. R. 178, S. R. 196, and S. R. 201 all possess some of the characters of *M. rugosa* and some of those of *M. bamffica*. Several of those in which the eye and circlet of hairs are of the *rugosa* type have no spines on the middle part of the hind margin of the carapace, and in some even the spines at the sides are wanting. Three specimens, again, which have the *rugosa* type of eye and circlet, have no spines on the dorsal surface of the fourth abdominal segment.

It will be seen that very few of the *Helga* specimens have all the characters of *M. rugosa* and that none have all those of *M. bamffica*. The majority have some of the characters of the one and some of the other. I therefore follow Hansen in regarding *M. bamffica* as a somewhat variable species in which the circlet of hairs is usually well developed, with some hairs extending far out on the cornea, in which the hind margin of the carapace may or may not bear spines on the central portion and sides, and in which spines may or may not be present on the fourth abdominal segment.

Size.—One very large specimen measuring 75 mm. was taken at station S. R. 215. Other large individuals, measuring 52 mm. and 42 mm., were also captured. Hansen's largest specimen was 53 mm. long.

General Distribution.—The most northerly record for this species is one given by Birula, between Jan Mayen and Greenland, at 73° 34' N., 17° 20' W. It is also known from the Varanger Fjord in the Murman Sea (G. O. Sars) and from the south and west of Iceland (Hansen). It extends along the whole west coast of Norway (Sars, Appellöf), is known from Bohuslän (Göes), and from the Skagerrak (Stephensen, Björck). It occurs round all the British coasts from the Shetlands to Falmouth, off the Breton coast (Bonnier), in the Bay of Biscay (Kemp), and extends southwards along the coasts of Spain and Portugal and west Morocco to Cape Bojador (Milne-Edwards and Bouvier). It also extends into the Mediterranean (Adensamer) and the Adriatic (Senna).

Vertical Distribution.—The species is commonest in depths 100–300 fathoms, though it is also frequently taken in much shallower water—Appellöf records it from 5½ fathoms at Byfjord, and also from very much greater depths, Hansen having taken five specimens off the south of Iceland, in 691 fathoms.

Irish Distribution.—Pocock, Bourne, and Calman all record this species from the south-west coast, and Thompson mentions it as having been found off Co. Down and at Youghal, Co. Cork.

Helga.

Helga LXXVII.—29 VI '01. 124 mls. W. by N.½N. of Cleggan Head, Co. Galway, 53° 24' 30" N., 13° 36' W., 91 fms., in stomach of fish.—One.

Helga CXVII.—23 VIII '01. 30 mls. W.N.W. of Cleggan Head, Co. Galway, 74½ fms., shelly sand and gravel. Dredge.—One, small.

Helga CXXI.—24 VIII '01. 64 mls. N.W.½W. of Cleggan Head, Co. Galway, 199 fms., sand. Trawl.—Twenty, all quite small.

S. 44.—12 II '02. 7 mls. off Howth, Co. Dublin, 25-27 fms., sand. Trawl.—Two.

S. 70.—9 VII '02. 7 mls. off shore, Lambay to Rockabill, Co. Dublin, 25-26 fms., fine sand and mud. Trawl.—One.

- S. 107.—17 iv '03. 2 mls. outside Kish Light, off Co. Dublin, 20-23 fms. Trawl.—One.
- S. 201.—23 i '04. 10 mls. off Rockabill, Co. Dublin, 44-48 fms. Trawl.—Two, 23 mm.
- S. R. 145.—24 viii '04. 50 mls. W.N.W. of Slyne Head, Co. Galway, $53^{\circ} 24' 30''$ N., $11^{\circ} 38'$ W., 112 fms., fine sand. Trawl.—Two.
- S. R. 178.—16 xi '04. $53^{\circ} 36' 30''$ N., $11^{\circ} 15' 30''$ W., $74\frac{1}{2}$ fms., coarse gravel. Dredge. Temperature at depth 10.8° C.—One, 32 mm.
- S. R. 185.—30 i '05. $50^{\circ} 20'$ N., $10^{\circ} 20'$ W., $82\frac{1}{2}$ fms., fine sand and shells. Trawl. Temperature at 80 fms., 11.05° C., salinity 35.62 ‰.—Four, 15-52 mm.
- S. R. 194.—10 ii '05. $54^{\circ} 49'$ N., $10^{\circ} 30'$ W., 366 fms., rock. Dredge. Temperature at 340 fms., 9.6° C., salinity 35.44 ‰.—Three, 20-33 mm.
- S. R. 196.—11 ii '05. $54^{\circ} 42'$ N., $10^{\circ} 34'$ W., 242 fms., stones and coral. Dredge. Temperature at 235 fms., 9.8° C.—Three, 27-42 mm.
- R. 8.—3 v '05. $16\frac{1}{2}$ mls. S.W. of Coningbeg Lightship, $51^{\circ} 47' 30''$ N., $6^{\circ} 52'$ W., 40 fms., mud. Trawl. Temperature at 40 fms., 8.9° C.—Two.
- R. 9.—3 v '05. $17\frac{1}{2}$ mls. S.W. $\frac{1}{2}$ W. of Coningbeg Lightship, 40 fms., fine sand and shells. Trawl.—Three.
- S. R. 215.—9 v '05. $52^{\circ} 1'$ N., $11^{\circ} 21'$ W., 106 fms., fine sand. Trawl.—One, 75 mm.
- S. 323.—21 viii '05. 6 mls. off Howth Head, Co. Dublin, $21\frac{1}{2}$ - $23\frac{1}{2}$ fms., fine sand. Trawl. Temperature at depth 13.5° C.—One.
- S. R. 360.—8 viii '06. $52^{\circ} 4'$ N., $11^{\circ} 27'$ W., 108-120 fms., fine sand. Trawl.—Two.
- S. R. 367.—11 viii '06. $51^{\circ} 38'$ N., $11^{\circ} 37'$ W., 287-332 fms., mud and sand. Trawl.—Two, 22 mm.
- R. 29.—17 viii '06. 15 mls. S.E. by S. of Mine Head, Co. Waterford, 40-42 fms., shelly sand and gravel. Trawl. Temperature at depth 9.6 C.—One, small.
- S. 457.—15 x '06. $19\frac{1}{2}$ mls. W.S.W. of Chicken Rock, Isle of Man, 41-80 fms., mud. Trawl.—Two.
- S. 476.—19 x '06. 6 mls. E.S.E. of Bailey Light, Co. Dublin, 23 fms., shelly sand. Trawl. Temperature at depth 12.6° C.—One.
- S. R. 399.—5 ii '07. $51^{\circ} 28'$ N., $11^{\circ} 33' 30''$ W., 342 fms., mud and stones. Dredge.—One, 12.5 mm.
- S. R. 447.—18 v '07. $50^{\circ} 20'$ N., $10^{\circ} 57'$ W., 221-343 fms., fine sand. Trawl. Temperature at 300 fms., 9.87° C., Salinity 35.48 ‰.—One, small.
- S. R. 581.—31 vii '08. 44 mls. S.W. by S. of Hook Light, Co. Wexford, 48 fms., coral sand and gravel. Trawl. Temperature at depth 8.8° C., Salinity 35.05 ‰.—One.

Munida tenuimana, G. O. Sars.

Pl. XI, figs. 15-16.

Munida tenuimana, G. O. Sars, 1871.*Munida tenuimana*, G. O. Sars, 1882.*Munida tenuimana*, Appellöf, 1906.*Munida tenuimana*, Hansen, 1908.

This species is very closely allied to *M. bamffica*, but it is separable from the latter by certain well-marked characters.

Appellöf (1906) gives the following summary of its characters :

“Eye-bulb broader than in *M. rugosa* (= *bamffica*); circlet of hairs quite rudimentary or altogether absent; spines always present on the middle part of hind margin of carapace; two spines on fourth abdominal segment; dorsal surface of abdominal segments with 6-7 furrows; limbs slenderer than in *rugosa* (= *bamffica*).”

All these characters are reliable, but Hansen points out that Appellöf has not observed the best distinguishing mark, viz., the surface of the sternal plates. He says: “In both species the sternum is divided into four segments by raised cross-lines furnished with marginal hairs. In *M. bamffica* it is further, as if covered with scales almost everywhere, which is due to the presence of numerous large and small, slightly-arched tubercles, the convex, anterior, or outer margin of which is well marked off and provided with hairs. . . . In *M. tenuimana* the sternum is very shining and without the scale-formations as in *M. bamffica*; there are some rows of bristles on a part of the first sternal segment, but the scale-like tubercles are rudimentary, and as a rule the second, third, and fourth segments are smooth, with altogether extremely few short rows of hairs, chiefly out towards the lateral margins; sometimes, also, we meet with a small number of such rows scattered over the surface of the segments, but the scale-formation, *i.e.*, the raised, seemingly imbricate areas are never developed.”

M. tenuimana is, on the whole, more slightly built than *M. bamffica*; the carapace is not quite so broad, and its margins are not so convex as in the latter species. The pereiopods, and in particular the first pair, are longer and more slender.

The circlet of hairs round the eye is almost entirely absent, and in some specimens completely so. The eyes are usually slightly larger than in *bamffica*. The sternum is as described by Hansen in all the specimens taken by the *Helga*. In some cases there are a few hair-fringed ridges on the second and third plates, but otherwise they are absent except near the anterior edge of the first sternal plate. In all the specimens of *bamffica*, on the contrary, the sternum is covered throughout with curved ridges and tubercles.

In all the specimens which I have examined the supra-orbital spines are elevated at a greater angle than they are in *bamffica*, in which, indeed, they lie almost in the same plane as the rostrum.

Another character which holds for all the Irish specimens, is the difference in the antero-lateral spines of the carapace. In *bamffica* these are barely half as long as the supra-orbital spines, and are thickened near the base; in *tenuimana*, on the other hand, they are very slender throughout, and are often very nearly as long as the supra-orbital spines.

Appellöf's distinction, based on the number of tergal furrows, is reliable only in the case of adult specimens, as the number of furrows varies with age. In *bamffica* there are from nine to fifteen, and in *tenuimana*, only six or seven.

The differences between the two species may, therefore, be tabulated as follows:—

M. bamffica.

M. tenuimana.

Eyes surrounded by circlet of hairs, some of which extend far out on corneal surface.

Circlet of hairs absent or rudimentary.

Sternal plates covered closely with raised tubercles and ridges which are bordered anteriorly with hairs.

Sternal plates devoid of such ridges and tubercles altogether, or having at most a few widely-scattered.

Spines on middle part of hind margin of carapace sometimes present.

Spines always present on middle part of hind margin, and usually larger than in *bamffica*.

Spines sometimes present on tergum of fourth abdominal segment.

Spines always present on fourth abdominal segment, and larger than in *bamffica*.

Supra-orbital spines horizontal or very slightly elevated.

Supra-orbital spines elevated at a considerable angle.

Spines at antero-lateral angles of carapace, about half as long as the supra-orbital spines.

Spines at antero-lateral angles of carapace, very long and slender, very nearly as long as the supra-orbital spines.

Dr. Lundbeck, of Copenhagen, has kindly sent me a specimen of *M. bamffica*, from the Faeroes, and three of *M. tenuimana* from the Skagerrak. These were named by Dr. Hansen, and I find that they agree exactly with the Irish specimens of the respective species.

Size.—The largest specimen measures 59 mm., and others in the collection are 58 mm., 53 mm., 51 mm., and 46 mm. Hansen mentions a female taken in the Skagerrak which was 87 mm. long, and a male taken by the *Ingolf* was about 74 mm. long.

General Distribution.—It is difficult to tell which records of this species are trustworthy owing to its having been confused with *M. bamffica* by Milne-Edwards, Bouvier, Senna, Adensamer, and others. It has been taken in the Norwegian fjords (Sars), in the Skagerrak (Stephensen, Björck), at a large number of stations to the west and south of Iceland (Hansen), and in Davis Straits (Stephensen). The *Helga* records are the first for the Irish marine area, but it is known from the Shetlands (Norman). It is at present impossible to mention a limit to its southern extension owing to its probable confusion by various authors with the last species.

Vertical Distribution.—*M. tenuimana* is a deep-water form, uniformly inhabiting greater depths than does *M. bamffica*. Sars took it in the Norwegian fjords in depths of 300–672 fms. Hansen records a remarkable haul of 104 specimens taken by the *Ingolf* off the south-west of Iceland, in a depth of 799 fms., the greatest yet recorded for the species. The *Helga* specimens were taken in 550–795 fms. Occasionally it seems to be found in comparatively shallow water, as Björck (1913 (a)) records it from 53 fms., from the Skagerrak.

Irish Distribution.—All the stations at which this species was taken lie close together, about 60 or 70 miles south-west of Tearaght, Co. Kerry.

Helga.

- S. R. 331.—9 v '06.—51° 12' N., 10° 55' W., 610–680 fms., ooze. Trawl. Surface Temperature 10·75° C.—Two, 43–50 mm.
- S. R. 353.—6 VIII '06. 50° 37'–50° 40' N., 11° 32' W., 250–542 fms., mud and sand. Trawl. Temperature at 500 fms., 8·58° C. Salinity 35·46‰.—Two, 26–46 mm.
- S. R. 363.—10 VIII '06. 51° 22' N., 12° W., 695–720 fms., ooze. Trawl.—24–58 mm.
- S. R. 364.—10 VIII '06.—51° 23' 30" N., 11° 47' W., 620–695 fms., ooze. Trawl. Temperature at 600 fms., 7·92° C., Salinity 35·37‰.—One, 32 mm.
- S. R. 401.—5 II '07. 51° 14' N., 11° 51' W., 600–660 fms. Trawl. Temperature at 580 fms., 8·35° C., Salinity 35·5‰.—One, 34 mm.
- S. R. 477.—28 VIII '07. 51° 15' N., 11° 47' W., 707–710 fms., ooze. Trawl. Temperature at depth 7·19° C.—Four, 28–53 mm.
- S. R. 491.—7 IX '07. 51° 57' 30" N., 12° 13' W., 491–520 fms. Trawl. Temperature at depth 8·53° C., Salinity 35·44‰.—One.
- S. R. 497.—10 IX '07. 51° 2' N., 11° 36' W., 775–795 fms., ooze. Trawl.—One, 43 mm.
- S. R. 499.—11 IX '07. 50° 55' N., 11° 29' W., 666–778 fms. Trawl. Temperature at 600 fms., 8·22° C., Salinity 35·41‰.—One.

- S. R. 504.—12 IX '07. 50° 42' N., 11° 18' W., 627–728 fms.. coral. Trawl.—One.
- S. R. 506.—12 IX '07. 50° 34' N., 11° 19' W., 661–672 fms. Trawl. Temperature at 600 fms., 8.22° C., Salinity, 35.53 ‰.—One.
- S. R. 593.—6 VIII '08. 50° 31' N., 11° 31' W., 670–770 fms., ooze. Trawl. Temperature at 650 fms., 7.75° C., Salinity, 35.53 ‰.—Two, very small.
- S. R. 752.—16, 17 V '09. 51° 48' N., 12° 11' 30" W., soundings 523–595 fms., ooze. Midwater otter trawl, 0–595 fms. Temperature at 500 fms., 8.9° C., Salinity 35.43 ‰.—Five, small.
- S. R. 753.—17 V '09.—51° 24' N., 11° 59' 30" W., 561–572 fms., ooze. Trawl. Temperature at 550 fms., 8.79° C., Salinity 35.46 ‰.—One, 59 mm.
- S. R. 805.—14 VIII '09. 60 mls. W. $\frac{1}{2}$ N. of Tearaght Light, Co. Kerry, 51° 50' 30" N., 12° 14' W., 539–544 fms., ooze. Trawl.—One, 21 mm.
- S. R. 1242.—14 VIII '11. 51° 27' N., 11° 55' W., 550–590 fms. Trawl.—Two, 44–51 mm.

GENUS *Munidopsis*, Whiteaves.

Munidopsis, Whiteaves, 1874. *Galathodes*, A. Milne-Edwards, 1880. *Orophorhynchus*, A. Milne-Edwards, 1880. *Elasmonotus*, A. Milne-Edwards, 1880. *Anoplomotus*, S. J. Smith, 1883. *Galathopsis*, Henderson, 1885. *Munidopsis*, Henderson, 1888. *Elasmonotus*, Henderson, 1888. *Munidopsis*, A. Milne-Edwards and Bouvier, 1894 (b). *Galathodes*, A. Milne-Edwards and Bouvier, 1894 (b). *Elasmonotus*, A. Milne-Edwards and Bouvier, 1894 (b). *Orophorhynchus*, A. Milne-Edwards and Bouvier, 1894 (b). *Bathyankeristes*, Alcock and Anderson, 1894. *Munidopsis*, Faxon, 1895. *Munidopsis*, Alcock, 1901.

Following Faxon and Alcock, I have united the various genera into which this group has been split up, in the single genus *Munidopsis*. The two species which have been taken in Irish waters, *M. tridentata* and *M. curvirostra*, are widely different, and might well be placed in separate genera were it not for the fact that they are connected by transitional forms which make it impossible to draw any hard and fast line between the various groups. Alcock (1901) gives the genera proposed by Milne-Edwards and Bouvier, and his own genus *Bathyankeristes*, the rank of sub-genera with a synopsis of their characters.

The two Irish species are easily separable by the form of the rostrum :—

Rostrum spiniform ; strongly upturned,

M. curvirostra.

Rostrum broad, ending in three teeth,
the central one the longest, ..

M. tridentata.

M. tridentata belongs to Alcock's sub-genus *Galathodes*, and *M. curvirostra* to *Munidopsis* proper.

Mundiopsis (Galathodes) tridentata (Esmark.)

Pl. XII, figs. 1-5.

Galathea tridentata, Esmark, 1856.

Galathodes rosaceus, A. Milne-Edwards, 1881.

Galathodes tridentata, G. O. Sars, 1882.

Munidopsis rosacea, Alcock and Anderson, 1899.

Galathodes tridentata, A. Milne-Edwards and Bouvier, 1899.

Munidopsis tridentata, Alcock, 1901.

Galathodes tridentata, Appellöf, 1906.

The carapace, excluding the broad, flattened rostrum, is roughly quadrilateral. The two lateral margins are very slightly convex, and each bears four small teeth. The posterior tooth is situated immediately behind the cervical groove, and the anterior and largest one forms the antero-lateral angle of the carapace. The rostrum is less than half the length of the carapace, and is slightly but distinctly carinated in the median line, ending in a trifold tip, the central point of which is the longest. Between the base of the rostrum and the antero-lateral spine there is a sharp tooth above the base of the antenna. The hind margin of the carapace is smooth and very slightly concave. The whole dorsal surface is rugose and covered with short hairs. The cervical groove is most distinct at the sides and is more vague in outline in the middle. On the central part of the cardiac region there is a short transverse furrow which extends about half way to either lateral margin and has at each end a circular depression. There is another depression just in front of the hind margin. The *linea anomurica* is distinct. The sub-lateral surface of the carapace is rugose like the dorsal part.

The abdomen, when straightened out, is of about the same length as the carapace, excluding the rostrum. None of the terga bear spines. The covering of setae is not so dense as on the carapace.

The second and third abdominal segments have a dorsal transverse groove which is wanting on the other segments. The pleura of the second segment are broader than the others. The basal part of the telson is bounded by a straight line in front and rounded behind. It is followed by a very small triangular plate. The hind part of the telson is divided by a deep median and two oblique lateral grooves.

The eyes are not faceted and are devoid of pigment. They are terminal on the sub-cylindrical eyestalks. Immediately to the exterior of each stalk there is a small sharp tooth.

The antennules are short, reaching only slightly beyond the tip of the rostrum when extended. The basal joint is massive

and bears two long spines. The second and third joints are about equal and become thicker distally. The two flagella are both quite short, the internal one consisting of only four joints, and being slender throughout, while the outer is made up of about fifteen joints and is broad at the base but narrows rapidly into a long, thin distal portion. The tip of the last peduncular joint bears a semicircle of long plumose hairs which surround the base of the exterior flagellum, which also has a dense fringe of hairs along its inner margin.

The antennal peduncle consists of four joints, the basal one of which is embedded in a sinus in the sub-marginal part of the carapace just at the end of the *linea anomurica*. It gives off an internal and an external spine, of which the former is the larger; both are thick and blunt. The second joint has a sharp spine at the outer side. The flagellum is very slender and is about one and a-half times as long as the carapace, including the rostrum.

The ischium of the third maxillipedes is triangular in section. It thickens very considerably towards the distal end, which bears two sharp teeth. The merus has two long spines on the inner side; the carpus is swollen and rough; the propodite is club-shaped.

The chelipeds are as long as, or longer than, the body from rostrum to tip of extended telson. They are well developed in both sexes, but are more massive in the male. They are covered above and below with little elongated tubercles or scales, from which spring groups of setae. The three basal joints are slender compared with the others. On the merus, which is more or less quadrilateral in section, there is a dorsal row of four or five teeth; on the upper distal part of the internal face a single large spine; near the proximal end of the lower side and pointing inwards, a row of three large spines; and at the distal extremity four sharp teeth. The carpus is short and bears several spines, including one large one on the inner face. The propodite is the largest joint of the appendage; the palm is nearly twice as long as the fingers; it bears no spines. The fixed finger curves slightly outwards at its base and touches the dactyl at the tip only. The interior edges of the fingers are minutely serrate. Opposite the hollow of the fixed finger the inner margin of the dactyl curves towards the latter, but not far enough to bring the two into contact.

It should be noted that the form and dimensions of the chelipeds of this species are extremely variable. Among 237 specimens Alcock could not find two in which the arrangement of spines was identical.

The next three pairs of legs are very similar in appearance. The dorsal side of the merus bears a row of sharp, forward-directed spines, the last of the row projecting distally beyond the joint. There is also a distal spine at the lower end of the merus. The carpus bears a similar sharp dorsal tooth at the tip, but the row of spines is continued on this joint merely by

a very fine denticulation. The propodite is sub-cylindrical with a slight dorsal ridge; the lower side bears two small distal teeth. The dactyl is only about half the length of the propodite, and its posterior edge bears about ten small teeth; it terminates in a sharp curved claw.

The fifth legs are feeble and are carried folded in the manner usual in this group of Decapods.

The first pair of pleopods arise very near the median line in the male; they have a stout basal part and a distal joint, which expands into a broad lamella which is curved downwards. The basal joint has a distal tuft of setae, and the inner edge of the lamella is fringed with hairs, which are longest at the proximal end. The second pleopods in the male have a very long and thick peduncular part which bears at its end a short, blunt tubercular process which represents the exopodite. The inner branch and the *appendix interna* are united to form a large flattened and twisted structure. It is heavily fringed with setae, and the outer portion at the broadest part is covered with short, stiff bristles. It is this part which constitutes the *appendix masculina*, and has become fused with the endopodite of the pleopod.

The pleopods of the third, fourth, and fifth segments are feeble and rudimentary.

In the female, pleopods are present on the second to fifth segments, and are all slender and feeble.

The exopodite of the uropods is rough and calcareous towards the outer edge, but the inner part is smooth. The endopodite is rough all over, and bears short transverse ridges armed with groups of little teeth. Both have marginal spines and fringes of setae.

Size.—The largest specimen taken by the *Helga* is a male which measures 33 mm.

General Distribution.—The species is found, but not commonly, on the west coast of Norway: Lofoten (Esmark), Hardangerfjord (Sars), Trondhjemsfjord (Norman). It has been recorded from the Bay of Biscay (Caullery, M. Edwards and Bouvier), off the west coast of Morocco and the Sudan, from the Azores, and Cape Verde (M. Edwards and Bouvier). It has also been taken plentifully in the Indian Ocean: Arabian Sea, North Maldivé Atoll, Travancore coast, off Ceylon (Alcock).

Irish Distribution.—This species has not previously been recorded from British waters.

Helga.

S. R. 335.—12 v '06. 51° 12' 30"—51° 17' 30" N., 12° 18'—12° 16' W., 893–673 fms. Trawl and Sprat net on Trawl.—Four.

S. R. 504.—12 ix '07. 50° 42' N., 11° 18' W., 627–728 fms., coral. Trawl and Sprat net on Trawl.—Two, one male and one immature.

S. R. 1004.—12 VIII '10. 51 mls. W $\frac{1}{2}$ S. of Great Skellig, 51° 22' 30" N., 11° 44' 30" W., 641–636 fms., fine sand. Trawl. Temp. at 630 fms., 7.12° C.—Two, one male, 33 mm., one female, 28 mm.

Vertical Distribution.—Like the other members of the genus, it inhabits deep water, occurring most commonly in depths of 550–750 fms. In the Bay of Biscay it was taken in 808 fms. In the Indian Ocean it apparently inhabits shallower water, the depths given by Alcock ranging from 210 fms. to 430 fms. Very often the specimens are found clinging to coral, especially *Lophohelia prolifera*.

Munidopsis curvirostra, Whiteaves.

Pl. XIII, figs. 1–4.

Munidopsis curvirostra, Whiteaves, 1874.

Munidopsis longirostris, A. Milne-Edwards and Bouvier, 1900.

Munidopsis curvirostra, Hansen, 1908.

Munidopsis curvirostra, Stephensen, 1912.

Hansen (1908) examined a specimen of *M. longirostris* taken by the *Talisman* off the west coast of the Sudan, and found that it agreed perfectly with the specimens of *M. curvirostra*, taken by the *Ingolf*. Neither the *Talisman* nor the *Ingolf* specimen, however, agrees with Milne-Edwards and Bouvier's figures (1900), which show the carapace wider in front than behind, and with very long and broad antero-lateral processes.

The sides of the carapace are almost parallel, converging very slightly in front. The lateral margins are entire and do not come to a sharp edge. The postero-lateral angles are rounded, and the posterior margin is feebly concave and unarmed. At each antero-lateral angle there is a large horizontally-projecting spine, with a broad, rounded base, and tapering rapidly to a fine point. The anterior edge of the spine bears a small accessory tooth near the tip. The front of the carapace is rounded and unarmed, except for the very long and slender upturned rostrum, which is usually about two-thirds the length of the carapace. The gastric region is more or less inflated and bears a variable number of spines. Behind this lies the deeply-channelled cervical groove, which on either side gives off a groove which runs forwards to the antero-lateral angle. On the middle of the cardiac region there is a sharply-defined transverse ridge bearing a single large spine. Almost the entire surface of the carapace is marked by low, short transverse ridges which are most numerous near the sides.

The arrangement of the spines on the gastric area is extremely variable. In the ten specimens taken by the *Helga*, six different arrangements can be seen. Normally there is a pair of spines in front, some distance behind the base of the rostrum, and

behind these one or two median unpaired spines. In some cases, however, as many as five median spines are present. (See also Hansen, 1908, Pl. III., figs. 2A-2D.)

The *linea anomurica* is distinct, and the sub-marginal part of the carapace is covered with low oblique ridges.

The carapace, excluding the rostrum, is as long as the straightened abdomen without the telson.

The first abdominal segment is partly hidden by the carapace and is very narrow. The second, third, and fourth segments have each a transverse furrow on the tergum. The second and third terga each bear a median spine which points forwards. Sometimes a spine is present on the fourth tergum also; it occurs in only one of the *Helga* specimens.

The pleura are well developed, and are long and narrow, with blunt ends, except those of the second segment which are broad and rounded. On the first segment they are rudimentary. On the anterior margin they are all fringed with setae, and on the sixth segment on both margins. The telson differs somewhat in structure from that of *M. tridentata*. The basal plate comes to a truncate end and is followed by three small plates in the middle, the central one of which is prolonged in a narrow process extending to the posterior margin.

The eyes are large but quite devoid of pigment. They vary somewhat in shape; in some the cornea is more or less pointed in front, and in others is quite globular.

The antennules resemble those of *M. tridentata*, except with regard to the basal joint of the peduncle, which bears three long spines instead of two. One of the spines, immediately at the base of the second joint, is divided into three points, and bears also two or three small teeth between the larger ones.

The antennal peduncle differs from that of *M. tridentata* in having the spines of the basal joint represented by blunt tubercles. The flagella are as long as the body excluding the telson.

The third maxillipedes are similar to those of *M. tridentata*, except that the two teeth on the internal margin of the merus are shorter, and the terminal teeth on the ischium are more rounded.

The chelipeds are long and slender. One is usually slightly larger than the other; this may be either the right or the left. They are covered throughout with small scales, some of which are fringed with extremely short setae, but they are devoid of long hairs, such as are present in *M. tridentata*. The first three joints are slenderer than the others, the thickening beginning at the base of the merus, which is more or less quadrangular in section. Each of the four edges of the merus ends in a sharp distal spine. The carpus terminates in two double spines above, and a broader spine below, which has also sometimes a double point. The propodite is broadest at the base of the fingers, which are in contact throughout their whole length. The cutting edges are serrate. The palm is longer than the fingers.

The next three pairs of legs are sub-equal and also bear a covering of small scales. The merus is unarmed except for one or two distal spines. On the carpus there is sometimes a distal spine on the dorsal side, but this is often absent in the third and fourth pairs. There is a small tuft of setae at the distal end of the propodite. The lower edge of the dactyl is furnished with a row of sharp teeth which increase in size towards the point, which has the form of a strongly-curved claw. These teeth are accompanied by fringes of setae.

In the male, the first pair of pleopods is practically identical in form with those of *M. tridentata*, but their point of attachment is not so near the median line. The second pair differs only in detail from that of the last species. The other pairs are reduced to the merest rudiments in the male. In the female, five pairs are present and are long and slender.

The uropods have no transverse suture on either exopodite or endopodite, and are usually carried half concealed under the telson.

All the female specimens taken by the *Helga* are ovigerous. The eggs are large and few in number. In the different individuals the eggs number 12, 20, 25, 30, 38 and 45. They measure from 1.2 mm. to 1.4 mm. in diameter.

Size.—The largest specimen taken is a male measuring 31 mm. Hansen's largest one was 35 mm. long.

General Distribution.—The species was first taken in the Gulf of St. Lawrence (Whiteaves), and has since been recorded from the east coast of the United States between 33° 35' N. and 40° N., and off Newfoundland. More recently it has been taken in Davis Straits (Hansen, Stephensen), and to the south and south-west of Iceland (Hansen). It has also been recorded, under the name of *M. longirostris*, from the west coast of the Sudan at 30° N. (Milne-Edwards and Bouvier).

Irish Distribution.—The *Helga* has taken this species on only one occasion.

S. R. 944.—17 v '10. 86 mls. W. $\frac{1}{4}$ N. of Great Skellig, Co. Kerry, 51° 22' N., 12° 41' W., 982 fms., ooze. Shrimp-Trawl.—Ten, three males, and seven ovigerous females, 31–25 mm.

Vertical Distribution.—Usually found in depths of about 700–900 fms., but has been taken in 180 fms. (Gulf of St. Lawrence), and in 1,175 fms. (off Sudan).

FAMILY PORCELLANIDAE.

GENUS *Porcellana*, Lamarck.

Chelipeds bear a dense fringe of long setae on their outer edge; carpus has a denticulated lobe at its inner lower angle; hands very large, *P. platycheles*.

Chelipeds devoid of setae; no denticulated lobe on carpus; hands narrow, .. *P. longicornis*.

Porcellana platycheles, Pennant.

Porcellana platycheles, Bell, 1853.

Porcellana platycheles, Heller, 1863.

The chief specific characters are the following: dense fringes of long setae on the propodite of the chelipeds; denticulated process near proximal end of carpus; carapace slightly longer than broad; its margins setiferous; front of carapace divided into three lobes, the central one having a slight median groove, but not divided as in *P. longicornis*; chelipeds, very massive, and practically equal; edges of abdominal segments heavily fringed with setae, especially in the female; walking-legs also setiferous.

Size.—Large specimens measure about 14–16 mm., from front to back of carapace.

General Distribution.—This species has a more limited distribution than *P. longicornis*. It occurs on all the British coasts, even as far north as the Orkneys and Shetlands (Bell). It is also found plentifully on the French side of the Channel, and in the Bay of Biscay (Milne-Edwards), off the Spanish and Portuguese coasts, and at the Canaries (Heller). It is very common throughout the shores of the Mediterranean and Adriatic (Heller).

Irish Distribution.—Found abundantly all round the coast. It is not apparently quite so common on the east as on the west coast, but the larger amount of shore-collecting done on the latter may explain the comparative paucity of records from the east.

Vertical Distribution.—Very common between tide-marks, and extending only a short distance beyond the low-water line.

Porcellana longicornis, Linn.

Porcellana longicornis, Bell, 1853.

Porcellana longicornis, Heller, 1863.

Porcellana longicornis, Meinert, 1877.

Carapace almost circular; the frontal margin divided into three lobes, the central one divided by a deep groove; the margin of the central lobe is denticulate. Antennules reach beyond the merus of the chelipeds. Antennae, long and very

slender. Eyes deeply sunk in their orbits, so as to be scarcely visible from above. Chelipeds, large and unequal. The inner edge of the carpus is smooth and unbroken. The fingers touch only at their tips and are slightly twisted. The wrinkles on the carapace are more conspicuous in the females than in the males.

Size.—Large specimens are sometimes 10 mm., from front to back of carapace, but the average measurement is about 6–8 mm.

General Distribution.—The species extends from the south-west of Norway, along the coasts of western Europe into the Mediterranean and the Black Sea. South-west of Norway (G. O. Sars, Appellöf), Skagerrak and Kattegat (Meinert, Björck), Sweden (Gcös), Heligoland (Ortmann), British coasts (Bell), Bay of Biscay (Milne-Edwards), Spanish and Portuguese coasts (Heller), Canaries (Heller), Mediterranean and Adriatic (Heller, Carus), Black Sea (Heller).

Irish Distribution.—Very common all round the coast.

Vertical Distribution.—From between tide-marks down to about 20 fms.

TRIBE THALLASSINIDEA.

The families containing Irish species may be separated as follows :—

A.—No *linea thalassinica*; abdominal pleura large, AXIIDAE.

B.—*Linea thalassinica* present; abdominal pleura usually small :—

1. Both endopodite and exopodite of uropods with transverse suture; podobranchs on at least first three pairs of pereopods, LAOMEDIIDAE.

2. Neither endopodite nor exopodite of uropods with transverse suture; pereopods without podobranchs, CALLIANASSIDAE.

FAMILY AXIIDAE.

The family contains four genera *Axius*, *Axiopsis*, *Calocaris*, and *Scytoleptus*, but we are concerned here with only two of these, *Axius* and *Calocaris*, which may be separated by the following characters :—

Body compressed; no median dorsal ridge on carapace; no suture on the exopodite of the uropods, *Axius*.

Body almost cylindrical; a median dorsal ridge on the carapace; a suture on the exopodite of the uropods, *Calocaris*.

GENUS *Axius*, Leach.

Borradaile (1903) has divided *Axius* into five subgenera *Axius*, *Neaxius*, *Iconaxiopsis*, *Eiconaxius*, and *Paraxius*. The only one of these with which we have to deal is the first, which is distinguished by having "the flat area of the back and the cervical groove well marked, the eyes well-pigmented, the antennal thorns both of a good size, pleurobranches on the second to fifth legs, vestiges of a podobranch and an arthrobranch on the second maxillipede, and a shallow-water habitat."

Axius stirhynchus, Leach.

Pl. XIV, figs. 1-4.

Axius stirhynchus, Bell, 1853.*Axius stirhynchus*, Norman, 1868.

The carapace is strongly compressed, and very slightly narrower in front and behind than in the middle. The rostrum is short and flat, triangular in shape and furnished with a slight ridge on either margin, and a median crest; its edges are lined with short, blunt teeth, and it bears setae on the dorsal surface. The gastric area is slightly flattened. The cervical groove is very distinct. The posterior margin of the carapace is deeply concave in its central part; the lateral parts of the margin project slightly over the first abdominal segment, and buckle it to the carapace. The ridges from the margins and centre of the rostrum are continued backwards on the gastric area, but do not extend more than one third of the distance to the cervical groove. The whole carapace surface is sparsely punctate.

The abdomen is very nearly twice as long as the carapace. The first segment is shorter and narrower than the others, which are practically uniform. The segments are all quite smooth, bearing no ridges, and are sparsely punctate. They have a slight sprinkling of fine setae. The pleura of the first segment are narrow and taper to a fine point, while those of the other segments are very broad and quite shallow, with rounded angles. On each pleuron of the third, fourth, and fifth segments there is a low oblique ridge from which springs a row of backward pointing hairs.

The telson is as long as the preceding abdominal segment, and slightly narrower at the base, from which it tapers very slightly towards the posterior end, which is truncate. The posterior angles are rounded, and the margin between them is fringed with setae. There are two small spines about the middle of the dorsal surface of the telson, and also a few scales from which spring tufts of bristles all pointing backwards. There is also a median tooth on the posterior margin.

The eyes are small and the eyestalks short. They are half hidden beneath the rostrum, and are fairly well pigmented.

The antennular peduncle extends beyond the tip of the

rostrum. The two flagella are of about equal length, but the outer is slightly thicker than the inner.

The antennal peduncle is five-jointed. The basal joint is short and broad, the second much larger, ending at its upper and outer angle in a strong fixed spine. Springing from the base of the latter, and lying between it and the fourth joint, is a long mobile spine representing the scale. The third joint lies more or less alongside of and below the second. The fourth and fifth joints are roughly cylindrical; the fourth is about one and a half times as long as the fifth. The flagellum is more than twice as long as the antennules, and almost twice as long as the carapace. The lower surface of the last three peduncular joints and of the proximal half of the flagellum is fringed with heavy plumose setae of a brownish yellow colour. This fringe is not absent in the female, as stated by Bell (1853).

The exopodite of the second maxillipedes reaches very nearly to the distal end of the propodite, which is broad and inflated; the carpus and the dactyl are both very short; the longest joint is the merus, which is about three times as long as the ischium. The appendage bears an epipodite, a podobranch and a rudimentary arthrobranch.

The third maxillipedes are pediform and unarmed. No one joint is much longer than the others. Each joint bears a heavy fringe of setae. The exopodite reaches slightly beyond the end of the merus.

The chelipeds are massive and unequal. The basal joints and the first half of the merus are very strongly compressed. The distal part of the merus, however, expands suddenly. The carpus is very short and broad. The propodite is the largest joint of the appendage; it is slightly compressed; the palm is one and a half times as long as the fingers; the lower margin bears a fringe of fine setae, and both fingers are covered with tufts of stiff bristles. The tips of the fingers curve towards one another, and cross when closed. The dactyl has a well marked ridge on the outer side, and bears more bristles than the fixed finger. The cutting edges are very minutely serrate, and, in the larger cheliped, there are also a few large crushing tubercles.

The second pereopods are much more slender than the first. They terminate in equal chelae, and are strongly compressed.

The fourth pereopods are the largest, with the exception of the first pair, and the fifth the shortest. The last three pairs all end simply, and are compressed and slender.

In the second pereopods setae are present on the lower edge of the merus, on the distal half of the carpus, and on the whole of the propodite and dactyl; there are tufts of longer hairs at the extremities of carpus and merus.

In the third pair the lower edge of the merus has only a row of short bristles; the propodite, dactyl, and carpus have setae on their lower margins.

The setae on the fourth pair are more sparsely scattered than on the third.

In the fifth pair they are most plentiful at the end of the propodite and on the dactyl.

Both the perfect specimens taken by the *Helga* are females, so I can give no description of the form of the pleopods in the male. The pleopods in the female are well developed and fringed with long plumose setae. To the inner branch there is attached a small *appendix interna*.

The uropods are as long as the telson, fringed with setae, rounded; neither endopodite nor exopodite has a suture. The endopodite has a strengthening midrib which bears four small spines; the exopodite has two similar ribs which end in small spines on the margin.

The gills are trichobranchiate, with the filaments arranged in one plane. The branchial formula is as follows:—

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	ep. 1	+ep.	ep.	—				
Arthrobranchs.	—	r	2	2	2	2	2	—
Pleurobranchs.	—	—	—	—	1	1	1	r

In the female specimens I have seen there is a curious structure situated between the coxae of the fourth pereopods. It appears to correspond to the "thelycum" of the Peneidae. It consists of two lateral plates, the outer edges of which are curved upwards to form sharp ridges. These extend forwards parallel to one another, but posteriorly they converge, and ultimately coalesce, at the same time becoming much flatter. Their anterior extremities are narrow and pointed, and between them there is a third plate, roughly triangular in outline, and situated transversely to the first two. Its anterior edge is upturned to form a ridge, but this is not so high as those of the lateral plates. These three plates together form a triangular hollow in the centre of which appears a small opening.

Size.—The largest specimen examined measures 72 mm.

General Distribution.—There are very few records of this species, its fossorial mode of life making it difficult of capture. Probably it has a considerably wider range than is indicated by the list of localities given here. It is known from the south coast of England (Spence Bate), Channel Islands (Sincl), France (Milne-Edwards), and the Mediterranean (Bell).

Vertical Distribution.—Littoral²; of burrowing habits.

Irish Distribution.—Two female specimens have been taken by the *Helga*, one in the Irish Sea and one in Ballynakill Harbour, Co. Galway. Half-digested remains have also been found on four occasions in the stomach of *Raja clavata*, each time in Galway Bay. In one case five specimens were found in one fish.

So far as I have been able to discover, the species [has not previously been recorded from Irish waters.

Helga.—

L. 288.—3 II '04.—Ballynakill Harbour, Co. Galway.—One.
72 mm.

S. 259.—21 II '05. 15 mls. off Clogher Head, Co. Louth,
32½ fms., mud. Trawl.—One.

GENUS *Calocaris*, Bell.

Calocaris, Bell, 1853. *Calocaris*, Alcock, 1901.

Body almost cylindrical; the back arched so that its middle point is considerably higher than the base of the rostrum. From either margin of the rostrum there extends backwards and outwards on the sides of the gastric area, a ridge armed with teeth; it does not reach the cervical groove, which is distinct. A low but distinct carina runs from the rostrum to the posterior margin along the dorsal median line of the carapace. There are no pleurobranchiae. There is a suture on the exopodite of the uropods. Deep-water habitat.

Calocaris Macandreae, Bell.

Pl. XIV, figs. 5-7.

Calocaris Macandreae, Bell, 1853.

? *Calocaris Macandreae*, Alcock, 1901. *Red Sea*

Calocaris Macandreae, Hansen, 1908. *No fig.*

Calocaris Macandreae, Wolleback, 1909.

Calocaris Macandreae, Björck, 1913 (b). *Port of ...*

This species has been so well described by Bell and Alcock, that it is unnecessary to give here more than a brief summary of the main characters.

Carapace compressed, shorter than abdomen. Rostrum slightly upturned, reaching very nearly to the end of the antennal peduncle; its margins are continued as prominent divergent ridges on the gastric area, and bear teeth.

Abdomen slightly tapering, smooth; pleura broad with rounded angles, except in the first somite. Telson broad; often more or less excavated on posterior margin; sometimes with a minute tooth at the tip; the sides sometimes bear two or three proximal teeth; there are two diverging rows of spines running down the telson, but not reaching the margin.

Eyes large and pigmentless; practically no eyestalk.

The fourth joint of the antennal peduncle is by far the longest; the scale is represented by a small spine, and to the inside of this there is a second still smaller one. The flagellum is slightly longer than the body.

The two branches of the antennules are lashlike and slender; they are longer than the carapace.

The third maxillipedes are pediform and slender; the ischium is long, and bears a row of strong teeth; the merus has a single large spine near the distal end of the inner margin.

The chelipeds are long and robust; the fingers especially are very much elongated; the merus, which is strongly compressed, bears a row of five or six teeth on the lower margin, and a single distal tooth above. The carpus is short and unarmed. The upper surface of the palm bears two crests, each of which ends distally in a tooth near the base of the dactyl. The fingers are long and compressed, and covered with tufts of setae. The fixed finger has its cutting edge serrate throughout; the proximal half of the dactyl, however, is quite smooth, and in the distal portion only very minute serration is present. At the base of the fixed finger there is a single large tooth. The fingers are not in contact except in their distal portions; the tips cross one another. The fingers are not quite twice the length of the palm.

The following pairs of pereopods are slender; the second pair are chelate, the others simple.

The pleopods, except the first pair, are biramous, and have a small and slender *appendix interna*, furnished with hooklets.

The outer margin of the exopodite of the uropods bears two or three spines, the distal one the largest; the endopodite has only one spine in a position corresponding to the large one of the exopodite. The latter has an oblique suture near the tip.

Branchial formula:—

	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	ep. ¹ + ep. ²	1 + ep. ³	1 + ep. ¹	1 + ep. ²	1 + ep. ³	ep. ⁴	—	—
Arthrobranchs	—	<i>r</i>	2	2	2	2	2	—
Pleurobranchs.	—	—	—	—	—	—	—	—

On the first abdominal somite there is a pair of simple appendages, the tip of which is expanded in the manner usual in male Decapods. This structure, however, is found in *all* adult specimens, and both the male and the female genital openings, on the coxae of the fifth and third pereopods, respectively, are always present.

In 1909 Wollebaek published a paper calling attention to the fact that *Calocaris Macandreae* was normally hermaphrodite. The union of sexes is not confined to the outward characters alone, but extends to the internal sexual organs; in each specimen there are to be found testes, and also ovaries. Wollebaek examined more than fifty specimens in the Bergen Museum, all of which exhibited hermaphroditism.

This species was taken by the *Helga* on several occasions, and in fairly large quantities. The specimens agree entirely with Wollebaek's results. The male and female openings are distinctly developed, and I have dissected several specimens and found both testes and ovaries present.

Spermatophores and spermatozoa of the peculiar shape described by Wollebaek were found in the long and spirally-twisted *vas deferens*. The testes are very small compared with the same organs in some other Decapods, such as the Lobster. In the latter they consist of a long uniform tube on either side of the gut, the two parts being connected by a bridge in their anterior part. In *C. Macandreae*, on the other hand, the testes form merely a small sac-like continuation of the first part of the *vas deferens*. They are attached to the gut, and are also more or less adherent to the posterior extremity of the ovaries. The *vas deferens* consists of three distinct parts: (1) The part nearest the testes, which is fairly wide, is bow-shaped, and not spirally twisted; it slopes downwards and backwards, and leads to (2) the middle part, which is curled and twisted in a number of small spirals; and this in its turn leads to (3) the *ductus ejaculatorius*, which is wider than the last, and opens on the coxae of the fifth pereopods.

The ovaries lie in front of the testes, and extend forwards on either side of the gut, more or less surrounded by the ramifications of the hepatic gland. In winter they are comparatively slender, but in specimens caught in summer the ova are very large, and fill a very large part of the thorax. For purposes of dissection winter specimens should be selected, as the relations on the various parts may then best be seen.

General Distribution.—This species was first taken by M'Andrew in Loch Fyne, and has since proved to extend over a very wide region. It is known from the south and west coasts of Norway (Norman, Appellöf), from Bohuslän, Sweden (Goës), the Kattegat (Meinert), and the Skagerrak (Stephensen). A single specimen was taken by the *Ingolf* off the south-west of Iceland (Hansen). It is found off the coasts of Britain (Norman, Scott, etc.), Holland and Belgium (Tesch), in the Mediterranean (Adensamer, Milne-Edwards), and the Adriatic. It has also been recorded from North American waters from the Gulf of St. Lawrence (Whiteaves).

Two dead specimens were found floating on the surface near New Zealand in 1878, but, so far as I know, it has not been recorded since from that region.

Alcock (1901) has recorded it from two localities in the Arabian Sea and the Bay of Bengal, near Ceylon. Hansen (1908) looks upon these records as doubtful and after comparing Alcock's description with the *Helga* specimens I am inclined to think that the Indian specimens may belong to a separate, though closely allied, species. Alcock says of the third maxillipeds "the inner border of the ischium is elegantly toothed, but that of the merus is unarmed." In all the Irish specimens the merus bears a single prominent tooth on the inner margin near the distal end. Further, when speaking of the chelipeds, he says, "the fingers are about three times as long as the palm,"

whereas in the specimens at my disposal the fingers are not quite *twice* the length of the palm.

Vertical Distribution.—The species has a wide vertical range, extending from about 25–30 fms. down to 600–700 fms. The *Helga* specimens were taken in comparatively shallow water from about 30–80 fms., with the exception of the single individual from the south west, which was captured at a depth of 447–515 fms.

Irish Distribution.—Bell and Stebbing mention the species as occurring in Irish waters, but give no localities. It does not occur in Kinahan or Melville's lists. The great majority of the numerous specimens taken by the *Helga* were found between the east coast and the Isle of Man. A solitary specimen was taken off the south west coast.

Helga.—

- S. 42.—30 I '02. 12 mls. off Laytown, to Drogheda bar, 28 fms. Trawl.—One, 18 mm.
- S. 146.—29 V '03. 19½ mls. off Dunany, Co. Louth, 46 fms. Trawl.—One, 24 mm.
- S. 163.—11 VI '03. Off Calf of Man, 37–45 fms. Trawl.—One, damaged.
- S. 201.—23 I '04. 10 mls. off Rockabill, Co. Dublin, 44–48 fms. Trawl.—One, 7 mm.
- S. 259.—21 II '05. 15 mls. off Clogher Head, Co. Louth, 32½ fms. Trawl.—One, damaged.
- S. 274.—24 V '05. 11 mls. S. of St. John's Point, Co. Down, 32½–39 fms. Trawl.—Three.
- S. 300.—14 VIII '05. 12 mls. S. of St. John's Point, Co. Down, 38–42 fms. Trawl. Temp., 11·9° C.—Sixteen, 44–16 mm., one ovigerous.
- S. 344.—2 XII '05. 18 mls. off Clogher Head, Co. Louth, 48½–50 fms. Trawl. Temp., 10·2° C.—Six, 43–15 mm.
- S. 429.—24 VII '06. 11 mls., S. ½ E. of St. John's Point, Co. Down, 33–45 fms. Trawl. Temp., 9·8° C.—Two.
- S. 457.—15 X '06. 19½ mls. W. S. W. of Chicken Rock, Isle of Man, 41–80 fms. Trawl.—One, 24 mm., and 8 very small.
- S. 458.—15 X '06. 18 mls. W. ½ S. of Chicken Rock, Isle of Man, 65–80 fms. Trawl.—Eighteen, 37–18 mm.
- S. 460.—16 X '06. 17½ mls., E. by S. of Dunany Point, Co. Louth, 32–38 fms. Trawl.—Four, 23–17 mm.
- S. 494.—22 II '07. 23 mls. W. S. W. of Chicken Rock, Isle of Man, 40–43 fms. Trawl. Temp., 7·03° C., Salinity 34·42 ‰.—Two, 42–29 mm.
- S. 497.—22 II '07. 15 mls. S. by W. of St. John's Point, Co. Down, 33–52 fms. Trawl.—Twenty-four, 46–16 mm.
- S. R. 502.—11 IX '07. 50° 46' N., 11° 21' W., 447–515 fms. Trawl. Temp., 8·8° C.—One, 26 mm.

- S. 560—24 x '07. 15 mls. W. S. W. of Chicken Rock, Isle of Man, 38½–42 fms. Trawl.—Four, 44–40 mm., 3 ovigerous.
- S. 561—24 x '07. 12 mls. W. by S. of Chicken Rock, Isle of Man, 34–38 fms. Trawl. Temp., at 30 fms., 12.75° C. Salinity 34.04 ‰.—Seventeen, 44–14 mm., 2 ovigerous.

FAMILY *LAOMEDIIDAE*.

GENUS *Jaxea*, Nardo.

Jaxea nocturna (Chiereghin) Nardo.

Pl. XV, figs. 1–8.

Cancer nocturnus, Chiereghin, 1818.

Jaxea nocturna, Nardo, 1847.

Calliaxis adriatica, Heller, 1863.

Trachelifer (*juv.*) Scott, 1899.

Jaxea nocturna, Scott, 1900.

The carapace is laterally compressed and considerably shorter than the abdomen. It is covered with a fur of short setae, which are most densely crowded on the cardiac area. There is a very distinct *linea thalassinica* on each side of the carapace, which is thus divided longitudinally into three parts. The middle and dorsal part is almost smooth, and projects anteriorly to form the sharp triangular rostrum, which is furnished with very fine teeth on either side. The upper surface of the rostrum is hollowed out, but this depression is not continued on the carapace proper. The lateral parts of the carapace are slightly inflated, and are covered with little tubercles which are most numerous near the lower margin. On the front margin there are three or four small teeth immediately below the beginning of the *linea thalassinica*. The anterior margin merges gradually into the lateral one without any sharp angle. The cervical groove is deeply marked, and does not cross the *linea thalassinica*. The posterior margin of the carapace is strongly concave, and is overlapped on each side by a short process of the first abdominal segment. The carapace is broadest about the middle of the cardiac region, and narrows slightly before and behind this.

The abdomen is longer than the carapace, and is of uniform breadth throughout. The terga are quite smooth, and bear a fairly thick covering of very short setae, set close together. The pleura of the first segment are sharply triangular, those of the other segments broadly so; they have a small projecting lobe on the posterior margin, except in the first and sixth segments. The anterior edge of the first pair of pleura bears three or four small teeth. On the following segments, both anterior and posterior edges of the pleura bear a number of very minute denticles, but these are apparently absent altogether in some cases.

The telson is quadrate, and its distal part is not so strongly

calcified as the rest, and is almost transparent. A median groove bounded by two ridges runs down the middle. There is also another ridge exterior to this on each side, and these converge and meet near the base of the telson.

The eyes are very minute and almost completely hidden by the rostrum. They are only slightly pigmented.

The antennules arise close together just under the rostrum, which is about one third as long as the peduncle, reaching to about the middle of the second joint. The first joint is the shortest, and the third the longest; it is about two and a half times as long as the second. The two flagella are each about as long as the third peduncular joint. They are both slender, but the outer one is slightly thicker, and very slightly longer, than the inner. The former bears a fringe of setae, and is composed of about twenty joints, the latter of fourteen or fifteen.

The peduncle of the antennae is five-jointed. The first three joints and the last are short, but the fourth is very long, longer than all the others together. The third joint lies partly hidden on the inner side of the second and fourth, and is not easily seen except from below. At the upper distal end of the second joint there is a broad, slightly-movable process which may represent the scale. In profile it appears as a sharp thorn. Its anterior edge bears two or three small teeth. The first joint also bears a pair of small teeth at its interior lower angle. The peduncle is longer than that of the antennules.

The mandible has a three-jointed palp, and a cutting edge furnished with sharp teeth.

The first maxillae have a long slender palp divided into two joints, the distal one much more slender than the proximal. The two inwardly-turned endites are fringed with teeth, which are very long and curved in the proximal one, and short and straight in the distal one.

At the posterior truncated end of the scaphognathite of the second maxillae there are three or four setae which are longer than the scaphognathite itself. There is a slender endopodite.

The first maxillipedes have a two-jointed endopodite, the distal joint of which is broad and expanded. The exopodite has a well-developed flagellum, which reaches beyond the tip of the endopodite. There is a large broad epipodite and a small podobranch.

The exopodite of the second maxillipedes is long, and bears a flagellum reaching beyond the endopodite. The epipodite is long and slender, and its margins bear delicate teeth. There is a large podobranch. The merus is the longest joint; all the others are uniformly short, and the propodite is greatly broadened by an expansion on its outer side.

The third maxillipedes are long, slender, and pediform. The exopodite is not so long as the endopodite. There is a long epipodite bearing small marginal teeth and giving off a slender process near the tip. There is a fair-sized podobranch. The

coxa bears a tuft of long hairs with serrate edges. The joints of the endopodite are unarmed, but bear fringes of setae.

The chelipeds are enormously developed, being very nearly as long as the body, from rostrum to end of telson. They are of equal size on each side. All the joints are more or less laterally compressed. The two basal joints are very short. The ischium is also short, and bears a row of four or five small teeth on its lower margin. The merus is more than twice as long as the ischium, and is strongly compressed. It is broader distally than at the proximal end, and its inner or lower border bears fourteen or fifteen teeth in a row, which is a continuation of that on the ischium; on the outer edge there is a faint crest. At the inner distal angle there is an excavation allowing the carpus to fold back close to the merus. The carpus is very short and broad, and much thickened at its distal end, where it has a tooth on the under side. The propodite is by far the largest joint of the whole appendage. The hand is broad and massive, and shorter than the finger, which is thin and tapering. Both the fixed finger and the dactyl are straight for the greater part of their length, and curve towards one another only near the tip. In their proximal part they are furnished with large and rather blunt teeth, whereas distally they have a row of small denticles. The dactyl is slightly longer than the fixed finger. The lower border of the propodite is very minutely serrate. The inner margin of the whole appendage bears a fringe of setae. The surface of the propodite is not smooth, but slightly granular.

The second pereopods are very much shorter and more slender than the chelipeds. They are strongly compressed, and bear fringes of setae. The merus is the largest joint. The propodite is very much flattened, and the dactyl can be folded back against it, forming a subchela. The edge of the dactyl is sharp, but has no teeth.

The next two pairs of pereopods end simply, but the fifth are subchelate, like the second. The third are slightly longer than the second, and also longer than the fourth, which in turn are longer than the fifth. In the third pereopods the lower edge of the dactyl bears on its proximal half a row of ten or twelve sharp curved spines, which are longest near the base of the joint, and decrease in size distally. This row of spines extends only half way along the dactyl, on the distal half of which it is continued as a very close-set series of much smaller spines extending to the tip. A similar arrangement may be seen in the fourth pereopods.

In the male the pleopods of the first segment are altogether wanting; in the female they are very slender and feeble. On the next four segments they are well developed, with strong basal joints, and two lanceolate blades fringed with pinnate setae. Both outer and inner branches of the uropods have a transverse suture guarded by a row of teeth. The outer margin of each branch has also three or four small teeth. There are two

divergent strengthening ribs on the outer branch, and a single midrib on the inner, which bears a row of small spines.

Each gill has the form of an axis which gives off rows of slender, somewhat flattened processes, which all lie in one plane, and decrease in size towards the tip of the axis.

The branchial formula is as follows :—

—	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.
Podobranchs.	1+ep.	1+ep.	1+ep.	1+ep.	1+ep.	1+ep.	ep.	—
Arthrobranchs	—	1	2	2	2	2	2	—
Pleurobranchs.	—	—	—	—	—	—	—	—

Size.—The single Irish specimen measures 41 mm. Two specimens from the Adriatic measure 42 mm. and 49 mm.

General Distribution.—The species is found most plentifully in the Adriatic, specimens from which were described by Heller and Nardo. It appears to be extremely rare in the other parts of the Mediterranean. Lo Bianco says it has been taken only once in twenty-five years in the Bay of Naples, though the larval form, the peculiar free-swimming stage known as *Trachelifer*, is frequently found there from May to September. So far as I know no adult specimen had been taken outside the Mediterranean until the single Irish specimen was taken in the Irish Sea in 1905.¹ Dr. Scott informs me that an adult specimen was taken by the Scottish Fishery Board cruiser, *Goldseeker*, in Loch Fyne, in 1908. Though these are the first two adult specimens to be found in British waters, fragments of *Jaxea* were found in fish taken near Ailsa Craig, in the Firth of Clyde, in 1899 (Scott, 1899).

The larval form, *Trachelifer*, has been taken with considerable frequency in the Irish Sea, and on the west coast of Ireland and Scotland. It is found fairly widely distributed in the Mediterranean.

Irish Distribution.—Only a single specimen, an adult male, has been found within the Irish marine area.

Helga.

S. 259.—21 II '05. 13 mls. off Clogher Head, Co. Louth, 32½ fms., mud. Trawl.—One, 41 mm.

Vertical Distribution.—The Irish specimen was taken in 32½ fms., and the Scottish in 34 fms.

¹ I have compared the Irish specimen with several from the Adriatic, which were sent to me through the kindness of Prof. Steuer of Innsbruck, and find complete agreement in all the characters.

FAMILY *CALLIANASSIDAE*.

There are two sub-families which are separable by the following characters :—

Rostrum large ; first pereopods equal ; no
appendix interna on pleopods three to five, ..
UPOGEBIINAE.

Rostrum small ; first pereopods unequal ; an
appendix interna on pleopods three to five, ..
CALLIANASSINAE.

SUB-FAMILY *CALLIANASSINAE*.GENUS *Callianassa*, Leach.

Callianassa, Heller, 1863. *Callianassa*, Spence Bate
1888. *Callianassa*, Borradaile, 1903.

The eyes are flattened against one another. The ischium and the merus of the third maxillipedes are broader than the carpus and propodite. The propodite of the third pair of pereopods usually much flattened and expanded. Fifth pereopods more or less subchelate. There are no epipodites on the third maxillipedes, or on the pereopods, but there is a large one on the first maxillipedes, and usually a small one on the second maxillipedes.

Borradaile (1903) divides *Callianassa* into five subgenera, *Calliactites*, *Cheramus*, *Trypœa*, *Callichirus*, and *Scallasis*.

To *Cheramus* belongs the genuine *Callianassa subterranea* (Mont.), the name of which, as Stebbing (1893) has shown, has been wrongly applied to another species. Borradaile has given to this second species the name *C. Stebbingi*. The Irish specimens belong to this second species; indeed it is doubtful whether the real *C. subterranea* has been taken anywhere except on the south coast of England.

***Callianassa Stebbingi*, Borradaile.**

Pl. XIV, figs. 8-10.

- ? *Callianassa subterranea*, Bell, 1853.
- Callianassa subterranea*, Heller, 1863.
- Callianassa subterranea*, Carus, 1885.
- Callianassa subterranea*, Ortmann, 1892.
- Callianassa subterranea*, Stebbing, 1893.
- Callianassa Stebbingi*, Borradaile, 1903.
- Callianassa Stebbingi*, Calman, 1911.

Some confusion has arisen as to the character of the third maxillipedes in this species, some writers calling them pediform, and others, operculiform. The explanation appears to lie in the fact that there are two distinct species which have been called by the same name. Stebbing (1893) points out that the original

specimens described by Leach and Montague have the third maxillipedes pediform. A large number of authors, however, say that the third maxillipedes are operculiform, and Stebbing has seen specimens from Jersey, in which they could not be called pediform, and in which the telson was more quadrate than in the original Devonshire specimens. These specimens in which the third maxillipedes are operculiform, really belong to a different species which has been mistaken for the genuine *C. subterranea*. Borradaile, (1903) has given this second species the name of *C. Stebbingi*. This species belongs to the subgenus, *Callichirus*, Stimpson, whereas the real *C. subterranea* of Montague and Leach belongs to another subgenus, *Cheramus*, Spence Bate. The two species may be separated as follows :—

Third maxillipedes pediform, slender ; telson
as long as the inner branch of the uropods, ..
C. subterranea.

Third maxillipedes operculiform, third and
fourth joints very broad, last three joints
slender ; telson distinctly shorter than the
inner branch of the uropods, *C. Stebbingi*.

It is not certain which species Bell had before him when he wrote his description. Under "Generic characters" he says,— "External pedipalps with the second and third joints very broad, constituting when in contact a broad oval disk, and terminating in a small seta formed of the last three joints." Farther on, however, he says;—"The external pedipalps are rather broad, pediform."

I have compared Irish specimens with two from the Bay of Naples, and find complete agreement between them.

The species has been several times described under the name of *C. subterranea*, and so it will be sufficient to give here merely a brief summary of its chief characteristics.

Carapace smooth, less than half as long as the abdomen. *Linea thalassinica* and cervical groove well marked. Rostrum practically absent, represented by at most a minute projection between the eyes, which are pressed close together. Corneal surface black. Antennules short, lash-like ; peduncle as long as flagella. Antennae considerably longer than the carapace. Third maxillipedes have the ischium and the merus very broad and flattened, so that they form an opercular plate when closed. Chelipeds extremely unequal, sometimes the right being the larger, sometimes the left. The last three joints of the large cheliped are very massive, and very much broader than the slender basal joints, which support them. The inner side of the merus bears a large curved process, the edges of which are slightly serrate, and the tip of which is sharp. Lower border of ischium slightly serrate. Lower margin of carpus and propodite fringed with setae, which are also present on the upper margin of the dactyl, which also bears tufts of bristles. The second pereopods are

chelate; next three pairs simple. The propodite of the third pair is expanded into a broad quadrilateral plate.

The abdomen is slightly narrower before and behind than in the middle; the second segment is the largest. The telson is distinctly shorter than the endopodite of the uropods; it is not quite quadrate, its angles being rounded. Pleopods of first and second segments slender; those of third, fourth, and fifth segments much more robust, and expanded into wide plates fringed with setae.

Size.—The largest specimen taken by the *Helga* measures only 33 mm. Adults are often about 50 or 60 mm. long.

General Distribution.—The species has been found in the Black Sea (Czerniavsky), in the Mediterranean (Heller, Carus, Adensamer, etc.), the Adriatic (Heller), the Bay of Biscay (Fischer), at Cape Gris Nez and Boulogne (Giard), on the coasts of Holland (Tesch, Metzger), in the Channel Islands (Sincl), coasts of England and Scotland (Bell, Scott, Sim). It does not extend as far north as the Danish and Norwegian coasts.

Irish Distribution.—Few specimens have actually been recorded but this is due to the burrowing habits of the species, and there is little doubt that it occurs all round the coasts, with the exception perhaps of the north. It is more frequently found in the stomach of bottom-living fishes such as *Raia clavata* than in the trawl or dredge.

Helga.—

- L. 298—3 III '04. Ballynakill Harbour, Co. Galway. Shore collecting.—One.
 L. 299—3 III '04. Ballynakill Harbour, Co. Galway. Shore collecting.—One, 33 mm.
 S. 561—24 x '07. 12 mls., W. by S. of Chicken Rock, Isle of Man, $34\frac{1}{2}$ – $38\frac{1}{2}$ fms., mud. Trawl. Temperature at 30 fms., $12\cdot75^{\circ}$ C., salinity $34\cdot04$ ‰.—One large cheliped.

It has been found frequently in specimens of *Raia clavata* taken in Galway Bay and the surrounding areas.

Vertical Distribution.—It occurs from between tide marks down to considerable depths as is shown by the record from S. 561 above. It is common in depths of about 10 or 12 fms.

GENUS *Upogebia*, Leach.

Upogebia, Leach, Edin. Encyclop., art. Crustaceology, 1814. *Gebia*, Leach, Trans. Linn. Soc., Vol. 5, 1815. *Thallassina*, Risso, 1816. *Gebios*, Risso, 1826. *Gebia*, H. Milne-Edwards, 1837. *Gebia*, Bell, 1853. *Upogebia*, Stebbing, 1893. *Upogebia*, Stebbing, 1900 (b). *Upogebia*, Borradaile, 1903.

Borradaile divides *Upogebia* into two subgenera, *Gebiopsis* and *Upogebia*, distinguished as follows:—

The thumb of the chelipeds almost or quite as long as the movable finger; no small tooth on anterior edge of carapace above the antenna, *Gebiopsis*, A. Milne-Edwards.

The thumb of the chelipeds distinctly shorter than the movable finger; a small sharp tooth on anterior edge of carapace above the antenna, *Upogebia*, Leach.

There are two British species, *U. deltaura* and *U. stellata*, but the latter has not so far been recorded from Ireland.

Upogebia (Gebiopsis) deltaura, Leach.

Gebia deltura, Bell, 1853.

Upogebia deltaura, Borradaile, 1903.

Gebia deltura, de Morgan, 1910.

Gebiopsis deltura, Stephensen, 1910.

It has been doubted by several writers whether *U. deltaura* and *U. stellata* are really separate species. This is probably due partly to the difficulty of obtaining specimens for comparison, owing to the fossorial habits of the animals. Bell, though he gives separate descriptions, is doubtful on the subject, and is inclined to regard the differences between them as sexual, and Norman (1906) looks on the two as synonymous. Borradaile (1903), however, places them in different subgenera, separated by the characters given above. The presence of the small tooth above the antenna in *U. deltaura* and its absence in *U. stellata* has also been noticed by de Morgan (1910) who has examined numerous specimens, including ovigerous females of both species, so that there can no longer be any doubt of the differences between them being specific and not merely sexual.

The two species, then, may be distinguished by the following characters.

The abdominal plates are much broader in *deltaura* than in *stellata* and the rostrum is less acute. *Stellata* is a much smaller animal and when alive is covered with orange-coloured spots. With regard to the chelipeds, the dactyl is very much larger than the fixed finger in *stellata*, so that the appendage might almost be called subchelate; in *deltaura*, on the other hand, the two fingers are nearly equal and the dactyl is thicker. The rostrum and gastric area of the carapace are thickly covered with setae in *deltaura*; they are much shorter and not so dense in *stellata*.

Size.—Full-grown individuals are often about 100 mm. long.

General Distribution.—It is difficult to make out the exact distribution of the species, as it is impossible to say how

far it has been confused with *stellata*. It has been recorded from the Kattegat (Stephensen), the north-east of Scotland (Sim), the Channel Islands (Sinel), the south of England (Norman) and the Mediterranean (Adensamer).

Irish Distribution.—It is not mentioned in the lists of Kinahan, Melville, and Thomson, but must nevertheless be fairly common all round the coast. Its burrowing habits make it difficult of capture.

Helga.

Bofin XCIX.—21 VIII '99. Shore collecting.—One male, 22 mm.

Bofin CLXXVII.—7 VIII '00. Between Inishskinny and Dog-fish Rock, 6–10 fms., Mosquito net on surface.—One, immature, 5.5 mm.

W. 40.—7 IX '05. Galway Bay, Black Head to Loo Rock, 12 fms., in stomach of *Raia clavata*.—Three males, 80–48 mm.

R. 30.—17 VIII '06. $9\frac{1}{2}$ mls. S.E. by S. of Mine Head, $37\frac{1}{2}$ –39 fms. Sand Grab.—One, 30 mm.

Vertical Distribution.—From littoral zone down to about 40 fms.

***Upogebia stellata*, (Montagu.)**

Gebia stellata, Bell, 1853.

Gebia stellata, Meinert, 1893.

Upogebia stellata, Borradaile, 1903.

Gebia stellata, Stephensen, 1910.

Upogebia stellata, de Morgan, 1910.

A good description of this species will be found in de Morgan's paper (1910).

Size.—It is usually about half the size of the preceding species.

General Distribution.—It has been recorded from the south-west coast of Norway (G. O. Sars), Bohuslän (Loven), the Kattegat (Meinert), Heligoland and the Dutch coast (Metzger), Belgium (Tesch), Channel Islands (Norman). It is also known, from the following British localities: Moray Firth (Scott) Aberdeen (Sim), St. Andrews (M'Intosh), Northumberland (Norman), and Plymouth (de Morgan).

Irish Distribution.—This species has not so far been recorded from the Irish coasts.

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Polycheles nanus (Smith), var. *Grimaldii*, Bouvier.

- Fig. 14.—Dorsal view of female, $\times 1.3$.
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Polycheles sculptus, Smith.

- Fig. 1.—Dorsal view of adult male, $\times 1.3$.
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 Fig. 2.—First pereopod, $\times 8$.

Palinurus vulgaris, Latreille.

- Fig. 3.—First pereopod, $\times 7$.

PLATE VII.

Nephropsis atlantica, Norman.

- Fig. 1.—Lateral view of female, $\times 75$.
 Fig. 2.—Mandible, $\times 3.5$.
 Fig. 3.—First maxilla, $\times 5$.
 Fig. 4.—Second maxilla, $\times 3.5$.
 Fig. 5.—First maxillipede, $\times 3.5$.
 Fig. 6.—Second maxillipede, $\times 3$.
 Fig. 7.—Third maxillipede, $\times 3$.
 Fig. 8.—First pleopod of female, $\times 3$.
 Fig. 9.—First pleopod of male, $\times 3$.
 Fig. 10.—Second pleopod of male with *appendix masculina*, $\times 3$.
 Fig. 11.—Openings of oviducts and spermatheca of female, $\times 3.5$.
 Fig. 12.—Spermatophore, $\times 5$.
 Fig. 13.—Spermatozoa, $\times 430$.

PLATE VIII.

Uroptychus rubrovittatus (A. Milne-Edwards).

- Fig. 1.—Dorsal view, $\times 3.5$.
 Fig. 2.—Lateral view of carapace, $\times 3.5$.
 Fig. 3.—Cheliped, $\times 3.5$.
 Fig. 4.—End of second pereiopod, $\times 13$.

Uroptychus nitidus, (A. Milne-Edwards), var. *concolor*, Milne-Edwards and Bouvier.

- Fig. 5.—Lateral view of carapace, $\times 3.5$.
 Fig. 6.—Antennal peduncle, $\times 21.5$.
 Fig. 7.—Third maxillipede, $\times 4.3$.
 Fig. 8.—Lower surface of ischium of cheliped, $\times 3.5$.
 Fig. 9.—End of second pereiopod, $\times 13$.
 Fig. 10.—Distal part of second pleopod of male, $\times 35$.

PLATE IX.

Uroptychus nitidus (A. Milne-Edwards), var. *concolor*, A. Milne-Edwards and Bouvier.

- Fig. 1.—Dorsal view, $\times 5.1$

Gastroptychus formosus (Milne-Edwards and Bouvier).

- Fig. 2.—First maxilla, $\times 17.3$.
 Fig. 3.—First maxillipede, $\times 14.6$.
 Fig. 4.—Second maxillipede, $\times 14.6$.
 Fig. 5.—Third maxillipede, $\times 4.6$.
 Fig. 6.—First pleopod of male, $\times 17.3$.
 Fig. 7.—Second pleopod of male, $\times 17.3$.
 Fig. 8.—Second pleopod of female, $\times 17.3$.

PLATE X.

Gastroptychus formosus (Milne-Edwards and Bouvier).

- Fig. 1.—Dorsal view, $\times 2.3$.

PLATE XI.

Galathea intermedia, Lilljeborg.

- Fig. 1.—Antennule, $\times 23.3$.
 Fig. 2.—First maxilla, $\times 17.3$.
 Fig. 3.—Second maxilla, $\times 17.3$.
 Fig. 4.—First maxillipede, $\times 17.3$.
 Fig. 5.—Second maxillipede, $\times 17.3$.
 Fig. 6.—Third maxillipede, $\times 17.3$.
 Fig. 7.—End of propodite of cheliped, $\times 17.3$.
 Fig. 8.—Fifth pereiopod, $\times 23.3$.
 Fig. 9.—First pleopod of male, $\times 17.3$.
 Fig. 10.—Second pleopod of male, $\times 17.3$.
 Fig. 11.—Third pleopod with two-jointed endopodite, $\times 28.6$.
 Fig. 12.—Third pleopod with one-jointed endopodite, $\times 28.6$.

Munida bamffica (Pennant).

- Fig. 13.—Dorsal view, $\times 4$.
 Fig. 14.—Thoracic sternum, $\times 8$.

PLATE XI.—*continued.**Munida tenuimana*, G. O. Sars.

- Fig. 15.—Dorsal view, $\times 4$.
 Fig. 16.—Thoracic sternum, $\times 8$.

PLATE XII.

Munidopsis tridentata (Esmark).

- Fig. 1.—Dorsal view, $\times 2$.
 Fig. 2.—Telson and uropods, $\times 3$.
 Fig. 3.—Third maxillipede, $\times 19\cdot 5$.
 Fig. 4.—First pleopod of male, $\times 13\cdot 5$.
 Fig. 5.—Second pleopod of male, $\times 18\cdot 5$.

PLATE XIII.

Munidopsis curvirostra, Whiteaves.

- Fig. 1.—Dorsal view, $\times 5\cdot 1$.
 Fig. 2.—Lateral view of carapace, $\times 4\cdot 6$.
 Fig. 3.—Telson and uropods, $\times 4$.
 Fig. 4.—Second pleopod of male, $\times 28\cdot 6$.

PLATE XIV.

Axius stirhynchus, Leach.

- Fig. 1. Dorsal view, $\times 83$.
 Fig. 2.—Lateral view of anterior part of carapace, $\times 3\cdot 6$.
 Fig. 3.—Cheliped, $\times 3\cdot 6$.
 Fig. 4.—Openings of oviducts and spermatheca of female, $\times 4\cdot 3$.

Calocaris Macandreae, Bell.

- Fig. 5.—Lateral view of ovaries and testes exposed, $\times 4\cdot 6$.
 Fig. 6.—Third maxillipede, $\times 4\cdot 6$.
 Fig. 7.—First pleopod, $\times 28\cdot 6$.

Callianassa Stebbingi, Borradaile.

- Fig. 8.—Outer side of third maxillipede, $\times 4\cdot 6$.
 Fig. 9.—Inner side of third maxillipede, $\times 4\cdot 6$.
 Fig. 10.—Third pereopod, $\times 4\cdot 6$.

PLATE XV.

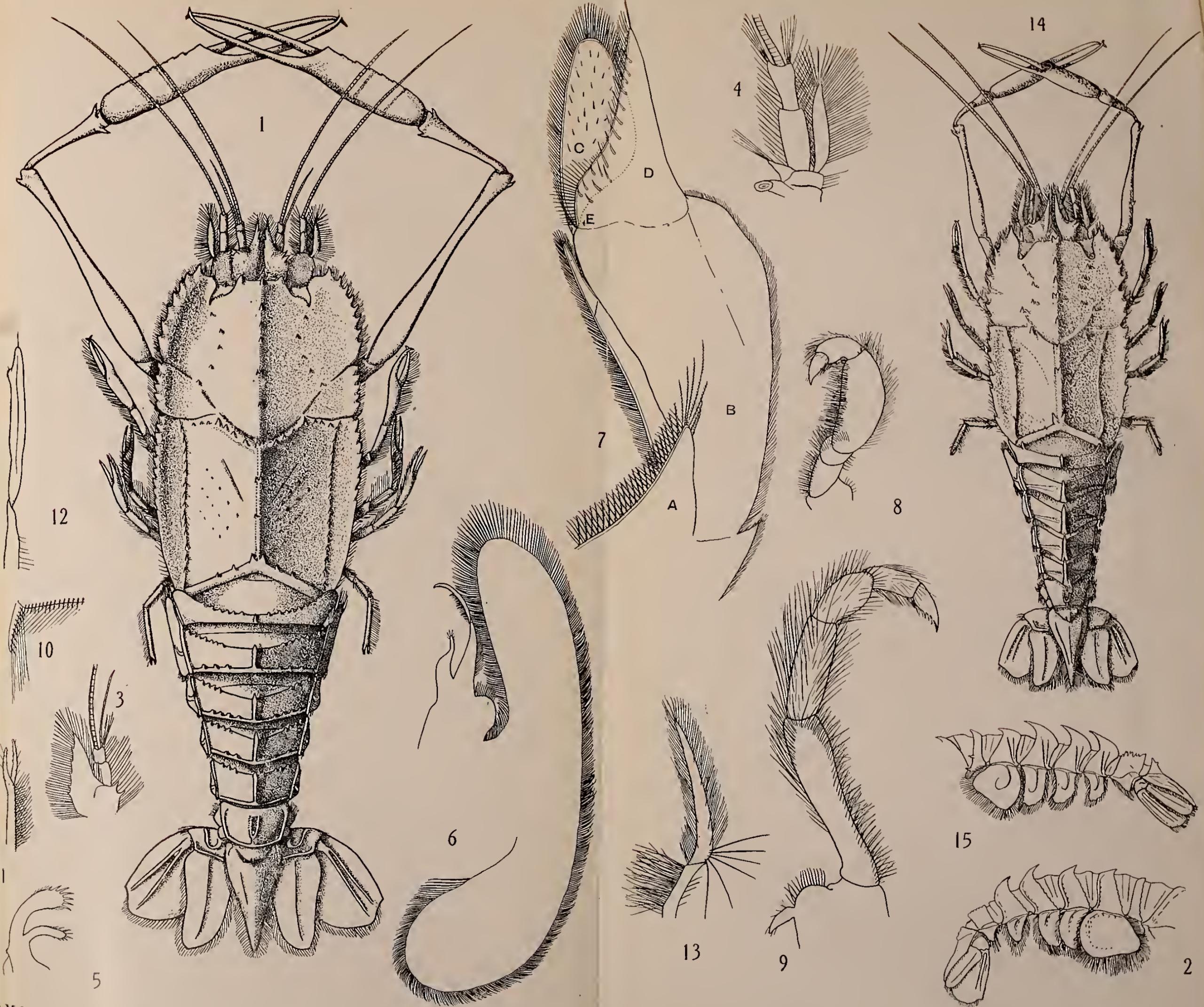
Jaxea nocturna, (Chiereghin) Nardo.

- Fig. 1.—Lateral view of adult male, $\times 4\cdot 3$.
 Fig. 2.—Telson and uropods, $\times 4\cdot 6$.
 Fig. 3.—Anterior end of carapace from dorsal aspect, $\times 4\cdot 3$.
 Fig. 4.—First maxilla, $\times 16$.
 Fig. 5.—Second maxilla, $\times 7\cdot 3$.
 Fig. 6.—First maxillipede, $\times 6$.
 Fig. 7.—Second maxillipede, $\times 10\cdot 6$.
 Fig. 8.—Third maxillipede, $\times 4\cdot 6$.

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C.

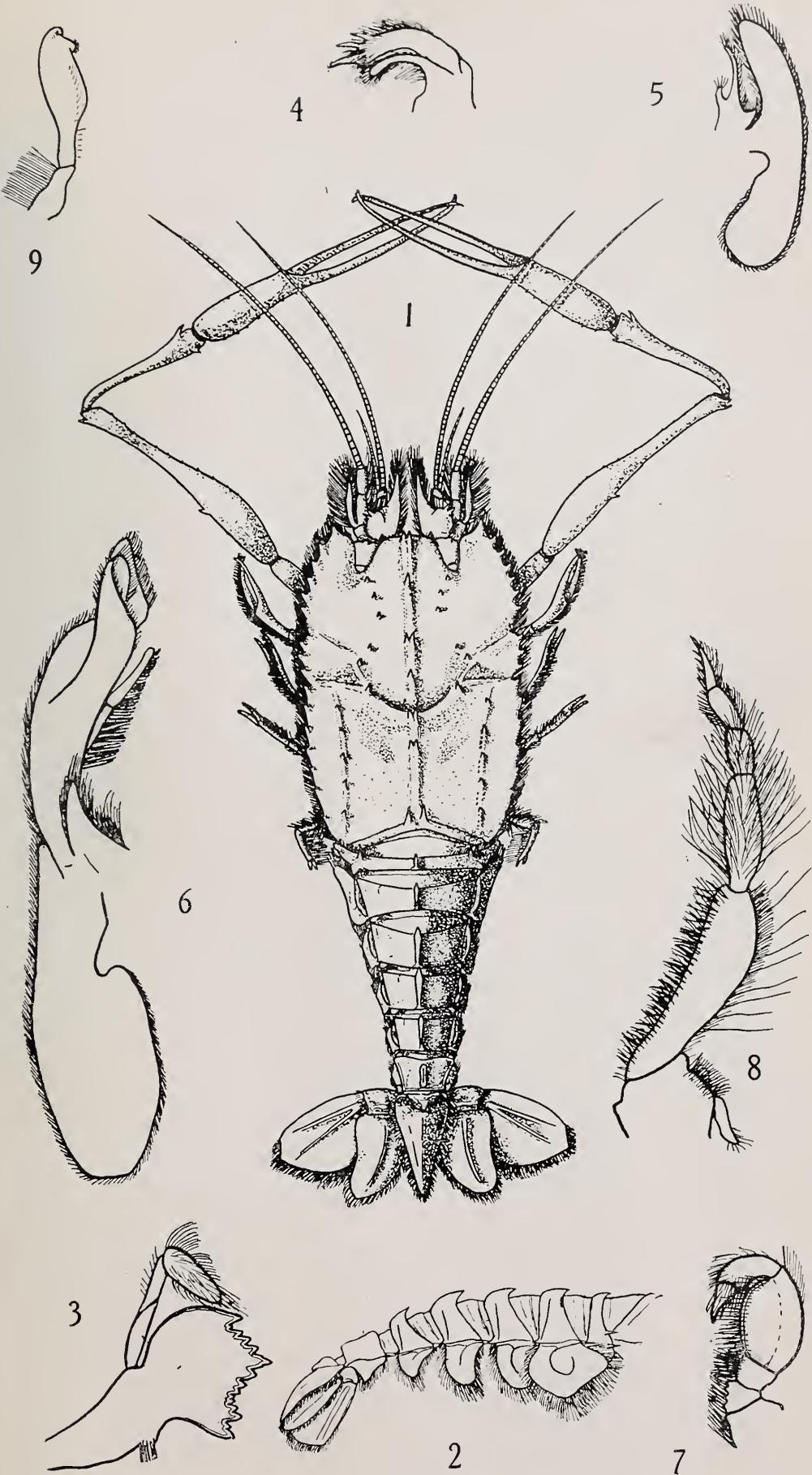


C.M.S. del.

Figs. 1-13.—*Polycheles typhlops*.

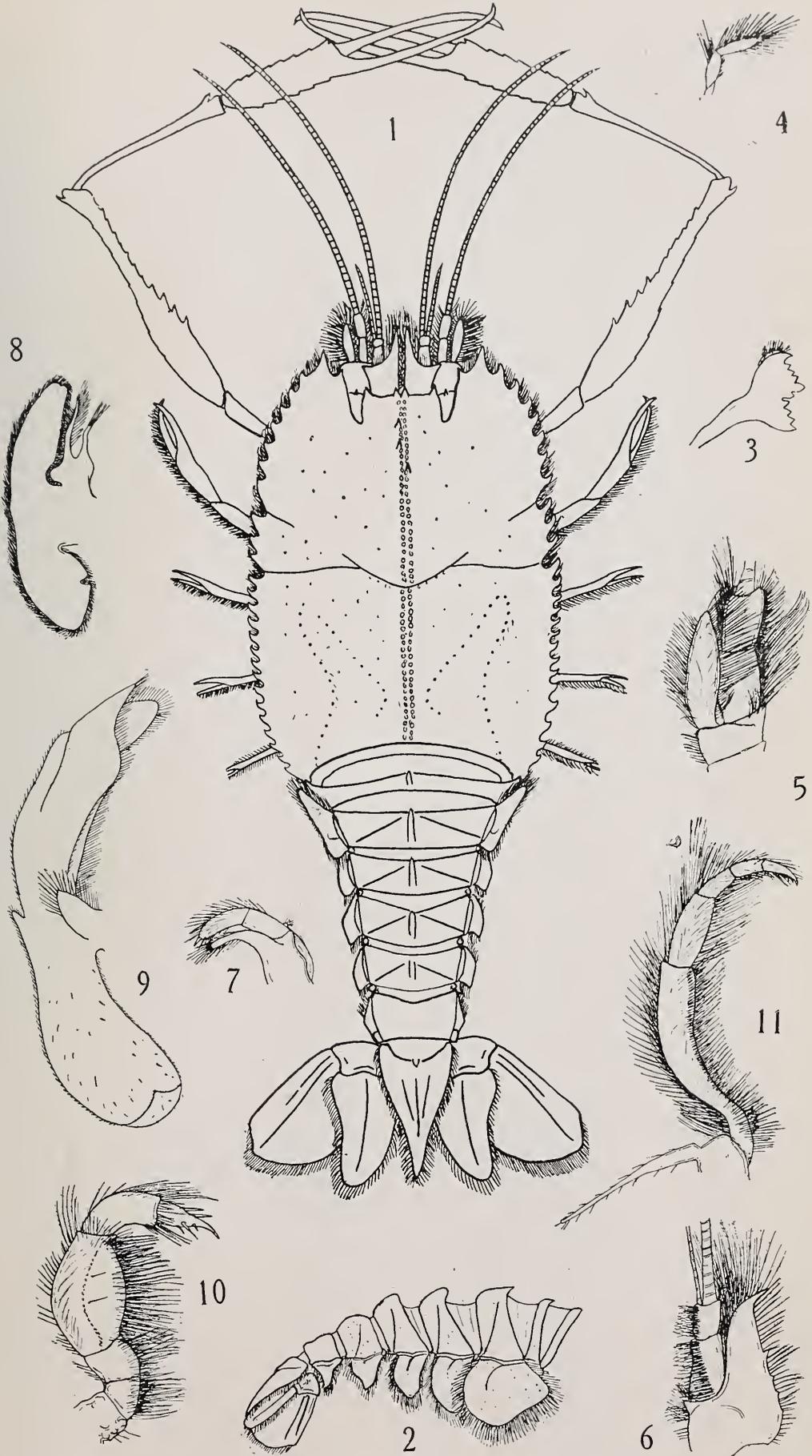
Figs. 14. 15.—*P. nanus, var. Grimaldii*.





C.M.S. del.

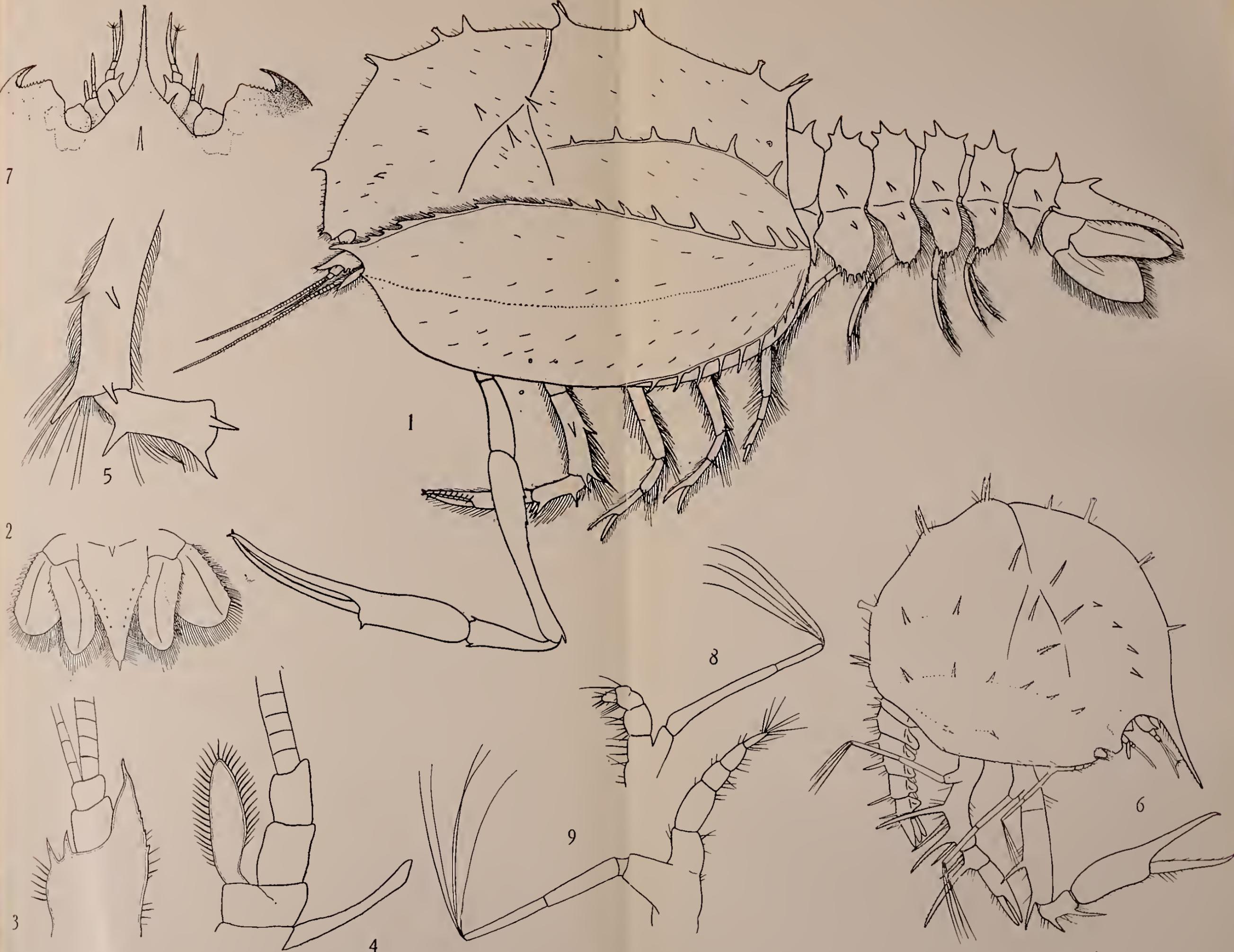
Polycheles sculptus.



C.M.S. del.

Polycheles granulatus.



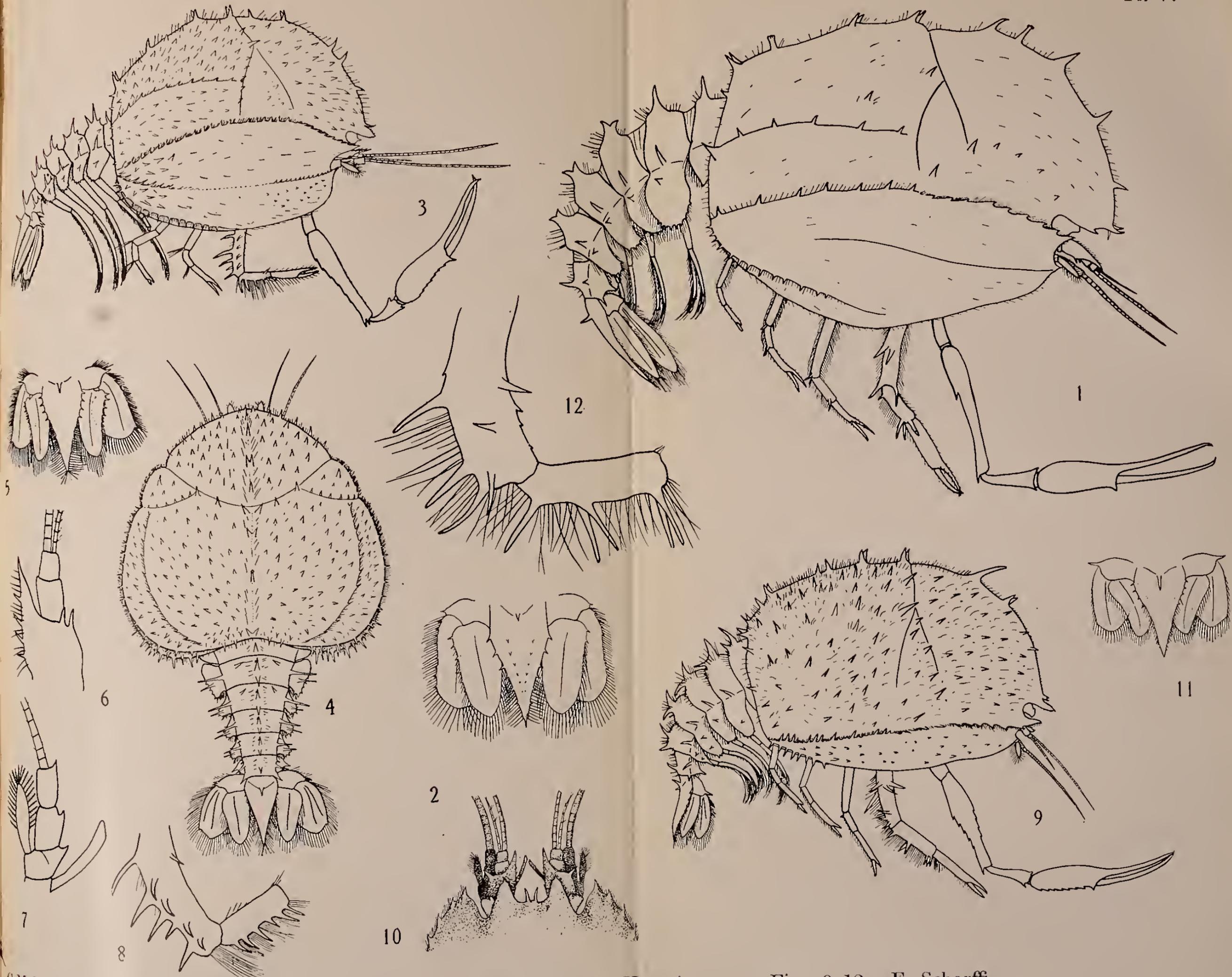


C.M.S. del.

Figs. 1-5.—*Eryonicus Faxoni*.

Figs. 6-9.—*Eryonicus sp. juv.*

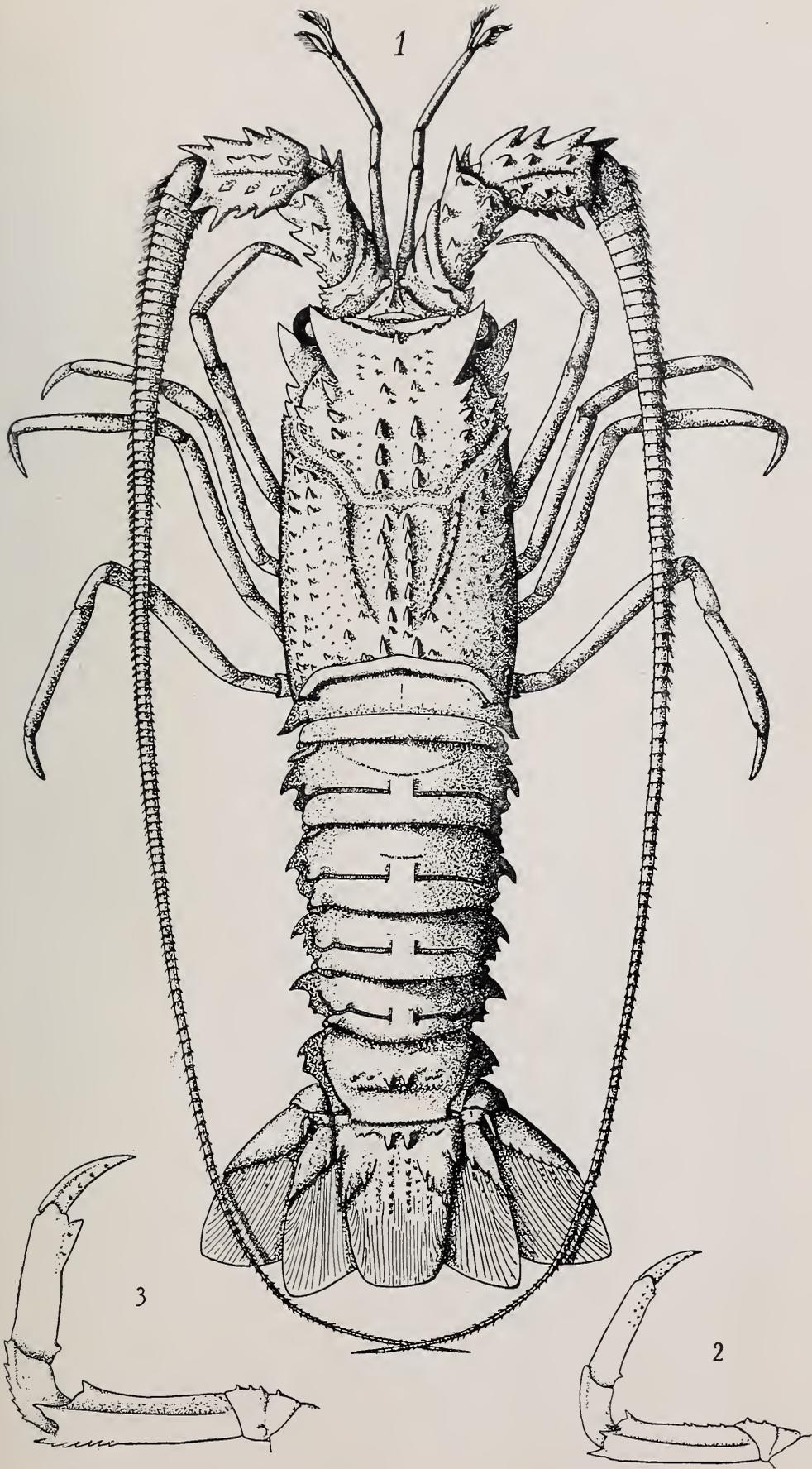




C.M.S. del. Figs. 1, 2.—Eryonicus hibernicus.

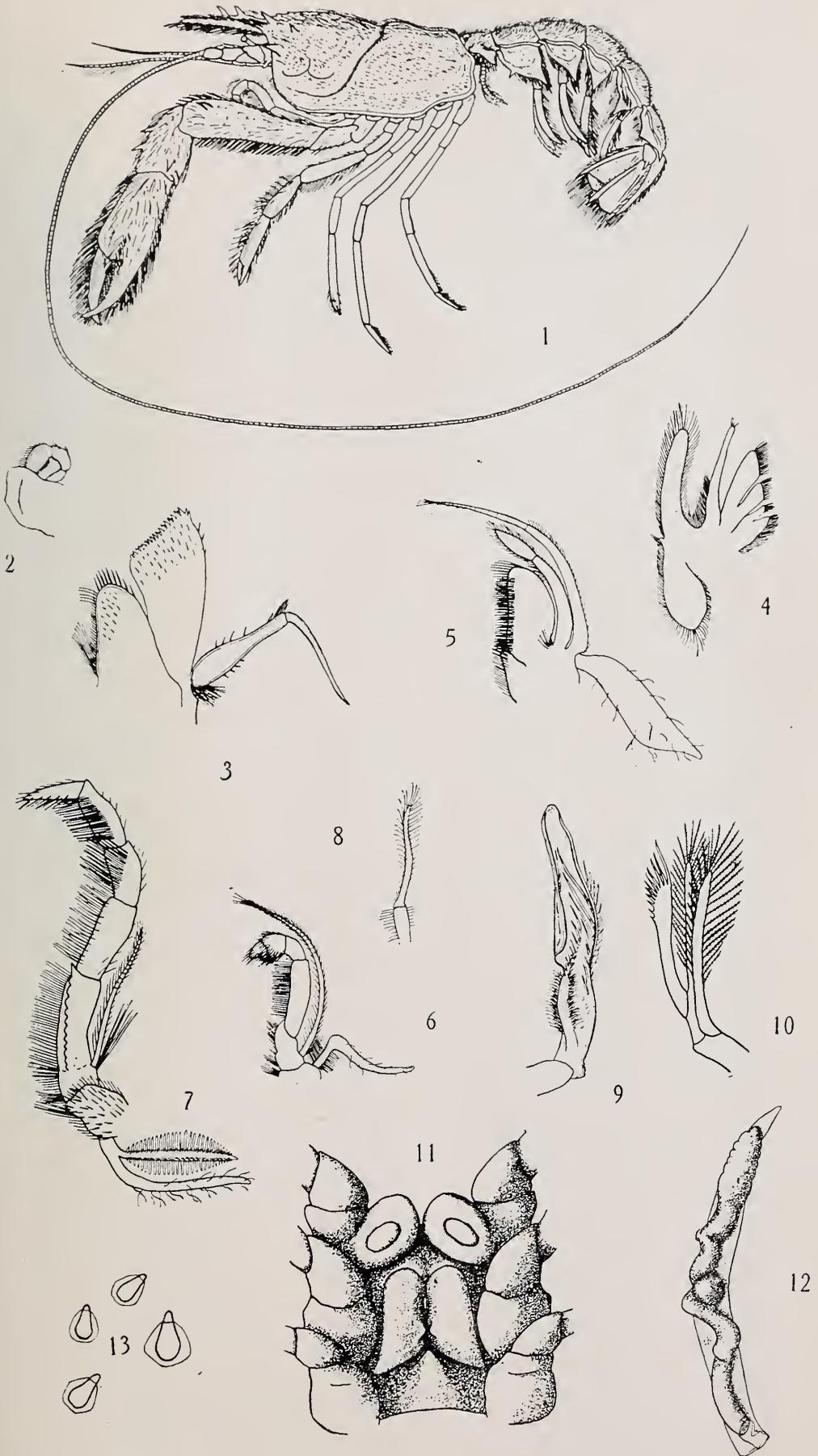
Figs. 3-8.—E. kempi.

Figs. 9-12.—E. scharffi.



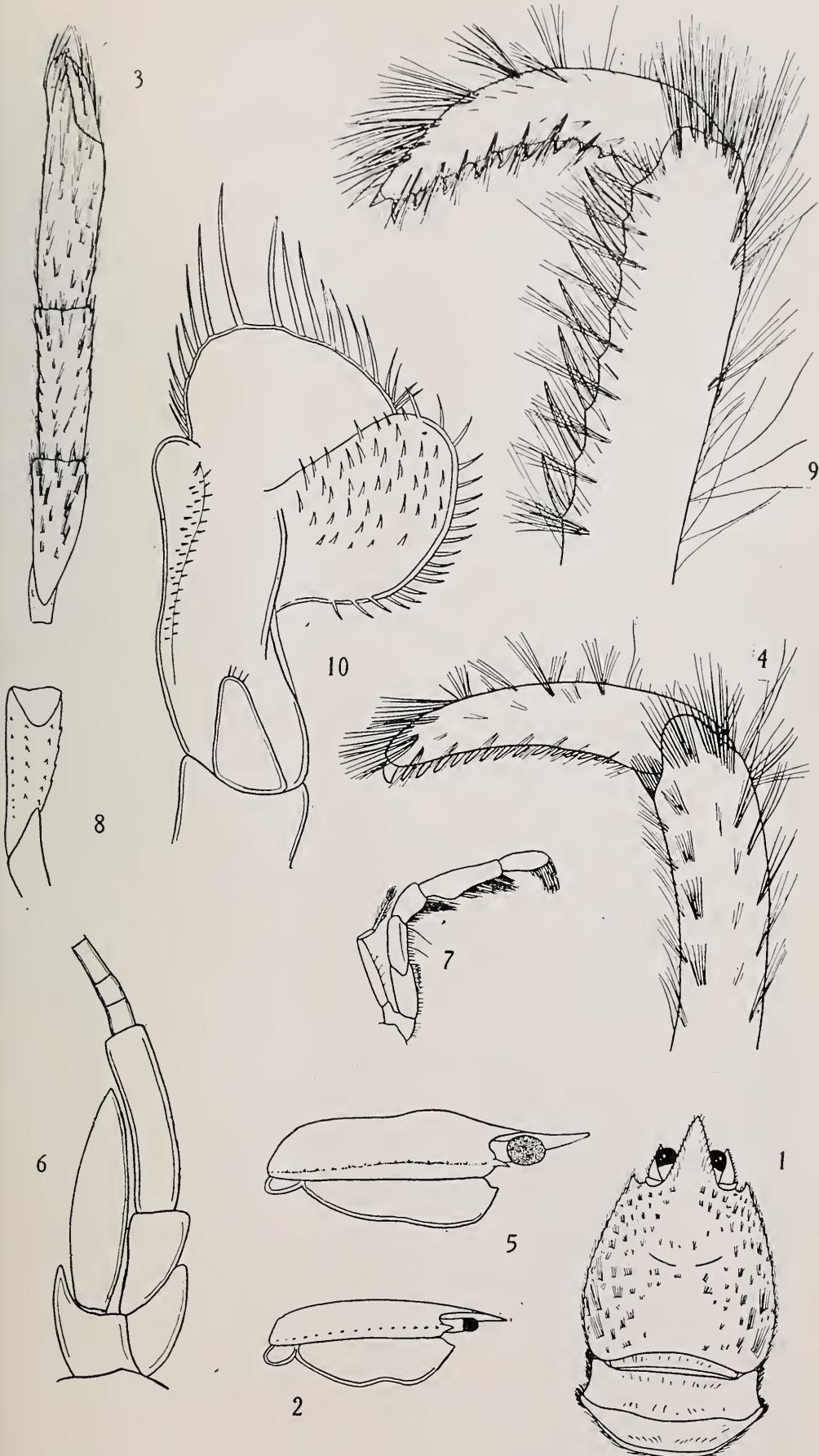
C.M.S. del.

Figs. 1, 2.—*Palinurus Thomsoni*.
Fig. 3.—*P. vulgaris*.



C.M.S. del.

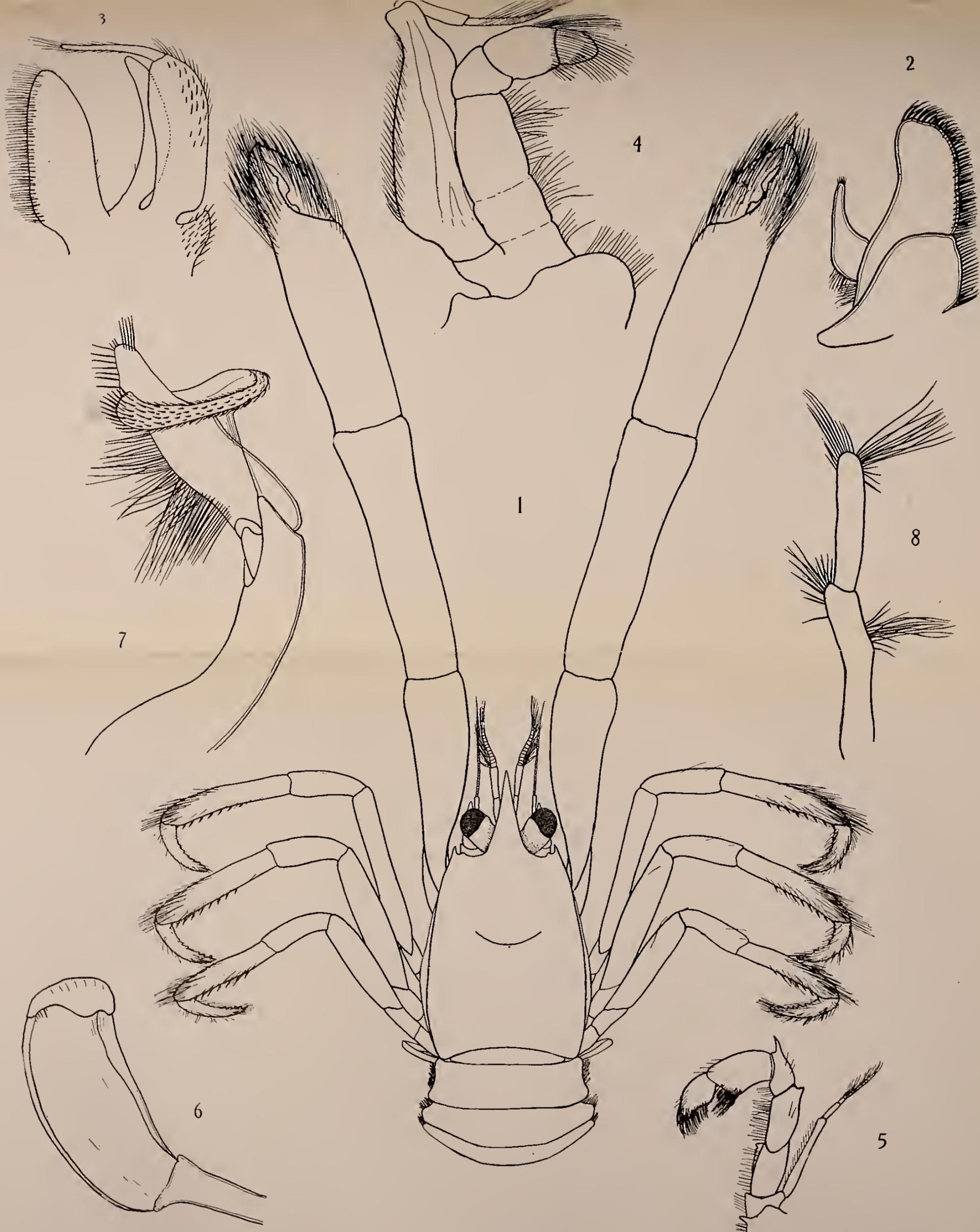
Nephropsis atlantica.



C.M.S. del.

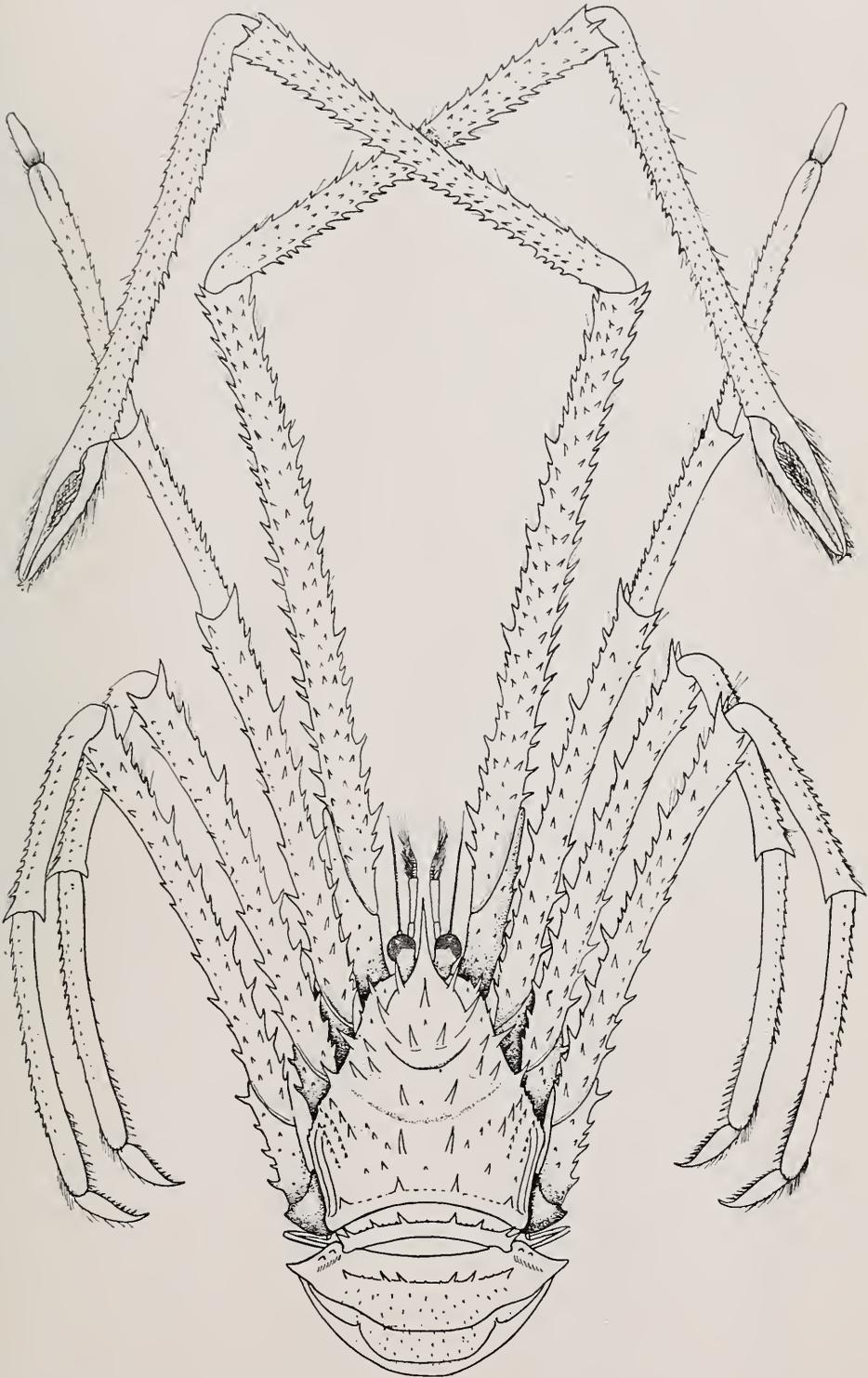
Figs. 1-4.—*Uroptychus rubrovittatus*.
Figs. 5-10.—*U. nitidus*, *var. concolor*.





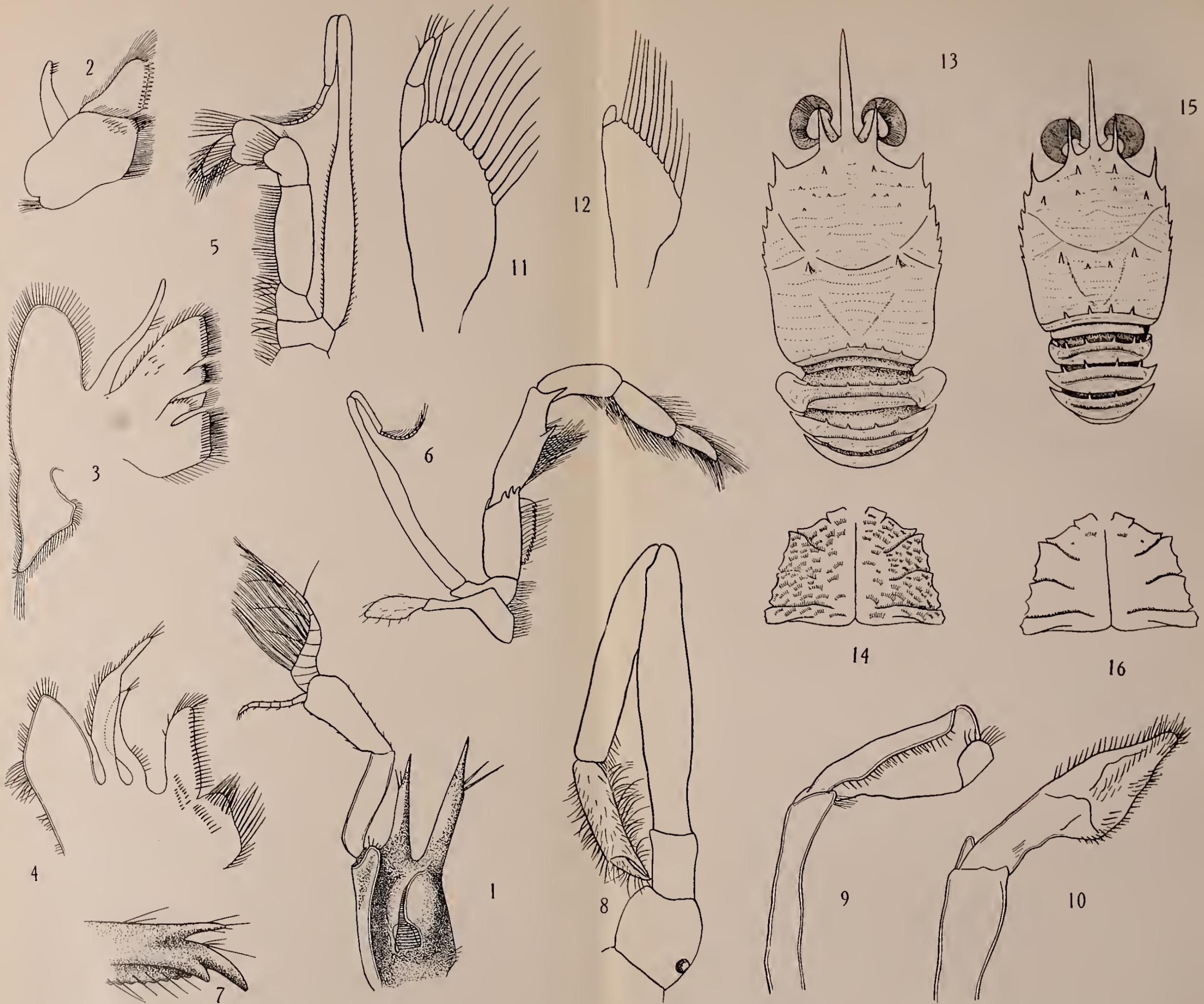
C.M.S. del.

Fig. 1.—*Uroptychus nitidus*, var. *concolor*.
Figs. 2-8.—*Gastroptychus formosus*.



C.M.S. del.

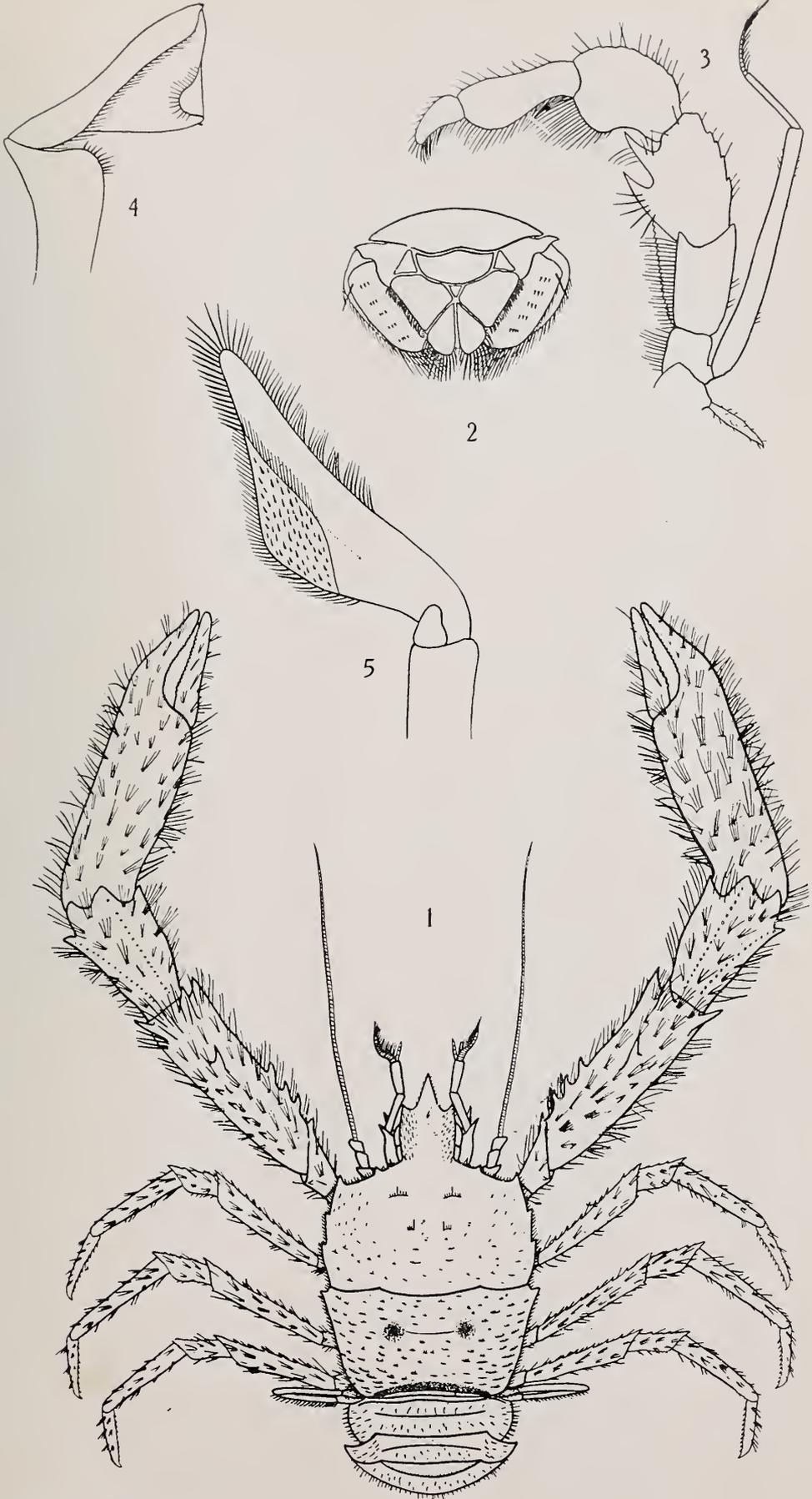
Gastroptychus formosus.



C.M.S. del. Figs. 1-12.—*Galathea intermedia*.

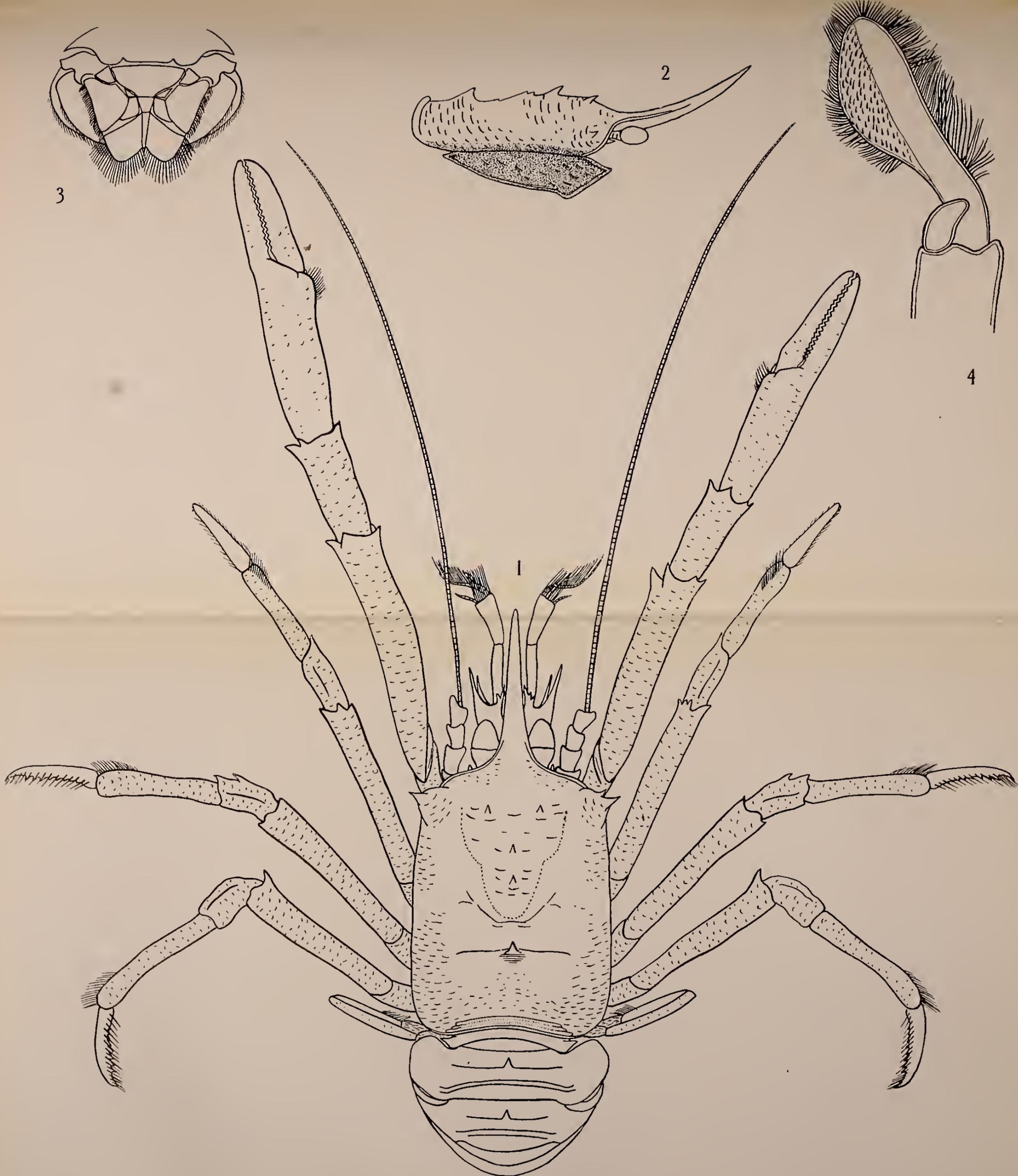
Figs. 13, 14 —*Munida bamffica*.

Figs. 15, 16.—*M. tenuimana*.



C.M.S. del.

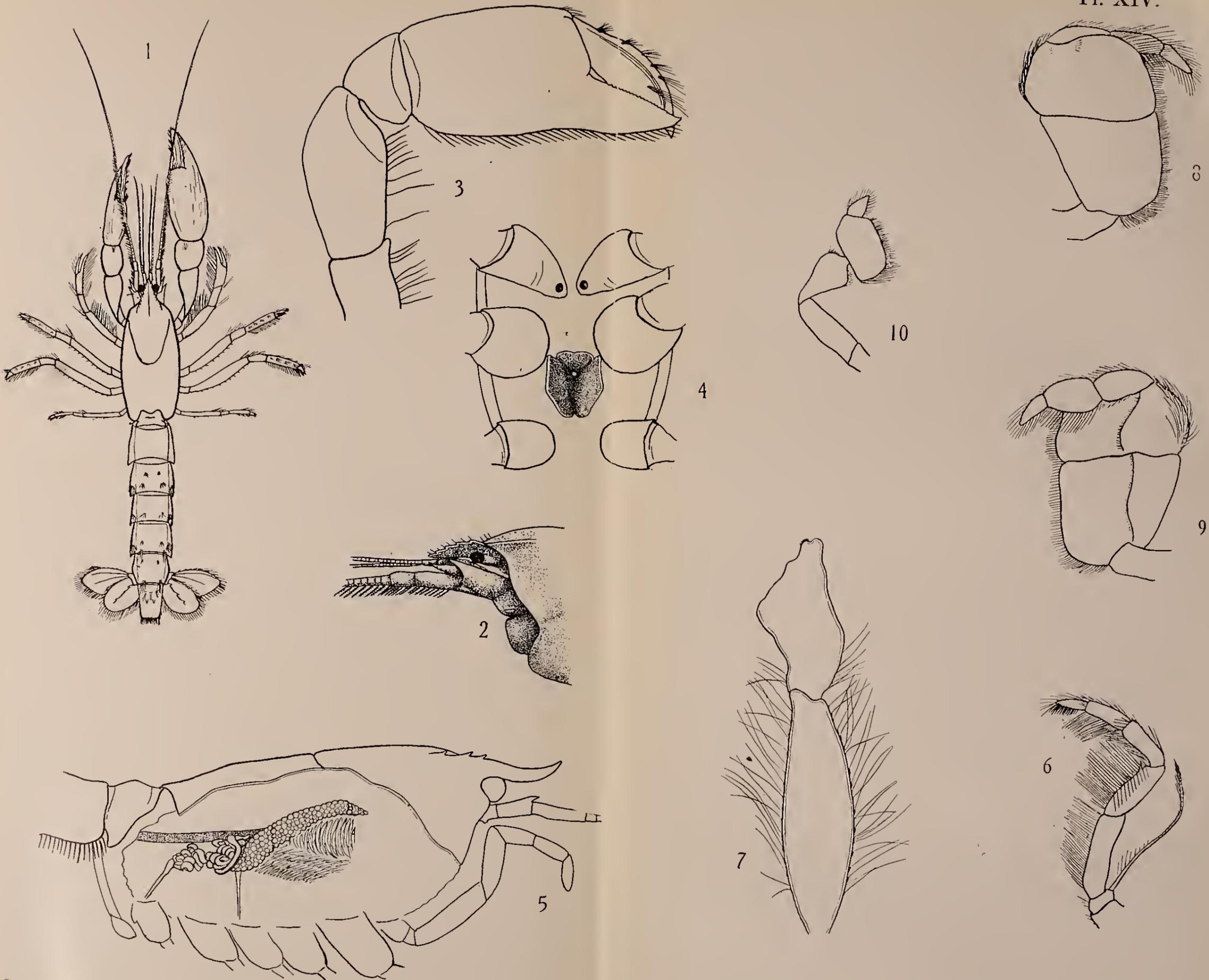
Munidopsis tridentata.



C.M.S. del.

Munidopsis curvirostra.





C.M.S. del.
Figs. 1-4.—*Axius stirhynchus*.

Figs. 5-7.—*Calocaris Macandreae*.

Figs. 8-10.—*Callianassa Stebbingi*.

