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## THE LOBSTERS OF THE SUPERFAMILY NEPHROPIDEA OF THE ATLANTIC OCEAN (CRUSTACEA: DECAPODA)<sup>1</sup>

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### ABSTRACT

An enumeration is given of the 18 known Atlantic species of Nephropidean lobsters. Special attention is devoted to the family group taxonomy, and to the morphology of the carapace. Keys are provided to all species. One subfamily, two genera and three species are described as new. The geographic distribution of each species is discussed, and all available information on the biology of the tropical forms is brought together. The species are provided with descriptions and figures or with references to such descriptions and figures published elsewhere.

### INTRODUCTION

The present paper is based in the first place on the Nephropid material from deeper water collected between 1962 and 1971 by the research ships of the University of Miami, R. V. GERDA and R. V. PILLSBURY. These collections were made in West Indian waters (GERDA, 1962-1971; PILLSBURY, 1966-1971) and off the west coast of Africa (PILLSBURY, 1964, 1965). Also all the Nephropid material from the tropical Atlantic present in the collections of the Institute of Marine and Atmospheric Science, University of Miami, Florida, U.S.A. (M), the National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A. (W), the Museum of Comparative Zoology, Harvard University, Cambridge, Mass., U.S.A. (MCZ), the British Museum (Natural History), London, England (BM), the Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (L), and the Muséum National d'Histoire naturelle, Paris, France (MP) has been consulted.

<sup>1</sup> Contribution from the Rosenstiel School of Marine and Atmospheric Science, University of Miami.

This study was started several years ago, but due to several circumstances could not be finished until now. Without the very cordial help that I received from many persons, I would not have been able to finish it at all. In the first place I want to thank Dr. Gilbert L. Voss and Dr. Frederick M. Bayer of the University of Miami, who placed all the GERDA and PILLSBURY material at my disposal, made it possible for me to partake in eight of the PILLSBURY and one of the GERDA cruises and assisted me in every possible way in this project. Dr. Fenner A. Chace and Dr. Raymond B. Manning of the Smithsonian Institution allowed me to examine all the material of the National Museum of Natural History and made arrangements enabling me to work for several months in the Museum on these collections; I am especially grateful to Dr. Manning for generously allowing me to publish on the *Eunephrops* material on which he himself originally intended to devote a study; he provided me also with all the illustrative material on that genus that he had brought together already. Dr. Herbert W. Levi of the Museum of Comparative Zoology, Drs. Isabella Gordon, R. W. Ingle and A. L. Rice of the British Museum, and Drs. M. de Saint Laurent and J. Forest of the Paris Museum gave me every possible help with the study of the material under their care.

The drawings illustrating the present paper are by Mrs. Constance Stolen McSweeney, at that time staff artist of the Institute of Marine and Atmospheric Science, Miami, Mrs. Carolyn Gast, staff artist of the Smithsonian Institution, Mr. W. C. G. Gertenaar, staff artist of the Rijksmuseum van Natuurlijke Historie, Leiden, and Mrs. Lilly Manning. The photographs are made by the staff photographers of the Smithsonian Institution and the Leiden Museum (Mr. Chr. Hoorn), with the exception of Figures 7 and 8, which were placed at my disposal by the U.S. Naval Oceanographic Office, through the kindness of Mr. Timothy W. Janaitis.

The abbreviation cl. is used in the text to denote the carapace length measured from the tip of the rostrum to the median point of the posterior margin of the carapace.

In the list of examined material the institutions holding the material in question are indicated with the letters that in the first paragraph of this introduction are given in parentheses after the full name of each institution.

#### SYSTEMATIC PART

The taxonomy of the true lobsters has been differently interpreted by different authors. In the most generally accepted classification of the Decapoda, Waterman & Chace (1960: 25) considered these animals to form the superfamily Nephropsidea of the section Macrura. Glaessner (1969: 400, 455) raised this group to the rank of an infraorder (= section in the classification of Waterman & Chace), which he named Astacidea; he was followed in this by Hobbs (1974: 2). When compared with the super-

families in Caridea, the Astacidea indeed deserve a higher rank than superfamily, and should be treated like an infraorder. The synonymy of this infraorder is as follows:

#### Astacidea Latreille, 1803

- Astacini p.p. Latreille, 1802-1803, *Hist.nat.Crust.Ins.*, 3: 32.  
 Macroura Divisio VI Leach, 1815, *Trans.Linn.Soc.London*, 11: 343.  
 Homardiens Desmarest, 1823, *Dict.Sci.nat.*, 28: 306.  
 Fissilaminata Haworth, 1825, *Philos.Mag.Journ.*, 65: 184.  
 Astacini Latreille, 1831, *Cours Entomol.*, 1: 378.  
 Astacina Burmeister, 1837, *Handb.Naturgesch.*, 3: 563.  
 Astacomorpha Huxley, 1880, *Crayfish*, (ed. 1): 338, 339, 341, 342, 363.  
 Homaridae Boas, 1880, *K.Danske Vidensk.Selsk.Skr.*, (6)1(2): 156, 174.  
 Homariderne Boas, 1880, *K.Danske Vidensk.Selsk.Skr.*, (6)1(2): 68.  
 Homaridea Ortmann, 1891, *Zool.Jb.Syst.*, 6: 1.  
 Nephropsidea Ortmann, 1898, *Bronn's Klass. Ordn.Thier-Reichs*, 5(2): 1138.  
 Astacura Borradaile, 1907, *Ann.Mag.nat.Hist.*, (7)19: 464, 467.  
 Astacidea Fowler, 1912, *Ann.Rep.New Jersey State Mus.*, 1911: 332.  
 Herpochelida Beurlen & Glaessner, 1930, *Zool.Jb.Syst.*, 60: 49, 53.  
 Nephlopsidea Yokoya, 1933, *Journ.Coll.Agric. Tokyo*, 12: 48.  
 Astacidea Glaessner, 1969, *Moore's Treatise Invert.Paleontol.*, R (4): 455.

The infraorder Astacidea was divided by Hobbs (1974) into three superfamilies: (1) the Astacoidea, containing the freshwater crayfishes of the northern Hemisphere, (2) the Parastacoidea, formed by the freshwater crayfishes of the Southern Hemisphere, and (3) the Nephropoidea containing the marine lobsters. In the present paper the Nephropoidea of the Atlantic Ocean are dealt with. Most attention is given to the species occurring in the tropical and southern zones of the Atlantic Ocean. The Northern Hemisphere, (2) the Parastacoidea, formed by the freshwater for completeness's sake; their synonymy and distribution are listed, some remarks are given, but no complete account is provided. The other species are more exhaustively dealt with.

#### Nephropoidea Dana, 1852

The Nephropoidea consist of two families, the Nephropidae (usually indicated as Nephropsidae or Homaridae) and the Thaumastochelidae. It is possible that also the Axiidae should be placed in this superfamily rather than in the Thalassinidea: they are connected with the Nephropidae by so many similarities and so few differences, that it is often difficult to decide whether a genus belongs to one or the other of these two families; so *Eutrichocheles* and *Enoplometopus*, which for a long time have been considered Nephropidae actually have to be placed with the Axiidae. The position of the Axiidae is not further considered here and only the Atlantic members of the families Thaumastochelidae and Nephropidae are dealt with.

Recently, Glaessner (1969) divided the heterogeneous assemblage of Nephropid genera into three subfamilies: Nephropinae, Homarinae, and Neophoberinae. The characters shown by *Homarus* are so close to those of Nephropine genera like *Nephrops*, *Metanephrops*, and *Eunephrops*, that I have not been able to distinguish a subfamily Homarinae, and have to refer *Homarus* to the Nephropinae. On the other hand the genera *Nephropsis*, *Nephropides*, and two new genera (*Thymops* and *Thymopsis*) described below, differ sufficiently from the other Nephropid genera to constitute a separate subfamily Thymopinae. Glaessner's subfamily Neophoberinae is a very distinct and well characterized taxon.

KEY TO THE FAMILIES THAUMASTOCHELIDAE AND NEPHROPIDAE

- 1 Eyes entirely absent, eventual remnants immovably fused with the ophthalmic somite. Telson unarmed. Chelipeds very unequal, the larger with fingers more than four times as long as the palm; cutting edges of the fingers of the larger cheliped with two rows of diverging slender spines. Fifth pereopod (at least in the female) with a chela. Abdominal pleura short, quadrangular, lateral margin broad, truncate, not ending in a point. Scaphocerite with several very large teeth on the inner margin. -----  
----- Thaumastocheilidae
- 1' Eyes well developed or reduced, always present as movable appendages. Telson with lateral and/or postlateral spines. Chelipeds equal or unequal, but fingers always considerably less than twice as long as palm; teeth on the cutting edge placed in the same plane. Fifth pereopod without a true chela. Abdominal pleura large, triangular or ovate, usually ending in a point. Scaphocerite, if present, with the inner margin evenly curved, unarmed. -----  
----- Nephropidae
- 2 Rostrum laterally compressed for the larger part of its length, with dorsal and ventral, but no lateral teeth. Carapace with branchiostegal spine. Body entirely covered by numerous closely placed and sharply pointed spinules. Lateral margin of the telson with 6 to 12 spines. ----- Neophoberinae
- 2' Rostrum dorsoventrally depressed with lateral (and sometimes ventral), but without dorsal teeth. Carapace without a branchiostegal spine. Body never uniformly covered with spinules, although granules may be present all over, or spinules may be placed on the carapace. The lateral margin of the telson with at most three lateral spines, which if present, are usually small and irregular. -----
- 3 Scaphocerite absent. Carapace without postorbital spine. Ab-

- dominal sternites unarmed in both sexes. No podobranch on second maxilliped. .... Thymopinae
- 3' Scaphocerite present. Carapace with a distinct postorbital spine. Sternites of second to fifth abdominal somites in the male with a sharp median spine each. Podobranch usually present on the second maxilliped. .... Nephropinae

Thaumastochelidae Bate, 1888

Thaumastochelidae Bate, 1888, Rep. Voy. Challenger, Zool., 24: 7, 11, 46.

*Definition.*—The rostrum is dorsoventrally flattened, with small lateral teeth. The carapace shows small postorbital and antennal spines, but no others. There are no carinae on the carapace, but postcervical, cervical and hepatic grooves are distinct; the gastro-orbital, antennal, branchiocardiac and parabranchial grooves are present but less clearly indicated. The anterior part of the carapace is densely pubescent, except for a narrow median rostral area and a large elongate triangular postrostral area which are naked. The carapace has no clavicular incision and is immovably fused with the epistome; a feature distinguishing this family from the Nephropidae.

The abdomen has the pleura short and wide, broadly truncate laterally. A sharp carina extends over the bases of the pleura of somites 1 to 3. The pleura of somites 4 to 6 have long soft hairs, which are also found on the central part of the second and the larger part of the third to sixth tergites. The telson is broadly quadrangular, without spines.

The eyes are absent, the last remnants are immovably fused with the ophthalmic somite.

The scaphocerite is distinct, it has the inner margin deeply dentate. The penultimate segment of the antennal peduncle is almost twice as long as the ultimate.

The epistome shows two short curved, anteriorly concave ridges in the anterior part, one on either side of the median line. Numerous spinules are present on the surface of the epistome. The posterior margin is a high ridge, which bears one median ventrally directed and about seven anteriorly directed spines. There is no clavicular ridge.

The mandible has a large and heavy molar part which ends in a few teeth, and carries a three-segmented palp. The maxilla has a large upper and a small lower lacinia; the palp consists of two segments, the distal of which is slender and flagellum-like. The maxilla has the two endites both deeply incised, so that four slender laciniae are formed, the upper of which is largest; the palp is elongate triangular, tapering to a slender point; the scaphognathite is large and elongate leaf-like. The two endites of the first maxilliped are narrowly separated, the upper is large; the palp is two-segmented and large; the exopod consists of two segments of which the basal is elongate

and narrow, the distal shorter, oval and not subdivided; a large epipod is present. The second and third maxillipeds are pediform with well developed exopods. The outer posterior margin of the third maxilliped is smooth, the inner posterior margin bears a row of very strong spines.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

The first pereiopods are the strongest and are strongly asymmetrical. The larger has the merus normal with an anterodorsal spine. The carpus is relatively very small, rounded and unarmed. The chela forms one of the most characteristic features of the group. The palm is swollen and short, with a few spinules. The fingers are extremely long, more than four times the length of the palm. From a short depressed triangular base they continue thin and compressed, low and of the same height almost throughout, with numerous long and slender spines which are placed obliquely on the cutting edge, pointing alternately to the right and to the left. The smaller chela has spinules on the carpus. The chela is of normal shape, the palm is elongate and more than half as long as the fingers, which have slender teeth that are placed in one plane. The second and third chelipeds are shorter and provided with normal chelae. The fourth leg has a simple dactylus, no chela, while the fifth leg again has a small but distinct chela (at least in the female).

The female shows a thelycum between the bases of the fourth pereiopods. This thelycum consists of three plates: a posterior median triangular one and two anterior submedian oval ones. The anterior plates approach one another anteriorly, being only separated there by the median slit; posteriorly they enclose the lateral margins of the triangular posterior plate.

The first abdominal somite of the female bears pleopods which consist of two narrow, almost filiform segments. The following pleopods have an oval leaf-like endopod and exopod. The endopods bear no appendix interna, but show only a rounded lobe in the basal part of the inner margin. This lobe carries some long stiff setae at the top.

The uropods have the endopod very short and wide. The posterior margin is about as long as the outer, but longer than the inner margin; it bears distinct blunt teeth. The exopod is larger, but also very wide and rather

short. It bears a distinct diaeresis so that the small distal part connects movably with the larger proximal part. There are numerous denticles placed on the anterior margin of the diaeresis.

No male specimens were at my disposal.

The family contains one genus:

*Thaumastocheles* Wood-Mason, 1874

*Thaumastocheles* Wood-Mason, 1874, Proc. Asiat. Soc. Bengal, 1874: 181.

Type species by monotypy: *Astacus zaleucus* Thomson, 1873, Nature, London, 8: 246. Gender: masculine.

Of this genus so far only two species are known: *Thaumastocheles japonicus* Calman, 1913, from Japanese waters, and the following West Indian species:

*Thaumastocheles zaleucus* (Thomson, 1873)

Fig. 1

*Astacus Zaleucus* Thomson, 1873: 246, 247, fig. 1; A. Milne Edwards, 1874: 1, pl. 20; Wood-Mason, 1874: 181; Von Willemoes-Suhm, 1875: 48, pl. 10 fig. 1; Thomson, 1877: 259, 260, fig. 60; Holthuis, 1956: 114.

*Astacus zaleucus* Pagenstecher, 1879: 37; Hemming, 1958: 138.

*Thaumastocheles zaleucus* Wood-Mason, 1874: 181; Filhol, 1886: 160, fig. 51; Perrier, 1886: 324; Calman, 1913: 230, fig. 1; De Man, 1916: 97; Bouvier, 1917: 14; Green, 1961: 126, 127, fig. 57; Manning, 1969: 307; Firth & Pequegnat, 1971: 91, fig. 14.

*Thaumastocheles zaleuca* Bate, 1888: 47, text-fig. 40, pl. 6 fig. b-q, pl. 7 fig. 1e-h; Marshall, 1888: 268, fig. 89; Hickson, 1893: 137; Stead, 1905: 36, fig. 7.

*Thaumastocheles zalencus* Bouvier, 1925: 420, pl. 3, pl. 4 figs. 2, 3.

*Thaumastocheles* Smith, 1940: 124, fig.

Deep-sea Lobster Duncan, 1948: pl. 15 fig. 5.

not *Thaumastocheles zaleucus* Doflein, 1906: 521, figs. 1-4; Doflein, 1906a: 270; Doflein, 1906b: 71; Rathbun, 1910: 314, pl. 6 figs. 1-3 (= *T. japonicus* Calman).

*Material*.—Straits of Florida, U.S.A.: GERDA sta. 222, 824 m, 1 female (M); sta. 226, 802-805 m, 2 damaged specimens (W,L); sta. 860, 722-754 m, 1 fragment (M).—E. of Nicaragua: OREGON sta. 1908, 640 m, 1 female (W).

*Description*.—The species has very extensively been described by Bate (1888), while Bouvier (1925) gave additional details. Of the illustrations especially Bouvier's (1925) are excellent.

Bouvier (1925: 420) indicated that the rostrum in his specimens had two pairs of lateral spines. On p. 422 Bouvier remarked that Bate (1888) had not mentioned the presence of spines on the rostrum, but that his figure showed three pairs. Actually Bate (1888: 48) did mention such spines: "the lateral margins of the rostrum are fringed with hairs and a few (four)

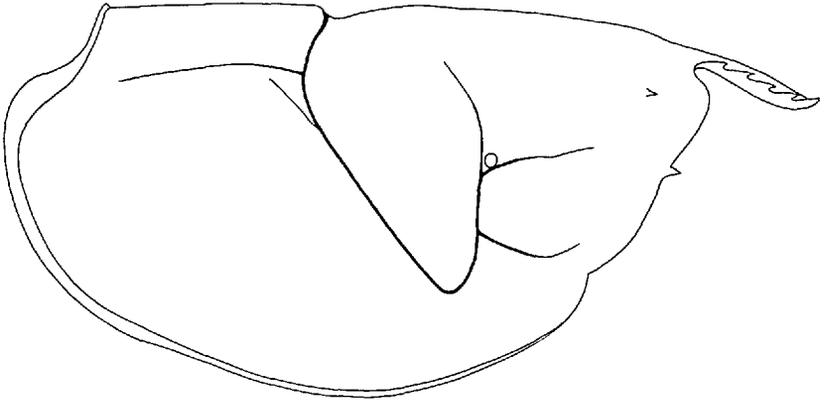


FIGURE 1. *Thaumastocheles zaleucus* (Von Willemoes-Suhm), schematic lateral view of the carapace.

short sharp teeth on each side". In the specimen from GERDA sta. 222 there are four spines on one side, five on the other; the fragment from GERDA sta. 860 shows six spines on one side, seven on the other.

In the diagnosis of the present genus Bouvier (1925: 417) stated: "test depourvu d'épines" and in his species description stressed this point again. However, the carapace in the material examined by me bears a small but distinct and slender antennal spine, and a still smaller post-orbital spinule. The antennal spine is shown in Bouvier's pl. 4 fig. 2. The spine and the spinule are largely obscured by the long pubescence of the anterior part of the carapace and thereby easily overlooked. The numerous granules and spinules in the posterior and lateral parts of the carapace evidently do not fall under Bouvier's definition of "épines".

The two specimens from GERDA sta. 222 and 860 had one scaphocerite with seven, the other with eight teeth on the inner margin (the distal tooth included).

Bouvier (1925:421) stated that the large cheliped "est complètement inerme jusqu'à la pince", which, however, is not true as the merus shows a distinct antero-dorsal spine, which indeed is shown in Bouvier's figures.

*Size*.—Of the present specimens only those from GERDA sta. 222 and OREGON sta. 1908 are complete. Both are females, they have the carapace length 55 and 54 mm respectively. The total length is about 135 mm. The type specimen was 100 mm long, and the specimen reported upon by Bouvier (1925) 155 mm (cl. 64.5 mm).

*Colour*.—The type specimen was said by Von Willemoes-Suhm to have in a living condition "the red colour of all deep-sea Crustacea" (Bate, 1888:

55). In full contradiction to this is the entry, made on the data sheet of GERDA sta. 222 immediately after the net was aboard, which described the specimen of *Thaumastocheles* as "a white, extremely long-chelated crustacean". A colour photograph made by Dr. R. B. Manning of the specimen from OREGON sta. 1908 likewise shows the animal as entirely pure white, with the hairs cream coloured. Evidently Von Willemoes-Suhm's sweeping statement is not correct.

*Distribution.*—So far *Thaumastocheles zaleucus* was known only from four localities, all in the West Indian area: Off the Caribbean coast of Yucatan Peninsula, Mexico, 18°57'N 87°09'W, 1143 m (Firth & Pequegnat, 1971), off the east coast of Nicaragua, 12°33'N 82°20'W, 640 m (Firth & Pequegnat, 1971), off Sombrero Island, 18°24'N 63°28'W, 824 m (type locality: Thomson, 1873, 1877; Von Willemoes-Suhm, 1875; Bate, 1888; Calman, 1913), off Grenada, 12°03'55"N 61°49'40"W, 1054 m (A. Milne Edwards, 1874; Bouvier, 1925). The present specimens are from the Straits of Florida and east of Nicaragua, the latter has already been mentioned by Firth & Pequegnat (1971).

*Habitat.*—The species has been taken from depths between 640 and 1054 m; five of the seven known specimens being found between 720 and 825 m. The bottom on which the species was found consisted of Pteropod ooze (type locality: Thomson, 1873, 1877; Von Willemoes-Suhm, 1875; Bate, 1888; Calman, 1913; and GERDA sta. 222), gray ooze (A. Milne Edwards, 1874; Bouvier, 1925). The bottom at GERDA sta. 226 was described as very flat.

*Habits.*—Several authors have speculated on the habits of this species. Bate (1888:53, 54) suggested that it is a burrowing form, basing his conclusions on various morphological features. Doflein (1906:524) when dealing with *T. japonicus*, did not agree with Bate, and thought especially the long cheliped a feature which would make the species unfit for fossorial habits; he suggested that *Thaumastocheles* more likely lives on Hexactinellid sponges. Bouvier (1925:419) was of the opinion that the animals live partly dug in, with the antennules, antennae and large chelipeds sticking out or lying on the mud. The available evidence is not sufficient for definite conclusions and everything said on this point is pure conjecture. The fact that the specimen of GERDA sta. 222 carries commensal Foraminifera on just those parts of the body that according to Bouvier are outside the burrow, seems to support his view. Another interesting item is that both the specimen from GERDA sta. 222 and that from sta. 860 are decapitated. In the first specimen the anterior half of the cephalothorax, including all the anterior appendages up to the first maxilliped is separated from the rest of the body as if cut off by a sharp knife, otherwise the specimen is undamaged. The fragment from sta. 860 consists of the anterior part of the

cephalothorax, which is smaller than the detached part of the specimen of sta. 222, it does not contain any mouthparts; the rest of this specimen was not taken by the net. The fragment of sta. 860 is likewise as if cut off by a sharp knife. It is possible, if Bouvier's surmise is correct, that the anterior part of the body of *Thaumastocheles* sticking out of the burrow was cut off by the passing net. The fact that the species is white may also be an indication that it is a burrower.

*Commensals.*—As already briefly referred to in the previous paragraph, the specimen from GERDA sta. 222 shows Foraminifera attached to various parts of the anterior half of the body: (1) one foraminiferon is placed on the ventral surface of one scaphocerite, (2) one on the inner anterolateral angle of the distal segment of one antennal peduncle, (3) nine on the antennular flagella, (4) two on one of the antennal flagella, and (5) one at the base of one of the spines in about the middle of a cutting edge of the large chela. Nowhere else on the body were such Foraminifera observed.

#### Nephropidae Dana, 1852

##### Fig. 2

Nephropinae Dana, 1852, Proc. Acad. nat. Sci. Philadelphia, 6: 15.

Homaridae Huxley, 1879, Proc. zool. Soc. London, 1878: 781, 785.

Homarina Huxley, 1880, The Crayfish, (ed. 1): 261.

Stomaridae Huxley, 1880, Arch. Zool. expér. gén., 8: 96.

Nephropsidae Stebbing, 1893, History Crustacea: 201.

Nephlopsidae Yokoya, 1933, Journ. Coll. Agric. Tokyo, 12: 48.

*Definition.*—The rostrum is well developed, with lateral, and sometimes dorsal or ventral teeth. The grooves, carinae and spines on the carapace are of great importance and will be dealt with rather extensively here.

The pattern of the grooves of the carapace is very striking and the homologies and the origin of these grooves in both recent and fossil Nephropidae have intrigued many scientists; much has been written on the subject, but the last word certainly has not been spoken yet. Many paleontologists have studied the problem, and the most up to date account is that by Glaessner (1969). In the present paper the terminology adopted by Glaessner is followed as far as possible; also the letters used to indicate the grooves both in figure 2 and in the text are mostly taken from Glaessner. The following grooves are recognizable in some or all Nephropidae:

- a. —branchiocardiac groove. This is the groove that separates the branchial region from the cardiac region of the carapace. In its posterior part it runs longitudinally, parallel with the median dorsal line of the carapace, and anteriorly it curves down to meet the post-cervical groove.
- b. —antennal groove. A groove that extends forward from the lower end of the cervical groove, and curves around the lower border of the

elevation of the carapace behind the antennal spine. Anteriorly it may split into two branches, often indistinct, one going straight forward, the other curving up towards the antennal spine.

- b'.—hepatic groove. A groove continuing from the posterior end of the antennal groove posteriorly, and uniting, with a loop-like curve, the lower ends of the cervical and post-cervical grooves.
- c.—postcervical groove. Usually the most conspicuous of the grooves of the carapace (by many older authors indicated as cervical groove, according to Glaessner incorrectly so). It extends from about the middle of the dorsum of the carapace (or somewhat behind it) downward and slightly forward, its end meeting the hepatic groove.
- c'.—intercervical groove. A groove not named or described by previous authors, although shown in the figures by some of them. This oblique groove connects the post-cervical and cervical grooves, starting in the upper part of the lower half of the post-cervical groove and ending somewhat above the lower end of the cervical groove.
- d.—gastro-orbital groove. A groove which extends forwards from the upper part of the cervical groove near point  $\alpha$ . It extends in the direction of the orbit and forms the upper border of the elevated area behind the antennal spine.
- e.—cervical groove. A transverse groove somewhat parallel to the post-cervical groove and placed before it. It starts at the confluence of the hepatic and antennal grooves, and extends upward to point  $\alpha$  or somewhat beyond; in recent Nephropidae it does not reach the dorsum. The part above point  $\alpha$  is sometimes indicated as e'.
- f.—buccal groove. A transverse groove crossing the mandibular elevation behind the antennal spine and connecting the gastro-orbital and antennal grooves.
- i.—inferior groove. A groove that extends from the posterior part of the hepatic groove downward, and might be considered a continuation of the postcervical groove.
- l.m., see m.
- m.—marginal groove. The groove that extends on the inner side of the marginal carina of the carapace. It can be divided into a postmarginal groove (p.m.) placed just before the posterior part of the marginal carina, and a lateromarginal groove (l.m.), just above the lateral part of the marginal carina.
- p.—parabranchial groove. A groove below and behind the combined branchiocardiac and postcervical grooves, and almost parallel with them. It joins the postcervical groove in its lower part. This groove possibly is the one that Glaessner (1969: fig. 227 no. 1, 5, 6) considered the hepatic groove or a continuation of it, while other authors

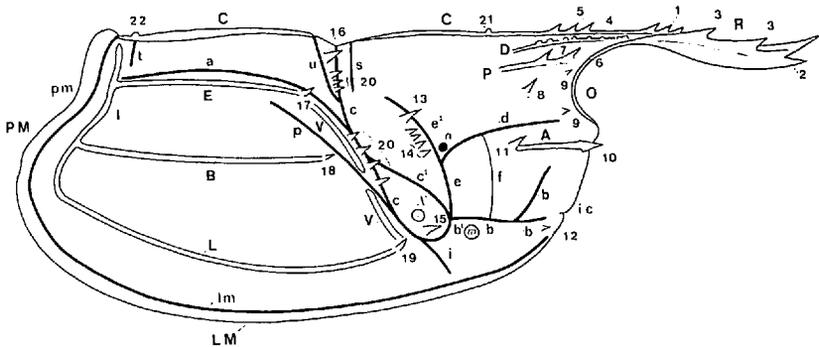


FIGURE 2. Schematic lateral view of Nephropid carapace showing the position of the various grooves, ridges, spines, teeth, tubercles, etc. listed on pp. 742-753.

confused it with the branchiocardiac groove. In my opinion this is a distinct groove that should be indicated with an own name.

p.m., see m

- r. —dorsomedian groove. A longitudinal groove which extends over the full length of the dorsal part of the carapace from the tip of the rostrum to the middle of the posterior margin (not indicated in Fig. 2).
- s. —sellar groove. A short saddle-like groove that crosses the dorsum transversely just before the postcervical groove. It is distinct in *Acanthacaris*. It has not been mentioned by previous authors.
- t. —intestinal groove. A short transverse groove in the median part of the posterior region of the carapace. This groove is interrupted in the middle by the intestinal tubercle.
- u. —urogastric groove. A short transverse groove in the median or submedian region of the carapace behind the postcervical groove. It often curves forward in its lower part and joins the upper part of the postcervical groove. By some authors (e.g., Glaessner, 1969: fig. 223 no. 1) it has been indicated as part of the branchiocardiac groove, but as clearly shown by the genus *Thymopsis* it is different.

Most of the genera show only some of these grooves and then often only partially, which makes homologizing them rather difficult. In Figure 2 I have tried to show in a schematized drawing a complete pattern of the grooves found in the various Nephropid genera. The grooves are not always as clear as they are shown in the drawing, often they are hardly indicated, or are so wide and irregular that a single line does not do them justice.

There are a few points on the carapace that can be used as field marks. They constitute the points where muscles are attached to the interior surface of the carapace. They are marked in the schematic drawing as follows:

- α. A small, smooth and shiny sunken area in the carapace some distance behind the antennal spine. It usually stands out because the surrounding region of the carapace is rough. This point lies at the place where the gastro-orbital groove branches off from the cervical. It probably is the place where the tendon of the musculus dorsoventralis anterior (= musculus tensor dorsoventralis maxillaris) is attached to the interior surface of the carapace.
- χ. The place of the attachment of the musculus dorsoventralis posterior (= musculus adductor testis), near the lower end of the postcervical groove; the position of this point is not clearly marked on the carapace.
- ω. A point placed near the end of the cervical groove. This point is likewise not well marked, and judging by the various accounts in the literature its position in regard to that of the grooves is not very constant.

Of all these points, those marked here α is the most distinct and reliable, even though it has not been mentioned by previous authors.

The following ridges can be found on the carapace:

- A.—antennal carina. A ridge extending from the antennal spine backward.
- B.—branchial carina. A longitudinal ridge extending over the branchial region behind the postcervical groove.
- C.—median carina. A longitudinal ridge extending over the full length of the middorsal area of the carapace from the tip of the rostrum to the middle of the posterior margin.
- D.—subdorsal carinae. Two longitudinal ridges, usually granulose or spinulose, extending from the submedian region of the rostrum backward and usually diverging posteriorly.
- E.—intermediate carina. A longitudinal ridge in the upper branchial region behind the postcervical groove, about halfway between the median and the branchial carinae and about parallel with these.
- I.—intestinal carina. A transverse ridge starting from the posterior end of the lateral carina upward, often connected with the posterior ends of the branchial and intermediate carinae, but usually not reaching the dorsomedian line of the carapace.
- L.—lateral carina. A longitudinal ridge extending over the lower part of the branchial area of the carapace behind the postcervical groove.
- M.—marginal carina. The ridge forming the posterior and lateral margins of the carapace, sometimes subdivided into posteromarginal (PM) and lateromarginal carina (LM).
- O.—orbital carina. The ridge forming the orbital margin.
- P.—supraorbital carina. The ridge extending backward from the supra-orbital spine.
- R.—rostral carina. The ridge forming the lateral margin of the rostrum, often passing into the orbital carina.

- S.—submedian carina. A longitudinal ridge at either side of the dorso-median groove (not shown in Fig. 2).
- V.—postcervical carina. A transverse ridge behind the postcervical groove, which may be connected with the anterior ends of the lateral, branchial and intermediate carinae.

The spines and teeth that can be found on the carapace are indicated here with the following names and numbers:

1. The dorsal rostral teeth, placed on the dorsal margin of the rostrum.
2. The ventral rostral teeth, placed on the ventral margin of the rostrum.
3. The lateral rostral teeth, placed on the rostral carinae.
4. The subdorsal teeth or spines, placed on the subdorsal carinae.
5. The median teeth, placed on the median carina.
6. The supraorbital spine, placed above and slightly behind the orbit, sometimes followed by the following.
7. The postsupraorbital spine, placed immediately behind the supraorbital spine. Usually only one postsupraorbital spine is present; sometimes there are more, in which case they are usually placed on the supraorbital carina. In some species the postsupraorbital spine is absent altogether.
8. The postorbital spine, placed behind the orbit at a lower level than the supraorbital spine.
9. The metorbital spines, placed behind the orbit before the postorbital and between the supraorbital and antennal spines. The metorbital spines are much smaller than either the supraorbital, postorbital or antennal spines.
10. The antennal spine, placed on the anterior margin of the carapace somewhat below the lower angle of the orbit.
11. The postantennal spine, a smaller spine placed behind the antennal, usually at the posterior end of the antennal carina.
12. The branchiostegal spine, placed near the anterior margin of the carapace some distance below the antennal spine.
13. The cervical spine, placed behind the cervical groove at the level of the postorbital spine.
14. The cervical denticles, a row of denticles or spinules placed behind the cervical groove between the cervical and hepatic spines.
15. The hepatic spine, placed in the center of the lateral surface of the carapace just above the hepatic groove and between the lower ends of the cervical and precervical grooves.
16. The postcervical spine, one of a pair of spines placed in the dorso-median region of the carapace behind the postcervical groove.
17. The intermediate spine, placed behind the postcervical groove at the anterior end of the intermediate carina.

18. The branchial spine, placed behind the postcervical groove at the anterior end of the branchial carina.
19. The lateral spine, placed behind the postcervical groove at the anterior end of the lateral carina.
20. The postcervical denticles, a row of spinules placed behind the postcervical groove and connecting the postcervical and lateral spines.
21. The gastric tubercle, an isolated tubercle in the anterior part of the dorsomedian groove about halfway between the orbit and the postcervical groove.
22. The intestinal tubercle, an isolated tubercle in the posterior part of the dorsomedian groove a short distance before the posterior margin.

The surface of the carapace, apart from the above mentioned grooves, ridges, spines and teeth, may be smooth, pitted, or provided with spinules, granules, tubercles and hairs.

All Nephropidae show in the anterolateral margin of the carapace an incisura clavicularis (i.c.), an incision the two lobes of which partly overlap each other, and which fits around a tubercle or ridge of the epistome (the clavicular carina) and evidently serves to lock the carapace to the epistome. The anterolateral margin of the carapace otherwise is entirely free.

The abdomen may be smooth, spinulose, granulose or hairy and sometimes is provided with grooves which may or may not be filled with short hairs. The pleura are usually well developed, being longer than wide and mostly pointed.

The telson is elongate quadrangular or trapezoid, longer than wide, with a strong spine at each posterolateral angle, sometimes with teeth along the lateral margin.

The eyes are always present. Sometimes they are reduced and without pigment, but are always recognizable and movable.

The mandible consists of a heavy and large molar process and bears a three-segmented palp. The maxilla has two laciniae of which the upper is the larger; the palp is two-segmented, the last segment is slender and whip-like but not subdivided. The maxilla has the two endites deeply incised so that they form four laciniae, of which the upper and lower are widest; the palp is well developed and undivided; the scaphognathite is well developed. The first maxilliped has the two endites deeply separated, the upper being the larger; the palp is either undivided or two-segmented; the exopod may consist of one, two or three segments, and may carry a flagellum; the epipod is large. The second maxilliped is pediform, it has a large epipod that may or may not carry a podobranch; an exopod is present or absent. The third maxilliped also is a large pediform organ, which carries an epipod and a podobranch; two arthrobranchs are present. The exopod is usually present, but may be lacking. The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	±	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	±	±	—	—	—	—	—

The first pereiopods are very heavy, the left and right are equal or dissimilar. The second and third are shorter and more slender, both, like the first, are provided with a chela. The last two pairs of pereiopods have no chelae. The dactylus shows a small pad-like process in the extreme basal part of the lower surface, which pad touches a tubercle on the distal margin of the propodus. These processes are larger in the fifth than in the fourth leg and larger in the female than in the male. They are more extensively described here for *Nephropides*, but are more or less distinct in all Nephropidae.

The sternite of the penultimate thoracic somite in the female carries a distinct thelycum.

The first pleopod of the male consists of one or two segments and is transformed to a single very rigid copulatory stylet. In the female the first pleopod is a narrow and slender two-segmented appendage. The second pleopod of the male bears an appendix masculina on the endopod. Appendices internae as a rule are absent in both sexes, although the endopod of the second to fifth pleopods may show a lobe in the basal part. Only the males of *Nephropsis* have a distinct and slender stylamblys implanted on the lower inner margin of the endopod of the third to fifth pleopods. It is doubtful that this appendage is homologous with the appendix interna, especially so since it is absent from the second pleopod of the male, and is neither found in the females. The endo- and exopods of the second to fifth pleopods are oval and leaf-like.

The uropods are well developed with wide exo- and endopods. The exopod may be provided with a diaeresis, but in some species it is lacking.

The family is subdivided into three subfamilies.

#### Neophoberinae Glaessner, 1969

Phoberinae Mertin, 1941, Nova Acta Leopoldina, (n. ser.) 10(68): 168.

Neophoberinae Glaessner, 1969, in R. C. Moore, Treatise Invert. Paleontol., R (2): 459.

*Definition.*—The rostrum is for the larger part laterally compressed, with dorsal and ventral teeth, no lateral teeth are present. The subdorsal carinae are low, in their extreme anterior (rostral) portion they bear one or two strong slender teeth, the rest of the margin carries small spinules. The

supraorbital spine is large and tooth-like, it is followed by a high supraorbital ridge which bears a number of strong laterally compressed spines, which diminish in size posteriorly. Anteriorly the supraorbital carina ends between the lateral rostral and subdorsal carinae. The lateral rostral carina bears no teeth, it reaches slightly beyond the orbit and is not fused with the orbital carina. A very strong antennal spine is present, sometimes followed by a row of spinules. A hepatic spine is present, but it is hardly larger than the other spinules of the carapace. Post orbital spines are lacking. A branchiostegal spine is present and placed somewhat behind the anterior margin of the carapace. Of the grooves the cervical and postcervical are distinct. The postcervical groove does not reach over the dorsum but stops short before reaching the median line. Just anteriorly of the postcervical groove a short but distinct sellar groove may be seen, extending over the dorsum. The beginning of an intercervical groove is sometimes visible as a short branch of the postcervical. The hepatic groove is distinct, the antennal much less so, also the gastro-orbital groove is only faintly indicated. The median carina is visible before and behind the postcervical groove. The surface of carapace and abdomen is covered with numerous small sharp spinules.

The telson has several spines on the lateral margin.

The eyes are strongly reduced and not pigmented.

The scaphocerite is large. The penultimate segment of the antennal peduncle is about twice as long as the ultimate. A spine is present near the base of the scaphocerite. Another spine is placed over the opening of the antennal gland.

The epistome is smooth. It projects between the bases of the antennular peduncles. The posterior margin is high and unarmed. The clavicular ridge forms the limit of the efferent branchial channel and is smooth; it almost reaches the posterior carina of the epistome.

The palp of the first maxilliped is two-segmented. The second and third maxillipeds have well developed exopods with multi-articulated flagella; podobranchs are present on both the second and third maxillipeds.

The pereopods of the first pair are equal, the segments are cylindrical and bear many small spinules. The second pereopods are exceptionally slender and long. The cutting edges of the fingers bear sharp and well spaced teeth. The third pereopods are much more robust and shorter than the second. The cutting edges of the fingers bear no teeth, but a row of closely placed horn-coloured comb-like arranged short spinules.

The first pleopod of the male consists of two immovably fused segments. The uropods have a complete diaeresis on the exopods.

The abdominal sternites in both male and female do not show any median spines.

The subfamily contains only a single genus:



FIGURE 3. Schematic lateral view of carapace of *Acanthacaris*, showing the various grooves and spines.

*Acanthacaris* Bate, 1888

Fig. 3

- Phoberus* A. Milne Edwards, 1881, Ann. Sci. nat. Zool. Paris, (6) 11 (4): 1. Type species, by monotypy: *Phoberus caecus* A. Milne Edwards, 1881, Ann. Sci. nat. Zool. Paris, (6) 11 (4): 1. Gender: masculine. Invalidated by *Phoberus* MacLeay, 1818, and *Phoberus* Kirsch, 1873.
- Acanthacaris* Bate, 1888, Rep. Voy. Challenger, Zool., 24: 171, 929, pl. 21 and explanation of pl. 21. Type species, by monotypy: *Acanthacaris tenuimana* Bate, 1888, Rep. Voy. Challenger, Zool., 24: 171, 929, pl. 21 and explanation of pl. 21. Gender: feminine.
- Acanthocaris* Bate, 1888, Rep. Voy. Challenger, Zool., 24: pl. 22 and explanation of pl. 22. Incorrect original spelling of *Acanthacaris* Bate, 1888.
- Phoderus* Ramos, 1950, Bol. Inst. Paulista Oceanogr., 1(2): 84, 85. Erroneous spelling of *Phoberus* A. Milne Edwards, 1881.
- Neophoberus* Glaessner, 1969, in R. C. Moore, Treatise Invert. Paleontol., R(2): 460. Replacement name for *Phoberus* A. Milne Edwards, 1881. Gender: masculine.

The genus contains two known species, the type species *Acanthacaris tenuimana* Bate, 1888, and *A. caeca* (A. Milne Edwards, 1881). The former is an inhabitant of the Indo-West Pacific region, the latter is known only from the West Indian area. Some authors (like Bouvier, 1925) consider *A. tenuimana* only a subspecies of *A. caeca*.

A discussion of the genus has been provided by Bouvier (1925).

The genus was introduced into the scientific literature by A. Milne Edwards as *Phoberus*, and has been known under that name almost ever since, although this name is twice preoccupied. Only as late as 1969 a replacement name, *Neophoberus* Glaessner, was proposed for the invalid *Phoberus*. However, this name cannot be used as there is an older available name for the genus. When studying the Macrura of the CHALLENGER Expedition,

Bate (1888) found the second species of this genus in his material and originally described it as *Acanthacaris tenuimana*. Plates 21 and 22 of Bate's report showing this species bear the names *Acanthacaris tenuimana* (pl. 21) and *Acanthocaris tenuimana* (pl. 22). These plates were printed, but not published, before the publication of A. Milne Edwards's (1881) paper. When Bate's report finally was published in 1888 he accepted the name *Phoberus* for the genus and used it in his text, explaining there why the name *Acanthacaris* (or *Acanthocaris*) appeared on the plates. *Acanthacaris* Bate, having been validly published in 1888, and being older than *Neophoberus* Glaessner, 1969, thus should be used for the present genus.

The only species represented in the Atlantic is:

*Acanthacaris caeca* (A. Milne Edwards, 1881)

Figs. 4-8

*Phoberus caecus* A. Milne Edwards, 1881: 1; A. Milne Edwards, 1883: pl. 36; Agassiz, 1888: 44, fig. 241; Bate, 1888: 175; De Man, 1916: 97; Bouvier, 1925: 413, pl. 1 fig. 5, pl. 2; Colman, 1950: 142, text fig. 19B, pl. 3; Springer & Bullis, 1956: 14; Bullis & Thompson, 1965: 9; Glaessner, 1969: 460.

*Phoberus Caecus* Young, 1900: 445.

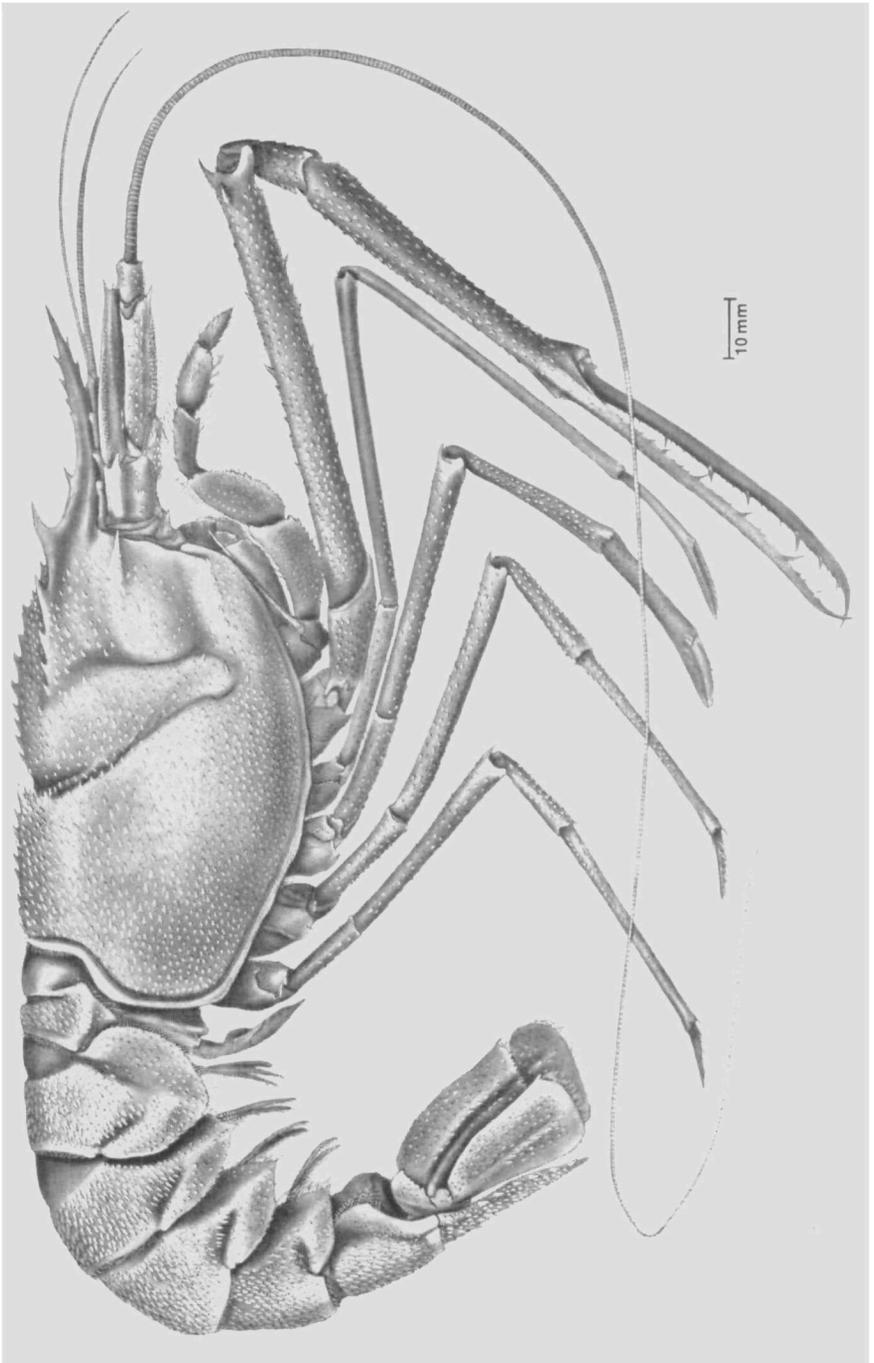
*Phoberus* Gordon, 1938: 1017, 1018, 2 coloured figures.

Spiny Lobster Merrifield, 1969: 40, fig. 33.

*Neophoberus caecus* Manning, 1969: 307, 308; Church, 1970: 121, fig; Firth & Pequegnat, 1971: 81, fig. 11; Opresko, Opresko, Thomas, Voss & Bayer, 1973: 6, 22, figs. 3, 8, pl. 6.

not *Phoberus caecus* Alcock, 1899: 33; Alcock, 1902: 127, 168, 264 (= *Acanthacaris tenuimana*).

*Material*.—Straits of Florida, U.S.A.: GERDA sta. 91, 605-648 m, 1 female (L); sta. 93, 733 m, 1 male, 1 female; sta. 131, 733-787 m, 1 male, 1 female (L); sta. 362, 631 m, 1 female (L); sta. 439, 566-584 m, 1 male; sta. 443, 792-829 m, 1 female. SILVER BAY sta. 1195, 641 m, 1 male (W).—Off W. Florida, U.S.A.: OREGON sta. 984, 27 m, 1 male (W).—Off Alabama, U.S.A.: OREGON sta. 319, 576-622 m, 1 female (W); sta. 3655, 641-695 m, 1 male (W); sta. 3660, 658-732 m, 1 male (W).—Off Texas, U.S.A.: OREGON sta. 549, 549-732 m, 1 male (L).—Off British Honduras: OREGON sta. 3635, 457-732 m, 3 males, 5 females (1 ovigerous) (W).—Off Honduras: OREGON sta. 1952, 549 m, 2 males (W); sta. 3628, 457 m, 1 male, 1 female (W).—Off Nicaragua: OREGON sta. 1908, 641 m, 1 female (W); sta. 1911, 641 m, 1 female (W); sta. 1915, 641 m, 1 male (W); sta. 3565, 439-458 m, 2 males, 3 females (W); sta. 3566, 275-293 m, 1 female (W); sta. 3571, 549-641 m, 2 females (1 ovigerous) (W); sta. 3575, 457 m, 1 male, 3 females (M, W); sta. 3609, 503 m, 1 male, 2 females (1 ovigerous) (W,L). PILLSBURY sta. 1355, 450-576 m, 1 male, 1 female (L).—Off Panama: OREGON sta. 3599, 457 m, 1 female (W). PILLSBURY sta. 447, 657-673 m, 1 male (M).—Off Colombia:



OREGON sta. 11248, 610 m, 1 male (W). PILLSBURY sta. 374, 373-434 m, 1 male (L); sta. 776, 408-576 m, 1 male (M).—S. of Jamaica: PILLSBURY sta. 1224, 878-906 m, 1 male (L); sta. 1261, 723-767 m, 1 male (L).—N.W. of Anguilla: PILLSBURY sta. 988, 686-724 m, 4 juveniles (M,L); sta. 989, 664-706 m, 1 female (L).—W. of Saba: OREGON sta. 2637, 659-695 m, 5 females (W).—Off Nevis: BLAKE sta. 151, 651 m, 1 juvenile male (MCZ).—Off Guadeloupe: PILLSBURY sta. 920, 531-733 m, 1 female (M); sta. 946, 733-833 m, 1 male (L).

*Description.*—The rostrum reaches about to the end of the scaphocerite or beyond, sometimes even overreaching the antennal peduncle. It is curved slightly upward, is laterally compressed and bears zero to three dorsal and six to nine ventral teeth; the dorsal teeth are placed in the distal part. The lateral carina of the rostrum is unarmed and continues posteriorly slightly beyond the orbit, it does not fuse with the orbital carina. The subdorsal carinae carry a sharp spine in their anterior part and continue backward slightly beyond the level of the supraorbital spines; they are armed with small spinules. A median carina is present both before and behind the postcervical groove: the anterior median carina starts at the level of the large supraorbital spines and extends all the way to the postcervical groove, it bears a single row of about 8 to 12 small spines. Behind the postcervical groove the median carina bears a few pairs of spinules in its anterior part and behind these an irregular row of four to eight single spinules. The supraorbital spine is large, laterally compressed and thereby tooth-shaped, it stands on the supraorbital carina, which more posteriorly bears three to six spines which diminish in size posteriorly; the last of these spines stands at about  $\frac{2}{3}$  of the distance between the orbit and the postcervical groove. Anteriorly the supraorbital carina ends between the rostral and subdorsal carinae. The antennal spine is strong and placed slightly behind the anterior margin of the carapace. Behind it there is a longitudinal row of two to seven spinules. A small hepatic spine is present, but often is hardly larger than the surrounding spinules. There is also a small branchiostegal spine, placed below the antennal carina somewhat behind the anterior margin of the carapace. The incisura clavicularis is distinct; the margin ventrally of the incisura forms a lobe which extends dorsally under the dorsal part of the incision, so that the carapace forms a fold there. The ventral lobe rests against the clavicular carina of the epistome.

The postcervical groove is very distinct and reaches from the hepatic groove up, but does not attain the middorsal line of the carapace. Just

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FIGURE 4. *Acanthacaris caeca* (A. Milne Edwards), male from PILLSBURY sta. 766. Mrs. Constance Stolen McSweeney del.  $\times .84$ .

before the postcervical groove is the sellar groove, which extends over the dorsum and laterally ends slightly below the dorsal end of the postcervical groove, so that these two grooves overlap each other for a short distance. The hepatic groove is distinct, the antennal groove is visible as a shallow depression. The cervical groove is sharply defined in its lower part (from the hepatic groove up), its distal part extends as a shallow depression almost as far as the supraorbital carina. The gastro-orbital groove is hardly indicated. Sometimes the beginning of the intercervical groove is visible. Numerous sharp anteriorly directed spinules are placed all over the carapace.

The abdominal somites, especially the terga, are densely packed with sharp posteriorly pointed spinules. In juvenile specimens, however, the terga may be completely smooth. On the pleura the spinules are less numerous. The pleuron of the first somite is small, rounded and partly hidden under that of the second somite. The pleura of somites 2 to 5 are large, oval, and end in a point, each overlaps the following one. The pleuron of the second somite has a wide and deep V-shaped depression. In the pleura of somites 3 to 5 the anterior half is sunken, the posterior half shows a single oblique groove. The pleuron of the sixth somite is short and wide and is bluntly triangularly produced in the anterior half. A groove extends over the posterior half of the base of the pleuron. There are no carinae on the abdomen. The telson is elongate quadrangular, covered by many spinules and having the lateral margin with about 6 to 12 spines of about equal size, the last of which is the posterolateral spine. The posterior margin is unarmed. The upper surface of the telson shows a transverse groove in the basal part and a median groove flanked by two low ridges.

The eyes are present, but strongly reduced and without pigment. They consist of a stalk and a slightly widened corneal end.

The antennular peduncle is formed by three subequal segments, which show no spines. The stylocerite shows as a short almost circular lobe at the outer basal part of the first segment of the antennula; it may bear a distal spine.

The scaphocerite is large with an oval blade and a sharp final tooth. It reaches almost to the end of the antennal peduncle. Spinules are present both on the dorsal and ventral surface of the blade, the dorsal ones being largest; in juveniles these spinules are absent. The final tooth reaches slightly beyond the blade. The peduncle shows a strong sharp tooth at the external side of the base of the scaphocerite, the segment carrying it also bears numerous spinules. The antepenultimate segment of the peduncle has a distinct ventral spine. The penultimate segment is more than twice as long as the last segment, it is widened at its inner margin and ends there in a sharp tooth. Small spinules are present on this and the ultimate segment.

The molar part of the mandible ends in a number of teeth. The exopod

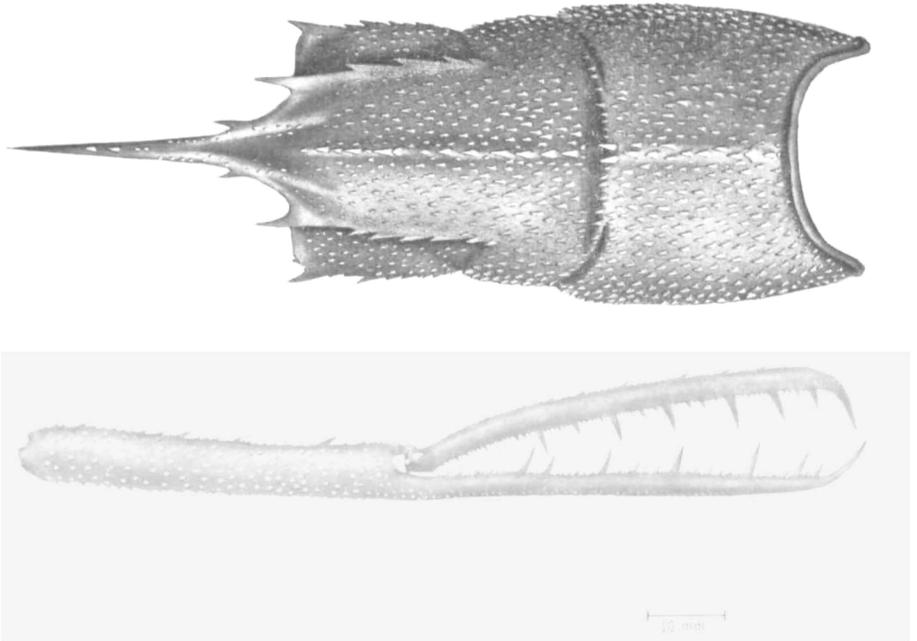


FIGURE 5. *Acanthacaris caeca* (A. Milne Edwards), male from PILLSBURY sta. 766. A, dorsal view of carapace  $\times 1.35$ ; B, right first chela  $\times 1.0$ . Mrs. Constance Stolen McSweeney del.

of the first maxilliped has an elongate peduncular segment and a multi-articulate flagellum. The third maxilliped has the distal three segments smooth and shining, without spinules. The merus and ischium are rather wide, with spinules on the outer surface, and with the lower margin denticulate. The inner lower margin of the ischium bears numerous small teeth, the distal of which is largest.

The pereopods of the first pair are equal in shape. They reach with part of the merus beyond the scaphocerite. They are cylindrical and slender. The fingers are about as long as the palm and have on their cutting edges five or six slender larger, and many smaller teeth; all of these are placed in one plane. The upper surface of the broadened base of the dactylus bears a distinct spine on either side; a row of five to seven spines and many spinules is visible on the upper margin of the dactylus. The dorsal margin of the palm bears two to eight larger and many smaller spinules. The carpus has an anterodorsal spine, and a second spine is placed on the inner surface a slight distance behind the anterior margin. The merus has 8 to 11 spines on the ventral, 4 to 6 on the dorsal margin. The distal two of the upper

spines are largest, but are not placed in a single row. All segments are covered with spinules.

The second legs are very slender. They reach with the carpus beyond the scaphocerite. The fingers are slightly shorter than the palm, their cutting edges show small, sharp and well spaced teeth. The chela is very slender, it is not wider than the carpus. The carpus is twice as long as the chela and practically as long as the merus. The ischium is half as long as the merus. The leg bears minute, hardly visible spinules on all segments. The third legs are much more robust than the second; they reach with the chela beyond the scaphocerite in large specimens, in small ones with only the fingers. The palm is about 1.5 times to almost twice as long as the fingers. The cutting edges of the fingers bear a row of very short, horn-coloured comb-like arranged spinules. A crest of hair is present on the dorsal margin of the dactylus. The carpus is about as long as the chela. The merus is about 1.5 times as long as the carpus and ends in a small anterodorsal spine. The ischium is slightly less than half as long as the merus. All segments have many small spinules. The fourth leg reaches with part of the propodus beyond the scaphocerite. The dactylus is simple, having two rows of setae on the upper surface. The propodus is almost three times as long as the dactylus. The merus is more than twice as long as the carpus and 3.5 times as long as the dactylus; it bears a distinct anterodorsal spine. The fifth leg is very similar to the fourth.

The sternite carrying the fourth pereopod shows in the female a thelycum, which consists of an elevated portion of about triangular shape. From near a median point in the anterior part of the sternite two broadly rounded carinae diverge posteriorly, having a median slit between them. The lateral margins of the thelycum are formed by two high longitudinal ridges, over which the coxae of the fourth legs slide. The posterior margin is triangularly incised.

The abdominal sternites bear no spines, neither in the male nor in the female. The first abdominal sternite of the male bears a blunt lobe near the outer part of the base of the pleopods.

The first pleopods of the male are transformed to rigid copulatory organs. They consist of two firmly fused segments with the posterior margin evenly and faintly convex. The inner anterior margin of the distal segment shows a distinct notch, below which there is a lobe, which at its posterior surface possesses an oval sunken area filled with short hairs. The distal segment is longitudinally concave posteriorly. The basal segment has a lobe in the distal part of its inner margin, which delimits a deep concavity which is the continuation of the concave channel of the distal segment. The endopod of the second pleopod of the male has a strong elongate appendix masculina which is almost as long as the endopod; it is rather wide and bears numerous spinules distally. The other pleopods are without appendix; like

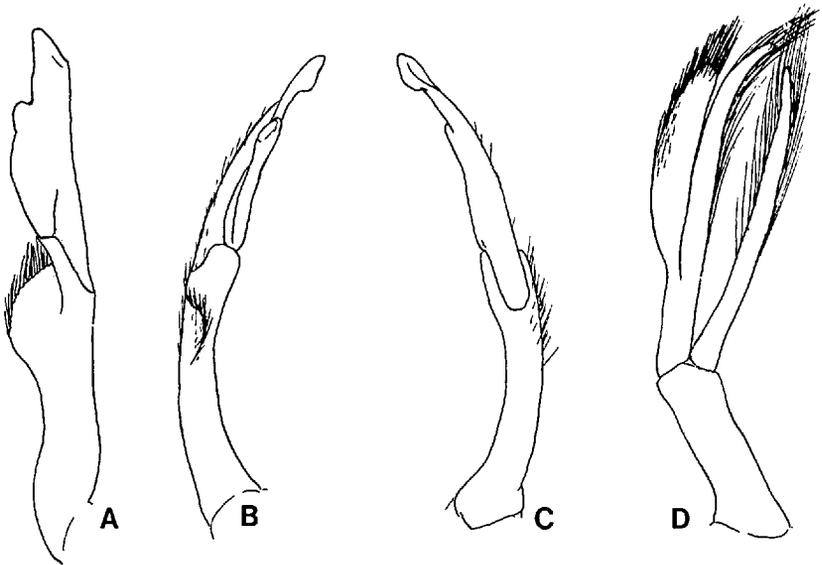


FIGURE 6. *Acanthacaris caeca* (A. Milne Edwards), male from OREGON sta. 3575. A-C, right first pleopod: A, anterior view; B, lateral view, inside; C, lateral view, outside. D, second pleopod. A-D,  $\times 12.5$ .

the second, they consist of a protopod and a narrowly leaf-like endo- and exopod. The first pleopod of the female consists of a single delicate slender branch formed by two narrow segments, the distal of which is articulated distally. The following pleopods have the endo- and exopod slender, no appendix is present.

The uropods are large, leafshaped, longer than wide. The exopod bears a distinct diaeresis which serves as the articulation between the anterior and posterior parts. A spine is present at the outer end of the diaeresis, and numerous spinules stand along its anterior margin. The endopod shows a single low longitudinal carina over the middle. In the exopod there is a similar carina, which, however, is flanked by a deep groove. The protopod of the uropods has several larger and smaller denticles on the margin of the dorsal lobes. Numerous spinules are placed all over the exo- and endopods.

The juveniles on the whole are far less spinuliferous than the adults.

*Size*.—The carapace length of the juveniles examined varied between 19 and 26 mm, that of the males between 43 and 173 mm and that of the females between 28 and 132 mm (always rostrum included). In the type specimen, a male from Grenada, the carapace was 170 mm long. Ovigerous females

have the carapace length between 99 and 140 mm. The eggs measure 2.0 to 2.5 mm in diameter.

*Colour.*—The first coloured figures ever to be published of this species appeared in the Illustrated London News of 4 June 1938 (Gordon, 1938: 1017, 1018), they show the pink animal in ventral and lateral views. An underwater photograph in colour of the animal in its natural habitat was published by Church (1970), it shows the pinkish colour of the animal quite well. Of several of the specimens collected by R/V GERDA and PILLSBURY colour photographs have been made or colour notes taken. The following description is based on this information. The body is of a clear, slightly purplish, pink all over. The pink colour is rather uniform, with the following exceptions: A large elongate whitish spot is present just laterad of the posterior end of the supra-orbital carina. The smooth anterior parts of the abdominal somites, which disappear under the previous somites when the abdomen is fully stretched, also are whitish. A small whitish spot is present at the articulations of the abdominal somites. The basal part of the antennal peduncle and the margins of the scaphocerite may be lighter pink than the rest.

The juvenile male from GERDA sta. 439 was described soon after capture as follows: Rostrum pink, rest of carapace very pale pink, almost white. The carapace before the cervical groove and the median part behind it brownish. Abdominal somites and tailfan bright pink. Eyes red. Antennula white with some pink. Scaphocerite white with a pink median line in the basal part. The base of the antenna is brownish, the penultimate segment white with a pink stripe along the inner margin. The mouthparts are white with pink distally. The third pereopod is white basally, with the palm pink and the fingers red. The fourth and fifth pereopods are white basally, with a pink propodus and a red dactylus. The pleopods are white and pink.

*Distribution.*—The species has been found throughout the Gulf of Mexico and the Caribbean Sea, including the Straits of Florida. The type locality is off Grenada, 12°03'15"N 61°48'30"W, 761 m (A. Milne Edwards, 1881, 1883; Agassiz, 1888; Young, 1900; Bouvier, 1925). Furthermore it has been reported from off Grenada, 787 m (Gordon, 1938; Colman, 1950); off Nevis, 17°08'21"N 62°42'00"W, 651 m (Bouvier, 1925); off British Honduras, 16°58'N 87°53'W, 455-728 m (Manning, 1969); off Honduras, 16°43'N 82°38'W, 430-612 m; off Nicaragua, 15°02'N 81°05'W, 439-622 m; and off Colombia, 11°33.8'N 73°45.1'W, 732 m (Firth & Pequegnat, 1971). Firth & Pequegnat (1971) also report that the species has been found off the west coast of Florida in 549-914 m. Church (1970) and Merrifield (1969) reported upon a specimen, which is figured in the present paper (Fig. 7); this specimen was seen at a depth of about 800 m

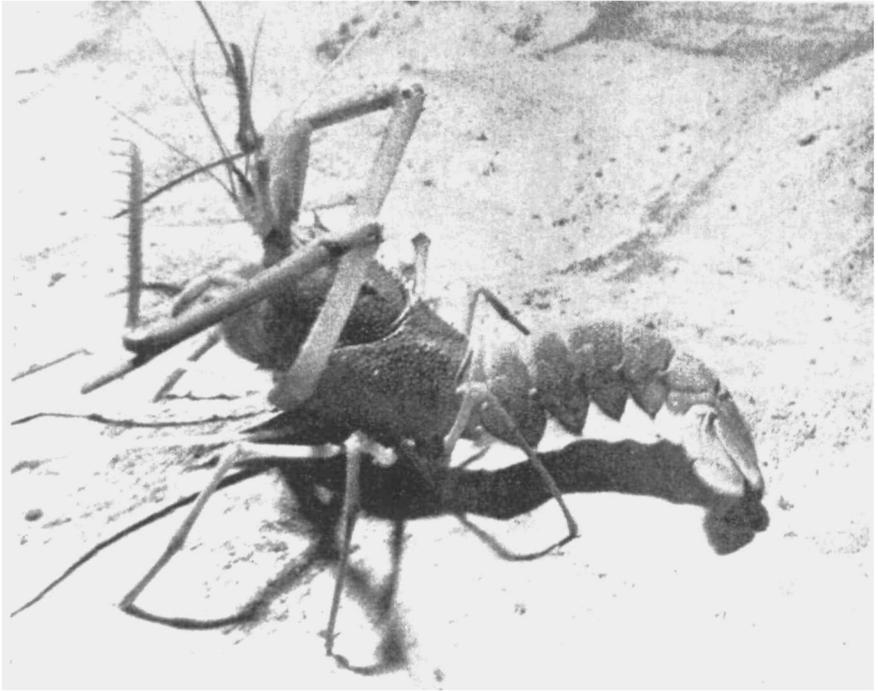


FIGURE 7. *Acanthacaris caeca* (A. Milne Edwards), live specimen photographed off Cay Sal, N. of Cuba, at a depth of 2500 feet (= 762 m); DEEPSTAR-4000 Dive no. 6, 18 November 1968. Courtesy Mr. Timothy W. Janaitis, U.S. Naval Oceanographic Office.

(2,500 feet) in the vicinity of Cay Sal, 23°58.5'N 80°30.0'W-23°58.2'N 80°28.0'W. Springer & Bullis (1956) mentioned the species from off Alabama, 29°20'N 87°25'W, 576-622 m, and from off Texas, 26°58.5'N 96°06.7'W, 549-732 m; their record of the species from OREGON sta. 984 (off N.W. Florida) is doubtful as the depth at this station was only 27 m (15 fm). Bullis & Thompson (1965) reported the species from three stations N.E. of Honduras, 16°42'N 82°33'W, 16°42'N 82°30'W, and 16°46'N 82°16'W, all three at a depth of 549 m. The submersible ALUMINAUT employed by the U.S. Naval Oceanographic Office took several photographs (three of which are reproduced here, Fig. 8) of this species during its dive no. 10 of 22 August 1968 near Vieques Island, E. of Puerto Rico, at depths of 704, 778, 816, and 829 m.

*Habitat.*—The depths at which *Acanthacaris caeca* is found vary from 293 to 878 m, but most finds (80%) are from between 550 and 825 m.

Of a few stations at which *Acanthacaris* was taken the bottom configuration is known; it is variously indicated as gray ooze (type locality), mud (PILLSBURY sta. 1224), sand and mud (OREGON sta. 2637; PILLSBURY sta. 1195), grey mud and shells (OREGON sta. 549), and smooth bottom (PILLSBURY sta. 920). The photographs of the species in its natural habitat (Merrifield, 1969; Church, 1970; present paper Figs. 7, 8) show the bottom to consist of fine sand or sandy mud; in some photographs ripple marks indicate that quite strong currents may have been present there. The bottom at OREGON sta. 984 consisted of coral and shells, but as already pointed out above this record is evidently incorrect (I did examine the specimen in USNM, it is a true *Acanthacaris* and bears the original label with the station number 984, but it is most unlikely that the species would occur at 27 m depth; a slip in the writing of the station number seems most probable).

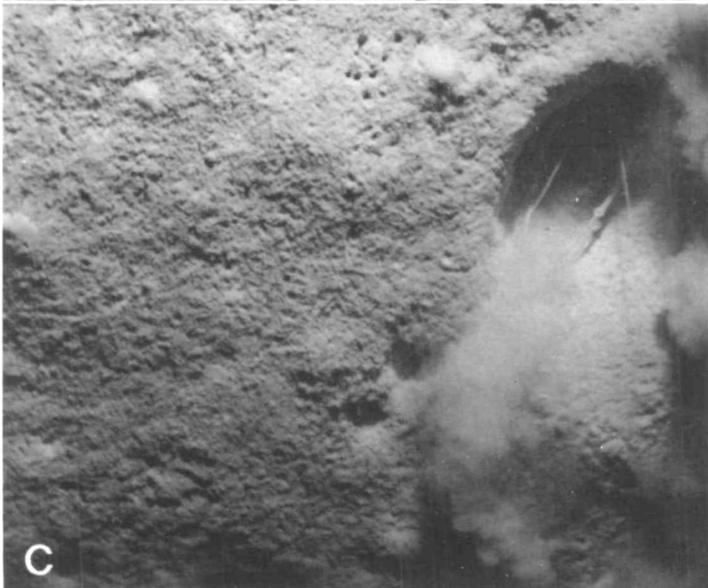
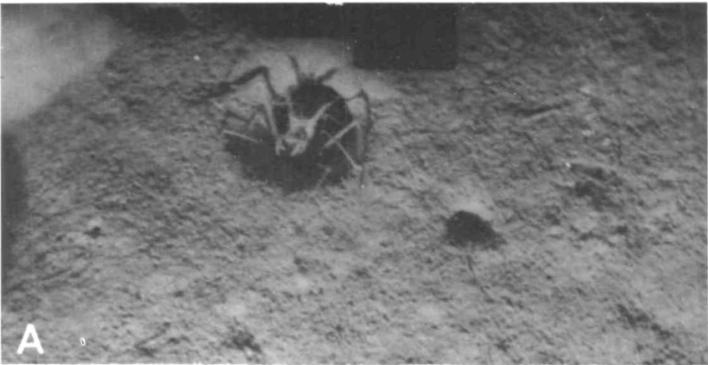
*Habits.*—Through the courtesy of Mr. Timothy W. Janaitis of the U.S. Naval Oceanographic Office, Washington, D.C., we obtained prints of photographs made by Mr. L. K. Hawkins of a live specimen of *Acanthacaris* taken near Cay Sal at a depth of 800 m on 18 November 1968 during dive no. 6 of the Westinghouse submersible DEEPSTAR-4000. One of these prints, which is reproduced here as Figure 7, has been published previously by Merrifield (1969). Another photograph of the same series taken of the same animal was published by Church (1970). All photographs show the animal in what might well be a defense attitude with the large chelae raised in such a way that the merus is directed obliquely up and slightly backward, the carpus and propodus make a sharp angle with the merus and are directed obliquely forward and down. The chelae are widely open, the dactylus standing perpendicular to the palm and fixed finger, or even leaning slightly over backwards. The very slender second legs are stretched almost straight forward, they have the chelae slightly open and do not touch ground. The third to fifth pereopods rest with their tips on the bottom; also the top of the tailfan rest on the bottom. The antenna, inclusive of the flagellum is directed straight upward or somewhat backward. The antennulae are pointed more obliquely forward.

Four other, so far unpublished, photographs were obtained through the kind offices of Mr. Janaitis. They were taken from the submersible ALUMINAUT during its dive 10 made on 22 August 1968 off Vieques Island,

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FIGURE 8. *Acanthacaris caeca* (A. Milne Edwards), live specimens with their burrows, photographed near Vieques Island; ALUMINAUT Dive 10, 22 August 1968. A, at 2550 feet; B, at 2715 feet; C, at 2675 feet. Courtesy Mr. Timothy W. Janaitis, U.S. Naval Oceanographic Office.



Puerto Rico. These four photographs, three of which are reproduced here (Figs. 8a-c) show that *Acanthacaris* is a burrowing species. Figures 8a and b, and a photograph not published here, show the animal sitting at the entrance of its burrow, with at least three pairs of legs, including the large chelipeds, reaching out. In one of the photographs (Fig. 8a) the last two pairs can be seen resting inside against the wall of the burrow. The third maxillipeds are directed forward and are curved down. The large chelipeds are more spread out and held forwards with a distinct bend at the carpus. In all three pictures, as in Figure 7, the chela is widely open, the dactylus standing about perpendicular to the palm. The second legs are bent at the end of the merus and stretched forward; they seem to touch the bottom at some distance in front of the burrow. The third legs are more strongly bent and with their tips seem to touch the bottom just before the opening of the burrow. The fourth photograph (Fig. 8c) is interesting because it shows *Acanthacaris* retracting itself into its burrow. A small mud cloud at the entrance indicates that the fine sediment of the bottom has been disturbed by the sudden movement. In the opening of the burrow the two antennal flagella and the two large chelipeds are visible. The chelipeds have the fingers practically closed. The bottom containing the burrows is rather barren, evidently consisting of fine loose sediment with several smaller and larger holes, the largest being those of *Acanthacaris*. The fact that *Acanthacaris* is a burrower is quite surprising, as nothing in the morphology of the animal points to this way of life.

*Commensals.*—Several specimens carried small Lepadid barnacles on the carapace, the abdomen, the antennal peduncle, and on the antennal and antennular flagella.

*Remarks.*—The second, and type, species of the present genus, *Acanthacaris tenuimana* Bate, is known from the Indo-West Pacific region. In the U.S. National Museum I examined a male specimen (cl. 88 mm) from Makassar Strait, Indonesia (1°19'S 118°43'E, 2161 m deep, grey mud, 30 December 1909, ALBATROSS sta. D 5670). The rostrum of this specimen is more slender than that of *A. caeca* and has five dorsal teeth. The spinules on the carapace are more slender, the subdorsal carinae are more distinct and bear slender spinules. The antennal spine is serrate. The abdomen bears fewer spinules, and there are about 10 larger and some smaller spines on the lateral margin of the telson. The antero-internal spine of the penultimate segment of the antennal peduncle reaches almost to the end of the ultimate segment. The palm of the large cheliped is relatively shorter (measuring about  $\frac{2}{3}$  of the length of the fingers). The merus is relatively less slender with the spinules longer. The legs are more sharply spiniferous, the fifth pereopod does not reach the end of the scaphocerite and its merus has a dorsodistal spine.

Opresko, Opresko, Thomas, Voss & Bayer (1973) used the vernacular name "Blind Deep-Sea Lobster" for the present species.

**Thymopinae**, new subfamily

Fig. 9

*Definition.*—The rostrum is dorsoventrally depressed and bears lateral teeth, sometimes ventral teeth are also present; dorsal teeth are always absent. The lateral margins of the rostrum merge with the orbital carinae. The subdorsal carinae are distinct and bear granules or spinules. A dorso-median groove extends over the full length of the dorsum of the carapace, being only interrupted at the post-cervical groove. Supra-orbital and antennal spines are present. The postorbital spines are absent. The post-cervical, hepatic, and cervical grooves are distinct, as is also the posterior part of the antennal. The gastro-orbital is less distinct or absent. Sometimes the sellar, urogastric, branchiocardiac, parabranial and inferior grooves are present, while also part of the intercervical groove may be visible. The surface of the carapace usually bears tubercles and shorter or longer hairs. The incisura clavicularis is present.

The abdominal somites show granules, grooves, carinae or pubescence. The pleura are well developed, longer than wide, ending in a laterally or posteriorly directed point or angle. The telson is elongate quadrangular with a single spine on either posterolateral angle and no or a few spines on the lateral margin.

The eyes are present and movable, but reduced, with or without pigment.

The antennae have no scaphocerite. The penultimate segment of the antennal peduncle is about as long as the ultimate.

The second maxillipeds have no podobranchs. Exopods are present or lacking in the second and third maxillipeds.

The first pereopods are equal, they carry granules or hair on the chelae.

The abdominal sternites bear no spines in either sex.

The first pleopods of the male consist of two fused segments and have become firm copulation stylets.

The uropodal exopods have or lack the diaeresis.

The subfamily contains four genera, two of which are new to science.

KEY TO THE GENERA OF THE SUBFAMILY THYMOPINAE

- 1 Second and third maxillipeds without exopods. Pleura of second abdominal somite wide and overlapping both the pleura of the first and third somites. Lower margin of rostrum with teeth. ....  
..... *Thymopsis* new genus
- 1' Second and third maxillipeds with exopods. Lower margin of rostrum without teeth. .... 2

- 2 Pleura of abdominal somites broadly overlapping. Lateral margin of telson with two to four spines. Exopod of second maxilliped without flagellum. .... *Thymops* new genus
- 2' Pleura of abdominal somites narrow, hardly if at all overlapping. Lateral margin of telson unarmed, but for the posterolateral spine. Exopod of second maxilliped with a distinct flagellum. .... 3
- 3 Eye not pigmented. Body granular and hairy, but not covered with evenly placed large pearly tubercles. Pleura of second abdominal somite ending in a long sharp point. .... *Nephropsis* Wood-Mason
- 3' Eye with pigmented, although small, cornea. Body entirely covered by conspicuous rounded pearly tubercles. Pleura of second abdominal somite broadly trapezoid, distal margin obliquely truncate, ending in a blunt posterior tooth. .... *Nephropides* Manning

### Thymopsis, new genus

*Definition.*—The rostrum has lateral and ventral, but no dorsal teeth. The antennal and supraorbital spines are present. The gastric and intestinal tubercles are not noticeable. Subdorsal, supraorbital and antennal carinae are distinct, granular or spinulate. The carapace has a dorsomedian groove before and behind the postcervical groove. The postcervical, cervical, sellar, branchiocardiac, hepatic and antennal grooves are distinct, the parabranchial, inferior, intercervical and gastro-orbital grooves are usually more faintly indicated.

The abdominal somites 2 to 6 have a median carina in the posterior half. The pleura are broad and those of somites 2 to 5 overlap distinctly.

The eyes are reduced and unpigmented. The cornea is as wide as the stalk, but much shorter.

The stylocerite lies as an oval plate over the basal part of the dorsal surface of the first segment of the antennular peduncle, it shows an incision in the inner half of the anterior margin.

The epistome is smooth.

The second and third maxillipeds have no exopods.

The large chelipeds are covered by many tubercles and show no conspicuous hairy areas. The second and third pereopods have short comb-like arranged spinules on the cutting edges.

The abdominal sternites do not have median spines.

The first male pleopods are short and stubby, the distal half is turned mediad. The appendix masculina of the second male pleopod is short and equilaterally triangular. No appendix is present on any of the other pleopods.

The uropods show a distinct diaeresis on the exopod.

Type species: *Thymopsis nilenta* new species.

Only one species is so far known of this genus:

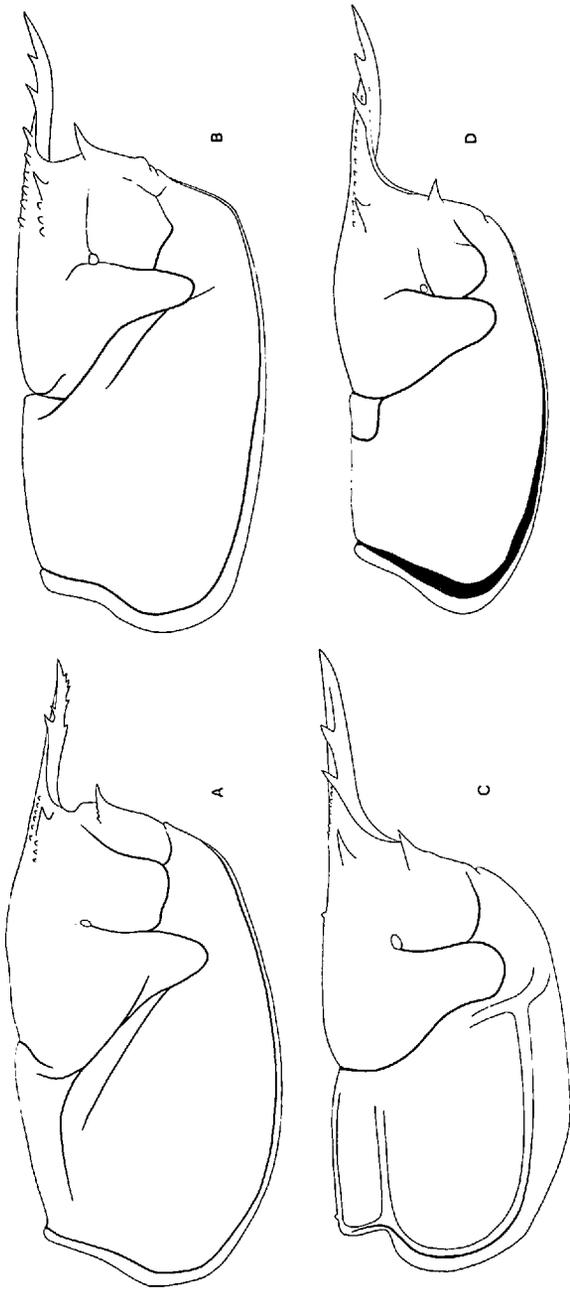


FIGURE 9. Schematic lateral view of the carapace of Thymopinae genera, showing grooves, spines, etc. A, *Thymopsis*; B, *Thymopsis*; C, *Nephropsis*; D, *Nephropides*.

**Thymopsis nilenta**, new species

Figs. 10, 11, 12

*Material*.—S.E. of the Falkland Islands, 55°01'S-55°10'S, 39°55'W-39°46'W; 2886-3040 m; 10 feet Blake trawl; 8 February 1966; ELTANIN 22 sta. 1537, 1 male, 1 female paratypes (W: U.S.N.M. no. 141258). S. of South Georgia, 60°04'S-60°08'S, 35°59'W-36°04'W; 1976-2068 m; 10 feet Blake trawl; 15 February 1966; ELTANIN 22 sta. 1555, 2 females (L,W). The female specimen (cl. 72 mm) preserved in the collection of the Smithsonian Institution (U.S.N.M. no. 141257) is the holotype.

*Description*.—The rostrum is slender, reaching slightly beyond the antennular peduncle. Its dorsal surface is flattened and bears five to eight lateral spines. From the posterior part of the rostrum two low and inconspicuous subdorsal carinae extend posteriorly, being still slightly visible in the anterior part of the carapace; they bear about seven or eight spinules, one or two of which are placed on the rostrum proper. The rostrum is triangular in cross section, its lower margin bears four teeth in the extreme distal part and is irregularly serrate in the rest of its length.

Apart from the two inconspicuous subdorsal carinae the carapace bears on either side a short longitudinal supraorbital carina, which ends anteriorly in a strong supraorbital spine, behind which there are some three somewhat smaller spinules. There is also a strong antennal spine, which is placed on the anterior margin of the carapace and is followed by a short granular antennal carina. The lateral rostral carina continues in the orbital carina. The anterior margin of the carapace forms a blunt rectangle at the lower orbital angle. The anterolateral margin of the carapace shows a triangular clavicular incision; the ventral lobe of the incision is distinct and almost rectangular, the dorsal lobe is inconspicuous and merges gradually with the margin. The incision fits around a ridge of the epistome.

The postcervical groove is wide and does not reach the dorsum, it is replaced there by the sellar groove. The branchiocardiac groove is distinct and reaches far posteriorly. A beginning of the intercervical groove is visible. The parabranchial groove is well developed and reaches almost to the branchiocardiac groove. The postcervical groove connects through the distinct hepatic groove with the cervical. The latter reaches up to and slightly beyond point  $\alpha$ . The gastro-orbital groove is indistinct, but the antennal groove is well marked in its basal part and branches distally. There is no median carina on the carapace, but an irregular smooth, slightly sunken median area before the postcervical groove and a smooth median line behind it indicate the median groove. A marginal groove is present.

All abdominal somites show a distinct transverse groove, which separates the smooth anterior part which disappears under the previous somite (or under the carapace in the case of the first somite) and a rougher posterior part. In the first somite the posterior part shows as a broad rounded transverse

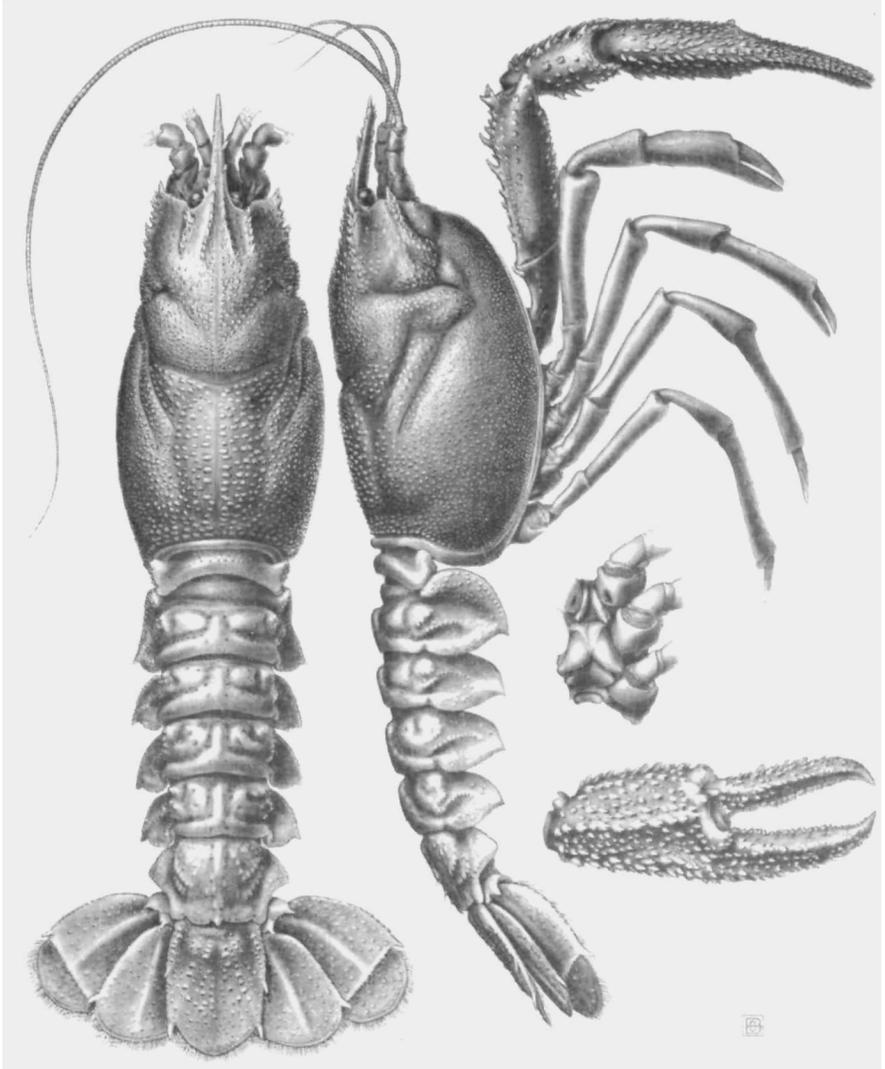
carina which has some shallow and inconspicuous depressions on its dorsal margin. In somites 2 to 5 there is a distinct median carina in the posterior part. This carina is rather low and rounded, but well discernable. On each side of this carina the posterior part of the tergum shows a transverse groove extending to the base of the pleura. Before this groove, in the lateral part of the tergum, some irregular depressions can be seen. The groove is distinct in somites 2 and 3, less conspicuous and interrupted in somites 4 and 5. The posterior margin of all these somites is straight and unarmed. The tergum of the sixth somite shows the median carina in the anterior half. The rest of the tergum shows irregular depressions. The posterior margin of the sixth somite is rather irregular and ends in a sharp median spine, no spines are present in the lateral part of this margin. The pleura of the first abdominal somite are very short, rounded and with irregularly and inconspicuously crenulate margins. The pleura of the second somite are large, oval, longer than wide, and end distally in a small posteriorly directed sharp tip. The surface is faintly granular. In the middle part of the base there is a deep depression followed by a ridge-like elevation. The pleura of the third to fifth somites are similar to that of the second, but smaller; they too end in a posteriorly directed tooth. The pleura of somite 3 still show a median depression at their base, in somites 4 and 5 there is a ridge over the pleural base, which is interrupted posteriorly. The pleura of the sixth somite are blunt and rather smooth; the posterolateral angle of the somite is rounded. The telson is elongate quadrangular. Its surface is granular and shows two indistinct, posteriorly diverging carinae, which end in the posterolateral spines. The lateral margin of the telson is armed with one or two small lateral and one large posterolateral spine; the posterior margin is convex and setose, but not spinose or granular.

The eyes are strongly reduced. The cornea is small, being distinctly shorter than, and about as broad as the peduncle. It is unpigmented and no distinct corneal elements can be seen.

The antennular peduncle consists of three unarmed segments; the basal is the longest and widest. The stylocerite lies as an oval body on the upper surface of this basal segment, and shows a blunt tooth antero-dorsally. The inner part of the anterior margin of the stylocerite is incised. The flagella are short, being about half as long as the carapace and rostrum together.

The antenna has the segments very short and stubby, the ultimate and penultimate segments are of about the same length. There is no antennal scale.

The epistome ends anteriorly in three short ridges, the median of which is separated from the two submedian by very deep grooves, in such a way as if the middle ridge is part of another somite. The submedian ridges are rounded, the median bears a distinct tooth. The posterior margin of the



epistome is marked by a high ridge with a narrow groove just in front of it. The upper margin of the ridge is smooth or shows a few tubercles. The clavicular ridge is high externally, less conspicuous medially.

The mandible consists of a heavy molar process, which bears a few teeth only, and a three-segmented palp. The maxillula has the upper lacinia somewhat larger than the lower, the palp is two-segmented, with the ultimate segment whip-like but undivided. The maxilla has the two endites deeply incised so that four slender laciniae are formed, the upper and lower of which are widest; the palp is unsegmented and well developed; the scaphognathite is large. The first maxilliped has the two endites separated by a deep incision. The palp is large, divided into two segments and triangular in transverse section. The exopod is slightly smaller than the palp and undivided; the epipod is large. The second maxilliped is pediform, it has a large epipod, but no podobranch, and the exopod is virtually absent, being reduced to a minute knob. The dactylus is short and semicircular, it is provided with strong dark spines along the distal margin. The propodus is slightly wider than the dactylus and is considerably wider than long. The third maxilliped reaches with part of the dactylus beyond the rostrum. The dactylus is elongate, widest somewhat above the basis and it ends in a sharp dark point. The propodus is about as long as the dactylus. The carpus is somewhat shorter and bears a spine in the ventral part of its distal margin. The merus is about 1.5 times as long as the dactylus; it bears a distinct antero-dorsal spine, while another large spine is present at the antero-ventral angle of the outer surface; behind this last spine the lower margin of the outer surface is somewhat serrate. The ischium has a very small anterodorsal spinule; a dentate row is present on the inner posterior margin; the outer posterior margin is slightly serrate. The exopod is even more strongly reduced than in the second maxilliped and is hardly visible, for practical purposes it may be considered absent.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	—	—	—	—	—	—	—

←

FIGURE 10. *Thymopsis nilenta* new genus, new species, holotype. Dorsal and side views, with as inserts female sternum and chela of first pereiopod.  $\times 0.8$ . Mrs. Carolyn Gast del.

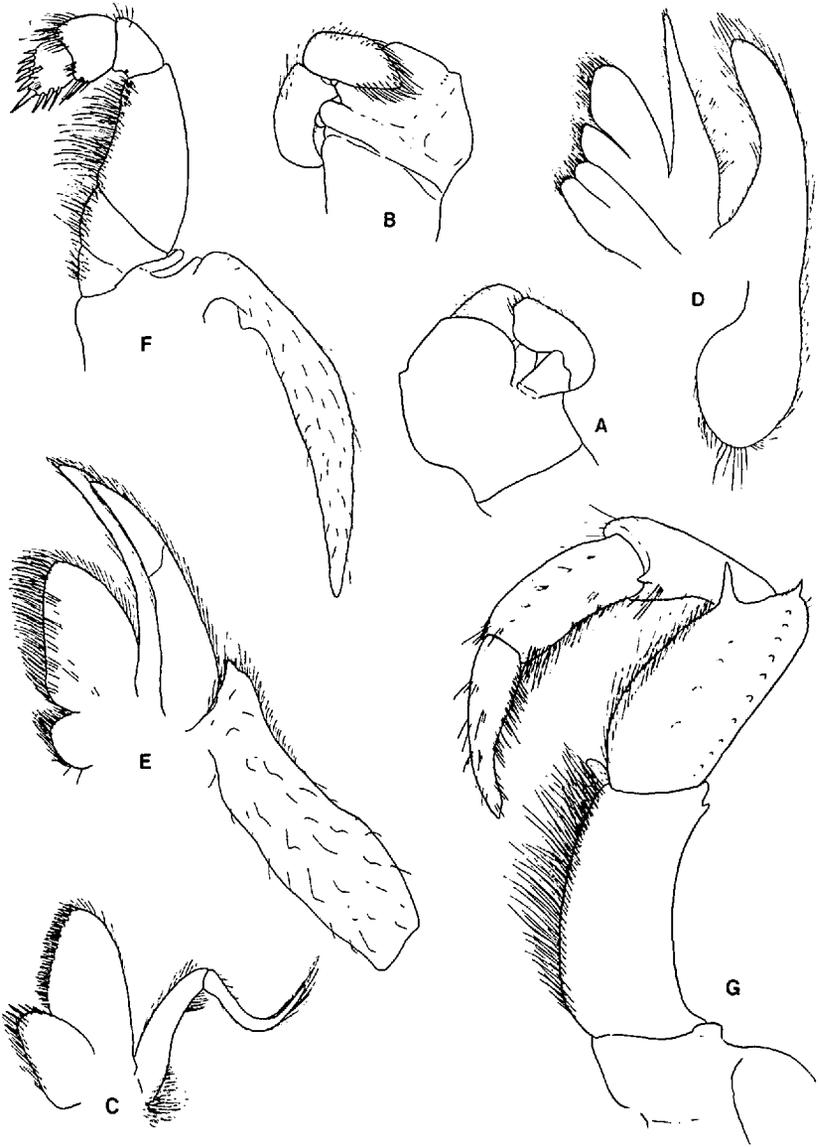


FIGURE 11. *Thymopsis nilenta* new genus, new species, ♀ holotype. A, B, mandible; C, maxillula; D, maxilla; E, first maxilliped; F, second maxilliped; G, third maxilliped. A-G,  $\times 5.75$ .

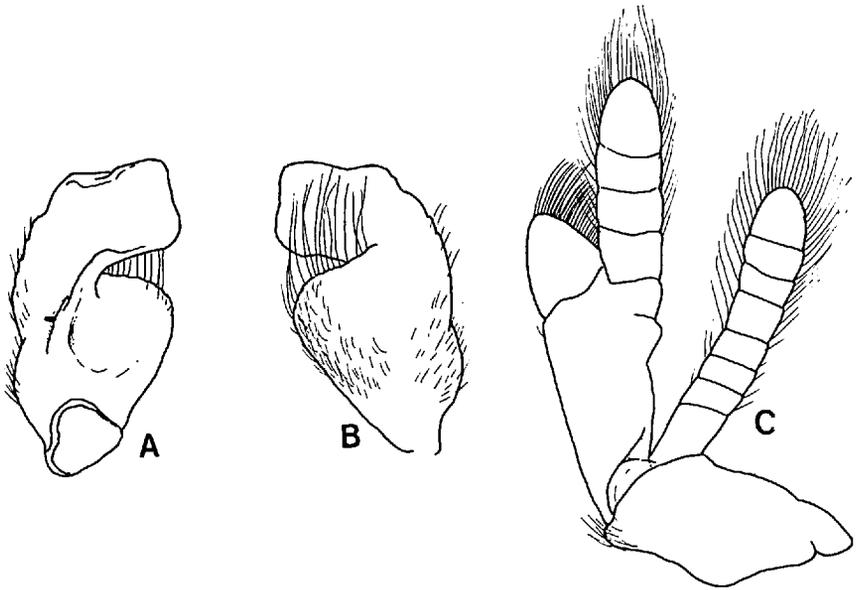


FIGURE 12. *Thymopsis nilenta* new genus, new species, ♂ paratype. A, pleopod 1, anterior view; B, pleopod 1, posterior view; C, pleopod 2, posterior view. A-C,  $\times 4.5$ .

The left and right pereopods of the first pair are equal; they reach with the larger part of the carpus beyond the rostrum. They are very heavy and spinuous all over. The fingers are slightly longer than the palm. The chela is laterally compressed. The cutting edges of both fingers are provided with numerous (20 to 25) small rounded teeth of about equal size. Both fingers has the tips curved so that these are crossing. The outer surface of the fingers shows a longitudinal ridge with several spinules, at each side of this ridge there is an area without or with a few spinules only. The lower margin of the fixed finger shows a single row of spinules, the upper margin of the dactylus has several rows of spinules. The inner surface of the fingers as well as both surfaces of the palm are covered by scattered spinules. The carpus is also covered by scattered spinules, of which some on the upper margin and a few on the inner surface are larger than the rest. The merus has the inner surface smooth and also shows a large smooth area over the middle of the outer surface; the upper and lower part of the outer surface of the merus bear several spinules. The upper margin bears three or four larger spines, one of which is subdistal; these spines are not placed in a distinct row.

The second pereopods reach with part of the carpus beyond the rostrum.

The fingers are slightly shorter than the palm. The merus is slightly longer than the chela and about twice as long as the carpus. The third leg is somewhat more slender than the second. It reaches with part of the palm beyond the rostrum. The fingers are half as long as the palm. The carpus is about half as long as the chela, while the merus is somewhat shorter than the chela.

The last two pereopods have no chela, but simple dactyli. The dactylus is about half as long the propodus. The carpus is about  $\frac{2}{3}$  as long as the propodus, and the merus is about as long as the propodus. The second to fifth pereopods have no spines or spinules, but are smooth with scattered tufts of hairs.

The first and second legs of the female are placed close together. Between the bases of the third legs there are two oblique, anteriorly converging submedian ridges, which end posteriorly in a rather sharp tooth and show a blunt notch in the middle; they end rectangularly anteriorly. The thelycum, situated between the fourth pereopods, consists of a triangular smooth, somewhat swollen structure. Its anterior end is bluntly truncated, it widens posteriorly and has the posterior margin V-shapedly incised in the middle. Behind this anterior structure there is a rounded flat posterior median plate on the last thoracic somite. This plate fits against the posterior surface of the anterior structure, it lies somewhat lower and is directed obliquely upward. The posterior margin of the last thoracic sternite is straight.

In the male the sternal plates of the first three pereopods are as in the female, but narrower, less swollen and slenderer. Those of the fourth leg are strongly produced backward and their posterior parts reach over the base of the last thoracic sternite as oblique circular lobes, their anterior parts being low and slightly convex. The fifth sternite shows no special structures.

The first pleopod of the male has become a short and stubby rigid copulation organ. The two segments are so closely fused that the line separating the two could not be detected. The distal part of the organ is directed mediad and has the top broadly truncated, it is of about equal width throughout its length and is concave anteriorly. It is placed obliquely on the lower part, which is triangular with broadly rounded angles, narrowing towards the base. This lower part also is hollowed anteriorly; the hollowed anterior surface shows a ridge in the middle distal part, which ridge continues in the inner margin of the distal part. The second pleopod of the male has the appendix masculina equilateral triangular; the outer margin is naked, the inner bears many long, rather stiff hairs. The exopod and the distal part of the endopod are articulated.

The first pleopod of the female consists of a single branch formed by a short basal segment and a much longer distal segment, which is subdivided into a large basal and six or seven smaller distal subsegments. The follow-

ing pleopods of the female as well as the third to fifth pleopods of the male have the endo- and exopod elongate, without any appendix; the inner margin of the endopod shows a lobe in the basal half, this lobe bears some stiff hairs and may be a remnant of the appendix interna. The endo- and exopod are elongate with the greatest width slightly below the top.

The abdominal sternites of neither male or female show any spines.

The uropods are large and wide, they are slightly longer than the telson. The two dorsal lobes of the protopod each end in a sharp spine. The endo- and exopod both have a strong posterolateral spine. The exopod shows a distinct and complete diaeresis, which is provided with a row of spinules. The posterior part of the exopod articulates movably with the anterior part along the diaeresis. A longitudinal carina is present on both exo- and endopod. The outer margin of the exopod is slightly serrate.

*Size*.—The carapace length (rostrum excluded) of the examined females is 53 and 57 mm, in the male it is 54 mm.

*Remarks*.—The present genus differs from all known genera of Nephropidae in the absence of exopods on the second and third maxillipeds. In the absence of a scaphocerite it resembles *Thymops*, *Nephropsis* and *Nephropides*, and agrees with the first and the last of these genera in having granular claws and carapace, and in the relatively wide abdominal pleura. It finds its closest relative in *Thymops* and at first was thought to be identical with that genus. It differs from *Thymops*, however, in the presence of ventral teeth on the rostrum, in the postcervical groove which does not reach the dorsum of the carapace, in the absence of lateral spines on the posterior margin of the sixth abdominal somite, and in the complete absence of exopods on the second and third maxillipeds. It is remarkable that the ranges of *Thymopsis nilenta* and *Thymops birsteini* are so close together in the South Atlantic. However, *Thymopsis* occurs far deeper than *Thymops*. The depth range of the former is (1976-) 2068 to 2886 (-3040) m, that of the latter (135-) 145 to 1200 m.

### **Thymops**, new genus

*Definition*.—The rostrum bears lateral, but no dorsal or ventral teeth. Antennal and supraorbital spines are present. The gastric and intestinal tubercles are hardly visible. Subdorsal, supraorbital and antennal carinae are present and carry spinules or granulae. A dorsomedian groove extends on the carapace before and behind the postcervical groove. The carapace shows cervical, postcervical, sellar, urogastric, parabranchial, hepatic, antennal and gastro-orbital grooves. An incisura clavicularis is present.

The abdominal somites 2 to 6 show a median carina in the posterior half. The pleura are broad and those of the somites 2 to 5 overlap. A broad

carina, which is most distinct in the posterior somites, extends over the base of the pleura.

The eyes are reduced, but present and movable, showing a distinct division between the cornea and the peduncular parts. The cornea is without pigment, it is about as wide as the stalk.

The stylocerite shows as a blunt lobe in the basal part of the outer margin of the first segment of the antennular peduncle, while there is also an oblique lobe on the upper surface of this segment.

The scaphocerite is absent.

The second maxilliped has the exopod reduced and without a flagellum. The exopod of the third maxilliped is small.

The large chelipeds are covered with many tubercles.

The first male pleopods are transformed to short stubby copulatory organs. The appendix masculina of the second male pleopod is short and about equilaterally triangular. No appendices internae are present in either sex.

The uropods have a diaeresis in the exopod.

Type species: *Nephropides birsteini* Zarenkov & Semenov, 1972.

*Thymops birsteini* (Zarenkov & Semenov, 1972)

Figs. 13, 14

*Nephropides birsteini* Zarenkov & Semenov, 1972: 599, figs. 1-6.

*Material*.—Off Buenos Aires Province, Argentina, 39°56'S 55°54'W; 800 m; 19 June 1966; WALTER HERWIG sta. 269, 2 males (L).—Off Chubut Province, Argentina: 45°15'S 59°54'W; 600 m; 24 June 1966; WALTER HERWIG sta. 305, 5 males, 1 ovigerous female (W,L) 46°13'S 59°49'W; 805 m; 17 January 1971; WALTER HERWIG sta. 191, 2 females (L).—N.E. of Falkland Islands, 52°05'S 55°20'W; 1200 m; 25 January 1971; WALTER HERWIG sta. 227, 1 female (L).

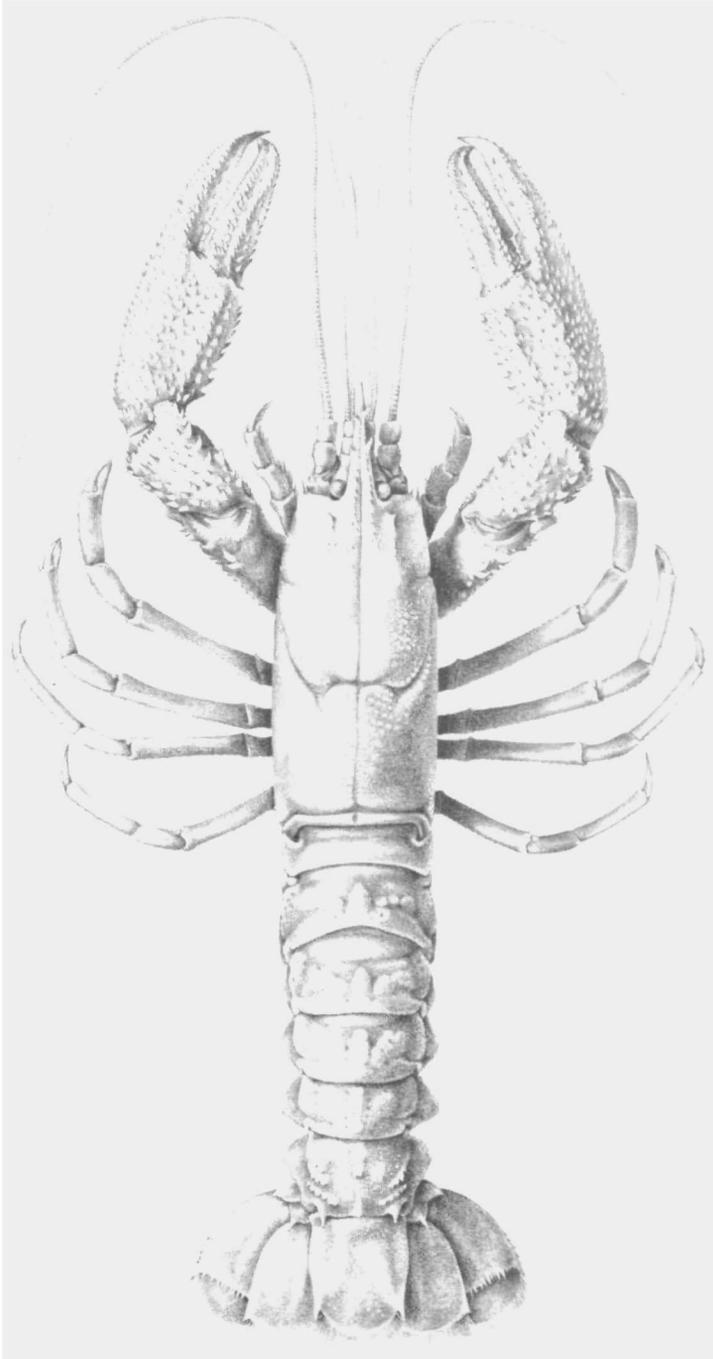
*Description*.—The rostrum is slender, it is elongate triangular in dorsal view and reaches far beyond the antennular and antennal peduncles. It has two or three lateral rostral spines. There are no ventral teeth. The upper surface of the rostrum shows a median groove which becomes deeper posteriorly. From the base of the rostrum, where the groove is deepest, it continues posteriorly as a shallow and depressed smooth linear area, which extends over the full length of the carapace. Starting at the middle of the rostrum there are two low subdorsal carinae, which become more distinct posteriorly; they reach slightly beyond the posterior supraorbital spine and diverge posteriorly. Seven or eight distinct sharp tubercular spines are present in the posterior half of these carinae. The carapace is irregularly and rather finely granular. The granules are largest and sharpest anterodorsally. Between the tubercles numerous short hairs are implanted, giving

the animal a hirsute appearance. There are two supraorbital spines, one placed behind the other. The anterior of these is placed some distance behind the orbital margin and is the largest; the posterior is often double or replaced by a row of spinules. The antennal spine is strong and placed on the anterior margin of the carapace, some distance behind it there is a small tubercle or spinule.

The postcervical groove is distinct and crosses the dorsum. It first goes down, where it meets with the urogastric groove it curves angularly forward to finally curve down again and with an anteriorly convex curve merge with the hepatic groove. The hepatic groove curves up and connects the postcervical groove with the cervical, forming a kind of loop. The cervical groove is distinct as far as point  $\alpha$  and then fades out. The urogastric groove is visible as a posterior branch of the upper part of the postcervical groove, it is short and does not reach the middorsal line. The sellar groove meets with the postcervical groove on the median line; from there it curves forward and down. The parabranchial groove is present, but not very distinct, it joins the postcervical groove somewhat above its lower end and is almost parallel with the middle part of the postcervical groove. Antennal and gastro-orbital grooves are present. The incisura clavicularis is distinct and consists of two small overlapping lobes; above the incisura sometimes a third lobe or some granules are visible on the anterior margin of the carapace. The marginal carina reaches up to the incisura clavicularis; it is distinct throughout its length, being widest posteriorly.

The abdomen has the anterior half of the somites (i.e. the part that moves under the previous somite in the fully stretched animal) entirely smooth. The posterior part shows a blunt and smooth longitudinal median carina, which is inconspicuous in the first, but distinct in the following somites. Each half of the tergites of the second to sixth abdominal somites has a broad transverse groove and several deep pits. The first somite only shows the pits. The pleura of the first somite is small and short, and is broadly widened distally; the posterior part is depressed for the reception of the pleuron of the second somite. The pleura of somites 2 to 5 are wide, the second overlaps both the first and the third, it shows two grooves, the posterior of which is the continuation of the groove of the tergite. These two grooves are parallel in their basal part and curve towards each other distally. The pleuron ends in a blunt apex. The following pleura are narrower, but have the same general shape, only the grooves are less distinct. The sixth somite has the pleura short and broadly triangular. The posterolateral angle of the somite is almost circularly rounded. The posterior margin bears three strong spines: one in the middle and two that are placed just mediad of the rounded posterolateral angle. The posterior margin of the somite is slightly concave in the middle.

The telson is much longer than wide, and longer than the sixth abdominal



somite. Its lateral margins bulge slightly in the middle and may carry a strong spine there, otherwise it is unarmed but for a strong posterolateral spine. The posterior margin of the telson is about as wide as the anterior; it is convex and reaches beyond the end of the posterolateral spines. The dorsal surface is granular and shows two low and blunt, rather wide diverging carinae.

The eyes are small and without pigment. There still is a corneal portion with recognizable facets, which is about as wide as the stalk.

The stylocerite lies on the basal part of the first segment of the antennular peduncle, it is wide, has rounded margins and ends in a small triangular apex. It is rather high and shows a broad crest. The distal of the two segments of the antennular peduncle are of equal length, they are shorter and narrower than the basal segment. The two antennular flagella are of about equal length and somewhat more than half as long as the carapace.

There is no scaphocerite. No spines are present on any of the segments of the antenna. The antennal flagellum is almost as long as the body.

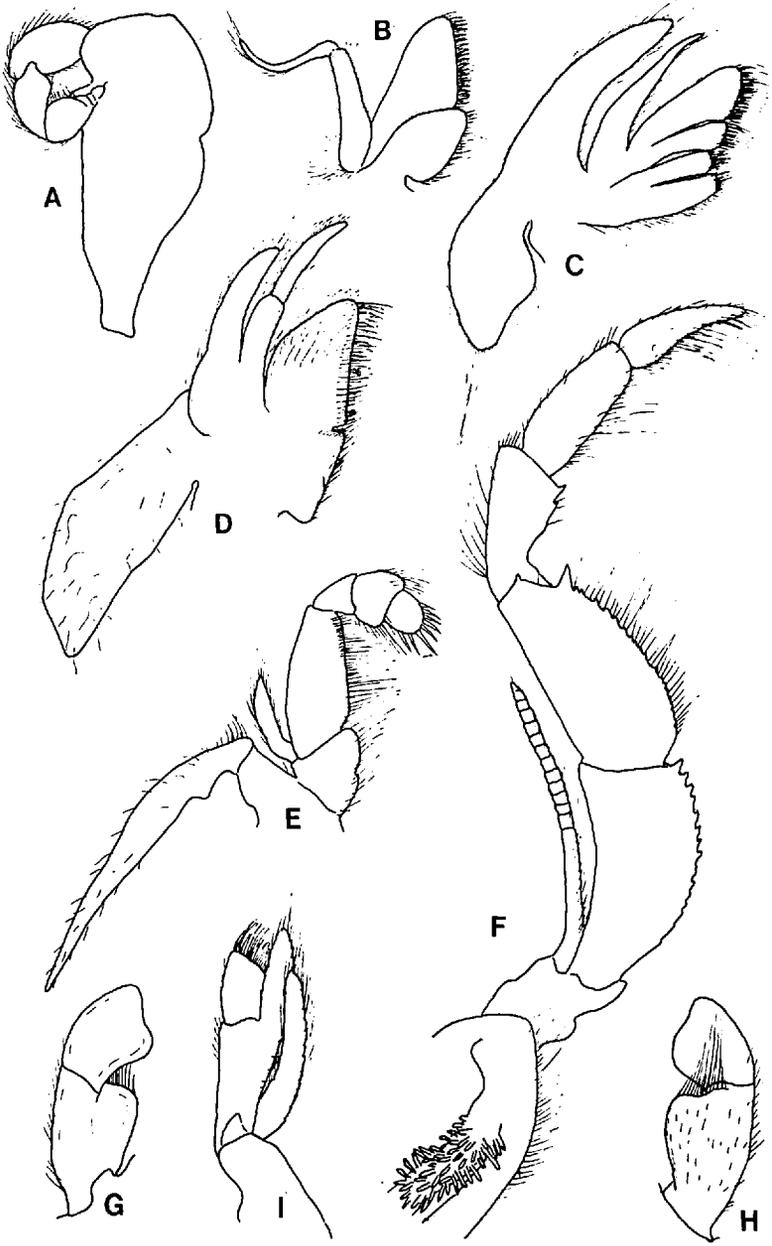
The epistome bears, slightly behind the opening of the antennal gland, a conspicuous high and broad transverse clavicular ridge, which connects with the incisura clavicularis of the carapace. The anterior margin of the epistome, near the bases of the antennulae, forms a high rounded marginal ridge, which is incised in the middle. The posterior ridge of the epistome is high, rounded, and smooth.

The mandible consists of a heavy molar process without distinct teeth and with a distinct three-segmented palp. The maxillula has the upper lacinia much higher than the lower; the palp is two-segmented, with the distal segment narrow and whip-like. The maxilla has the two endites deeply cleft so that four narrow laciniae are formed; the palp is slender and simple; the scaphognathite is large and narrow, it ends posteriorly in a long bundle of hairs. The first maxilliped has the two endites separated by a deep notch; the palp is two-segmented; the exopod is single, shorter than the palp and undivided; a large epipod is present. The second maxilliped is pediform. It has a large epipod, but no podobranch. The exopod is present, but is reduced; it consists of a single segment, which reaches about to the middle of the merus. The dactylus is almost circular and carries some strong spines. The propodus is wide and short. The third maxilliped reaches with part of the propodus beyond the antennal peduncle. The dactylus is elongate, without spines. It is slightly shorter than the propodus. The carpus is about as long as the dactylus and bears one or two spines in the distal part of the lower margin. The merus is longer than any of the

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FIGURE 13. *Thymops birsteini* (Zarenkov & Semenov), female from WALTER HERWIG sta. 227, dorsal view. W. C. G. Gertenaar del.  $\times 0.7$ .



preceding segments; its lower margin bears numerous granules and ends anteriorly in a strong spine; a small spine is present on the outer anterolateral angle. The ischium is about as long as the merus; its outer posterior margin is serrate with blunt teeth; the inner posterior margin bears a strong dentate ridge extending over almost its full length. No teeth are present on the posterior margin of either merus or ischium. There is a small, but distinct exopod, which bears a multi-articulate flagellum; it reaches slightly beyond the middle of the merus.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1r	1	—	—	—	—	—

The first pereiopods are very large and heavy. The right and left are equal and reach with the larger part of the carpus beyond the rostrum. The fingers are about as long as the palm. They bear many spinules which on the outer surface of the dactylus are arranged in a single longitudinal row; on the inner surface of the dactylus and on both surfaces of the fixed finger the spinules are irregularly grouped together in the median area. The upper surface of the dactylus is covered by irregularly placed spinules. The apices of the fingers are sharp, curved, and crossing. The cutting edges of both dactylus and fixed finger are provided with one large tooth, that of the dactylus being placed before the one of the fixed finger; the rest of the edges is crenulate or serrate. The palm bears numerous spinules which are densest in the lower half and on the upper surface, least dense in the upper half of both inner and outer surfaces. The median row of the outer surface consists of larger tubercles than the rest. The basal part of the upper half of the palm, both on the outer and inner surfaces bears closely placed soft hairs. Similar hairs are present on the upper and upper inner surfaces of the carpus. The outer and lower inner surfaces of the carpus bear numerous spines of various sizes, two on the inner surface are conspicuously larger than the rest. The merus is compressed and has the inner

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FIGURE 14. *Thymops birsteini* (Zarenkov & Semenov), male from WALTER HERWIG sta. 305. A, mandible; B, maxillula; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped; G, first pelepod, anterior view; H, same, posterior view; I, second pelepod. A-I,  $\times 3.7$ .

and outer surfaces with hardly any spines. The upper surface bears two slightly diverging rows of rather large spines and several small spinules. The lower surface is hairy and bears small spinules along the outer and inner margins.

The second pereopod reaches with the chela beyond the rostrum. The fingers are about  $\frac{2}{3}$  of the length of the palm. The fingertips are of a dark horn colour and the cutting edges are provided with numerous very short dark horny spinules. A few scattered tufts of setae are present on the chela, but no hairy fringes. The carpus is about as long as the palm. The merus is about twice as long as the carpus. The third pereopod resembles the second, but is more slender; it reaches with part of the chela beyond the rostrum. The fingers are about half as long as the palm, and have the same arrangement of spinules and hairs as in the previous leg. The carpus is distinctly shorter than the palm and slightly more than half as long as the merus.

The fourth leg reaches with part of the propodus beyond the rostrum. The dactylus is simple and half as long as the propodus. The lower margin of the propodus bears a single spine anteriorly. The carpus is somewhat less than  $\frac{2}{3}$  as long as the propodus. The merus is of about the same length as the propodus. The fifth pereopod does not reach the end of the rostrum. The dactylus is about half as long as the propodus. The propodus bears no spines. The carpus is slightly less than  $\frac{2}{3}$  as long as the propodus. The merus is slightly shorter than the propodus.

The sternites at the base of the first pereopods form two submedian plates, which are placed against each other; each consists of two rounded lobes. Similar plates are present between the bases of the second pereopods, they are, however, more longitudinally placed, diverging slightly posteriorly; these plates also are more elongate than those of the first pair of legs. In the next sternite the plates form diverging ridges that end in a rather sharp point. In the male the plates of the sternite of the fourth legs form large oblique lobes that are posteriorly rounded and overhang the next somite, forming a cavity in which the male gonopods rest. No plates are visible in the last thoracic sternite. The female sternum differs from that of the male only in the structure of the sternite of the fourth pereopods. This forms here a thelycum consisting of a high triangular swollen structure that widens posteriorly and ends in a bluntly rounded margin, which is somewhat concave in dorsal view and is minutely incised in the middle. When seen from behind the structure is  $\sqcap$ -shaped. The posterior opening is filled by an almost vertical plate which is wider than long and has the lateral margins convex.

The abdominal sternites of males and females show no median spines. The first abdominal sternite of the male shows a large rounded lobe laterad of the base of the pleopods.

The first pleopod of the male consists of two segments which are im-

movably fused to form a rigid copulatory organ. The distal segment is broad, it is curved mediad and has the distal margin broadly truncate and slightly emarginate in the middle. The segment is about as long as wide and has all angles broadly rounded. The anterior surface of this distal segment is concave. The basal segment is about as wide as, but distinctly longer than the distal; it shows a large blunt lobe on the distal part of its mediad margin. The second male pleopod has the endo- and exopod slender. The endopod is widened in the middle and bears a short and broad appendix masculina, which does not reach to the end of the endopod proper, it is about triangular in shape. The third to fifth pleopods have the endo- and exopod slender, without appendices; however, there is a small lobe visible in the basal half of the inner margin of the endopod; this lobe possibly is a vestige of an appendix interna. In the female the first pleopod is present and consists of a single branch formed by two narrow segments, a short basal and a long distal one. The following pleopods resemble the last three pairs of pleopods of the male, the lobe on the inner margin of the endopod is somewhat more distinct.

The protopodite of the uropods has the two lobes over the bases of the endo- and exopod ending in a small spine. The endo- and exopod are broad. The outer margin of the endopod ends in a single spine. The exopod shows a distinct diaeresis, which carries on its anterior margin about 20 sharp spinules of various sizes. The outer margin of the exopod shows about 6 to 10 spines, the largest of which is placed at the end. Both the exo- and endopod carry a median longitudinal carina, the exopod moreover shows an indication of a second carina laterad of the base of the first.

*Size.*—The males have the carapace length (rostrum included) varying between 50 and 82 mm, without rostrum between 36 and 61 mm. In females these figures are 65 to 99 mm (with rostrum), and 44 to 67 mm (without rostrum). An ovigerous female of which the rostrum is broken had the carapace length (without rostrum) 51 mm. The eggs are 1.7 mm in diameter.

*Distribution.*—The species is known from the continental slope of the Atlantic coast of southern South America between about 40° and 52°S and between 55° and 61°W. The only previous localities reported for the species are those of the type material given by Zarenkov & Semenov (1972) and all of which lie off Santa Cruz Province, Argentina, north of the Falkland Islands: 47°31.5'S 61°00'W, 243-275 m; 47°48.5'S 60°34'W, 510-540 m; 48°07.3'S 61°17.3'W, 135-145 m; and 49°09.2'S 59°34.8'W, 405 m. The present material extends the known range of the species both to the north and to the south.

*Habitat.*—The depth at which *Thymops birsteini* has been taken varies between 145 (actually 135-145) and 1200 m; all of the present material

has been caught at distinctly greater depths (600-1200 m) than the type material (135-540 m).

*Remarks.*—*Thymops birsteini* resembles *Thymopsis nilenta* closest, especially in the presence of the parabranchial grooves, in the wide abdominal pleura, and the poorly developed exopods of the second and third maxillipeds. It differs, however, in lacking the ventral rostral teeth, in the different arrangement of the branchiocardiac and sellar grooves, in possessing spines on the lateral margin of the telson and the uropodal exopods, and in having three spines on the posterior margin of the sixth abdominal somite. The presence of exopods, although somewhat reduced in size, on the second and third maxillipeds is one of the main characters to separate the present genus from *Thymopsis*.

The description and figures of the present species, which I considered new and planned to name in honour of Dr. E. E. Boschi, Mar del Plata, Argentina, had long been finished when I received through the kindness of Messrs. Zarenkov and Semenov a reprint of their recent paper describing *Nephropides birsteini*. There can be little doubt that the present material actually belongs to that species. The few discrepancies between the original description and figures of *Nephropides birsteini* on the one hand and the WALTER HERWIG material on the other, probably are due to different interpretations and slight inaccuracies. Zarenkov & Semenov stated that the fifth pereopod lacks the pleurobranch, but possesses an arthrobranch. In my opinion the gill that they call an arthrobranch actually is a pleurobranch, which indeed is placed rather low; in the presence of this pleurobranch, *Thymops* agrees with all other genera of this family. None of my specimens has an epipod on the fifth pereopod as indicated by Zarenkov & Semenov. Two arthrobranches and a podobranch are present on the third maxilliped in my material; according to the branchial formula given by Zarenkov & Semenov all three are lacking in their specimens.

I want to thank Dr. E. E. Boschi, Instituto de Biología Marina, Mar del Plata, Argentina, for his kindness in placing this most interesting WALTER HERWIG material at my disposal.

#### *Nephropsis* Wood-Mason, 1873

*Nephropsis* Wood-Mason, 1873, Ann. Mag. nat. Hist., (4) 12: 60. Type species, by monotypy: *Nephropsis stewarti* Wood-Mason, 1873, Ann. Mag. nat. Hist., (4) 12: 60 Gender: feminine.

*Nephropsis*.—Verrill, 1922, Trans. Connecticut Acad. Arts Sci., 26: 32. Erroneous spelling of *Nephropsis* Wood-Mason, 1873.

*Definition.*—The rostrum is narrowly elongate triangular. It is straight and reaches beyond the antennular peduncle. It has no ventral teeth, but one or two pairs of laterals, which are directed outward and forward. A fringe of setae extends along the entire lateral margin. The dorsal surface

of the rostrum bears two rounded subdorsal carinae, which in the larger part of their length are separated by a median groove, but before reaching the rostral tip they fuse to a single median elevated area. Behind the rostrum the carinae diverge and fade out gradually; in some species they carry spinules or spines. The carapace has a distinct supraorbital and an antennal spine; sometimes a smaller postsupraorbital spine is present behind the supraorbital. In the dorsomedian line of the carapace, behind the base of the rostrum, a distinct gastric tubercle is present; near the posterior margin there is an intestinal tubercle. Apart from the dorsomedian groove there are the following grooves: the cervical, postcervical and hepatic grooves are distinct, as is also the marginal; the antennal and intestinal grooves are usually present but inconspicuous. The subdorsal, supraorbital and antennal carinae are present, the two latter not always distinct. The posterior part of the carapace shows a lateral, intermediate, intestinal and postcervical carina on each half, the marginal carina is distinct. The incisura clavicularis is well developed.

The abdomen has the first somite smooth, without carina. A median carina may be present or absent on the other somites. A blunt ridge extends over the base of the abdominal pleura. This ridge is straight in somite 1; in somites 2 to 6 it is convex with an incision in the posterior part, this incision being placed more posteriorly and being less distinct in the posterior somites. Hairs may be implanted on the ridge. The pleura end in sharp ventral points and are somewhat depressed in the central area, the margins being raised. The pleura are narrowly triangular and do not overlap. The sixth somite ends in slender sharply pointed posterolateral angles. The telson is elongate quadrangular, narrowing slightly before the middle and with a slender spine on each posterolateral angle. From the submedian part of the anterior margin of the telson a carina extends to either posterolateral angle.

The eyes are small, there is a narrow stalk and a slightly broader globular cornea, which, however, contains no pigment.

The third segment of the antennular peduncle is longest. The two antennular flagella are shorter than the carapace. The stylocerite shows as a blunt lobe on the upper surface of the basal antennular segment, it does not project laterally.

The antennal peduncle has no scaphocerite. The flagellum is much longer than the body.

The epistome is smooth and somewhat depressed in the middle. The anterior margin shows as a ridge and is medially produced between the bases of the antennulae. The posterior margin is a high ridge with two large blunt submedian teeth. The clavicular ridge is distinct and forms the anterior limit of the efferent branchial channel.

The exopod of the first maxilliped has a distinct flagellum and is wid-

ened in the basal part. The second maxilliped has both the exopod and epipod well developed. The third maxilliped is pediform. The merus bears no spines. The inner posterior margin of the ischium bears a carina with a row of blunt teeth. The exopod and epipod are well developed.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	-	-	-	-	1	1	1	1
Arthrobranchs	-	-	2	2	2	2	2	-
Podobranchs	-	-	1	1	1	1	1	-
Epipods	1	1	1	1	1	1	1	-
Exopods	1	1	1	-	-	-	-	-

The chelipeds of the first pair are equal. The finger tips are narrow, curved and crossing. The segments are relatively little compressed and bear no other sculpturation than spines and granules; often also hairs are present. The fingers are about as long as the palm and have the cutting edges finely crenulate. The second and third legs are much shorter and more slender than the first. The second is more robust than the third and bears a dorsal and ventral fringe of long hairs along the anterior and posterior margins of the chela, carpus and propodus. The cutting edges of the fingers bear a row of very short horny spinules, which are comb-like arranged. The third leg is more slender and longer than the second and does not possess the fringes of hair, although on the outer surface of the dactylus hairs are arranged in a conspicuous oblique row, being directed with their tops towards the cutting edge. The cutting edges have similar spinules as in the second leg. The last two pairs of pereiopods are simple and have the dactylus ovate with two rows of hair dorsally. The propodus of the fifth leg, but not that of the fourth, bears a distal tuft of long hairs. The coxa of the third leg of the male carries a plate-like process which often is provided with spines.

The sternite of the fourth thoracic legs of the female shows a distinct thelycum.

The first male pleopod is transformed to a firm and rigid copulatory organ without a trace of segmentation. It is elongate and consists of a basal part which is elongate rectangular and somewhat flattened, its posterior margin is straight and naked, the anterior margin more convex, especially in the distal part and provided with hairs. The distal part of the pleopod is elongate, situated in a single line with the basal part, and tapering distally. Between the two parts there is a deep incision on the anterior margin, which fits exactly over the male sexual opening on the coxa of the

fifth pereopod. From this incision a wide groove leads up the distal part of the pleopod. The posterior limit of the groove is formed by a carina that comes up from the anterior margin of the basal part of the pleopod, the anterior limit is formed by the anterior margin of the distal part. No spines are present at the base of the male gonopods. In the female the first pleopod is a slender, flexible, uniramous, two-segmented appendage.

The second pleopod of the male has a well developed elongate appendix masculina, but no appendix interna. The third to fifth male pleopods all have a styliform appendix interna. No appendix is present on any of the pleopods of the female.

The uropods have the protopodite ending dorsally in a spine. The exo- and endopodite are broad and firm and each has a spine at the end of the outer margin. A diaeresis may be present or absent.

No spines are present on any of the abdominal sternites of males or females.

Of the genus *Nephropsis* at present seven species are known from the Indo-West Pacific region, one from the East Pacific and five from the Atlantic. Of the Atlantic species one is restricted to the East Atlantic, the four others inhabit the West Atlantic. The depth at which the various species have been found lies between roughly 100 and 1000 fathoms (180 to 1800 m).

#### KEY TO THE ATLANTIC SPECIES OF THE GENUS *NEPHROPSIS*

- |    |  |                  |
|----|--|------------------|
| 1  | Rostrum with one pair of lateral spines .....  | 2                |
| 1' | Rostrum with two pairs of lateral spines .....   | 3                |
| 2  | Distance between the supraorbital spine and the gastric tubercle half or less than half the distance between the gastric tubercle and the post-cervical groove. No spine behind the supraorbital spine. Carpus of second cheliped longer than palm. Carpus of third cheliped more than half as long as chela .....                       | <i>aculeata</i>  |
| 2' | Distance between the large supraorbital tooth and the gastric tubercle about $\frac{2}{3}$ the distance between this tubercle and the post-cervical groove. A postsupraorbital spine present behind the supraorbital spine. Carpus of second cheliped distinctly shorter than palm. Carpus of third cheliped half as long as chela ..... | <i>rosea</i>     |
| 3  | Anterior margin of abdominal pleura without spines .....   | <i>neglecta</i>  |
| 3' | Anterior margin of at least second abdominal pleura with a strong spine .....  | 4                |
| 4  | Abdomen with a median carina. Exopod of uropod with a diaeresis .....  | <i>atlantica</i> |
| 4' | Abdomen without median carina. Exopod of uropod without a diaeresis .....  | <i>agassizii</i> |

*Nephropsis aculeata* Smith, 1881

Figs. 15, 16A, 16B

*Nephropsis aculeatus* Smith, 1881: 431; Norman, 1882: 686; Verrill, 1885: 558; Kingsley, 1899: 822; Hansen, 1908: 43; Fowler, 1912: 568.

*Nephropsis Agassizii*.—Agassiz, 1888: 43, fig. 240 (not *N. agassizii* A. Milne Edwards).

? *Nephropsis agassizii*.—Howe, 1901: 240.

*Nephropsis agassizi*.—Boone, 1927: 99.

*Nephropsis aculeata*.—Schmitt, 1931: 392; Holthuis, 1946: 72; Springer & Bullis, 1956: 14 (p.p., not Sta. 543, 549, = *N. rosea*); Bullis & Thompson, 1965: 8; Dawson, 1965: 16; Roe, 1966: 92, fig. 1<sup>a,c</sup>, 3, 5; Manning, 1969: 307, 308; Manning, 1970: 868; Firth & Pequegnat, 1971: 87, fig. 6; Musick & McEachran, 1972: 192; Opresko, Opresko, Thomas, Voss & Bayer, 1973: 6, 16, fig. 5, pl. 3.

not *Nephropsis aculeata*.—Faxon, 1896: 156; Bouvier, 1917: 20; Bouvier, 1925: 409, pl. 1 fig. 1, pl. 4 fig. 1, pl. 6 fig. 7. (= *N. rosea*).

*Material*.—East of New Jersey, U.S.A.: FISH HAWK sta. 873 (type locality), 183 m, 1 male lectotype, 1 male paralectotype (W); sta. 876, 220 m, 1 female paralectotype (W); sta. 1148, 183-229 m, 1 juvenile. GRAMPUS sta. 5005, 190 m, from fish stomach, 1 male (W). Hudson Canyon, 137 m, CAP'N BILL III, January 1963, R. H. Backus, 3 males (W).—East of Virginia, U.S.A.: off mouth of Chesapeake Bay, 37°02'N 74°30'W, 183 m, 20 January 1968, 1 female (W).—East of northern Florida, U.S.A.: PELICAN sta. 13, 329 m, 1 male, 3 females (W); sta. 25, 274-320 m, 2 males, 1 female (W); sta. 31, 329-384 m, 2 males (W); sta. 41, 339-344 m, 1 male, 1 female (W); sta. 42, 375 m, 1 ovigerous female (W); sta. 43, 408-443 m, 3 females (1 ovigerous) (M,W); sta. 46, 317-329 m, 1 male (W); sta. 53, 293 m, 2 females (W). COMBAT sta. 185, 338 m, 1 male, 1 female (W); sta. 226, 329 m, 3 males, 1 female (W); sta. 329, 384 m, 1 male (W); sta. 469, 366 m, 1 ovigerous female (W); sta. 486, 384 m, 1 male (W); sta. 499, 366 m, 3 males, 3 females (2 ovigerous) (W). SILVER BAY sta. 449, 512-576 m, 1 female (W); sta. 1606, 329-366 m, 1 male, 1 female (W); sta. 2725, 172 m, 1 male, 1 female (W); sta. 3080, 348 m, 2 females (W). Off Flagler Beach, 311 m, shrimp trawler, April 1962, W. Anderson, 3 females (2 ovigerous) (W). ESE of the Cape Canaveral Buoy, 40 m, February 1963, T. A. Smirch, 1 ovigerous female (W).—Bahama Islands: GERDA sta. 191, 824-860 m, 1 male (L); sta. 251, 293-311 m, 1 male, 1 female; sta. 256, 467-494 m, 1 male (L); sta. 260, 549-567 m, 1 male (L); sta. 524, 513-715 m, 1 female (L); sta. 709, 724 m, 1 juvenile (L). ALBATROSS sta. 2655, 619 m, 3 males, 2 females (W).—Straits of Florida, U.S.A.: GERDA sta. 15, 275-302 m, 1 male; sta. 66, 366 m, 2 males, 1 female; sta. 67, 351 m, 1 male, 2 females (M); sta. 76, 344-348 m, 1 male, two females (M); sta. 77, 329-339 m, 1 male, 1 female (M); sta. 122, 686-715 m, 1 female (L); sta. 161, 412-421 m, 1 female (L); sta. 172, 183 m, 1 female (L); sta. 173,

200-220 m, 1 male (L); sta. 175, 421-430 m, 3 males, 2 females; sta. 197, 329 m, 1 female; sta. 228, 320 m, 2 females (L); sta. 265, 329-335 m, 1 female (L); sta. 435, 384-417 m, 5 males, 1 female; sta. 437, 362-384 m, 4 males, 10 females (L); sta. 439, 566-584 m, 1 female; sta. 440, 549-567 m, 1 male, 1 female; sta. 460, 207-247 m, 4 males, 1 female (L); sta. 462, 174-201 m, 1 female; sta. 464, 357-370 m, 6 males, 1 female (L); sta. 465, 403 m, 4 males, 5 females (L); sta. 467, 348-370 m, 5 males, 5 females (L); sta. 469, 357-384 m, 1 male, 2 females (L); sta. 475, 550 m, 1 male; sta. 649, 494 m, 1 male, 2 females (L); sta. 652, 393-403 m, 6 males, 3 females (L); sta. 654, 324 m, 1 male, 4 females (1 ovigerous) (L); sta. 655, 262-287 m, 11 males, 12 females (4 ovigerous) (L); sta. 657, 200-216 m, 2 females (L); sta. 658, 310-320 m, 9 males, 4 females (L); sta. 659, 366 m, 1 male, 4 females (1 ovigerous) (L); sta. 766, 297-309 m, 2 males, 3 females (1 ovigerous) (L); sta. 830, 342 m, 3 males, 1 female (M); sta. 834, 79-86 m, 3 males, 2 females (M,W); sta. 845, 296-318 m, 1 male, 1 female (M); sta. 847, 137-201 m, 1 female (L); sta. 848, 201 m, 1 male (M); sta. 851, 210-214 m, 1 male (M); sta. 855, 207-247 m, 2 males (M); sta. 960, 1692-1697 m, 1 ovigerous female (M); sta. 968, 320-437 m, 2 females (L); sta. 969, 269-402 m, 1 male, 2 females (M); sta. 970, 512 m, 2 females (M); sta. 997, 285-302 m, 8 males, 5 females (1 ovigerous) (L); sta. 998, 366-375 m, 5 males, 2 females (L); sta. 1096, 329-366 m, 1 ovigerous female (L); sta. 1098, 459-494 m, 1 male, 2 females (W). PILLSBURY sta. 1309, 310 m, 8 females (1 ovigerous) (M). PELICAN sta. 17, 263-366 m, 1 male (W); sta. 18, 430 m, 1 female (W). COMBAT sta. 281, 393 m, 1 male, 2 females (W,L). FISH HAWK sta. 7281, 554 m, 1 female (W). Off Miami Beach, 201 m, 29 March 1965, 2 females (L). 24°19'N 82°20'W, 329-366 m, 29 March 1960, EXPLORER Geo 3, J. Thompson, 1 male (W).—Near Dry Tortugas, Florida, U.S.A.: OREGON sta. 1005, 348 m, 8 males, 13 females (2 ovigerous) (W); sta. 1006, 348 m, 1 male, 1 ovigerous female (W); sta. 1007, 329 m, 2 males (W); sta. 1010, 412 m, 1 male (W); sta. 1321, 311-366 m, 1 male, 2 females (W); sta. 1326, 366-412 m, 2 males (W); sta. 1539, 402 m, 1 male (W); sta. 1550, 388 m, 3 males, 2 females (W). 16-20 miles S. of Dry Tortugas, leg. W. L. Schmitt: 329 m, 31 July 1930, sta. 37-30, 1 male, 1 female (W); 402-433 m, 31 July 1930, sta. 38-30, 1 female (W); 375-404 m, 3 July 1931, sta. 18-31, 17 males, 25 females (7 ovigerous), 2 juveniles (BM,W); 530 m, 3 July 1931, sta. 19-31, 1 male, 3 females (W); 366-463 m, 8 July 1931, sta. 21-31, 9 males, 6 females (2 ovigerous) (W); 463-518 m, 8 July 1931, sta. 22-31, 1 male, 2 females (W); 280-289 m, 22 July 1931, sta. 32-31, 1 male (W); 549 m, 3 August 1931, 1 male (W); 540-576 m, 19 July 1932 (W); sta. 54-32, 13 males, 8 females (W); 360 m, 3 August 1932, sta. 68-32, 1 female (W); 455-655 m, 3 August 1932, sta.

69 + 70-32, 3 males, 1 female (W); 348-380 m, 5 August 1932, sta. 71-32, 3 males, 2 females (W). Tortugas, 1931, P. Bartsch, 14 males, 5 females (1 ovigerous) (W). Tortugas, 366 m, 1940, R. V. ANTON DOHRN, W. C. Schroeder, 2 males, 3 females (MCZ). Tortugas, 5-7 June 1939, A. A. Boyden, 1 male, 1 female (W).—West of Florida, U.S.A.: OREGON sta. 489, 465 m, 3 females (W); sta. 491, 366 m, 2 females (W); sta. 4082, 366 m, 9 males, 1 ovigerous female (W). TURSIOPS 7110 sta. 9, 29°27'N 87°21'W, 366 m, 4 October 1971, 1 juvenile (Florida State University). 150 miles S. of Pensacola, Florida, 470 m, 20 April 1971, E. E. Lewis, 1 male, 1 female (W).—Gulf of Mexico off Alabama, U.S.A.: OREGON sta. 1283, 476 m, 1 female (W); sta. 1450, 439 m, 1 female (M); sta. 3651, 457-549 m, 3 males, 3 females (W); sta. 3652, 365 m, 9 males, 9 females (1 ovigerous) (W, L); sta. 3676, 366 m, 1 male (W); sta. 3739, 494 m, 1 male, 1 female (L).—Gulf of Mexico off Mississippi, U.S.A.: OREGON sta. 127, 424-472 m, 1 male, 1 female (W); sta. 260, 38 m, 1 male (W); sta. 307, 402 m, 2 males, 2 females (W); sta. 481, 384 m, 1 male, 1 female (W).—Gulf of Mexico off Louisiana, U.S.A.: OREGON sta. 532, 402-549 m, 3 females (W); sta. 1407, 472 m, 4 females (W); sta. 3296, 446-951 m, 1 female (W).—Gulf of Mexico off Texas, U.S.A.: OREGON sta. 503, 366 m, 3 males (W); sta. 542, 457-549 m, 1 female (W); sta. 1506, 503 m, 2 males, 4 females (W).—Upper Gulf of Mexico: ANTILLAS sta. 53, 402 m, 1952, 1 ovigerous female (M); sta. 78, 457 m, gray mud, September-October 1952, 2 males, 1 ovigerous female (M).—Off British Honduras: OREGON sta. 3634, 348 m, 23 males, 17 females (W,L); sta. 3635, 457-732 m, 1 ovigerous female (W).—Off Honduras: OREGON sta. 1871, 457 m, 2 males (W); sta. 3628, 457 m, 1 male (W).—Off Nicaragua: OREGON sta. 3570, 366-439 m, 3 males, 2 females (W,L); sta. 3571, 549-604 m, 1 female (W); sta. 3574, 366 m, 1 male (W); sta. 3575, 457 m, 1 male, 1 female (W); sta. 3609, 503 m, 1 ovigerous female (W); sta. 3610, 457 m, 2 males, 3 females (L).—Off Caribbean coast of Panama: PILLSBURY sta. 340, 304-362 m, 2 males (M); sta. 445, 338-342 m, 2 males (M). OREGON sta. 3583, 512 m, 4 females (W,L); sta. 3598, 366-402 m, 1 male (W); sta. 3599, 457 m, 1 male (W).—Off Caribbean coast of Colombia: PILLSBURY sta. 374, 373-434 m, 1 male, 3 females (L); sta. 394, 416-634 m, 2 males, 2 females (1 ovigerous) (M); sta. 776, 408-576 m, 12 males, 8 females (1 ovigerous) (M,L); sta. 781, 530-567 m, 1 male (M).—Off Venezuela: PILLSBURY sta. 753, 384-607 m, 6 males, 12 females (M). OREGON sta. 2351, 338-366 m, 1 male (W); sta. 2353, 388-457 m, 3 males, 2 ovigerous females (W).—E. of Trinidad: OREGON sta. 1985, 274 m, 1 female (W).—Off Surinam: OREGON sta. 2005, 366 m, 2 males, 2 females (W); sta. 2006, 412 m, 1 male, 1 female (W).—Off French Guiana: OREGON sta. 4294, 549 m, 3 males (W).—South of Jamaica: PILLSBURY sta. 1225, 530-558 m, 4 juveniles (L).—

Near Puerto Rico: OREGON sta. 2639, 412-439 m, 1 female (W). 18° 32'N 66°21'15"W, 476-658 m, 4 February 1933, Johnson-Smithsonian Deep Sea Expedition sta. 23, 1 male (W).—N.E. of Virgin Islands: OREGON sta. 2606, 384 m, 2 females (W).—Near Guadeloupe: PILLSBURY sta. 918, 399-497 m, 1 male (L).—Near Grenada: OREGON sta. 2770, 393 m, 1 male, 4 females (W); sta. 2772, 329 m, 5 males, 4 females (W); sta. 2774, 357-388 m, 2 females (W); sta. 2780, 393-421 m, 1 male, 5 females (2 ovigerous) (W).—Near Curaçao: ALBATROSS sta. 2125, 380 m, 1 female (W).

*Description.*—The rostrum bears only one lateral tooth at each side; this tooth is strong and placed slightly behind the middle of the rostrum. The subdorsal carinae are as finely granulate as the carapace and do not carry any spines. The carapace is finely granulate throughout and shows no spines apart from the supraorbital and the antennal. There is no trace of a second spine behind the supraorbital. The distance between the level of the supraorbital spines and the gastric tubercle, measured in the median line of the carapace, is half or less than half the distance between the gastric tubercle and the postcervical groove. The postcervical, hepatic and cervical grooves are distinct. The lateral and intermediate carinae are low and not very conspicuous. The median groove shows as a smooth sunken line.

The abdomen is finely granulated without spines on the tergites or pleura. The posterior margins of the various somites show a smooth zone. A distinct but low median carina is visible on the second to sixth somites, it is smooth and naked. The pleura of the first abdominal somite are low and rounded and gradually merge with the transverse carina of the sternite. No spine is present. The anterior margin of the pleura of the second abdominal somite is strongly, almost semicircularly rounded and rather abruptly changes into the sharp tip. The anterior margin of the pleura of the third somite is distinctly convex, those of the fourth and fifth somites are straight. None of the pleura bears a spine on the anterior margin.

The chelipeds are heavily setose outside, especially on the chela and the carpus. The chela is slightly less than half as high as long. The carpus has a single spine slightly inwards from the middle of the upper border. The anterior border has two spines, one dorsally and one ventrally. The merus has a subterminal distal dorsal spine, and an inner distal ventral one. No other spines are present on the cheliped, which is finely granulated.

The second pereopod has the carpus decidedly longer than the palm. In the third pereopod the carpus has much more than half the length of the chela. The fourth leg has the propodus less than twice as long as the dactylus. In the fifth leg the dactylus is relatively slightly longer than in the fourth.

The inner distal part of the coxa of the second pereopod of the male shows a bluntly rounded low knob, that of the third leg has a small plate,

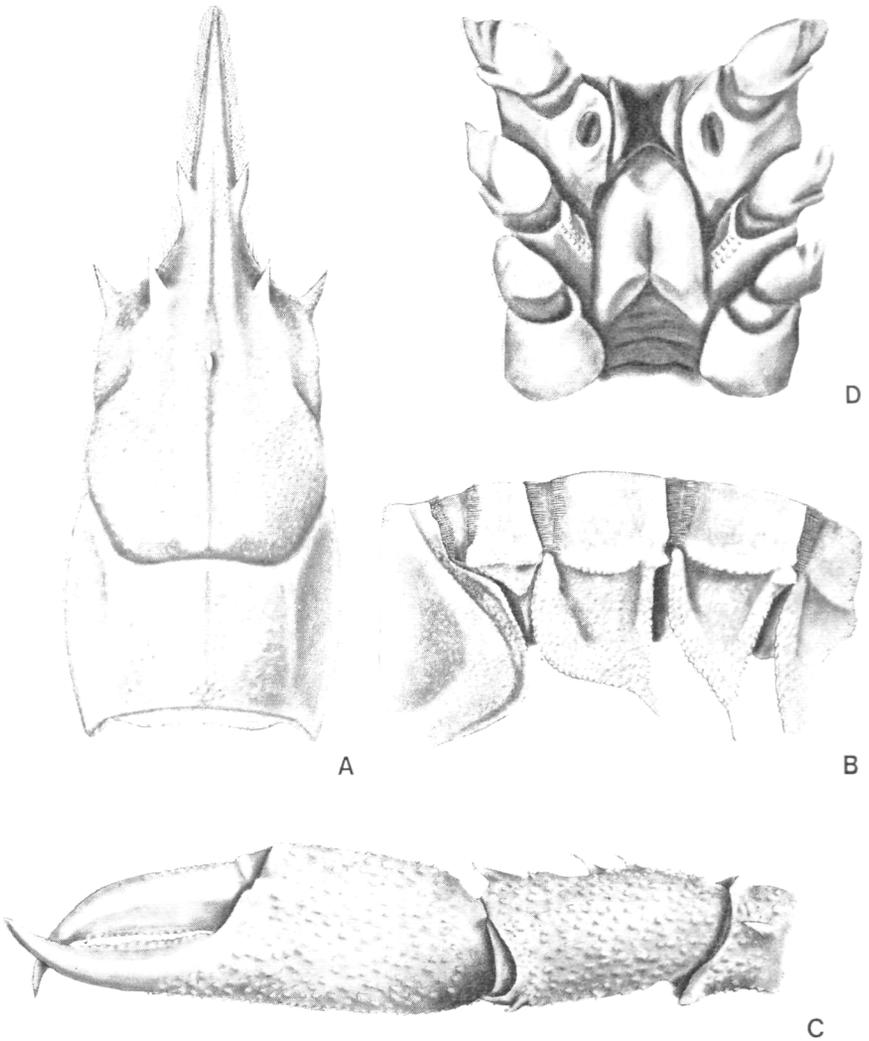


FIGURE 15. *Nephropsis aculeata* Smith, female from GERDA sta. 122. A, carapace in dorsal view; B, anterior part of abdomen in lateral view; C, cheliped; D, thelycum. A,  $\times 2.0$ ; B,  $\times 2.5$ ; C,  $\times 4.3$ ; D,  $\times 6.0$ . Mrs. Constance Stolen McSweeney del.

which ends in three large curved claw-like teeth. In the same place at the fourth leg there are two small spines.

The thelycum of the female is high. The posterior end shows a rather narrow (less than  $90^\circ$ ) triangular incision. The posterior end of the me-

dian slit has at either side a convexity which rather abruptly drops down to the lower level of the extreme posterolateral part of the thelycum. Anteriorly the thelycum slopes down to a rounded anterior margin between the bases of the third legs. Before the thelycum, between the bases of the second and third legs, there are two distinct narrowly elevated submedian ridges. Between the first and second legs there is a median ridge, which is interrupted in the middle. The coxa of the third leg of the female, above the sexual opening, shows a blunt tubercle.

The first male pleopods are narrowed in the distal part, which is concave inside. The anterior margin shows a deep incision in the middle; this incision is obscured in lateral view since the distal part of the pleopod overlaps with its basal part the distal end of the proximal part. The appendix masculina of the second pleopod of the adult male reaches slightly beyond the end of the endopod, it is narrowly elongate and bears bristles at the distal margin and the extreme distal part of the anterior margin.

The exopod of the uropod shows a distinct diaeresis, the margin of which bears several small granules. The protopod has the outer lobe rounded, the inner lobe ends in a spine which usually is shorter than that of the next species.

*Size*.—The smallest specimens examined have the carapace length 14 and 15 mm. The largest male has cl. 65 mm, the largest female cl. 68 mm. Oviparous females were found with cl. between 30 and 65 mm (mostly between 47 and 62 mm). The lectotype is a juvenile with cl. 16.4 mm. The eggs have a diameter of about 2 mm.

*Colour*.—The median dorsal area of the carapace, including the rostrum is reddish, pink, pale orange or pale orange brown. The tip of the rostrum is white or pink and there is a white spot over the orbit. Also the gastric and intestinal tubercles are white. Outside the pink dorsal area there is a longitudinal band of white extending from near the antennal spine posteriorly. A third longitudinal area, again pink, extends along the lateral margin. Sometimes the distal part of the rostrum, the spines and the subdorsal carinae are somewhat darker red than the rest. The dorsal part of the abdomen is of the same colour as that of the carapace. The pleura are pink and a whitish band extends over the bases of the pleura. The posterior margins of the somites are whitish. The articulations of the somites may show a small orange spot. The tailfan is entirely uniformly pink, being rather darker than the pleura, sometimes with a triangular orange spot on the basis of the telson, and with the posterolateral spines of the telson rather darker.

The eyestalk is pink, the cornea cream coloured.

The antennular and antennal peduncles are white or pink; the inner

margin of the antennular peduncle is sometimes darker. The flagella are either all white or pink, or all are dark red or purple.

The mouthparts are dark red or pink. The outer surface of the large chelipeds is white on the merus, very pale pink on the carpus and chela. The inner surface of the merus and carpus is dark red, of the chela much lighter red or orange red. Dorsally the palm is lighter than ventrally. The second and third pereopods are white, with the lower margin of the merus, carpus and chela red; the hairs of these segments also are red. The other pereopods are white with the ventral surface red, the dactylus being entirely red.

The lower surface of thorax and abdomen is usually red, sometimes pink. The pleopods are usually red.

There seem to be two colour variants in this species, one in which the colour of the ventral part of thorax and abdomen and that of the thoracic and abdominal appendages is deep red, as described above, and a second form in which the lower surface of the body and appendages is whitish or pink. Furthermore in some specimens the antennular and antennal flagella are whitish, on others they are dark red or purple. The colours of the ventral surface of the body and that of the flagella are not correlated. There are forms with dark red underside and red flagella, and others with the same ventral colour but pale flagella. The red and pale forms occur together in samples like GERDA sta. 465 and 467, in GERDA sta. 464 all specimens are red, while that of GERDA sta. 462 is red and those of GERDA sta. 475 are white. The colour is not correlated with sex either.

The eggs are blue in the earlier stages of development; later they turn brownish.

*Distribution.*—The type locality of the species is East of New Jersey, U.S.A., 40°02'N 70°57'W, 183 m, bottom soft sticky mud. This locality at the same time is the most northern locality known for the species. The known range of *Nephropsis aculeata* extends from E. of New Jersey, U.S.A., to French Guiana, including the entire Gulf of Mexico and Caribbean Sea. The records in the literature are the following: E. of New Jersey, U.S.A.: ? 40°04'N 70°20'W, 174 m (Howe, 1901), 40°02'N 70°57'W, 183 m (type locality; Smith, 1881; Firth & Pequegnat, 1971), 39°57'N 70°56'W, 220 m; 39°56'N 70°54'18"W, 230 m (Smith, 1881). E. of Virginia, U.S.A.: Off Chesapeake Bay, 37°02'N 74°30'W, 183 m (Musick & McEachran, 1972). Bahama Islands: Little Bahama Bank, 27°22'N 78°7.5'W, 618 m (Firth & Pequegnat, 1971). Off the Atlantic coast of Florida, U.S.A.: 29°48'N 80°12'W, 293 m; 29°29'N 80°8'W, 384 m; 29°15'N 80°5'W, 384 m; 29°7'N 80°1'W, 366 m; 28°2'N 79°50'W, 329 m (Bullis & Thompson, 1965). Near Dry Tortugas, Florida, U.S.A.: South of Dry Tortugas, 280-549 m (Schmitt, 1931), 24°20'N 83°20'W, 348 m; 24°26'N 83°24'W, 329 m; 24°31'N 83°35'W, 366-412 m; 24°35'N 83°40'W, 412 m; 24°49'N 84°

06°W, 311-366 m (Springer & Bullis, 1956), 24°28'N 83°29'W, 388 m (Bullis & Thompson, 1965). Gulf of Mexico (Dawson, 1965). Gulf of Mexico, W. of Florida, U.S.A.: 27°44'N 85°09'W, 464 m; 27°49'N 84°59'W, 366 m (Springer & Bullis, 1956), 29°10'N 87°06'W, 788-918 m (Firth & Pequegnat, 1971). Gulf of Mexico off Alabama, U.S.A.: 29°6'N 88°19'W, 476 m (Springer & Bullis, 1956). Gulf of Mexico off Mississippi, U.S.A.: 29°42'N 88°25.5'W, 38 m; 29°2'N 88°34'W, 424-472 m; 29°00'N 88°35'W, 402 m; 28°57'N 88°40.5'W, 384 m (Springer & Bullis, 1956), 28°58'N 88°28'W, 752 m (Firth & Pequegnat, 1971). Gulf of Mexico off Louisiana, U.S.A.: 27°34.3'N 93°10.2'W, 402-549 m (Springer & Bullis, 1956). Gulf of Mexico off Texas, U.S.A.: 27°48.5'N 94°39'W, 366 m; 27°41'N 94° 59'W, 457-549 m (Springer & Bullis, 1956), 27°40'N 94°58'W, 503 m (Bullis & Thompson, 1965), 27°38'N 95°21.5' W, 512-640 m; 27°38'N 95°22.5'W, 476 m (Firth & Pequegnat, 1971). Off eastcoast of Mexico: 25°38.4'N 96°18.3'W, 512 m (Firth & Pequegnat, 1971). Gulf of Campeche, Mexico: 19°02.6'N 95°27.5'W, 476 m; 19°03'N 95°27'W, 457-823 m (Firth & Pequegnat, 1971). Off British Honduras: Glover Reef, 885 m (Boone, 1927). Off Honduras: 16°09' N 84°37.1'W, 338-530 m; 16°43'N 82°38'W, 430-612 m; 15°02'N 81°05' W, 439-622 m (Firth & Pequegnat, 1971). Off Nicaragua: 13°13'N 82°13' W, 637 m (Manning, 1969). Off the Caribbean coast of Colombia: 11° 29'N 73°33'W, 485 m (Firth & Pequegnat, 1971). Off Surinam: 7°36'N 54°42'W, 412 m (Bullis & Thompson, 1965).

*Habitat*.—The species has been reported from depths between 38 and 1692 m. However, there are only three records from below 100 m (38 m, 40 m, and 79-86 m) and one from more than 850 m (1692-1697 m). Leaving these exceptional (and possibly incorrect) records aside, the range of the species extends from 137 to 824 m, with more than 90 per cent of the records from between 200 and 600 m, and more than 70 per cent from between 300 and 500 m.

The bottom composition at a number of stations where *Nephropsis aculeata* was taken is known. It usually consists of mud or fine sand; the records are: mud (OREGON sta. 307, 503, 1407, 2351, 2353; COMBAT sta. 226; SILVER BAY sta. 1606), soft sticky mud (FISH HAWK sta. 873, 876, 877), grey mud (OREGON sta. 542, 1871; ANTILLAS sta. 53; PELICAN sta. 17, 31, 41, 46, 53, SILVER BAY sta. 449), light grey mud (OREGON sta. 1539), blue mud (OREGON sta. 489, 1985, 2006; PELICAN sta. 13, 25), black mud (OREGON sta. 127), brown mud (OREGON sta. 491), green mud (COMBAT sta. 185, 329, 469, 486, 499), green clay and mud (OREGON sta. 1005, 1007), coral mud (OREGON sta. 1006, 1010), yellow mud and sand with black specks (ALBATROSS sta. 2125), sand and mud (OREGON sta. 260, 532, 1550), sand (FISH HAWK sta. 7281), fine sand (GRAMPUS sta. 5005), grey sand (ALBATROSS sta. 2655; PELICAN sta.

18), ? hard sand (FISH HAWK sta. 7068), sand and shells (OREGON sta. 2606), coralline and shell rubble with plant debris (PILLSBURY sta. 340), mud, pteropods, wood and *Thalassia* leaves (PILLSBURY sta. 781), broken shell and coral (PILLSBURY sta. 753), rock and mud (Schmitt sta. 38-30), rock (PELICAN sta. 43).

*Habits.*—The species carries eggs practically throughout the year; in the present material ovigerous females were taken in the following months: February, April, May, July, September, October, December. Roe (1966) also found ovigerous females throughout the year, and moreover remarked that females carrying ripe eggs were taken at the same time as females bearing newly spawned eggs.

*Commensals and Parasites.*—Lepadids were found on several specimens, viz., the ovigerous female from GERDA sta. 654, two females from GERDA sta. 655 and a specimen from Dry Tortugas. The lepadids were mostly attached to the carapace, but also were found on the rostrum and the abdomen. Another specimen from Dry Tortugas carried three Rhizocephalan parasites.

*Predators.*—The species evidently is often eaten by fish. The specimen from GRAMPUS sta. 5005 was taken from a fish stomach, while one of the syntypes, viz. the specimen from FISH HAWK sta. 876 was found in the stomach of a species of *Lopholatilus*.

*Economic importance.*—Roe (1966) mentioned that since 1962 the species has been sold on the east coast of Florida markets and have “met with excellent public acceptance”; they were sold at U.S. \$0.35 per pound (heads-on), 10 to 37 individuals (average 18) to the pound. The main areas for these catches were off St. Augustine, Florida, near the Dry Tortugas, and off the Mississippi River delta. The animals were given the trade name “Danish Lobsterettes”; Roe proposed the name “Florida Lobsterettes” for them.

*Types.*—The four syntypes of this species are present in the collection of the U.S. National Museum. Of these the largest male specimen from FISH HAWK sta. 873 is chosen to be the lectotype of the species (USNM 39953).

*Remarks.*—*Nephropsis agassizii* A. Milne Edwards, 1880, *N. aculeata* Smith, 1881 and *N. rosea* Bate, 1888 at first were considered to be one species. Faxon (1895) still synonymized the three and even suggested that *N. agassizii* and the other five *Nephropsis* species that he did recognize might be just “geographical races of one widely distributed species”. One year, later, however, Faxon (1896: 156) changed his views drastically and even distinguished *N. agassizii* and *N. aculeata* as two separate species, still synonymizing *N. aculeata* and *N. rosea*. De Man (1916: 97) in his

enumeration of the species of Nephropidae adhered to the old view that *N. aculeata* and *N. rosea* are synonymous with *N. agassizii*. Bouvier (1917: 20, 21) upheld Faxon's (1896) view and clearly showed *N. agassizii* to be different from *N. aculeata*. Most subsequent authors followed Bouvier. Manning (1969) was first to indicate that also *N. aculeata* and *N. rosea* are distinct species, and separated them in his key to the American Nephropidae. In this he was followed by Firth & Pequegnat (1971).

Smith's (1881) original description of the present species was not accompanied by any illustration, the first figure of it was published by Agassiz (1888), who followed the practice of that time and showed it under the name *Nephropsis agassizii*. The specimens reported upon by Faxon (1896) as *N. aculeata* could be examined by me in the Museum of Comparative Zoölogy at Harvard College, Cambridge, Massachusetts, U.S.A., and proved to be *N. rosea* (see there). Howe (1901) mentioned, without description, *Nephropsis agassizii* from FISH HAWK sta. 7068, east of New Jersey, U.S.A., at 95 fm (174 m). It seems most likely that Howe's specimen actually belongs to *N. aculeata*, since that is the only species of *Nephropsis* known from this minor depth and from this far north. Bouvier (1917, 1925) under the name *N. aculeata* dealt with specimens of *N. rosea* as is clear from his (1917) statement that a hepatic (more correctly, post-supraorbital) spine is present in the species, while in his 1925 paper, when dealing more extensively with "*Nephropsis aculeata*", he made the identity of his material with the true *N. rosea* perfectly clear by his description and figures of it; although his pl. 1 fig. 1 does not show the postsupraorbital spines, his figure is clearly that of *N. rosea*, and the spines evidently have been left out by mistake. Both specimens of BLAKE sta. 264 mentioned by Bouvier, viz., the female in the collection of the Museum of Comparative Zoölogy of Harvard University and the male in the Paris Museum, have been examined and both proved indeed to belong to *N. rosea*. The specimen from BLAKE sta. 260 has not been seen by me.

Boone's (1927) account of *N. agassizii*, a species with which she synonymized *N. aculeata*, shows that her material belongs to the present species. She namely described the rostrum as having one pair of lateral rostral spines (named by her superior subdistal spines), mentioned only one pair of supraorbital spines (named by her branchiostegal spines), and finally described the propodus of the second pereiopods as "of no greater size than the carpus" all of which shows her material to belong to *N. aculeata* rather than to *N. agassizii* or *N. rosea*.

The material mentioned by Springer & Bullis (1956) and Bullis & Thompson (1965) as *N. aculeata* could be examined. All these specimens actually proved to belong to that species with the exception of those from OREGON sta. 543 and 549 mentioned by Springer & Bullis, which showed to belong to *N. rosea*.

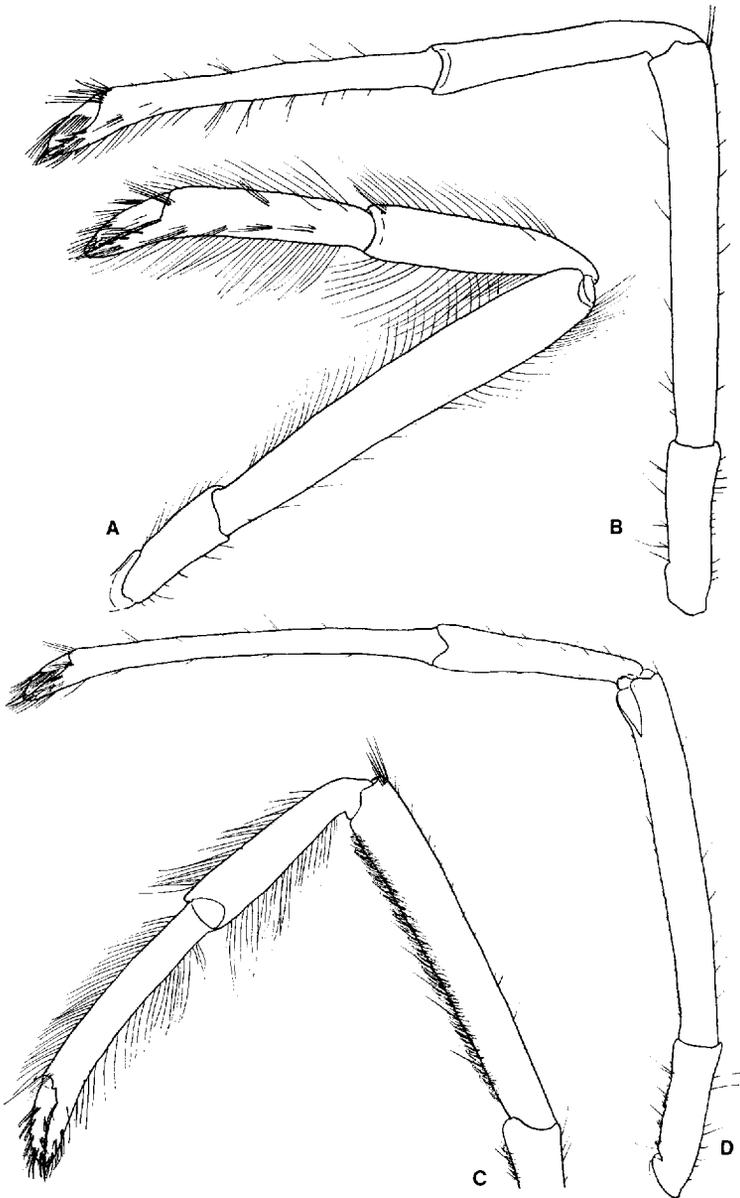


FIGURE 16. A, B, *Nephropsis aculeata* Smith, GERDA sta. 655; C, D, *Nephropsis rosea* Bate, GERDA sta. 672. A, C, second pereopod; B, D, third pereopod. A-D,  $\times 2.7$ .

*Nephropsis rosea* Bate, 1888

Figs. 16C, 16D, 17

*Nephropsis rosea* Bate, 1888: 178, text fig. 39, pl. 23 figs. 1, 2, pl. 24 fig. 1; Young, 1900: 445; Verrill, 1922: 32, pl. 9 figs. 3, 4; Manning, 1969: 307, 308; Manning, 1970: 867; Firth & Pequegnat, 1971: 90.

*Astacus roseus* Bate, 1888: 178.

*Nephropsis aculeata*.—Faxon, 1896: 156; Bouvier, 1917: 20; Bouvier, 1925: 409, pl. 1 fig. 1, pl. 4 fig. 1, pl. 6 fig. 1 (not *Nephropsis aculeata* Smith, 1881).

*Pentacheles roseus*.—Fowler, 1912: 569.

*Material*.—Gulfstream E. of Florida: GERDA sta. 672, 796 m, 1 female (L).—N.W. Providence Channel, Bahama Islands: GERDA sta. 190, 733-897 m, 1 female (W); sta. 918, 805-823 m, 1 female (M).—Straits of Florida, U.S.A.: GERDA sta. 93, 733 m, 2 males, 1 female (L); sta. 94, 733 m, 1 male (L); sta. 131, 733-787 m, 5 males, 5 females (M,L); sta. 152, 641 m, 2 females (L); sta. 161, 412-421 m, 1 male; sta. 222, 824 m, 1 male (W); sta. 225, 805 m, 1 female (W); sta. 226, 802-805 m, 1 female (L); sta. 439, 566-584 m, 1 female (W); sta. 442, 742-753 m, 2 males (L); sta. 870, 754-807 m, 3 males, 2 females (L). SILVER BAY sta. 1196, 732 m, 2 males (W).—Near Dry Tortugas, Florida, U.S.A.: 16-20 miles S. of Dry Tortugas, leg. W. L. Schmitt: 530 m, 3 July 1931, sta. 19-31, 1 male, 1 female (W); 671-686 m, 15 July 1932, sta. 47-32, 1 male, 2 females (W); 717-786 m, 18 July 1932, sta. 51-32, 1 male (W); 686-717 m, 18 July 1932, sta. 52-32, 3 males (W); 455-655 m, 3 August 1932, sta. 69 + 70-32, 3 males (W).—Gulf of Mexico off Alabama, U.S.A.: OREGON sta. 2824, 668-722 m, 1 male (W); sta. 3655, 641-695 m, 1 male (W); sta. 3660, 658-732 m, 1 female (W).—Gulf of Mexico off Texas, U.S.A.: OREGON sta. 543, 640-732 m, 1 male, 1 female (W); sta. 549, 549-732 m, 1 female (W).—Off Yucatan, Mexico: PILLSBURY sta. 607, 713-786 m, 7 males, 1 female (L).—Off British Honduras: OREGON sta. 3635, 457-732 m, 3 males, 1 female (W,L).—N.E. of Honduras: OREGON sta. 1949, 549 m, 1 male (W).—Off Nicaragua: OREGON sta. 1906, 594 m, 1 male (W); sta. 1908, 641 m, 1 male, 1 female (W); sta. 1909, 641 m, 1 male, 2 females (W); sta. 1910, 641 m, 2 males, 1 female (W); sta. 1911, 641 m, 1 male, 1 female (W); sta. 1915, 641 m, 1 female (W); sta. 1919, 503-549 m, 1 male (W); sta. 3571, 549-604 m, 4 males, 5 females (1 ovigerous) (W); sta. 3576, 549-585 m, 1 female (W). PILLSBURY sta. 1355, 450-576 m, 2 males (L).—Off Panama: PILLSBURY sta. 447, 657-673 m, 1 male (M).—Off Colombia: PILLSBURY sta. 381, 724-597 m, 1 male, 1 female (M); sta. 388, 814-1050 m, 3 males (L); sta. 394, 416-634 m, 1 male, 1 female (M); sta. 776, 408-476 m, 1 male, 1 female (L); sta. 781, 530-567 m, 2 males, 1 female (M); sta. 784, 567-713 m, 1 juvenile (L).—Off Venezuela: PILLS-

BURY sta. 753, 384-607 m, 1 male (L).—Off French Guiana: OREGON sta. 4293, 732 m, 8 males, 2 females (W,L); sta. 4294, 549 m, 7 males, 6 females (W).—South of Jamaica: PILLSBURY sta. 1256, 603-655 m, 1 male.—N.W. of Anguilla: PILLSBURY sta. 988, 686-724 m, 4 males, 1 female (L); sta. 989, 664-706 m, 3 males, 1 female (L).—S.W. slope of Saba Bank: LUYMES sta. 141, 300-600 m, 1 male (L).—Near St. Christopher: OREGON sta. 6721, 622-695 m, 1 male (W).—Near Guadeloupe: PILLSBURY sta. 946, 733-833 m, 2 males, 1 female (L).—Near Dominica: BLAKE sta. 185, 609 m, 2 females, 1 juvenile (MCZ); sta. 188, 681 m, 1 male (MCZ).—Near St. Lucia: BLAKE sta. 222, 772 m, 2 females, 1 juvenile (MCZ).—Near St. Vincent: BLAKE sta. 226, 776 m, 1 male (MCZ). PILLSBURY sta. 861, 357-658 m, 1 male (W).—Near Grenada: BLAKE sta. 264, 761 m, 1 male (MCZ), 1 female (MP). PILLSBURY sta. 478, 576-598 m, 8 males, 15 females (1 ovigerous) (L).—Near Tobago: PILLSBURY sta. 847, 733-1281 m, 2 females (M).—East of Trinidad: OREGON sta. 1980, 640 m, 3 females (W).

*Description.*—The rostrum bears only one lateral tooth at either side; these teeth are strong and placed slightly behind the middle of the rostrum. The subdorsal carinae are finely granular, like the rest of the carapace and bear no spinules. The granulation of the carapace is fine, although it is coarser than in *N. aculeata*. Behind each supraorbital spine, which is about as strong as the lateral rostral spines, there is a much smaller, but distinct, postsupraorbital spine. The distance between the level of the anterior supraorbital spines and the gastric tubercle, measured in the median line of the body, is about  $\frac{2}{3}$  of the distance between the gastric tubercle and the postcervical groove. This proves to be a most constant and reliable character to distinguish the present species from *N. aculeata*. All the grooves of the carapace are as distinct and have the same extent as in the previous species.

The second and third abdominal somites have the median carina shorter than in *N. aculeata*. The pleura of the first abdominal somite, like those of *N. aculeata*, are low, rounded and merge with the transverse ventral carina of the somite. The pleura of the second somite have the anterior margin distinctly convex, but less strongly so than in *N. aculeata*. The anterior margin of the third to fifth somites are straight. The granulation of the abdomen is coarser than in *N. aculeata*, but otherwise is very similar. Like in *N. aculeata*, the anterior margin of the pleura of the second somite does not bear a spine, neither do those of the following somites.

The large chelipeds are less densely setose than in *N. aculeata*, the hairs as a rule are shorter; they are longest on the fingers. The chela is distinctly less than half as high as long. The carpus bears a distinct spine in the upper

part somewhat to the inside of the dorsal margin; it is often followed by a smaller similar spine. The dorsal and ventral spine of the anterior border of the carpus as found in *N. aculeata* are also present here. A small spine, not present in *N. aculeata*, is found on the outer surface, some distance above the ventral anterior spine, and placed just behind the anterior margin. The merus shows the same two spines as in *N. aculeata*. The granulation of the leg is somewhat coarser than in the previous species. The second pereiopod has the carpus shorter than the palm. In the third pereiopod the carpus is half as long as the chela. The propodus of the fourth leg is twice as long as the dactylus. The dactylus of the fifth leg is slightly less than  $\frac{2}{3}$  as long as the propodus.

The processes on the coxae of the second to fourth legs of the male are similar to those found in *N. aculeata*. The thelycum of the female is narrower than in *N. aculeata*. The anterior part at either side of the end of the median slit shows an oblique ridge before which the anterior part drops steeply down. Similar ridges are found near the posterior end of the slit. The posterior incision of the thelycum is wider than in *N. aculeata*.

The first pleopod of the male is very similar to that of the previous species, but is more slender and the two edges of the lateral incision do not overlap to such a great extent. The other pleopods of both sexes show no appreciable difference from those of *N. aculeata*.

In the uropods, the outer lobe of the protopodite ends in a tooth externally; in other respects the uropods of this and the previous species are very similar.

*Size*.—The smallest specimen examined has cl. 11 mm. The largest male has cl. 70 mm, the largest female 60 mm. Oviparous females had cl. 52 to 57 mm. The diameter of the eggs is 2 to 2.5 mm.

*Colour*.—The upper part of the body is pale, the ventral surface darker, red or orange-red. The rostrum and the anterior dorsal part of the carapace may be reddish, darker than the rest of the carapace which is pink or whitish, sometimes greenish (after preservation large parts of the carapace in this and related species often turn bright green, this is also true for the legs). The tergum of the abdomen is pale pink with the pleura reddish or darker pink. The tailfan is again somewhat darker than the pleura. The hairs of the tailfan are orange-red. The upper parts of the antennulae and antennae are light pink or whitish. The mouthparts are orange red. The upper part of the large chelipeds are pink with a whitish pubescence. The fingers are pale orange, the merus and ischium often whitish. The underside of the chelipeds and the other legs, as well as the pleopods and the thoracic and abdominal sternites are red. The two-tone impression (dorsally whitish, ventrally red) is quite striking.

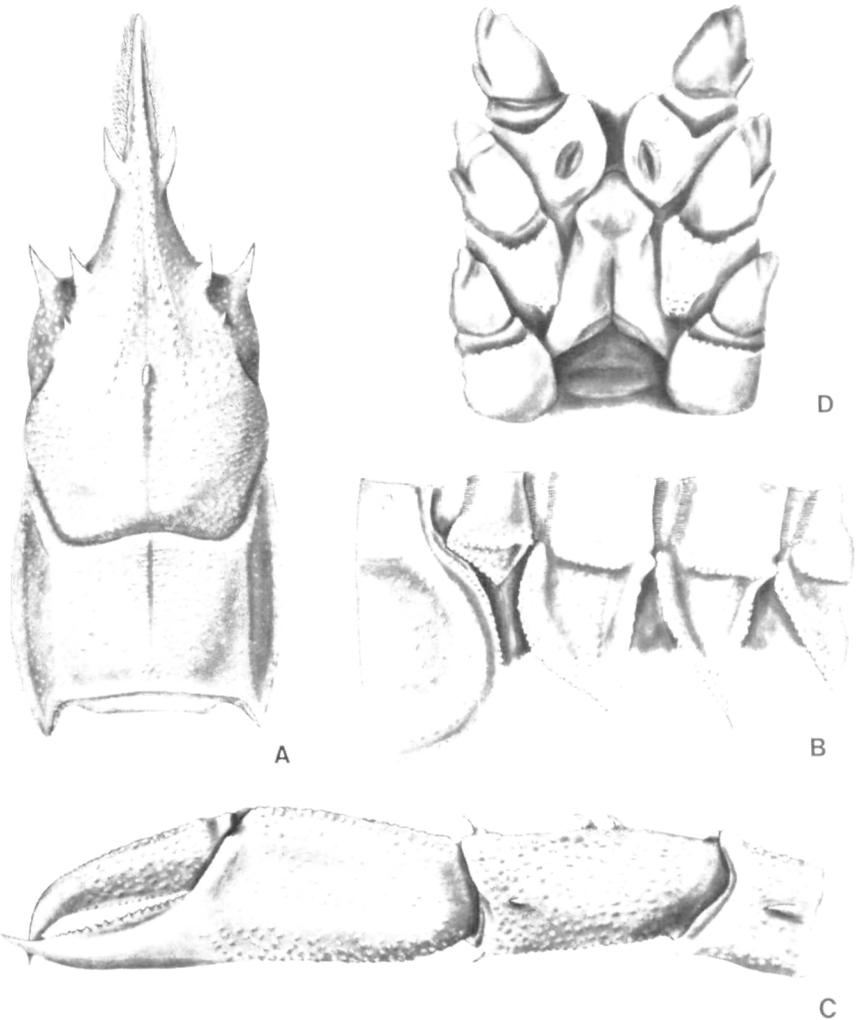


FIGURE 17. *Nephropsis rosea* Bate, female from GERDA sta. 93. A, carapace in dorsal view; B, anterior part of abdomen in lateral view; C, cheliped; D, thelycum. A,  $\times 2.0$ ; B,  $\times 2.5$ ; C,  $\times 4.3$ ; D,  $\times 4.8$ . Mrs. Constance Stolen McSweeney del.

*Distribution.*—The species is known from the western Atlantic between Bermuda and French Guiana, including the Bahama Islands, the Gulf of Mexico and the Caribbean. The records in the literature are: off Bermuda,  $32^{\circ}11'7''\text{N } 65^{\circ}3'20''\text{W}$ , 1262 m (type locality; Bate, 1888; Young, 1900;

Verrill, 1922), off Texas, U.S.A.: 27°38'N 95°21.5'W, 512-640 m; 27°35'N 95°23'W, 732 m (Firth & Pequegnat, 1971), off N.E. Mexico, 25°38.4'N 96°18.3'W, 512 m (Firth & Pequegnat, 1971), off British Honduras, 16°58'N 87°53'W, 455-728 m (Manning, 1969), off Nicaragua: 14°10'N 81°50'W, 546-601 m; 12°44'N 82°14'W, 637 m; 12°35'N 82°19'W, 637 m; 12°33'N 82°20'W, 637 m; 12°25'N 82°15'W, 546-582 m (Manning, 1969), off Nicaragua: 15°02'N 81°05'W, 439-622 m; 12°40'N 82°18'W, 640 m (Firth & Pequegnat, 1971), off Colombia: 11°33.8'N 73°45.1'W, 732 m; 12°40'N 72°00'W, 622-658 m (Firth & Pequegnat, 1971), near Dominica: 15°24'55"N 61°27'10"W, 609 m; 15°16'15"N 61°24'40"W, 681 m (Faxon, 1896), near St. Lucia, 13°58'37"N 61°04'45"W, 772 m (Faxon, 1896), near St. Vincent: 13°13'20"N 61°18'45"W, 848 m; 13°09'05"N 61°16'20"W, 775 m (Faxon, 1896), 12°03'30"N 61°47'10"W, 532 m; 12°03'15"N 61°48'30"W, 761 m (Bouvier, 1925).

*Habitat*.—The species has been reported from depths between 421 and 1262 m. However, about 90 per cent of the records is from between 500 and 800 m and almost 80 per cent from between 550 and 750 m. On the whole it inhabits deeper waters than *Nephropsis aculeata*. It has been found on the following bottoms: mud (LUYMES: sta. 141; PILLSBURY sta. 381), blue mud (OREGON sta. 1980), yellow mud (OREGON sta. 1915), gray ooze (BLAKE sta. 264), gray mud (OREGON sta. 543, 1910), gray mud and shells (OREGON sta. 549), mud, pteropod shells, wood and *Thalassia* debris (PILLSBURY sta. 781), mud with many solitary corals (PILLSBURY sta. 861), mud and sand (SILVER BAY sta. 1196), brown clay (PILLSBURY sta. 388), fine sand and mud (BLAKE sta. 185, 188), sand and ooze (BLAKE sta. 222, 260), fine dark sand (BLAKE sta. 226), broken shells and coral (PILLSBURY sta. 753).

*Type*.—The holotype of *Nephropsis rosea* Bate was preserved in the British Museum (Natural History), London. The jar (no. 88.22) that contained the specimen, however, only shows some powderlike debris and has a label inside dated June 1961, written by Dr. Isabella Gordon stating that at that date the specimen was already "completely disintegrated". The specimen was collected at Station 57 of the CHALLENGER Expedition near Bermuda, 32°11'7"N 65°3'20"W at 690 fathoms.

*Remarks*.—Until very recently Bate's *Nephropsis rosea* has generally been considered synonymous with *Nephropsis aculeata*. The differences between the two species, however, prove to be clear cut and constant. Although Bate's type no longer exists, his description and figures leave not the least doubt that the specimen belongs to the present species. The materials listed by Faxon (1896) as *Nephropsis aculeata* is kept in the Museum of Comparative Zoology, Cambridge, Massachusetts, where I examined it in June

1970, thanks to the kind permission of Dr. Herbert Levi. All of the specimens proved to belong to *Nephropsis rosea*, and not to *N. aculeata*. The material reported upon by Bouvier (1917, 1925) as *N. aculeata* actually is *N. rosea*, as is clearly shown by Bouvier's descriptions and figures (see under *N. aculeata*).

### ***Nephropsis neglecta*, new species**

Fig. 18

*Nephropsis agassizii*.—Faxon, 1896: 156 (not *Nephropsis agassizii* A. Milne Edwards, 1880).

*Material*.—Straits of Florida, U.S.A.: GERDA sta. 144, 751 m, 1 female (L); sta. 225, 805 m, 1 male (L); sta. 368, 961-1016 m, 3 males, 2 females (M).—16-20 miles S. of Dry Tortugas, Florida, 1065 m, 30 July 1932, W. L. Schmitt sta. 65-32, 1 ovigerous female, holotype (W).—Off Caribbean coast of Colombia: PILLSBURY sta. 388, 814-1050 m, 1 female (M); sta. 391, 1222-1748 m, 1 male (M).—Off Venezuela: PILLSBURY sta. 741, 1052-1067 m, 1 male (L); sta. 754, 684-1574 m, 1 male (L).—Off Suriname: PILLSBURY sta. 673, 1042-1070 m, 1 male (L); sta. 675, 1234-1271 m, 2 males, 2 females (1 ovigerous) (L).—S. of Jamaica: PILLSBURY sta. 1256, 603-655 m, 1 female; sta. 1262, 914-1065 m, 1 female, 1 juvenile (L). GILLISS sta. 31, 1088-1116 m, 1 juvenile female (M).—Between Jamaica and Haiti, PILLSBURY sta. 1187, 1034 m, 1 juvenile (L).—Near Guadeloupe, PILLSBURY sta. 946, 733-833 m, 1 female (M).—Off Martinique: PILLSBURY sta. 892, 1116-1354 m, 1 female (L). BLAKE sta. 195, 918 m, 1 female (MCZ); sta. 200, 864 m, 1 male (MCZ).—Off St. Vincent, BLAKE sta. 227, 1046 m, 1 male (MCZ).—Off Tobago: PILLSBURY sta. 846, 650-1126 m, 1 male (L); sta. 847, 733-1281 m, 1 male (M).

*Description*.—The rostrum bears two pairs of lateral teeth, one pair at either lateral margin. These teeth are placed rather close together, the anterior, which is the stronger, stands in the middle of the length of the rostrum or slightly behind it. The larger specimen of PILLSBURY sta. 1262 is abnormal in that one of the teeth on the right side is missing. Seldom a third tooth is present on the lateral margin. The subdorsal carinae are rather coarsely tuberculate and bear a row of two to six spiniform tubercles in the posterior part; the anteriormost of these tubercles is more like a small spine and is placed at about the level of the supraorbital spines. A distinct postsupraorbital spine is present. The distance between the level of these spines and the gastric tubercle, measured in the median line of the carapace, is about half that between the gastric tubercle and the postcervical groove. The median smooth line of the carapace is somewhat elevated near the cardiac tubercle. The postcervical, cervical and hepatic grooves are dis-

tinct. The intermediate carina is inconspicuous, but the lateral is very distinct.

The second to sixth abdominal somites show the median carina quite distinctly. There are hardly any tubercles on the dorsal surface of the abdomen. The tergum is densely and shortly pubescent (except for the median carina), while the surface of the pleura for the greater part is smooth and shiny. The anterior margin of the pleura of the second to fifth somites are convex, slightly more so in the second than in the following somites. All end in a sharp point. In none the anterior margin shows a spine or tooth. The pleura of the sixth somite have the top usually more rounded and the posterolateral angle has the spine shorter than in the previous two species.

The first chelipeds have only some long hairs on the upper margin of the merus and carpus, and near the base of the cutting edges of the fingers. The chela is slender, being about three times as long as high. The carpus has a large anterodorsal and a smaller anteroventral spine. A small spine is placed on the outer surface somewhat behind the middle of the outer anterior margin. A strong spine is placed just to the interior of the dorsal margin in about the middle of the length of the carpus; sometimes a smaller spine is placed behind it. Finally, a strong spine is placed on the inner anterior margin near the articulation with the palm. The merus resembles that of *N. aculeata* and *N. rosea* in having a subdistal dorsal spine and a spine at the inner anterior angle of the lower surface. The carpus of the second leg is shorter than the palm. That of the third leg is more than half as long as the chela. The dactylus of the fourth leg is about half as long as the propodus. That of the fifth leg is more than half as long as the propodus.

The process at the coxa of the second pereopod of both the male and female is broadly rounded. That on the coxa of the third leg of the male is rounded at the base and ends externally in a rather broad and high tooth which ends in a single sharp point. In the female these coxae carry the female openings and show no trace of a spine. The thelycum of the female is high. The groove which contains the median slit is continued anteriorly beyond the slit, so that the entire thelycum is bisected by the median groove. The anterior margin of the thelycum ends in two bluntly rounded lobes and drops down abruptly, almost perpendicularly. The posterior incision of the thelycum is wide and shows two semicircular ridges in the submedian region. Two submedian ridges are present between the second and third pereopods.

The first pleopod of the male is wider than in either of the previous species and has the incision between the distal and basal half wider. The appendix masculina in the second male pleopod is almost as long as the endopod and widens slightly near the top, where it bears spinules both on the distal margin and in the distal part of the inner margin. The outer lobe of

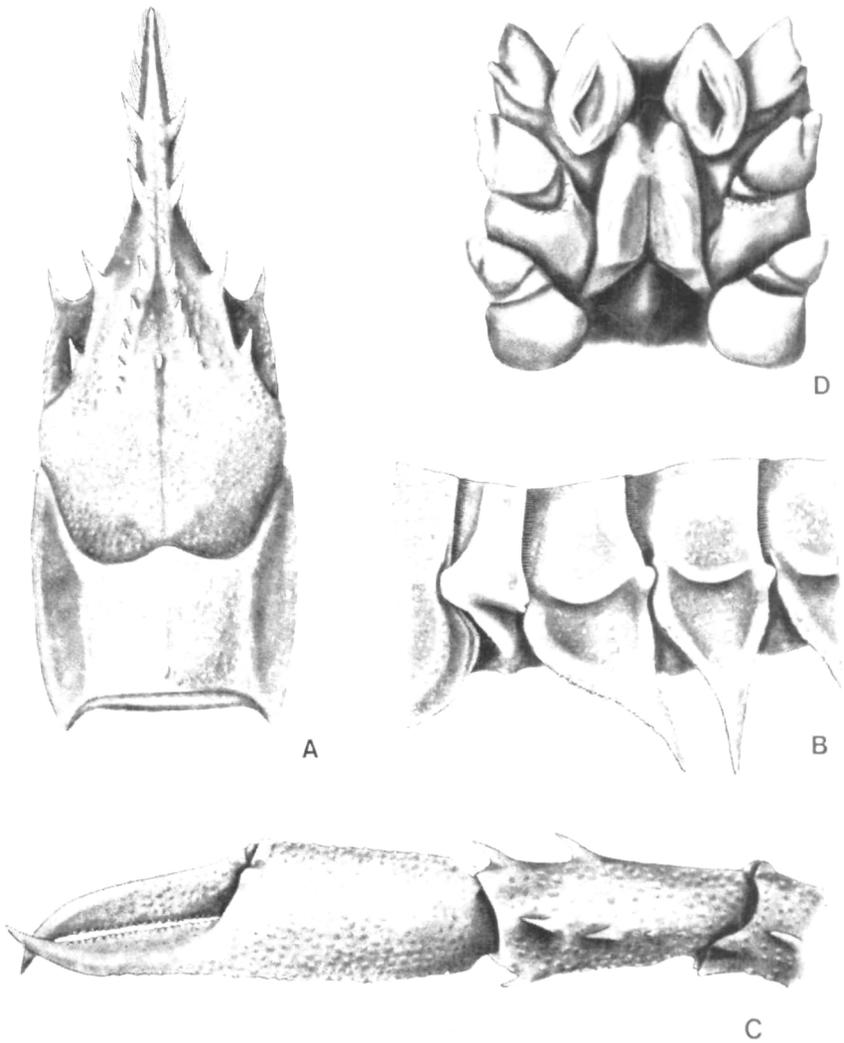


FIGURE 18. *Nephropsis neglecta*, new species, female paratype GERDA sta. 144. A, carapace in dorsal view; B, anterior part of abdomen in lateral view; C, cheliped; D, thelycum. A,  $\times 2.7$ ; B,  $\times 3.4$ ; C,  $\times 3.8$ ; D,  $\times 5.0$ . Mrs. Constance Stolen McSweeney del.

the uropodal protopodite ends in a bluntly rounded or sharply pointed tooth. The inner lobe has a rather short but very distinct spine. The uropodal exopod bears a distinct and complete or almost complete diaeresis, but no tubercles or spines are placed along it, just hairs.

*Size*.—This is a rather small species compared to the other western Atlantic forms. The carapace length of the examined males varies between 15 and 31 mm, that of the females between 20 and 34 mm; an ovigerous female had cl. 28 mm. The diameter of the eggs is 2.5 mm.

*Colour*.—This species does not have the distinct two-tone of the previous species. The body is entirely red or orange-red, although the colour is slightly lighter above. So, in the abdomen the pleura and tailfan are somewhat darker than the tergum, but the difference is slight. The eye peduncle is red, the cornea white with a yellowish sheen. The antennular peduncle is red, the antennal peduncle uncoloured. The flagella are uncoloured. All the legs are red or orange-red. Of the large chelipeds the palm is lightest, the carpus darkest.

In some specimens, after preservation a distinct green colour is noticed on the carapace, especially in the dorsal and anterior parts. This colour evidently is an artifact and will eventually disappear. The specimen from Dry Tortugas was described on the field label as "scarlet-vermillion".

*Distribution*.—The species is known from the Straits of Florida, Dry Tortugas, the Lesser Antilles from Guadeloupe to Tobago, from the Caribbean Sea N.E. and S. of Jamaica, off Colombia and off Venezuela, and from off the Guianas.

*Habitat*.—It has been found at depths between 655 and 1234 m (actually between 603-655 and 1234-1271 m), most catches (about 80 per cent) were made between 800 and 1300 m. The species clearly does occur in greater depths than the previous two. *Nephropsis neglecta* has been reported from the following types of bottom: sand (BLAKE sta. 200), fine sand, ooze and black specks (BLAKE sta. 195), sand and ooze (BLAKE sta. 227), brown mud and dead shells (PILLSBURY sta. 391), brown clay (PILLSBURY sta. 388), mud with solitary coral rubble and pteropod shells (GILLISS sta. 31).

*Types*.—The holotype (USNM no. 136690) is preserved in the National Museum of Natural History, Washington, D.C., all other species are paratypes.

*Remarks*.—The species resembles *N. agassizii* in having two pairs of lateral rostral teeth, and also in its uniformly red coloration, but it may immediately be distinguished by the lack of a spine on the anterior margin of the pleura of the second abdominal somite, and by having a distinct diaeresis on the uropodal exopod.

The specimens identified by Faxon (1896) as *Nephropsis agassizii* were examined by me in the Museum of Comparative Zoology in Cambridge, Massachusetts, in June 1970, thanks to the kind permission of Dr. Herbert Levi. All the specimens proved to belong to the present species.

*Nephropsis agassizii* A. Milne Edwards, 1880

Figs. 19, 20

*Nephropsis Agassizii* A. Milne Edwards, 1880: 1; Filhol, 1885: 144, pl. 1 fig. 5; De Man, 1916: 97, 110, 111.

*Nephropsis agassizii*.—Fowler, 1912: 569; Roe, 1966: 92; Manning, 1969: 308; Firth & Pequegnat, 1971: 89.

*Nephropsis Agassizi*.—Bouvier, 1917: 21.

*Nephropsis agassizi*.—Bouvier, 1925: 407, pl. 1 figs. 2-4; Opresko, Opresko, Thomas, Voss & Bayer, 1973: 6, 18, fig. 6, pl. 4.

not *Nephropsis Agassizii*.—Agassiz, 1888: 43, fig. 240 (= *N. aculeata*).

not *Nephropsis agassizii*.—Faxon, 1896: 156 (= *N. neglecta*); Howe, 1901: 240 (= ? *N. aculeata*).

not *Nephropsis agassizi*.—Boone, 1927: 99 (= *N. aculeata*).

*Material*.—Tongue of the Ocean, Bahama Islands: C. ISELIN sta. 21, 1545-1573 m, 1 male (M); sta. 57, 1391-1408 m, 1 female (M); sta. 58, 1390-1426 m, 1 ovigerous female (L); sta. 59, 1435-1455 m, 1 female (M); sta. 101, 1604 m, 1 male (L); sta. 103, 1450 m, 1 female (W); sta. 105, 1370 m, 1 ovigerous female (M); sta. 107, 1311 m, 1 male (W); sta. 125, 1485 m, 1 female (L); sta. 144, 1483-1506 m, 2 males (L); sta. 145, 1430-1447 m, 1 female (M); sta. 164, 1372 m, 1 male (W).—Exuma Sound, Bahama Islands, C. ISELIN sta. 193, 1739-1756 m, 1 female (L).—Straits of Florida, U.S.A.: PILLSBURY sta. 586, 1682-1737 m, 1 female (L); sta. 634, 1638-1757 m, 1 female (L).—Gulf of Mexico off the Mississippi delta, OREGON sta. 2820, 1829 m, 1 male (L).—S. of Jamaica: PILLSBURY sta. 1197, 1481-1504 m, 1 female (L); sta. 1235, 1362-1586 m, 1 male, 1 juvenile female (L); sta. 1238, 1591-1829 m, 1 male, 1 female (M,L).—Gonave Bay, Haiti, PILLSBURY sta. 1178, 1765-1902 m, 3 females (M).—Off Tobago, PILLSBURY sta. 844, 1464-1848 m, 2 males (M,L).—Off Venezuela, PILLSBURY sta. 748, 1784-1958 m, 1 male, 2 females (L).—Off São Paulo, Brazil, WALTER HERWIG sta. 85, 1 male (L).

*Description*.—The rostrum bears two very strong lateral teeth at either side. The anterior is placed just behind, in or just before the middle of the rostrum. The posterior pair stands halfway between the anterior pair and the level of the supraorbital spines, or closer to the former. The subdorsal carinae are granulate with pearly tubercles, anteriorly they merge to a single carina. Behind the level of the supraorbital spines they bear distinct spines, which are about half as long and half as wide as the supraorbital. The entire carapace is covered with smoothly rounded pearly granules of different size; they usually are largest in front of the postcervical groove and smallest in the posterolateral area. Few short and stiff hairs are implanted on the tubercles. The distance between the gastric tubercle and the level of the anterior supraorbital spines is about  $\frac{2}{3}$  of the distance between the gastric tubercle and the postcervical groove. Behind and somewhat below the supraorbital spine is placed a smaller postsupraorbital spine, sometimes a group or row of spinules is present here. The postcervical, cervical, and

hepatic grooves are distinct and deep. The intermediate carina is inconspicuous, the lateral carina is very distinct and well defined. The dorso-median groove shows as a smooth somewhat sunken line.

The tergum of the first abdominal somite is smooth or somewhat granular, those of the second to fifth somites are smooth and pitted, showing only some granules laterally (this granular area is larger in the posterior than in the anterior somites). The transverse groove on the somites is interrupted in the median line, but there is no median carina on any of the somites. The tergum of the sixth somite is covered with pearly granules similar to those on the carapace. The pleura of the first somite are triangular and end in a sharp point. Those of the second somite are much larger but also triangular and pointed. They bear one or two strong spines (if two, the proximal one is less strong than the distal) in the basal half of the anterior margin. The posterior margin shows some tubercles in the basal half. The third and fourth somites carry a single strong spine in the basal part of the anterior margin. The posterior margin shows granules. The surface of the pleura have some granules near the margins and a few in the middle. The fifth somite has no spine on the anterior margin of the pleura, but may possess a strong one in the basal part of the posterior margin. The pleura of the sixth somite are rounded or bluntly angular at the top and the posterolateral angle ends in a sharp spine. The telson has the usual shape and bears numerous pearly granules.

The chelipeds bear long sleek hairs, which are not woolly as in *N. aculeata*, and do not obscure the outline of the segments. The chela is not fully three times as long as high. The carpus has a strong anterodorsal spine, and one on the anteroventral angle of the outer surface. In the middle of the outer surface there are one or two spines (if two, one is placed behind the other, the anterior being the strongest), placed at a slight distance behind the anterior margin. The inner surface has a spine at the anteroventral angle, and one slightly below the middle of the upper margin. The upper margin of the merus is granular in the basal part, bearing a row of about six spines or spinules in the distal half, the last of these spines is very strong. The ventral surface bears only a single strong spine at the anterior inner angle. The second pereopods have the carpus shorter than the palm. The carpus of the third leg is slightly more than half as long as the chela. The dactylus of the fourth leg is slightly less than half as long as the propodus. The dactylus of the fifth leg is half or slightly more than half as long as the propodus, in large specimens sometimes slightly less. The tuft of hairs at the end of the propodus of the fifth leg is very small.

The coxal process of the second pereopod of both the male and female is low and ends in a blunt angle. That of the third pereopod in the male is larger and ends in three to six teeth which may be low and indistinct. In the female it consists of a single small triangular tooth just over the female

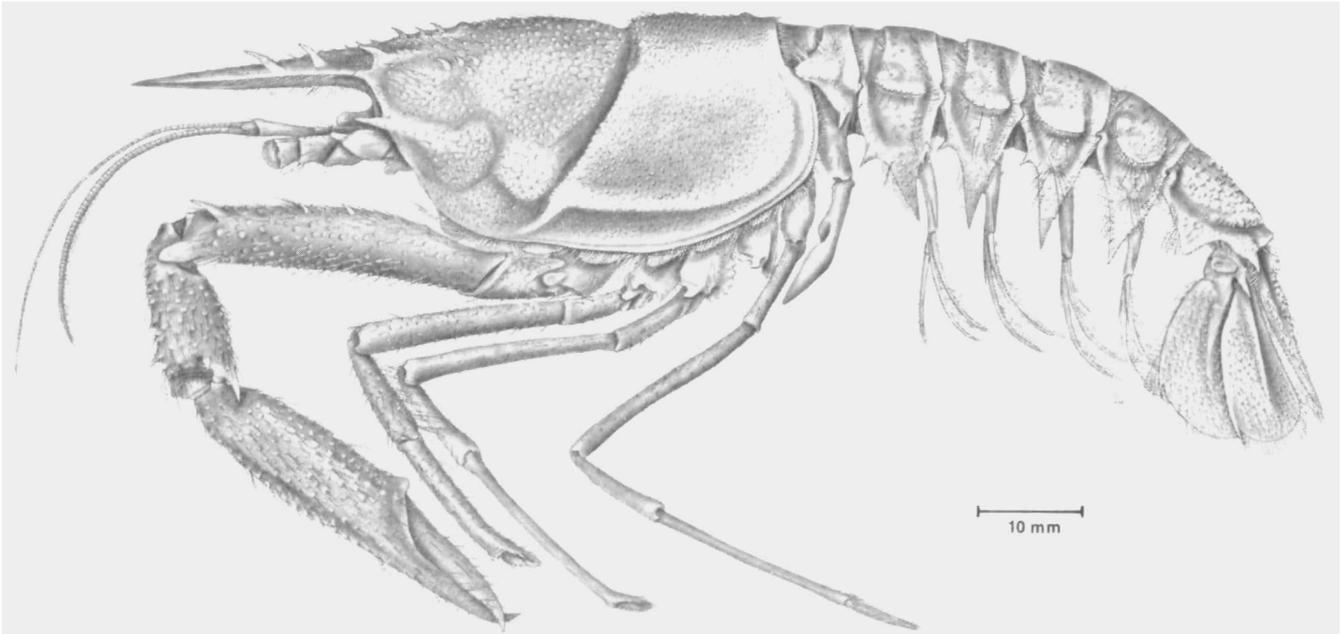


FIGURE 19. *Nephropsis agassizii* A. Milne Edwards, male from OREGON sta. 2820, lateral view.  $\times 1.4$ . Mrs. Constance Stolen McSweeney del.

coxal opening. The coxal process of the fourth leg of the male is triangular, ending in a curved tooth, sometimes with a tubercle at its base. In the female the process of the fourth leg is blunt.

The thelycum of the female does not stand out, but is sunken between the bases of the fourth legs. The median groove extends over the full length of the thelycum, widening anteriorly. The anterior part slopes down forward. Posteriorly the thelycum shows a sharp broad triangular incision. The median groove of the thelycum bears a rounded tubercle at either side and at both ends. Between the bases of the third pereopods two oblique submedian ridges are visible.

The first pleopod of the male is rather robust, with a wide incision between the two parts. The appendix masculina of the second male pleopod is shorter than the endopod, it narrows towards the top; long bristles are implanted on the distal margin, shorter ones are placed in the distal part of the outer margin.

The outer lobe of the uropodal protopodite is blunt, the inner bears a distinct spine. The upper surface of the exo- and endopod are pearly granular. The exopodite does not show a trace of a diaeresis.

In juveniles the tuberculation of the body is less distinct than in large specimens.

*Size*.—The examined males had the carapace 26 to 56 mm long, in the females it is 17 to 52 mm long. The ovigerous females had the carapace 39 and 43 mm long. The diameter of the eggs is 2.6 mm.

*Colour*.—The male from PILLSBURY sta. 1235 was noted to have the following colours when alive: The general impression is that of a bright red lobster, as this is the main colour of the body. The dorsal part of the carapace is pink, being especially light behind the post-cervical groove. The rostrum, the larger part of the carapace before the post-cervical groove and that below the submedian carinae are red. The dorso-median area of the abdomen is pink, this pink area narrows posteriorly, showing on the sixth somite only as a narrow median band. The eyestalk is red distally, pink proximally, the cornea is white. The antennulae are red, the antennal peduncle is white, its flagellum red. The other appendages, from the mouthparts to the uropods are brilliant red. The first pereopods have the merus slightly lighter in the middle, showing there a more orange tinge.

*Distribution*.—The type locality is given in the original publication as “detroit de Floride, à 1,500 metres de profondeur” (A. Milne Edwards, 1880). Bouvier (1925: 409) doubted the correctness of this locality indication and thought that the type in all probability came from BLAKE sta. 33, which is situated N. of Yucatan Bank at 24°01'N 88°58'W, at a depth of 1400-1568 fm (= 2562-2869 m). The specimen from this station had been examined by A. Milne Edwards, and was the only specimen of this species

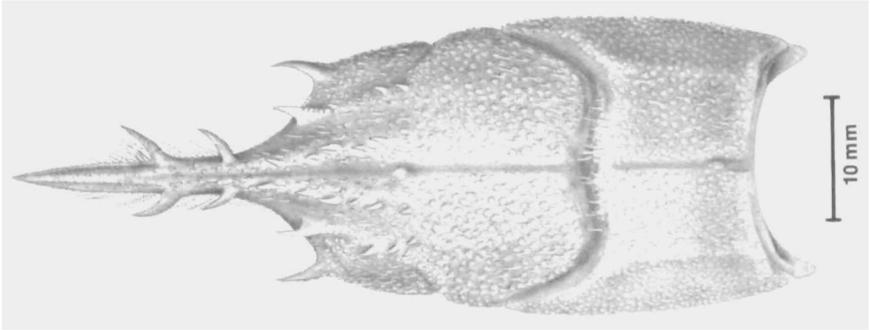


FIGURE 20. *Nephropsis agassizii* A. Milne Edwards, male from OREGON sta. 2820, dorsal view of carapace.  $\times 1.6$ . Mrs. Constance Stolen McSweeney del.

present when Bouvier studied A. Milne Edwards's BLAKE collection. As at several occasions (e.g., with *Bathynomus giganteus* A. Milne Edwards, see Holthuis & Mikulka, 1972: 581) A. Milne Edwards' locality indications showed to be unreliable, it is quite well possible that Bouvier is correct here. The specimen from BLAKE sta. 33 described and figured by Bouvier (1925, pl. 1 figs. 2-4), even if not the holotype of the species, still is very important as it is the only existing specimen of the species examined by A. Milne Edwards and assigned by him to the present species.

Until 1971 no other definite records of *Nephropsis agassizii* have been published and at that time the BLAKE sta. 33 specimen was the only one known with certainty (the other specimens published as belonging here were either *N. aculeata* or *N. neglecta*); Roe (1966: 95) reported that exploratory vessels of the U.S. Bureau of Fisheries had "collected the species sparingly in the northwestern and north central Gulf [of Mexico] in 500 to 1,000 fathoms", but he gave too few details of this material to make its identity beyond all doubt. In 1971 Firth & Pequegnat added considerably to our knowledge of the range of the species, which they reported from the following localities: Gulf of Mexico off Texas,  $27^{\circ}24.3'N$   $94^{\circ}32'W$ , 942 m; Gulf of Mexico off the Mexican coast,  $25^{\circ}38'N$   $96^{\circ}07.3'W$ , 878 m,  $21^{\circ}35'N$   $96^{\circ}45'W$ , 1326 m, and  $21^{\circ}29'N$   $96^{\circ}41.5'W$ , 1189-1280 m. Off Yucatan Peninsula, Mexico,  $18^{\circ}57'N$   $87^{\circ}09'W$ , 1143 m. Off Honduras,  $16^{\circ}30.2'N$   $84^{\circ}40'W$ , 1875 m.

The species at present is known from the Bahamas, the Straits of Florida, the northern and eastern Gulf of Mexico, the central, southern and eastern Caribbean Sea, the area of Tobago, and off São Paulo, Brazil. It is interesting that the species did not turn up in the extensive collections made by R/V GERDA in the Straits of Florida.

*Habitat*.—The depths at which *Nephropsis agassizii* has been collected range from 878 to 2560 (actually 2560-2867) m, almost all specimens were

taken between 1100 and 1900 m. The bottom of seven stations at which *N. agassizii* was taken is known: mud and rock (PILLSBURY sta. 634), soft mud (PILLSBURY sta. 1235), silty mud (ISELIN sta. 144), white pteropod mud (ISELIN sta. 164), yellow clayey mud with much log debris, heavily infested with borers (PILLSBURY sta. 1178), silty fine pale gray clay (ISELIN sta. 145), and much *Thalassia* debris as well as terrestrial plant debris (PILLSBURY sta. 1238). The present species is inhabiting the greatest depths of all known Atlantic species of the genus.

*Remarks.*—The specimen figured by Agassiz (1888, fig. 240) as *N. agassizii* does not belong to the present species but is *Nephropsis aculeata*, probably one of the types of the latter species. Also the specimen referred by Boone (1927) to *N. agassizii* cannot be that species, as Boone's description clearly shows it to be *N. aculeata*. Howe (1901) mentioned the capture of "*Nephropsis agassizii*" at FISH HAWK sta. 7068 at a depth of 95 fm (= 174 m). As at that time several species were confused under the name *N. agassizii*, and as the only *Nephropsis* found so far north and at such a small depth is *N. aculeata*, it seems most probable that Howe's record pertains to that species. The specimens assigned by Faxon (1896) to the present species could be examined by me and proved to belong to *Nephropsis neglecta* new species.

Roe (1966) used the trade name "Agassiz's Lobsterette" for the species. Opresko, Opresko, Thomas, Voss & Bayer (1973) employed the name "Prickly Lobsterette".

### *Nephropsis atlantica* Norman, 1882

#### Fig. 21

*Nephropsis atlantica* Norman, 1882: 684; Norman, 1886: 7; Stebbing, 1893: 206; Caullery, 1896: 384; Thompson, 1901: 17; Norman, 1905: 8; Hansen, 1908: 43; Murray & Hjort, 1912: 539; Selbie, 1914: 48, pl. 7 figs. 1-13; Williamson, 1915: 444; De Man, 1916: 97, 112; Bouvier, 1917: 21, 22, pl. 1 figs. 1-5; Stephensen, 1923: 79; Hansen, 1925: 131, 132, 134, 143, pl. 8 fig. 4; Grieg, 1927: 28; Miranda y Rivera, 1933: 21; Delphy & Magne, 1938: 83; Bouvier, 1940: 59, pl. 2 figs. 2, 3; Dollfus, 1956: 135; Sivertsen & Holthuis, 1956: 43; Allen, 1967: 56, 88, fig.; Maurin, 1968: 45; Maurin, 1968a: 482; Zariquiey Alvarez, 1968: 202, fig. 83; Bourdon, 1971: 372.

*Nephropsis* Voss, 1966: 19.

not *Nephropsis atlantica*.—Wood-Mason, 1891: 198, fig. 4; Alcock, 1894: 230; Alcock & Anderson, 1894: 162; Anderson, 1896: 96; Alcock, 1899: 33; Alcock, 1901: 161; Stebbing, 1902: 34; Stebbing, 1902a: 130; Stebbing, 1910: 379; Gilchrist, 1918: 48; Von Bonde, 1932: 59, 61, 63; Von Bonde & Marchand, 1935: 6; Barnard, 1950: 530, fig. 99b-e; Barnard, 1964: 12; Bruce, 1966: 223.

*Material.*—Faeroe Channel west of Wyville Thomson Ridge, 59°40'N 7°21'W, 944 m, 1882, TRITON sta. 10, 1 male, 1 female (BM).—Off S.W. Ireland: MICHAEL SARS 1910 sta. 4, 923 m, 1 specimen (L).—

West of Gibraltar: MICHAEL SARS 1910 sta. 24, 1615 m, 1 specimen (L).—Off Morocco: TALISMAN 1883 sta. 13, 1216 m, 1 female (MP).—Near the Canary Islands: TALISMAN 1883 sta. 48, 1180 m, 2 females; sta. 51, 1238 m, 2 males, 2 females (MP).—Off Spanish Sahara between Cape Bojador and Cape Garnet, 2 December 1962, THALASSA Expedition, C. Maurin, 1 male (L).—Off Liberia: PILLSBURY sta. 74, 641-733 m, 17 males, 14 females (W,L).—Off Ivory Coast: PILLSBURY sta. 41, 641-842 m, 5 males, 11 females (1 ovigerous) (W,L).—Off Nigeria: PILLSBURY sta. 256, 409-485 m, 3 males (L).—Off Gabon: GERONIMO sta. 206, 455-610 m, 1 female; sta. 223, 640 m, 1 male (W).

*Description.*—The rostrum bears two lateral teeth at either side. These teeth are strong and both are placed in the basal half of the rostrum. The subdorsal carinae are granular, and in addition carry some small spinules and two spines (one on each carina); these spines are slightly smaller than the lateral rostral teeth and placed some distance behind the posterior of those. The carapace is finely granular; the granules are coarsest before the cervical groove and on the carinae. There is a strong supraorbital and an antennal spine of the same size. A smaller supraorbital spine is placed behind the supraorbital. The distance between the level of the supraorbital spines and the gastric tubercle, measured in the median line, is about  $\frac{2}{3}$  that of the distance between the gastric tubercle and the postcervical groove. The intestinal tubercle is high. The postcervical, hepatic and cervical grooves are distinct, the antennal less so. The dorsomedian groove shows as a smooth line with the gastric and intestinal tubercles as clear humps. The intermediate carina is faint, the lateral and intestinal are more distinct.

The abdomen is finely granular, without spines on the surface. A distinct but low median carina is visible on somites 2 to 6, it is smooth and naked. A much higher, somewhat crenulated carina extends over the bases of the pleura, it shows an incision in the posterior part. The tergum shows a dense and rather long pubescence; on the pleura the pubescence is much less conspicuous. The pleuron of the first abdominal somite shows an anterior rounded lobe, posteriorly it merges with the transverse carina of the sternite. The anterior margin of the second pleuron is convex and shows one or two distinct strong spines in the basal half. All pleura end in a sharp point and have their margins with sharp small granules, but none of the pleura, apart from those of the second somite, show any marginal spines.

The chela of the first leg is heavily setose, especially on the outside. It is about  $\frac{1}{3}$  as high as long. The carpus has a strong anterodorsal and an anteroventral spine. On the outer surface two more spines are present at a slight distance behind the anterior margin; one closer to the anterodorsal and one closer to the anteroventral spine; behind the upper of the two an

additional spine is present. In the upper half of the inner surface of the carpus a single spine is present some distance behind the anterior margin. The merus has a strong anterodorsal and a similar anteroventral spine. Behind the anteroventral spine there is a longitudinal row of smaller spines, which diminish in size posteriorly. There are numerous very small granules and spinules on the various segments, but these are entirely obscured by the rather long and soft pubescence. The second pereopod has the carpus slightly shorter than the palm. In the third pereopod the carpus is distinctly longer than half the chela. In the fourth leg the propodus is decidedly less than twice as long as the dactylus. The dactylus of the fifth leg is of about the same length as that of the fourth, but the propodus is slightly shorter.

The inner margin of the coxa of the second legs of the adult male shows a curved broadly rounded carina, which ends in a bluntly triangular process. The coxa of the third leg of the male shows a large flattened rounded plate, which bears a single very strong sharp and curved tooth distally. The coxa of the fourth leg shows two spines on the inner margin.

The thelycum of the female is high and its anterior end drops almost perpendicularly down. The posterior incision is rather narrow, being less than  $90^\circ$ . The surfaces at either side of the median slit are not smooth and level, but show each a distinct rounded transverse ridge, the two of which divide the median groove in two unequal parts. Before the thelycum, between the bases of the second and third legs there are two widely separated longitudinal ridges. Between the bases of the second legs there are two small oblique, almost transverse, submedian plates, which have the inner margin slightly crenulate. Similar plates, but even more transverse, are present between the bases of the first legs. The median carina between the first and second legs is low, with an indistinct depression in the posterior part.

The first pleopods of the male have the distal part rather more tongue-shaped than triangular, with a rounded apex. The inner margin of the basal part of the pleopod is not prolonged beyond the beginning of the inner margin of the distal part so that the outline of the pleopod in lateral view does show a narrow incision. The appendix masculina of the second pleopod of the male is about as long as the distal part of the endopod, but shorter than the exopod; it is rounded at the end and provided with bristles on the distal margin and in the distal part of the outer surface; these bristles become gradually longer distally and posteriorly.

The exopod of the uropod shows a distinct diaeresis, before the inner half of which granules are visible. The uropodal protopod has the outer lobe blunt, the inner with a slender spine.

*Illustrations.*—The species has been well illustrated by Selbie (1914: pl. 7 figs. 1-13) and Bouvier (1917: pl. 1 figs. 1-5).

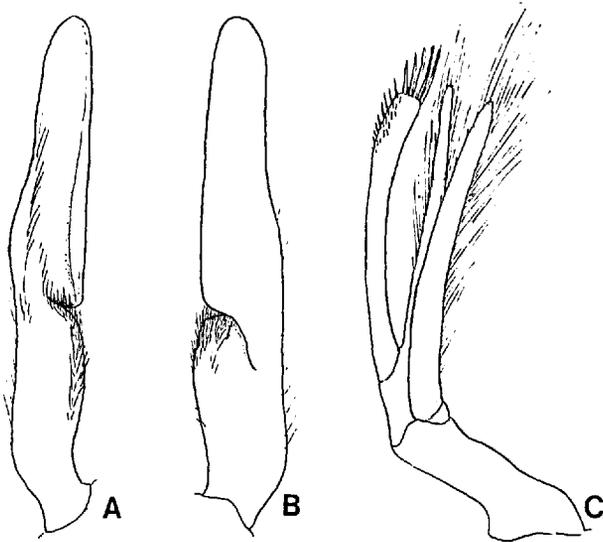


FIGURE 21. *Nephropsis atlantica* Norman, male from PILLSBURY sta. 41. A, first pleopod inside view; B, first pleopod, outside view; C, second pleopod. A-C,  $\times 3.4$ .

*Size*.—The examined males have the carapace length between 22 and 46 mm, the females between 25 and 50 mm. Selbie (1914) gave the total length of his specimens as 52 to 103 mm. The examined ovigerous female has cl. 46 mm. Stephensen (1923) gave the total length of ovigerous females as 79 to 97 mm. Sivertsen & Holthuis (1956) mentioned ovigerous females with a total length of 71 and 87 mm. The eggs in the present material measure 2.5 to 3 mm in diameter. Caullery (1896) gave the egg size as 1 mm, Stephensen (1923) as 2.25 mm.

*Colour*.—A coloured figure of this species was published by Bouvier (1917, pl. 1 fig. 1). It shows the entire body bright orange red, with a grey pubescence on the posteromedian part of the carapace and on the abdominal tergites. Stephensen (1923) described it as a “red species with colourless eyes”.

*Distribution*.—*Nephropsis atlantica* is known from the eastern Atlantic between about 61°N and 3°S. The records in the literature are: Faeroe Channel between Scotland and the Faeroe Islands: 59°33'N 7°14'W, 1015 m (type locality; Norman, 1882), 61°08'N 9°46'W, 823 m (Hansen, 1908), 61°7'N 9°33'W, 1372 m (Grieg, 1927), 59°40'N 7°21'W, 945 m (Thompson, 1901), 59°33'N 7°50'W, 1100 m (Grieg, 1927), 59°28'N

8°01'W, 1061-1257 m (Hansen, 1908). S.W. of Ireland: 51°43.5'-51°38'N 12°15'-12°18'W, 1006-1463 m; 51°37'N 12°9'W, 1019-1058 m; 51°35.5'N 12°26'W, 914-951 m; 51°35'N 11°57'W, 1101-1116 m; 51°22'N 12°W, 1271-1317 m; 51°21'N 11°49'W, 960-1097 m; 51°15'N 11°47'W, 1293-1298 m; 51°14'N 11°51'W, 1097-1207 m; 51°12'N 11°55'W, 1116-1244 m; 50°34'N 11°19'W, 1209-1229 m; 50°31'N 11°31'W, 1225-1408 m (Selbie, 1914), 49°38'N 11°35'W, 923 m (Sivertsen & Holthuis, 1956), 49°25'N 12°20'W, 1180-1275 m (Hansen, 1908; Stephensen, 1923). Bay of Biscay: 45°09'N 3°18'W, 1804 m (Bouvier, 1917), 44°36'N 4°25'W, 650 m (Caullery, 1896). West of Portugal: 43°30'N 9°37'45'W, 1743 m (Bouvier, 1917), 40°23'N 13°23'W, 1200 m (Stephensen, 1923). West of Gibraltar: 35°34'N 7°35'W, 1615 m; 35°32'N 7°7'W, 1215 m (Sivertsen & Holthuis, 1956). Near Madeira, 32°34'45"N 17°05'30"W, 1700 m (Bouvier, 1917). Near Lanzarote, Canary Islands, 29°6'30"N 13°2'45"W, 1098 m (Bouvier, 1917). Off Spanish Sahara, near Cap Bojador and Cap Garnet, 530-720 m (Maurin, 1968, 1968a). Near Cape Verde Islands: 15°15'N 23°04'05"W, 660 m; 15°14'N 23°03'45"W, 628 m (Bouvier, 1917). Off Pointe Noire, Congo, 5°03'S 11°16'E, 550-750 m (Bourdon, 1971).

*Habitat*.—The species is known from a depth range from 485 (actually 409-485) to 1804 m, with a maximum number of records between 900 and 1400 m (about 60%). The bottom at the stations where the species was collected consisted of mud (Norman, 1882; Caullery, 1896; Bouvier, 1917; TALISMAN 1883 sta. 48), yellow mud (TALISMAN 1883 sta. 51), muddy sand (Bouvier, 1917; Maurin, 1968), mud and sand, sandy mud, and sand and rock (Bouvier, 1917), mud and coral (TALISMAN 1883 sta. 13).

*Parasites*.—Bourdon (1971) described a bopyrid parasite from the branchial cavity of the present species; he assigned it to a new subspecies *Pseudione nephropsis atlantica*.

*Remarks*.—The records of *Nephropsis atlantica* from the Indo-West Pacific region are based on material which actually belongs to a distinct species, which is being described as new by Dr. Raymond B. Manning of the National Museum of Natural History, Washington, D.C.

*Type*.—The two specimens from the Faeroe Channel collected by the TRITON in 1882, and now in the collection of the British Museum, were marked as types. But, as indicated on a label in Dr. Isabella Gordon's handwriting, these specimens cannot be types, as the type material was collected in 1880 by the KNIGHT ERRANT. The whereabouts of the true types are not known. The TRITON specimens are important as they have been examined by the Rev. A. M. Norman.

*Nephropides* Manning, 1969

*Nephropides* Manning, 1969, Crustaceana, 17(3): 303. Type species, by original designation and monotypy: *Nephropides caribaeus* Manning, 1969, Crustaceana, 17(3): 304. Gender: masculine.

*Definition.*—The rostrum is dorsoventrally depressed, it bears neither dorsal nor ventral teeth, but is provided with lateral spines. Supraorbital, postorbital and antennal spines are present. The subdorsal carinae are short, and bear granules like those of the carapace. The carapace is covered with closely placed distinct and smooth pearly granules. The dorsomedian groove shows as a narrow smooth sunken linear area, which extends over the full length of the carapace. The gastric and intestinal tubercles are hardly or not at all noticeable. The postcervical, hepatic and cervical grooves are deep and sharp, also the antennal, and to a lesser degree the gastro-orbital grooves are distinct. The urogastric groove is clear and the two halves meet or almost meet in the middle of the dorsum. The marginal groove is distinct, being widest near the posterolateral angles of the carapace. The incisura clavicularis is well developed.

The abdomen is covered with granulae similar to those of the carapace. The posterior halves of the tergites do not show either transverse or longitudinal grooves or carinae. There are, however, indistinct longitudinal ridges over the bases of the pleura. The pleura are well developed, but hardly overlap. That of the second somite is of a trapezoid shape with a truncate distal margin and a posterolateral tooth. The following pleura are more triangular. Two grooves are present on each pleuron. The sixth abdominal somite does not show any spines or teeth on the posterior or lateral margins. The telson is elongate quadrangular, slightly, but rather abruptly narrowed in the middle. Apart from a spine at each posterolateral angle, no spines are present on the margins of the telson. The posterior margin is convex and overreaches the posterolateral spines.

The eyes are small and elongate. The cornea is globular, somewhat wider than the distal end of the stalk and distinctly pigmented.

The stylocerite is visible as a high swollen lobe which covers about  $\frac{3}{4}$  of the dorsal surface of the basal antennular segment. The three antennular segments are short and stubby, the last being slightly longer and more slender than the second. The segments are practically smooth. The inner antennular flagellum is narrower and longer than the outer, both are shorter than the carapace.

The segments of the antennal peduncle also are very short and stubby, they all show a few rather indistinct granules. The scaphocerite is absent. There are no spines on the peduncle, but the anteroventral margin of the basal segment is triangularly produced above the opening of the antennal gland.

The anteromedian end of the epistome is triangularly produced between

the bases of the antennulae. The lateral margins of this triangular part are raised and a longitudinal groove is visible in the median line. At each side of the base of this triangle a tubercle is present. The surface of the epistome carries scattered tubercles and shows a longitudinal pit in the center. The posterior margin of the epistome is raised to a high carina and shows two large blunt submedian teeth. The clavicular ridge is well developed.

The mandible consists of a heavy molar part which shows some indistinct teeth on its cutting edge, and a high transverse carina on its anterior surface; it carries a large three-segmented palp. The maxillula has the lower lacinia oval, the upper is much higher, the palp is bisegmented, with the distal segment long and whip-like. The maxilla has the two endites both deeply cleft so that four elongate laciniae are formed, the upper and lower being widest; the palp is well developed and narrow, especially in the distal part; the scaphognathite is long and slender and has a long tuft of hair on the posterior apex.

The first maxillipeds have the two endites separated by a deep notch. The palp is two-segmented; the exopod is well developed with a multi-articulated flagellum; the epipod is large. The second maxilliped is pediform, with a well developed exopod carrying a multi-articulated flagellum; a large epipod but no podobranch is present. The third maxilliped is slender; the merus is unarmed; the ischium bears a longitudinal crest with strong teeth on the inner posterior margin, while the outer posterior margin is serrate; the exopod is well developed with a multi-articulated flagellum.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	—	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

The first pereiopods are equal, strong and slender, with many granules on all segments. The fingers are clothed with long soft hairs. The second and third legs are much shorter, narrower, and slender. The second has a fringe of setae along the upper and lower margin of the chela. The third leg is far more slender and narrow than the second and is without a fringe of hair on the chela, but it carries a row of short stiff hairs at either side of the cutting edge of the dactylus. The cutting edges of both the second and third pereiopods are beset with numerous very short horny spinules.

The dactylus of the fourth and fifth legs has a row of stiff hairs on either

lateral margin of the upper surface. The lower surface of the dactylus of the fourth leg has a very small pad-like elevation in the extreme basal part; this elevation rests against a knob on the ventral part of the anterior margin of the propodus. In the fifth leg of the male the knob of the propodus is enlarged to a small lobe-like structure, which rests against a pad-like structure on the dactylus which is similar but larger than the one in the fourth leg. In the female the entire organ is more strongly developed, so that a small subchela is formed. The lobe on the propodus has become a short hollowed fixed finger with a conspicuous dark horn-coloured tubercle. The pad on the dactylus has become a large elevation which is hollowed on the inner surface and is beset on the rim with a row of short horny tubercles which are placed so close together that they form an uninterrupted series. The hollowed part of the pad is filled with appressed short hairs. Distally of the pad two small setiferous tubercles may be seen.

The thoracic sternum of the male shows between the third legs two submedian plates, which are rather short and wide and converge anteriorly, they bear one or two tubercles. The next sternite has two elongate submedian plates which likewise converge anteriorly. Each is incised in the middle so that it actually forms two almost circular lobes with granular margins.

The thoracic sternite of the third legs of the female is like in the male, that of the fourth legs shows a distinct thelycum. This thelycum is high and shows a median slit in the posterior two thirds. From each posterolateral angle of the thelycum a broad ridge extends forward and mediad. The two ridges converge toward the anterior end of the median slit and then diverge, ending in the anterolateral angles of the thelycum. Especially the anterior part of these ridges is distinct, high, and relatively narrow. The anterior median part of the thelycum between the ridges is concave and drops obliquely off anteriorly, ending in a rather straight transverse line. Laterally of the ridges the sides of the thelycum drop off rather steeply. The ridges posteriorly stop short somewhat before the posterolateral angles of the thelycum, which are produced upward like a distinct tooth. The posterior margin of the thelycum is widely V-shapedly incised; the median part of the incision ends in the median slit. An obcordate median plate lies just behind and against the thelycum filling the space of the V-shaped posterior incision; the plate points forward and has the lateral margins somewhat raised.

The male has the first pleopod transformed to a stiff elongate copulatory organ. It consists of two immovably fused segments. The distal is elongate, almost diamond-shaped and ends in a slender top with the apex bluntly rounded. It is fused along an oblique line with the basal segment, which narrows slightly distally. The inner surface of the basal segment has a longitudinal blunt and hairy ridge, which forms the posterior margin of

the beginning of a broad groove which goes up the inner surface of the distal segment. The appendix masculina of the second male pleopod is elongate, more than  $\frac{1}{2}$  as long as the endopod and with spine-like bristles on the distal margin and in the distal half of the outer margin. The appendix is about four times as long as wide and of about equal width throughout its length.

In the female the first pleopod consists of two slender segments and is almost filiform. The second to fifth pleopods of both sexes have no appendix interna, but show a lobe in the basal part of the inner margin of the endopod, which lobe is more distinct in the females than in the males.

The uropods have the protopodite with a spine on either of the lobes over the bases of the exo- and endopod. Both the exo- and endopod are covered by granules. The endopod has a single, the exopod a double median longitudinal carina. The diaeresis is very distinct in the exopod and has its anterior margin with many denticles.

*Remarks.*—The genus *Nephropides* is one of the most characteristic genera of Nephropidae and can easily be distinguished from all other forms.

The generic name *Nephropides* has been treated in the literature sometimes as masculine, sometimes as feminine. Manning (1969) in the original description was correct to assign the masculine gender to it. Article 30(a) (ii) of the International Code of Zoological Nomenclature, namely states in the Example that "Names ending in -ides . . . . are masculine".

The type and only known species of the genus is:

*Nephropides caribaeus* Manning, 1969

Figs. 22, 23

*Nephropides caribaeus* Manning, 1969: 304, text fig. 1, pl. 1; Zarenkov & Semenov, 1972: 601.

*Nephropides caribaea.*—Manning, 1970: 865; Firth & Pequegnat, 1971: 85.

*Material.*—Off British Honduras, OREGON sta. 3635, 457-732 m, 1 male paratype (W), 1 male (L).—Off Honduras, OREGON sta. 1947, 549 m, 1 female paratype (W).—Off Nicaragua: OREGON sta. 3571, 549-604 m, 2 male paratypes (W); sta. 1918, 549 m, 2 female paratypes (W); sta. 1915, 641 m, 1 male paratype (W); sta. 1911, 641 m, 1 male paratype (W); sta. 1909, 641 m, 1 female paratype (W); sta. 1908, 641 m, 1 male paratype (W); sta. 3609, 503 m, 1 male paratype (L); sta. 3576, 549-585 m, 1 male holotype (W: U.S.N.M. no. 113741).—Off the Caribbean coast of Colombia, OREGON sta. 4902, 732 m, 1 male paratype (W).

*Description.*—A good description with excellent illustrations has been given by Manning (1969). Some additional details may be found in the present paper in the diagnosis of the genus *Nephropides*.

*Size*.—The present material, which includes all the type specimens, has the range of the carapace lengths in the males from 51.5 to 58.0 mm (total length 156 to 170 mm), and in the females from 54.9 to 55.4 mm (total length 164 to 165 mm). Firth & Pequegnat (1971) reported upon a female with a carapace length of 60 mm.

*Colour*.—Firth & Pequegnat (1971: 85) provided the following colour description of this species: "The 'Alaminos' specimen is cream and red. The chelipeds are bright red, whereas the pubescence on the dactyli is white. The remaining pereopods are of a dull shade of red. The branchial regions have tinges of red, and the abdominal pleura have a blotched appearance. The frontal region of the carapace and the rostrum are outlined in red-orange, and the antennae are of the same color".

*Distribution*.—The species so far has only been found in the extreme western Caribbean between British Honduras and Colombia. The records in the literature are as follows: British Honduras, 16°58'N 87°53'W, 455-728 m (Manning, 1969), off Honduras, 16°42'N 82°33'W, 546 m (Manning, 1969), 15°2'N 81°05'W, 439-622 m (Firth & Pequegnat, 1971), off Nicaragua, 14°10'N 81°50'W, 546-601 m; 13°25'N 82°01'W, 546 m (Manning, 1969); 13°13'N 82°13'W, 637 m; 12°44'N 82°14'W, 637 m (Manning, 1969; Firth & Pequegnat, 1971); 12°35'N 82°19'W, 637 m; 12°33'N 82°20'W, 637 m; 12°26'N 82°24'W, 511 m; 12°25'N 82°15'W, 546-582 m, type locality (Manning, 1969), off Colombia, 9°24'N 76°31.5'W, 728 m (Manning, 1969).

*Habitat*.—The species has been found at depths between 511 and 728 m. The bottom at OREGON sta. 1915 is indicated as "yellow mud"; of the other stations where the present species was taken the bottom is unknown.

#### Nephropinae Dana, 1852

##### Fig. 24

*Definition*.—The rostrum is dorsoventrally compressed with lateral and sometimes ventral teeth, never with dorsal teeth. The lateral margins of the rostrum are continued in the orbital margin. Supraorbital, postorbital and antennal spines are present. Sometimes the supraorbital carina is continued posteriorly from the supraorbital spine as a high and toothed ridge. An antennal ridge may be present also. In some genera small spinules are present between the supraorbital and antennal spines, being placed usually before and above the postorbital spine; the spines are indicated here as metorbital spines. A cervical and a hepatic spine may be present, sometimes they are connected by a row of cervical spinules. Behind the postcervical groove a pair of postcervical, intermediate, branchial and

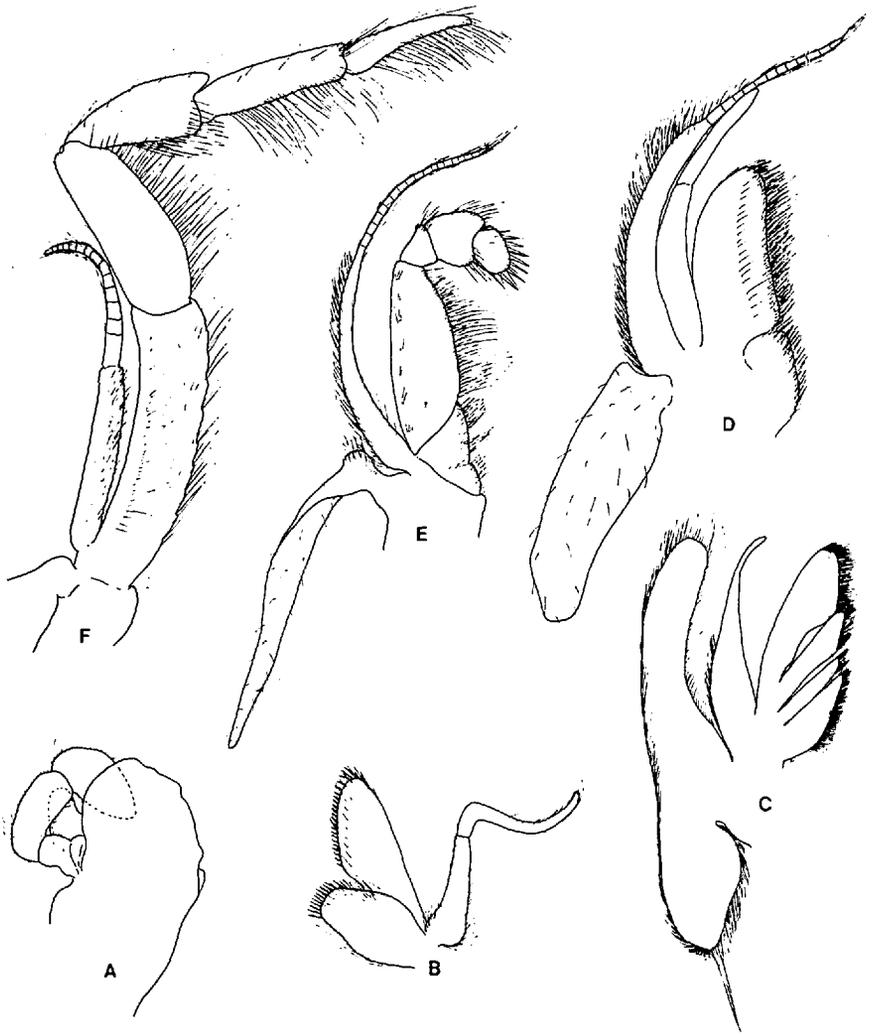


FIGURE 22. *Nephropides caribaeus* Manning, female from OREGON sta. 1918. A, mandible; B, maxillula; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. A-E,  $\times 2.7$ ; F,  $\times 2.2$ .

lateral spines may be present, sometimes mutually connected by a row of postcervical spinules.

The subdorsal ridges may be present or (in *Metanephrops*) lacking altogether. The supraorbital carina may be absent (*Homarus*), indicated

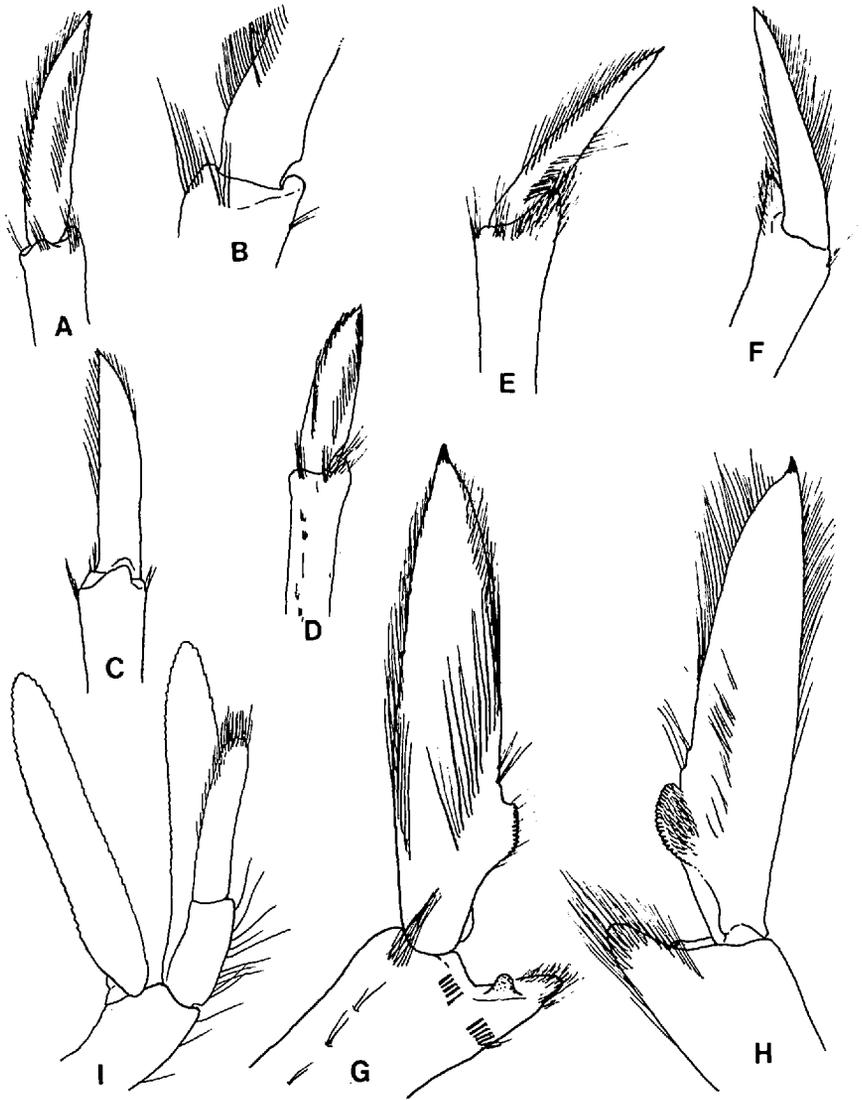


FIGURE 23. *Nephropides caribaeus* Manning, male from OREGON sta. 1908, female from OREGON sta. 1918. A-H, dactylus of pereiopods. A, p4, ♀, dorsal view; B, basis p4, ♀, lateral view; C, p4, ♀, ventral view; D, p5, ♂, dorsal view; E, p5, ♂, lateral view; F, p5, ♂, ventral view; G, p5, ♀, oblique dorsal view (the long stiff hairs at the distal end of the propodus are cut); H, p5, ♀, oblique ventral view. I, second pleopod of male. A, C-F, I,  $\times 3.8$ ; B, G, H,  $\times 6.4$ .

by one or more small spines (*Nephrops*, *Eunephrops*) or formed to a strong and high carina with large teeth, reaching anteriorly on to the rostrum and posteriorly almost as far as the postcervical groove (*Metanephrops*). The antennal carina may be strong (*Metanephrops*, *Eunephrops*) or practically non-existent (*Homarus*, *Nephrops*). The intermediate, branchial and lateral ridges in the posterior half of the carapace may be distinct or partly or entirely absent.

The postcervical groove is always distinct, at least in its dorsal part. Also the hepatic, cervical, antennal and marginal grooves are well defined. In several genera (*Homarus*, *Nephrops*) the intercervical groove is clearly discernible, in *Homarus* it even replaces the lower part of the postcervical groove. The gastro-orbital groove is usually clear.

The incisura clavicularis is present in all genera.

The abdomen is either smooth or with carinae and grooves. The pleura are well developed and overlap. They end in a small posteriorly directed tooth or angle. The telson is elongate quadrangular, narrowing somewhat posteriorly. The lateral margins have no spines apart from the strong posterolateral spines; sometimes (e.g., in *Eunephrops*) the telson shows a few serrations in the middle of the lateral margin. The posterior margin is slightly (*Metanephrops*, *Eunephrops*) to distinctly (*Homarus*, *Nephrops*) convex. The dorsal surface of the telson shows two wide and low diverging carinae, which start in the anteromedian part of the telson and are directed towards the posterolateral angles. At their confluence they may show a low tubercle or short transverse ridge (*Homarus*, *Nephrops*, *Eunephrops*) or two distinct submedian spines (*Metanephrops*).

The eyes are well developed. The cornea is distinctly pigmented and much wider than the stalk, sometimes it is kidney-shaped.

The antennulae have the basal segment longer than the others. The two antennular flagella are shorter than the carapace; the outer is somewhat broader than the inner, but they are of about the same length.

The antennal peduncle shows a distinct scaphocerite. The flagellum is strong and is longer than the carapace.

The first maxilliped has the palp large and two-segmented; the exopod bears a multi-articulated flagellum; a large epipod is present, reaching far backward, hardly at all forward. The second maxilliped also has the exopod well developed, with or without a multi-articulated flagellum, the epipod is large and resembles that of the first maxilliped, it may or may not carry a podobranch. The third maxilliped has the ischium provided on the inner medial margin with a strong dentate ridge, which extends the full length of the segment. The exopod is well developed and has a multi-articulated flagellum. The epipod is large and broad and carries a well formed podobranch. The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	±	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

The first pair of legs is very strong, the left and right are equal in shape (*Metanephrops*, *Eunephrops*) or definitely unequal (*Homarus*, *Nephrops*). The chelipeds may show ridges, spines and grooves, or may be almost entirely smooth. The second and third legs are slender and carry a narrow chela. The cutting edges of both chelae show a row of very short comb-like arranged horny spinules over their full length. The last two pereiopods are without true chelae. The dactyli are simple and carry a fringe of hairs on either lateral margin of the upper surface.

The thoracic sternites are visible as distinct plates between the bases of the legs (*Metanephrops*), or are so narrow, that they only show as two oblique or longitudinal carinae between the bases of the legs, which are closely approximated (*Homarus*, *Nephrops*, *Eunephrops*). The females show a thelycum at the sternite of the fourth pair of legs.

The pleopods are of the normal type. The male first pleopod has the two segments fused to a rigid copulatory stylet. No appendix interna is present on any of the pleopods, either in the male or the female.

The male abdominal sternites 2 to 5 carry a strong median spine each.

The uropods have the endo- and exopod wide. The endopod has a single longitudinal carina, the exopod has two (*Nephrops*, *Metanephrops*, *Eunephrops*) or both have the surface smooth (*Homarus*). A diaeresis is present in all species.

*Remarks.*—Glaessner (1969: 458, 459) placed the genera *Nephrops* and *Homarus* in two distinct subfamilies, Nephropinae and Homarinae. The definition of the Nephropinae given by him was "Carapace with longitudinal keels or rows of spines; abdomen with median keel", and of the Homarinae "Carapace and abdomen mostly without coarse spines or carinae and only lightly granulated; chelae usually without carinae, heterochelous". I have been unable to keep these two subfamilies separate. *Eunephrops* has no longitudinal keels or rows of spines on the carapace and thus should belong to the Homarinae, but it is coarsely granulated and homochelous. Several species of *Metanephrops* have no median carinae on the abdomen, and *Nephrops* itself is heterochelous. In most important features the four genera *Nephrops*, *Homarus*, *Metanephrops* and *Eunephrops* resemble each other so much that it seems best to keep them in one subfamily. Therefore the subfamily Homarinae is included within the Nephropinae.

## KEY TO THE RECENT GENERA OF NEPHROPINAE

- 1 Left and right first chelipeds unequal, one a crushing claw, the other a cutting claw. Antennal spines without a strong posterior ridge. First abdominal sternite of the male without a median spine. ----- 2
- 1' Left and right chelipeds of the first pair similar in size and shape. Antennal spine followed by a strong antennal carina. A distinct ridge separates the abdominal tergites from the pleura. First abdominal sternite of the male with a median spine. ----- 3
- 2 Palm of chelipeds smooth, without ridges. Subdorsal ridges without spinules. Abdominal somites smooth, without grooves; no ridges separating the tergites from the pleura. ----- *Homarus*
- 2' Palm of the first chelipeds with distinct longitudinal grooves, ridges and rows of spines. Subdorsal carinae spinulate. Abdominal somites dorsally with distinct transverse grooves, a blunt ridge separates the tergites from the pleura. ----- *Nephrops*
- 3 Supraorbital tooth followed by a strong toothed ridge which extends almost to the postcervical groove. Posterior part of carapace with intermediate, branchial and lateral ridges. .... *Metanephrops*
- 3' Supraorbital tooth followed by a single post supraorbital spine, no supraorbital ridge is present. The posterior part of the carapace is evenly granulate, without longitudinal carinae. ----- *Eunephrops*

*Homarus* Weber, 1795

*Homarus* Weber, 1795, Nomenclator Entomol.: 94. Type species, selected by Fowler (1912, Ann. Rep. New Jersey State Mus., 1911: 333): *Astacus marinus* Fabricius, 1775, Syst. Entomol.: 413 (= *Cancer gammarus* Linnaeus, 1758). Gender: masculine.

Homard Latreille, 1825, Fam. nat. Règne animal: 279 (vernacular name).

*Homarus* Guérin, 1825, Encycl. méthod. Hist. nat. Ins., 10: 768. Type species, by original designation and monotypy: *Cancer gammarus* Linnaeus, 1758, Syst. Nat., (ed. 10)1: 631. Gender: masculine.

*Homarus* H. Milne Edwards, 1837, Hist. nat. Crust., 2: 333. Type species, selected by E. Desmarest (1858, in Chenu, Encycl. Hist. nat. (Crust.-Moll.-Zooph.): 38): *Homarus vulgaris* H. Milne Edwards, 1837, Hist. nat. Crust., 2: 334 (= *Cancer gammarus* Linnaeus, 1758). Gender: masculine.

*Homarus* Oersted, 1844, Regionib. mar.: 77. Erroneous spelling of *Homarus* H. Milne Edwards, 1837.

*Hommarus* Nardo, 1847, Sinonimia moderna Chiereghini: 4. Erroneous spelling of *Homarus* H. Milne Edwards, 1837.

*Stomarus* Huxley, 1880, Arch. Zool. expér. gén., 8: 96. Erroneous spelling of *Homarus* H. Milne Edwards, 1837.

*Homarus* Fishmongers Co., 1949, Distinctive Features of Fish: 82, 83. Erroneous spelling of *Homarus* H. Milne Edwards, 1837.

*Definition.*—The genus *Homarus* is characterized by its smooth exterior. The rostrum bears lateral and sometimes ventral teeth. A supraorbital,

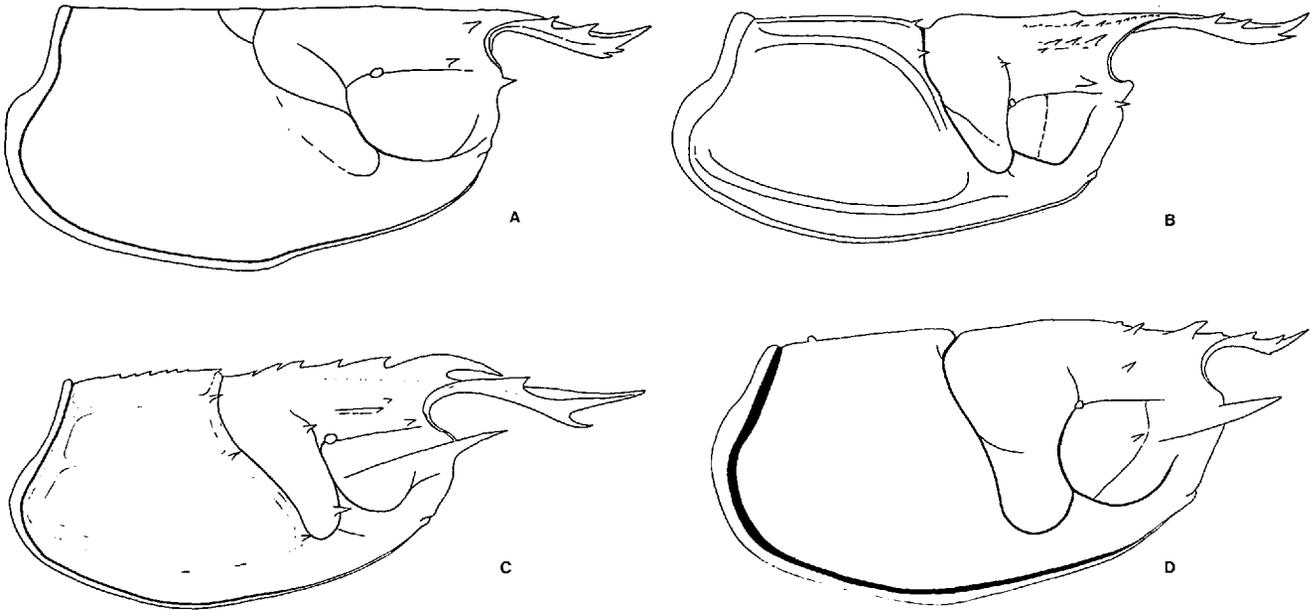


FIGURE 24. Schematic lateral view of the carapace of Nephropinae genera, showing grooves, spines, etc. A, *Homarus*; B, *Nephrops*; C, *Metanephrops*; D, *Eunephrops*.

postorbital and an antennal spine are present, but no other spines or teeth are found on the carapace. The subdorsal carinae are low, a distinct dorso-median groove extends over the full length of the carapace and rostrum. The postcervical groove is distinct in its upper part, its lower part is very faint and it is practically entirely replaced there by the intercervical groove, which is distinct and connects the upper part of the postcervical groove directly with the cervical. The urogastric groove is distinct, as are also the cervical and antennal grooves. The gastro-orbital and hepatic grooves are quite obscure. Apart from the marginal groove and carina, the carapace does not show any further grooves or ridges.

The abdomen is characterized by the total absence of ridges or grooves. The tergites are smooth and continue without any interruption in the smooth surface of the pleura. In all other genera of Nephropinae, even in species in which the tergites are smooth, there is a longitudinal carina separating the tergites from the pleura. The telson distinctly narrows posteriorly. The posterior margin is very convex. A pair of posterolateral spines is present. The upper surface of the telson shows in the basal part a short transverse ridge in the median, but there are no spines.

The second maxillipeds have the exopod with a distinct multi-articulated flagellum.

The chelipeds of the first pair are heterochelous, one has a crushing claw with gaping fingers and some big molar-like teeth in addition to smaller teeth, the other cheliped has a cutting claw with the fingers closing and the cutting edges straight and provided with numerous small denticles of about equal size, if larger teeth are present, these are not molar-like and are usually not placed on the cutting edge proper. The chelae, apart from a few spines, are smooth and show no carinae or grooves.

The thoracic sternum is very narrow: the sternites of the first to third pereopods show as narrow single or double median or submedian ridges. In the somite of the fourth pereopods the sternite bears two posteriorly diverging ridges in the male, in the female it carries the thelycum, but still is rather narrow.

The sternites of the second to fifth abdominal somites bear a median spine in the male, such a spine is absent from the first somite. In the adult females the abdominal sternites are unarmed, or the spines are strongly reduced.

The first pleopods of the male are transformed to rigid copulatory stylets and consist of two immovably fused segments. The distal segment is elongate triangular, and somewhat concave on the inner surface. No spines are present near the base of the gonopods. The appendix masculina of the second male pleopod is robust, but elongate; it reaches about  $\frac{3}{4}$  of the length of the endopod and bears many bristles distally.

The dorsal lobes of the protopod of the uropod end both in a tooth, the

apex of which is narrowly rounded. The exo- and endopod show no longitudinal carinae. A diaeresis is present on the exopod.

*Remarks.*—Until 1904, and long after, H. Milne Edwards (1837) was cited as the author of the genus *Homarus*. Rathbun (1904) pointed out, however, that the long overlooked name *Homarus* Weber, 1795, is both a synonym and a homonym of H. Milne Edwards's name. Until now it has escaped the attention of most carcinologists that another name, although junior to *Homarus* Weber, is a senior homonym and synonym of *Homarus* H. Milne Edwards, 1837. In 1825, namely, Guérin (1825: 768) already used the name *Homarus* in its present sense, citing Latreille as the authority for it; so far as I know Latreille never did use this name in print.

The genus *Homarus* consists of only three species, two of which are North Atlantic. The third, *Homarus capensis* (Herbst), has only been reported from South Africa. The former two species are listed here with their synonyms and distribution.

*Homarus americanus* H. Milne Edwards, 1837

*Astacus marinus* Say, 1817: 165 (not *Astacus marinus* Fabricius, 1775).

*Homarus americanus* H. Milne Edwards, 1837: 334.

*Astacus americanus* Stebbing, 1893: 203.

*Homarus mainensis* Berrill, 1956: 224.

*Homarus americana* Richards, 1951: 102.

*Description.*—The beautifully illustrated monographs of *Homarus americanus* by Herrick (1895, 1911) are still the fundamental treatises on the morphology and biology of the species. Furthermore there are many modern publications dealing with various aspects of this economically highly important species.

*Distribution.*—East coast of America from the Strait of Belle Isle, Newfoundland (Canada) to Cape Hatteras, North Carolina (U.S.A.). The species is commercially fished for practically throughout its range. Its known depth range extends from 0 to 480 m. The animals usually are found between 4 and 50 m, but occur as far as the edge of the continental shelf.

*Type.*—Say (1817) was the first to recognize the American *Homarus* as distinct from the European. He gave the former species the name *Astacus marinus*, employing *Astacus gammarus* for the latter. Say was under the impression that the specific name *marinus*, being invalid for the European species, might be used for the American. Under the present rules of nomenclature this is not correct, however, and *Homarus americanus* H. Milne Edwards, 1837, is the first available name for the present species. The type locality of Say's species is Long Branch, New Jersey, U.S.A. and one of the specimens from that locality may be indicated as the lectotype

of Say's species. *Homarus americanus* H. Milne Edwards is based on material of this species present in the Paris Museum and on Say's account of *Astacus marinus*. It seems best to make the lectotype of Say's species also the lectotype of *Homarus americanus* H. Milne Edwards, 1837, so that the two species become objective synonyms, and Long Branch, New Jersey, also becomes the type locality of *Homarus americanus*. The name *Homarus mainensis* has been facetiously suggested by Berrill to replace *H. americanus* and can fall as an objective synonym of the latter.

*Homarus gammarus* (Linnaeus, 1758)

*Cancer Gammarus* Linnaeus, 1758: 631.

*Astacus verus* Borlase, 1758: 274.

*Astacus marinus* Fabricius, 1775: 413.

*Astacus gammarus* Pennant, 1777: 8.

*Homarus marinus* Weber, 1795: 94.

*Astacus Europeus* Couch, 1837: 171.

*Homarus vulgaris* H. Milne Edwards, 1837: 334.

*Astacus vulgaris* H. Milne Edwards, 1838: 163.

*Homraus vulgaris* Oersted, 1844: 77.

*Hommarus vulgaris* Nardo, 1847: 4.

*Homarus gammarus* White, 1847: 72.

*Homarus europaeus* Przibram, 1902: 80; 1902a: 515, 516, 520.

*Homarus gammaracus* Bosca Seytre, 1916: 462.

*Homaris vulgaris* Fishmongers Co., 1949: 82, 83.

*Description.*—Descriptions of the species can be found in handbooks like those by Bell (1847: 242-249, fig.), Lagerberg (1908: 43, pl. 4 fig. 4), Pesta (1918: 177-182, figs. A, 57), Schellenberg (1928: 52-56, figs. 42-44), and Zariquiey Alvarez (1968: 199, fig. 86a). Coloured figures have been published by Leach (1875: pl. 35), Schaaning (1929: pl. 1, abnormality; 1931, pl. 1), Muus & Dahlstrøm (1964: 198, fig. 165) and many other, often popular, publications (not including cook books, gourmet advertisements, etc., where the species usually is figured cooked and thereby bright red).

*Distribution.*—The species inhabits the Atlantic coast of Europe and N.W. Africa from western Norway (Lofoten Islands) south to the Azores and Morocco. The species is also found throughout the Mediterranean and in the Black Sea. It inhabits depths between 0 and 60 m, and is of great commercial importance, especially in the northern part of its range.

*Type.*—The above names, with the exception of *Astacus verus* Borlase, which is an unavailable name (see Hemming, 1955: 355-368), are either erroneous spellings or otherwise objective synonyms of *Cancer gammarus* Linnaeus, 1758. *Cancer gammarus* L. is based not only on specimens from Scandinavia (specifically mentioned by Linnaeus) and on material from the Mediterranean (through Linnaeus' references to prelinnaean authors),

but also on North American specimens of *Homarus americanus* collected by P. Kalm and seen by Linnaeus. *Cancer gammarus* L., therefore, is a composite species, being based on both the European and the American species of *Homarus*. So far as I know no lectotype has ever been selected for *Cancer gammarus*, and in order to prevent any possible confusion, I now select the female specimen described by Linnaeus (1747: 174) as "Hummer. *Cancer gammarus dictus*" to be the lectotype of *Cancer gammarus* Linnaeus, 1758, and at the same time of *Astacus marinus* Fabricius, 1775, and of *Homarus vulgaris* H. Milne Edwards, 1837. Hereby these three nominal species become objective synonyms. The lectotype specimen was obtained by Linnaeus on or around 16 July 1746 at Marstrand on the west coast of Sweden at about 57°53'N 11°32'E, which locality thus now becomes the restricted type locality of the present species. The actual specimen cannot be traced and must be considered lost.

*Remarks.*—Couch (1837: 171) used the name "*Astacus Europeanus*, Leach" for the present species, without giving his reasons for doing so. The name, as far as I can find, has never been published by Leach. It was likely intended as a replacement name for *Cancer gammarus* L., 1758, and thus an objective synonym of the latter. Przibram (1902, 1902a) is, so far as I know, the only author who used Couch's name, be it in a different spelling.

#### *Nephrops* Leach, 1814

*Nephrops* Leach, 1814, in Brewster, Edinburgh Encycl., 7: 398, 400. Type species, by monotypy: *Cancer norvegicus* Linnaeus, 1758, Syst. Nat., (ed. 10)1: 632. Gender: masculine.

*Nephrops* H. Milne Edwards, 1837, Hist. nat. Crust., 2: 335. Erroneous spelling of *Nephrops* Leach, 1814.

*Nephros* Veranyi, 1846, Catal. Animali Invertebrati Marini Golfo di Genova e Nizza: 8. Erroneous spelling of *Nephrops* Leach, 1814.

*Neophrops* Gilchrist, 1921, Rep. Fish. mar. biol. Surv. S. Africa, 1: 80. Erroneous spelling of *Nephrops* Leach, 1814.

*Nephlops* Yokoya, 1933, Journ. Agric. Tokyo, 12: 48. Erroneous spelling of *Nephrops* Leach, 1814.

*Nephtops* Collings, 1934, Trans. Suffolk Nat. Soc., 2: 269. Erroneous spelling of *Nephrops* Leach, 1814.

*Nephropus* Yasuda, 1957, Bull. Naikai regional Fisher. Res. Lab., 10: 29. Erroneous spelling of *Nephrops* Leach, 1814.

*Definition.*—The rostrum has lateral and a ventral tooth. The subdorsal carinae are distinct and spinulate, especially some spinules in the middle of its length are distinct. The supraorbital spines are well developed, but not very large, and are followed by a row of sharp spinules, there is no actual supraorbital carina. A well-developed postorbital spine is present.

There is a single additional spinule slightly below the end of the row of spinules behind the supraorbital spine. An antennal, but no hepatic spine is present. There is a single small cervical spine. Behind the postcervical groove there is a pair of postcervical and intermediate spinules, but no others.

The postcervical, hepatic, cervical and antennal grooves are distinct. The intercervical groove is visible in its posterior part. The antennal groove anteriorly curves up to behind the antennal spine, there is no forward branch. The gastro-orbital groove is not very distinct, and in the middle gives off the buccal groove, which is rather faint and extends towards the antennal groove. The inferior groove is present but faint. The marginal groove and marginal carina are well indicated. The median carina extends from the gastric tubercle back. It carries a double row of granules and is interrupted by the postcervical groove. The intermediate and lateral ridges are present behind the postcervical groove, but not the branchial ridge.

The abdominal tergites show a pattern of transverse and longitudinal carinae and grooves, the latter are wide and filled with short hairs. A median carina is present on somites 2 to 6. A broad ridge, which is interrupted posteriorly separates the tergites from the pleura. The sixth abdominal somite carries no spines on the dorsal surface, neither are any spines placed on the posterior margin.

The telson is trapezoidal, narrowing slightly posteriorly. The posterior margin is somewhat convex and the posterolateral spines are well developed. At the base of the two diverging carina of the upper surface, the telson shows a short and sharp transverse median carina, but no spines.

The eyes are well developed. The cornea is large, well pigmented and kidney-shaped.

The first antennular segment is very long. The stylocerite is visible as a large lobe over the base of the segment, with an anterolateral spine, which reaches beyond the lateral margin of the segment.

The antennal peduncle bears a large and wide spine near the base of the scaphocerite. The latter is well developed, but rather narrow, with the inner margin convex, and regularly tapering towards the sharp apex. A spine is present above the opening of the antennal gland.

The epistome has a distinct ridge along the anterior margin, which bears a median forward directed tooth. The clavicular ridge is distinct. The posterior margin of the epistome is a high rounded ridge, which bears no spines or teeth. Just before the ridge there is a transverse groove and a deep median pit.

The second maxilliped has the exopod with a distinct multi-articulated flagellum. The third maxilliped has no spines or teeth on the carpus and merus.

The chelipeds of the first pair are dissimilar. One, the crushing claw,

has the fingers provided with a few large, rounded teeth in addition to a few denticles, it is gaping in large specimens. The other, the cutting claw, has the cutting edges closing and provided with numerous small denticles of about the same size; a large tooth is usually present mediad of the cutting edge of the fixed finger. The segments of these legs bear distinct longitudinal carinae with strong spines.

The chelae of both the second and third pereopods have a fringe of hair along the upper and lower margin; in the third leg this fringe is inconspicuous proximally. The fingers of the second and third legs bear no row of closely placed hairs on the outer surface.

The thoracic sternites are very narrow and visible only as single or double carinae between the bases of the legs which are placed close together. In the sternite of the fourth leg of the male the ridges diverge posteriorly slightly more than in previous somites and in the female there is a thelycum there.

The first pleopods of the male are formed to rigid copulatory stylets and consist of two immovably fused segments. There are no spines at the base of these gonopods. The appendix masculina of the second male pleopod is elongate, more than half as long as the endopod, truncated at the apex and with short bristles there.

The sternites of the second to fifth abdominal somites of the males and young females each bear a median spine. This spine is absent or strongly reduced in adult females.

The uropods have one median ridge on the endopod and two on the exopod. The diaeresis of the exopod is distinct and bears numerous denticles on the anterior margin. The protopodite has either dorsal lobe ending in a spine.

*Remarks.*—After Jenkins (1972) removed the Indo-West Pacific and West Atlantic species from the old genus *Nephrops* to a distinct genus *Metanephrops*, a single species was left in the genus *Nephrops* in its restricted sense, viz.:

*Nephrops norvegicus* (Linnaeus, 1758)

- Cancer norvegicus* Linnaeus, 1758: 632.
- Astacus medius* P. F. Gmelin, 1761: 20.
- Cancer caesareus* Linnaeus, 1764: 456.
- Astacus Norvegicus* Fabricius, 1775: 416.
- Astacus norvegicus* De Geer, 1778: 398.
- Astacus Gothicus* Meuschen, 1778: 85.
- Astacus norwagicus* Fabricius, 1781: 512.
- Cancer norvegicus* J. F. Gmelin, 1790: 2989.
- Homarus norwagicus* Weber, 1795: 94.
- Nephrops norvegicus* Leach, 1814: 400.
- Astacus rugosus* Rafinesque, 1814: 22.

- Nephrops Norwegicus* Guérin, 1844: 14.  
*Nephrops norvegicus* Veranyi, 1846: 8.  
*Nephropsis cornubiensis* Bate & Rowe, 1880: 160.  
*Nephrops norvegiacus* Groult, 1888: 118.  
*Nephrops norvegiens* Scott, 1889: 259.  
*Nephrops norwegius* Sheldon, 1905: 347.  
*Nephrops norvegica* Floericke, Kuhlmann, Lindemann & Muschler, 1911: 96.  
*Nephrops norvegicus* Collings, 1934: 269.  
*Nephrops norvegicus meridionalis* Zariquiey Cenarro, 1935: 26.

*Description.*—Descriptions of *Nephrops norvegicus* can be found in many handbooks of European Decapoda like those by Bell (1847: 251-254, fig.), Lagerberg (1908: 44, pl. 4 fig. 1), Pesta (1918: 183-189, fig. 58), Schellenberg (1928: 57-59, figs. 45, 46), Zariquiey Alvarez (1968: 201). Coloured figures are published by Leach (1816: pl. 36), Muus & Dahlstrøm (1964: 200, fig. 166) and in several popular and economic books.

*Distribution.*—The species is known from the eastern Atlantic from Iceland and W. Norway south to the Atlantic coast of Morocco. It is also found in the Mediterranean, but seems scarce or absent in the eastern part, and it does not occur in the Black Sea. It is known from depths between 20 and 824 m, and seems to prefer a muddy bottom.

*Remarks.*—In all species of Thymopinae the podobranch of the second maxilliped is absent, while in all species, but one, of the Nephropinae it is present. This one exception is *Nephrops norvegicus*, where this character is variable. In the Mediterranean and in the southern part of its Atlantic range the podobranch usually is present in this species, in the northern populations it usually fails; intermediate forms with a small podobranch on one side and nothing on the other have also been encountered. Zariquiey Cenarro (1935) erected the subspecies *meridionalis* for the southern form.

The names *Astacus medius* P. F. Gmelin, 1761, *Cancer caesareus* Linnaeus, 1764, and *Astacus gothicus* Meuschen, 1778, all three are unavailable names. The first and the last have been published in works that are rejected for purposes of nomenclature by the International Commission on Zoological Nomenclature: Gmelin's (1758-1777) "Onomatologia" in Opinion 123 (1931, Smithson. miscell. Coll., 73(7): 34-36), and Meuschen's (1778) "Museum Gronovianum" in Opinion 260 (1954, Opin. Decl. Int. Comm. zool. Nomencl., 5(21): 265-280). *Cancer caesareus* was first used by Linnaeus (1764) in the synonymy of *Cancer norvegicus*, and for that reason is unavailable (International Code, Article 11d).

*Types.*—Linnaeus' (1758: 632) original description of *Cancer norvegicus* is clear, and also all his references pertain to the present species. The type locality given by him is "in Mari Norvegico". His oldest reference is to Aldrovandus (1606: 113), whose specimen probably originated from the

Mediterranean, although this is not definitely stated. The next oldest reference is his own (Linnaeus, 1736: 39) record in "Elenchus animalium per Sueciam observatorum" in which no concrete locality (apart from "Suecia" as given in the title) is provided. In "Fauna Suecica" (ed. 1, 1746: 357, 358), however, Linnaeus refers to this 1736 record and to Aldrovandus, giving as locality "in mari Lapponiae adjacenti copiose". It is possible therefore that these two early Linnaean records are based on material that he saw when during his Lapland travels he reached the Atlantic coast of Norway at Sjørfold and Rørstad. However, this is by no means certain, and it seems best to select here as the lectotype of *Cancer norvegicus* the specimen (or the largest of the specimens) mentioned in the next oldest reference (Linnaeus, 1751: 327), viz., his "Skånska Resa" as "Kayser-Hummer kalladas Cancer". This specimen was obtained by Linnaeus near Kullen Peninsula in S. Sweden, 56°18'N 12°28'E. The latter locality thus becomes the restricted type locality of the species. The type specimen itself is in all probability lost.

The type locality of *Astacus rugosus* Rafinesque is Sicily; the type specimen (or specimens) is no longer extant.

*Nephropsis cornubiensis* Bate & Rowe, is based on an immature specimen of the present species, which was "taken floating on the surface of the sea". The type locality is "off the Dudman" (Dodman Point, Cornwall, England, 50°13'N 4°48'W). The whereabouts of the type material are unknown to me; Bate & Rowe (1880: 161) stated that the "collections that we may secure we propose to deposit in the museum of the Athenaeum at Plymouth. . .".

*Nephrops norvegicus meridionalis* Zariquiey Cenarro was described from syntype material originating from off both the Spanish Atlantic and Mediterranean coasts (Atlantic: Huelva, San Sebastian, and Coruña; Mediterranean: Rosas, Barcelona, Alicante, and Melilla; the latter locality in Spanish Morocco). The type material, or part of it, is in the Zariquiey collection in the Instituto de Investigaciones Pesqueras in Barcelona, Spain.

#### *Metanephrops* Jenkins, 1972

*Metanephrops* Jenkins, 1972, Crustaceana, 22(2): 161. Type species, by original designation: *Nephrops japonicus* Tapparone-Canefri, 1873, Mem. R. Accad. Sci. Torino, (2)27: 327. Gender: masculine.

**Definition.**—The rostrum shows lateral and a ventral, but no dorsal teeth. The subdorsal ridges are absent, but a median carina may be present, being most conspicuous near the apex of the rostrum and near the gastric tubercle. The supraorbital teeth are large and followed by a strong ridge, which extends almost to the postcervical groove and carries several strong teeth. Anteriorly the supraorbital ridge continues for a very short distance beyond the supraorbital spine and gradually disappears, it ends at the inner side of the lateral rostral ridge. This lateral rostral carina merges with the or-

bital carina. A large postorbital and antennal spine are present, as well as one or more metorbital spinules, which are placed before the postorbital and between the supraorbital and antennal spines. The antennal spine is very strong and continues posteriorly as a sharp and high antennal ridge, which reaches the cervical groove or stops short before it; sometimes a post-antennal spine is present. Behind the cervical groove a cervical and hepatic spine are present, these sometimes are connected by a row of cervical denticles; in a few species the cervical spine is absent. Behind the postcervical groove there are postcervical, intermediate, branchial and lateral spines, which sometimes are connected by a row of postcervical denticles; the branchial spines are sometimes small or absent.

Apart from the carinae mentioned above, the carapace shows sometimes a small postorbital carina behind the postorbital spine and a hepatic carina behind the hepatic spine. The intermediate, branchial and lateral carinae on the posterior half of the carapace are usually well developed (in some species the intermediate ridge is indistinct or absent). The marginal carina is always distinct. Of the grooves, the postcervical, hepatic, cervical and antennal are very distinct. The gastro-orbital is rather vague and the inferior is just indicated. Apart from the marginal no other grooves are shown.

The abdominal somites may show transverse or longitudinal grooves and ridges. In some species the tergites are perfectly smooth, but there is always a ridge separating the tergite from the pleuron; this ridge is either complete or interrupted in the posterior part. The pleura are large and overlap, they also may show some sculpturation or be entirely smooth. The sixth abdominal somite has one spine (sometimes more) on the ridge separating the tergite from the pleura, one in the middle of the posterior margin, and sometimes also one or more on the posterolateral angles and in the median line of the upper surface. The telson is quadrangular, slightly narrower posteriorly than anteriorly. The posterior margin is slightly convex, the posterolateral spines are well developed. At the base of the two oblique dorsal carinae there is a pair of sharp submedian spines.

The eyes are well developed with a large pigmented cornea.

The stylocerite forms a large lobe, which projects sideways beyond the lateral margin of the basal antennular segment, but it has no spine.

The scaphocerite is well developed, semicircular, or almost circular, the lamella sometimes overreaching the final tooth. There is a small spine at the antennal peduncle near the base of the scaphocerite. Over the opening of the antennal gland there is a lobe but no spine.

The epistome is smooth and in the center it is somewhat concave. The anterior margin is triangularly prolonged in the middle between the bases of the antennulae, it may show a pair of spines there. The posterior margin is high and unarmed. A distinct clavicular ridge is present.

The exopod of the second maxilliped is reduced and bears no flagellum. The third maxilliped has the posterior margin of the merus provided with spinules.

The large chelipeds have the chelae smooth, granulate or with ridges and spines. Spines are also present on the carpus and merus. The second pereiopod has a fringe of hair along the upper and lower margin of the chela, being indistinct proximally. The outer surface of the fingers shows some tufts of hair; these tufts being placed rather far apart. The third leg hardly shows a trace of the hair fringes, but the rows of tufts on the fingers have combined to a solid row of hairs that are directed towards the cutting edge. The last pereiopod has a distinct tuft of hairs at the anterodorsal end of the propodus.

The sternum of the thorax is wider than in *Nephrops*. Between the second to fifth legs sternal plates are visible which may end in antero- and posterolateral spines. In the female the sternal plates of the segment of the fourth leg have become a thelycum.

The first male pleopods consist of two immovably fused segments, which form a rigid copulatory stylet, which is slender and tapers distally. The sternite of the first abdominal somite of the male bears a strong spine at the external side of the base of the pleopods. The appendix masculina of the second male pleopod is a short oval lobe, which is twisted inwards and is far less than half as long as the endopod. No appendices internae are present on any of the pleopods. The protopodite of the uropods has the outer dorsal lobe unarmed and rounded, the inner ends in a spine. The exo- and endopod of the uropod are similar in shape to those of *Nephrops*.

The sternites of the first to fifth abdominal somites in the male and juvenile females have a sharp median spine, which is absent or greatly reduced in the adult females.

*Remarks.*—Until recently all the species now placed in *Nephrops* and *Metanephrops* were assigned to the former genus, although several authors, like De Man (1916: 98), Bouvier (1917: 17, 18) and Yaldwyn (1954: 730) remarked that *N. norvegicus* differs in several important details from the rest of these species. In 1972 Jenkins finally took the logical step and separated the Indo-West Pacific and American species as a separate genus from the old genus *Nephrops*, in which only the type species, *N. norvegicus*, was left. In the new genus *Metanephrops* Jenkins placed the 13 other recent species. These 13 species were divided by him (Jenkins, 1972: 171) into four groups, which, however, are not sufficiently sharply separated to be considered subgenera.

One of these groups is formed by the two Atlantic species of *Metanephrops*, both of which are restricted to American waters. These two species differ from the other *Metanephrops* species in the following characters:

1. The antennal carina bears a distinct spine in its posterior part just

before the cervical groove. This postantennal spine is absent in all Indo-West Pacific species.

2. A spine is placed above the cervical spine and a closely placed row of cervical denticles extends along the posterior margin of the cervical groove between the cervical and hepatic spines. In the Indo-West Pacific species the posterior margin of the cervical groove only bears the cervical and hepatic spines, rarely a few scattered spines are placed in between.

3. In the American species also the postcervical groove bears a row of postcervical denticles along its posterior margin, this row extends between the postcervical and the lateral spines. The Indo-West Pacific species only show here the postcervical, intermediate, branchial and lateral spines.

4. The combination of entirely smooth abdominal tergites and strongly spinulate ridges on the large chelae is only found in the American species.

#### KEY TO THE ATLANTIC SPECIES OF *METANEPHROPS*

- 1 Between the supraorbital ridges no tubercles or spinules are present. There are two or more metorbital spinules between the postorbital spine and the supraorbital ridge. The intermediate carina bears several distinct spinules over its full length. The ridge separating the tergite from the pleura of abdominal somites 3 to 5 is unarmed. .... *M. binghami*
- 1' Between the supraorbital ridges some scattered tubercles or spinules are present. There are only two metorbital spines, one before, the other obliquely below the postorbital spine. The intermediate carina bears, apart from the intermediate spine at the postcervical groove, no spines or spinules. The ridge separating the tergites from the pleura in abdominal somites 3 to 5 bears one or more spines in the anterior part. .... *M. rubellus*

#### *Metanephrops binghami* (Boone, 1927)

Figs. 25, 26

*Nephrops binghami* Boone, 1927: 91, figs. 18-20; Holthuis, 1946: 72; Holthuis, 1964: 75; Roe, 1966: 92, figs. 1-1, 1-2, 2, 4, 5; Manning, 1969: 307, 308; Firth & Pequegnat, 1971: 86; Jenkins, 1972: 163; Opresko, Opresko, Thomas, Voss & Bayer, 1973: 6, 20, figs. 2, 7, pl. 5.

*Nephrops rubellus*—Glassell, 1934: 454 (not *Metanephrops rubellus* (Moreira)).

*Nephrops rubellus binghami*—Springer & Bullis, 1956: 14; Bullis & Thompson, 1965: 9.

*Metanephrops binghami*—Jenkins, 1972: 171.

*Material examined.*—Bahama Islands: ALBATROSS sta. 2655, 619 m, 4 specimens (W,L).—GERDA sta. 256, 467-494 m, 1 male; sta. 925, 439-457 m, 1 juvenile (L).—Straits of Florida: COMBAT sta. 447, 549 m,

1 ovigerous female (W).—Gulf of Mexico off Mississippi: OREGON sta. 1380, 1719 m, 1 female (M).—Off British Honduras: OREGON sta. 3634, 348 m, 2 males, 1 female (M); sta. 3637, 220-311 m, 4 females (2 ovigerous) (L).—N.E. of Honduras: OREGON sta. 1868, 320 m, 5 males, 3 ovigerous females (W); sta. 3627, 366 m, 1 female (W).—Off Nicaragua: PILLSBURY sta. 1356, 296-375 m, 7 males, 11 females (9 ovigerous) (M, L). OREGON sta. 1900, 2067 m, 1 male, 3 females (W); sta. 3565, 440-458 m, 6 males (W); sta. 3566, 275-293 m, 1 male, 2 ovigerous females (L); sta. 3570, 366-439 m, 1 male (W); sta. 3574, 366 m, 5 males, 1 female (W); sta. 3575, 457 m, 1 male (W); sta. 3610, 457 m, 1 male (L).—Off the Caribbean coast of Panama: PILLSBURY sta. 340, 304-362 m, 1 male, 1 female (M); sta. 445, 338-342 m, 5 males, 7 females (6 ovigerous), 1 juvenile (M,L); sta. 446, 109-295 m, 1 female (M). OREGON sta. 3584, 366 m, 1 ovigerous female (W); sta. 3585, 247-256 m, 1 female (W); sta. 3590, 229 m, 1 female (L); sta. 3598, 366-402 m, 1 male (W).—Off Venezuela: PILLSBURY sta. 753, 384-607 m, 2 specimens (L). OREGON sta. 2351, 338-366 m, 1 male (W).—Near Grenada: OREGON sta. 2772, 329 m, 2 males, 5 females (W).—East of Trinidad: OREGON sta. 1983, 229 m, 1 male (W); sta. 1985, 274 m, 1 male, 1 ovigerous female (W).—N. of Cuba: OREGON sta. 1340, 457 m, 6 males, 15 females (13 ovigerous) (W,L); sta. 1341, 439 m, 10 males, 11 females (8 ovigerous) (W,L); sta. 1343, 457 m, 2 males, 5 females (1 ovigerous) (W).

*Description.*—The rostrum is large and slenderly triangular, reaching far beyond the antennular peduncle. It has a single large ventral tooth. The lateral margins are directed obliquely upward and have a single pair of large teeth. The upper surface of the rostrum behind the lateral teeth is concave, the anterior part shows a median carina. The supraorbital spines are strong and continue backward in a supraorbital ridge which extends almost to the postcervical groove. Either ridge bears three or four teeth behind the supraorbital. The supraorbital tooth is larger than the lateral rostral teeth and also larger than the teeth of the supraorbital ridge, the latter diminish in size posteriorly, the posterior may be very small. The antennal spine is very large and continues posteriorly as a high antennal carina, behind which there is a small postantennal spine. A distinct postorbital spine is present and a number of metorbital spinules, the lower of which is the largest. One or two of the metorbital spinules stand above the postorbital spine. The cervical spine, although small, is distinct, while also the hepatic spine is well developed. A row of cervical spinules extends along the posterior margin of the cervical groove between the cervical and hepatic spines, while usually one of these spinules is placed above the cervical spine. One or two small spinules are placed just before the upper part of the postcervical groove. Behind this groove there is a row of postcervical spinules, which connects the postcervical, intermediate, branchial and

lateral spines. Of those four spines the postcervical are the most distinct, the branchial the least. A row of paired spinules extends over the posterior median carina, and a single row over each of the intermediate carinae. The other ridges have no spinules.

The postcervical groove is distinct, extends all over the dorsum, and forms with the deep hepatic and cervical grooves a distinct loop. The antennal groove also is quite deep and reaches almost to the anterior margin of the carapace; its upper branch is indistinct. The gastro-orbital and inferior grooves are hardly noticeable. The marginal groove is distinct, as is also the marginal carina. Behind the postcervical groove the median, intermediate, branchial and laterobranchial carinae are well developed. The incisura clavicularis is quite distinct.

The abdominal somites are smooth or pitted, but do not show any grooves or carinae on the dorsal surface. The tergites are higher than the pleura and thereby are separated from them by an abrupt longitudinal carina, which shows a sharp incision in the posterior half; this incision is particularly noticeable in the second and third somites. In the sixth somite the carina has a spine just behind the middle; in none of the other somites such a spine is present. The upper surface of the sixth somite has one or two pairs of submedian spines; the posterior of these spines usually is placed farther apart than the anterior and sometimes is entirely or partly lacking. The posterior margin of the somite bears a single median spine. The pleuron of the first abdominal somite ends in a blunt tooth anteriorly, posteriorly it gradually merges with the sternite. The second pleuron is large and wide, it overlaps both the first and third pleura, and ends in a sharp posteriorly directed tooth. It shows in its basal part a wide transverse carina flanked by two depressed areas, and a smooth pit in the distal part. The third, fourth and fifth pleura are similar but they become gradually narrower and with less conspicuous sculpturation. In the sixth somite the pleura are bluntly angular, the posterolateral angle is roundedly rectangular with a spine just mediad of the angle on the posterior margin of the somite.

The telson is rectangular, slightly widened in the middle. It has a posterolateral spine at either side of the wide posterior margin, which is slightly convex. There are two submedian spines in the basal part of the telson at the confluence of the submedian carinae. Along the lateral margins there are two carinae, one on each side, which are as low and wide as the submedian.

The eyes are large and have large globular corneae, that are much wider than the eyestalk.

The basal segment of the antennular peduncle is elongate. The stylocerite forms a lobe at the outer margin of the base. The distal two segments are short.

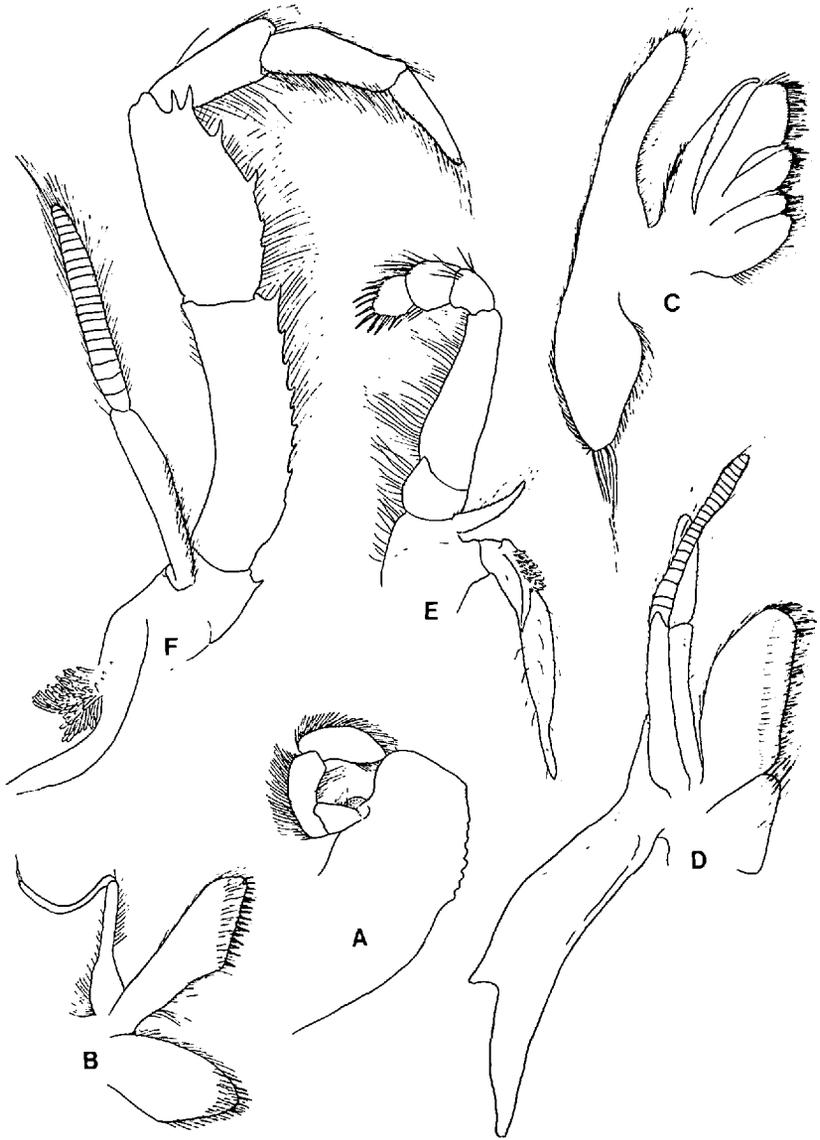


FIGURE 25. *Metanephrops binghami* (Boone), male from OREGON sta. 1900. A, mandible; B, maxillula; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. A-F,  $\times 3.4$ .

The scaphocerite is about as wide as long, the inner margin of the lamella is strongly convex, the final tooth is distinct and reaches with its full length beyond the lamella. There are two short blunt teeth on the external surface of the peduncle near the base of the scaphocerite, one of these teeth ends in a spinule. The lobe over the opening of the antennal gland is crenulate or may end in a small spinule. The penultimate segment of the antennal peduncle is a little longer than wide and somewhat longer than the ultimate. The antepenultimate segment shows a large ventral spine.

The second maxilliped is peculiar in that the exopod is short, failing to reach the middle of the merus, and possesses no flagellum. This feature proves also to occur in *M. rubellus* and in the type of the present genus, *Metanephrops japonicus*, as well as in the other species of the genus that I examined. It evidently is a generic character of *Metanephrops*.

The merus of the third maxilliped is rather wide and bears four to six sharp spines on its posterior margin, the distal of these being strongest. The ischium has the outer posterior margin serrate with the distal tooth largest, the inner posterior margin bears a number of short strong teeth and ends in a longer, stronger and sharply pointed inwards curved tooth.

The first pereopods reach with the entire carpus or part of it, sometimes with part of the merus, beyond the rostrum. The chela is about 8 to 10 times as long as wide. The fingers are about 0.6 to 0.7 times the length of the palm; their tips are crossing. The cutting edges of the fingers show a few small and many very small teeth; that of the fixed finger bears in addition a large triangular tooth slightly before the middle. The dactylus has in the basal part of the upper surface one large anteriorly directed spine and several spinules. There is also a small spine at either side of the articulation with the palm. The palm shows five longitudinal carinae each bearing a row of large blunt spines. The dorsal carina bears two rows of spines. The lateral carinae, each with one spine row, extend over the middle of either lateral surface. The two lower carinae (also bearing each a single row of spines) are placed side by side on the ventral margin and extend on to the fixed finger; the spines of the inner ventral row as a rule are the smaller. The carpus is about half as long as the palm. The anterior margin bears five large spines: two near each articulation and one anterodorsal in between. There are five rows of spinules, some of which also bear a few spines. The merus has three or four spines on the dorsal margin, the anterior of which is the largest. Also the lower margin bears three or four spines. On the outer surface of the merus there is a short row of spinules ending in a spine; in old specimens the spinules are indistinct, but the spine is present.

The second pereopod reaches with part of the palm beyond the rostrum. The leg is entirely unarmed. The fingers are  $\frac{2}{3}$  as long as the palm, about as long as the carpus and  $\frac{1}{3}$  as long as the merus. The third leg is some-

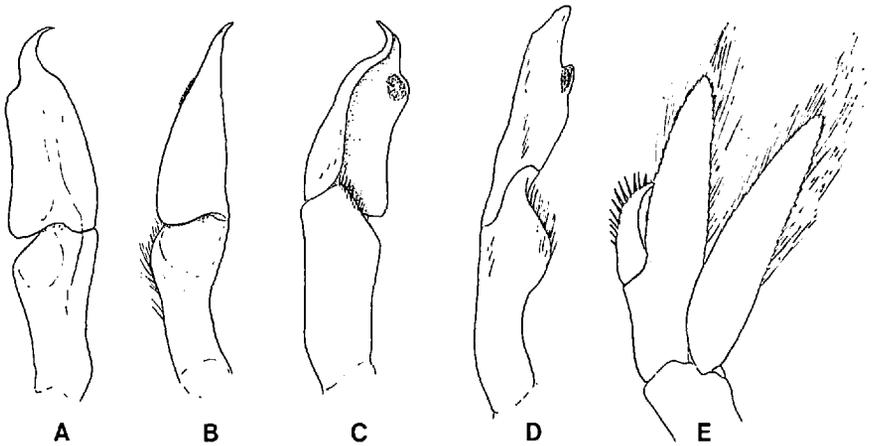


FIGURE 26. *Metanephrops binghami* (Boone), male from PILLSBURY sta. 340. A-D, pleopod 1: A, anterior view; B, lateral view from outside; C, posterior view; D, oblique lateral view from inside; E, second pleopod. A-E,  $\times 7.0$ .

what more slender than the second, it reaches slightly beyond the tip of the rostrum. The fingers are distinctly less than half as long as the palm. The carpus is  $\frac{2}{3}$  as long as the palm and almost half as long as the merus. The fourth leg reaches with part of the propodus beyond the rostrum. The dactylus is  $\frac{2}{3}$  to  $\frac{1}{2}$  as long as the propodus. The carpus is  $\frac{1}{2}$  to  $\frac{2}{3}$  as long as the propodus. The merus is about twice as long as the carpus and ends in an anterodorsal spine. The fifth leg fails to reach the end of the rostrum. The dactylus is somewhat less than half as long as the propodus. The propodus is about as long as the merus and somewhat more than twice as long as the carpus. The merus is unarmed.

Between the first pair of pereopods of the male the thoracic sternite forms a triangular structure that is connected by a median ridge with the more quadrangular sternite between the second legs. This latter sternite ends anteriorly in two anterolateral spines and has a median groove. The sternite between the third legs is similar to, but larger than that between the second legs, the median groove is wider, and it has not only anterolateral, but also posterolateral spines. Between the fourth legs the sternite is so deeply and widely hollowed, that the groove is far wider than the lateral parts, which actually have become almost vertical plates, the anterior end of which is rounded with a small notch, the posterior end being more triangular with a blunt tooth.

In the female the sternites between the second and third pereopods are similar to those of the male. That between the fourth legs is wider and more U- than V-shaped in transverse section. The lateral plates are of

about the same shape. The thelycum is low and not swollen at all, it consists of two anterior and one posterior plates. The anterior plates are separated by a median groove, which shows a little knob-like elevation at either side of its posterior end; from either of these elevations a ridge runs obliquely outward and backward to the end of the plate. The posterior plate lies in the median line of the body and is laterally enclosed by the posterior parts of the two anterior plates. The posterior plate has a rounded top, behind which it is somewhat constricted, and it widens posteriorly. The posterior margin of it is convex and ends in a median point.

The first pleopod of the male consists of two rather broad segments. The distal is peculiar by that its apex ends in a slender, sharply outwards curved spine. The posterior surface of this segment is concave in such a way that the outer part is folded over inward. An indistinct lobe is present on the inner margin; it bears on the posterior surface an oval field of short hairs, which possibly act as retinacula. The basal segment is hollowed out in the distal part of its inner surface, this concavity communicates with that of the distal part. It seems well possible that during the copulation the appendix masculina of the second pleopod acts as a plunger in the channel-like excavation of the first pleopod, the lower end of which probably covers then the male opening.

The appendix masculina of the second pleopod is much shorter than the endopod, it is curved at the top and at its inner margin it bears some 12 strong spinules.

The uropods have the protopod with the outer lobe rounded, the inner with a sharp spine.

*Illustrations.*—Good figures of the species are provided by Boone (1927, figs. 18-20).

*Size.*—The male specimens examined have the carapace length (inclusive of the rostrum) between 40 and 94 mm. In the females this length varies between 37 and 82 mm, in ovigerous females between 62 and 82 mm. There are two juveniles which have cl. 19 and 25 mm. The eggs are 2 to 3 mm in diameter. The total length of Boone's (1927) male holotype is "six and one-half inches" (about 166 mm). Her other three males had cl. (inclusive of the rostrum) 64 to 84 mm (46 to 51 mm without rostrum) and her female cl. 56 mm (35 mm without rostrum). Firth & Pequegnat (1971) reported their specimens to have carapace lengths (rostrum excluded) of 22 to 55 mm, while their single ovigerous female had the carapace (again without rostrum) 39 mm long.

*Colour.*—The rostrum is entirely bright white; this white colour usually extends dorsally as a narrow median band as far as the cervical groove. The rest of the carapace is pink or pale orange, usually with a brownish or greenish tinge. The pink colour as a rule is paler before the cervical

groove than behind it. Behind the postcervical groove the area above the intermediate carina is pink, below it the carapace is either white or dark pink. The teeth of the supraorbital carinae are pale orange or brownish as are also all spines of the carapace; those of the rostrum are white. Two conspicuous transverse bands of white are present on the carapace: the first occupies the cervical groove and the area just before it, the second the postcervical groove and a narrow strip just before that. These white bands, especially the second, is wider laterally than dorsally; they seem to be more sharply set off in juveniles than in the adults.

The dorsal surface of the abdomen is of the same orange or slightly brownish pink colour as the carapace. There is a white posterior band on the terga, which band is usually wider in the young than in the adults, where it may be very narrow or practically absent. The pleura are pink or white with a brownish or orange center. This brownish or orange area is sometimes indistinct, in other specimens it can be very striking. The sixth abdominal somite has two white elongate submedian spots on the anterior margin just outside the submedian spines, and a largish posterolateral white spot. The tailfan is red with a broad white band along the posterior margin; this white band also extends along the outer margin of the exopod. In some specimens these bands are pink and hardly distinguishable from the rest of the tailfan.

The eyestalk is pink or brownish. The cornea is black. The antennulae and antennae are pink with the flagella darker. The inner margin of the scaphocerite is darker than the rest.

The mouthparts and all legs are pink. Sometimes the second to fifth pereopods are whitish above or entirely white. The dactylus of the fourth and fifth legs, and the fingers of the second and third are dark pink or red. The large chelipeds have the fingers white or pale pink with the base red. The palm is red with a pink or whitish band at the base. The carpus is red with a narrow white or pink band distally. The merus is white, pink, or red with a pale distal band. The ischium is white or pink. In the juveniles the red bands are more distinct than in the adults.

The pleopods are pink. The eggs are bright blue. In specimens with the eggs in an advanced stage of development (the eyes being visible) the eggs were green. According to Roe (1966) still later stages of the eggs become yellowish red.

*Distribution.*—The species has a rather wide distribution in the West Indian region, its known range extends from the Bahama Islands to French Guiana and includes the Gulf of Mexico and the Caribbean Sea. The records in the literature are the following: N. of the Bahama Islands, 27°22'N 78°07.5'W, 619 m (Holthuis, 1964), Straits of Florida W. of the Bahama Islands, 25°07'N 79°15'W, 550 m (Bullis & Thompson, 1965; Firth & Pequegnat, 1971), off the northcoast of Cuba, 22°55'N 79°27'W, 440 m, and

22°55'N 79°16'W, 440 m (Springer & Bullis, 1956; Holthuis, 1964; Firth & Pequegnat, 1971), N. of Glover Reef, British Honduras, 885 m (type locality, Boone, 1927), N. of Honduras, 16°09'N 84°37.1'W, 338-530 m, 16°40.5'N 82°40'W, 284 m, and 16°43'N 82°38'W, 430-612 m (Firth & Pequegnat, 1971), E. of northern Nicaragua, 15°02'N 81°05'W, 439-622 m (Firth & Pequegnat, 1971). A distribution map of the species has been provided by Roe (1966: 95, fig. 2), who evidently saw material from near Trinidad.

*Habitat*.—The depths at which the species was taken varies from 229 to 703 m (with one haul from 109-295 m; see also discussion under "Type"). There are two records from greater depths, viz., 1719 m (OREGON sta. 1380) and 2067 m (OREGON sta. 1900), in both cases, however, the label evidently is incorrect as the collecting gear of sta. 1380 is said to be a dip net, and that of sta. 1900 a long line; therefore it is best to leave these two stations out of consideration. About 60 per cent of the catches was taken from between 300 and 500 m, and more than 80 per cent from between 250 and 600 m. The species was found on the following types of bottom: gray sand (ALBATROSS sta. 2655), coral sand (COMBAT sta. 447), coral-line bottom with shell rubble and plant debris (PILLSBURY sta. 340), shell and coral rubble (PILLSBURY sta. 753), hard clay (PILLSBURY sta. 1356), mud (OREGON sta. 2351), blue mud (OREGON sta. 1985), gray mud (OREGON sta. 1868).

*Biology*.—The species carries eggs throughout the year (Roe, 1966); in the present material ovigerous females are found from the months of January, May, June, July, August, and November.

*Type*.—The holotype specimen is preserved in the Bingham Collection of Yale University, New Haven, Connecticut, U.S.A. The type locality was given by Boone (1927: 91) as "from north of Glover Reef, in 484 fathoms of water, April 20, 1925". However, these data do not entirely agree with those given in the log of the PAWNEE, which gives the following entry for that day: "Monday April 20th '25. . . . . 9.17 AM trawl out on 950 fathoms of cable. Ship heading N ½ E. 10 AM started to heave home the trawl. 11.20 AM trawl home. Lat. 16°49'38"N Long. 87°58'15"W. Depth of water 384 fathoms. 11.45 started to let out the trawl. 0.15 PM trawl out on 950 fathoms of cable. Ship heading N.N.E. Running at slow speed under starboard engine. 1.15 PM started to heave in the trawl. 2.30 PM trawl home. Secured a number of valuable specimens in both hauls. Lat. 16°55'N Long. 87°55'30"W. Depth of water 473 fathoms. 2.45 PM started to let out trawl. 3.15 PM trawl out on 950 fathoms of cable. Ship heading Nx E, running as before under starboard engine. 4.07 PM started to heave home trawl. 5.15 PM trawl home in 590 fathoms of water. Lat. 17°00'20" N Long. 87°55'15"W." Of the three stations made on 20 April 1925 by the

PAWNEE the first is most likely the one that yielded the holotype of *Nephrops binghami* Boone. Boone's indication of the depth as 484 fathoms possibly is an error for 384 fathoms; the depths of the two other stations are even more different from the one given by Boone. There is a possibility that the material of the three stations was not kept separate and that the depth given by Boone is the average of the three (which average actually is 482.33 fathoms). The fact that none of the certain records of *Metanephrops binghami* gives a depth greater than 619 m also makes the possibility that the PAWNEE took the species at its shallowest station (384 fathoms = 703 m) greatest.

*Commensals.*—Some specimens carried lepadid Cirripedia on the carapace and the rostrum.

*Economic importance.*—Roe (1966), who suggested the trade name "Caribbean Lobsterette" for this species, dealt with its possible economic importance, especially in the southern and southwestern Caribbean.

*Remarks.*—*Nephrops binghami* was first described by Boone in 1927. Glassell (1934) in a critique of Miss Boone's work assigned it to the synonymy of *Nephrops rubellus*. Dr. Fenner A. Chace, Jr., recognized that the two taxa are distinct, although closely related, and considered the present species a subspecies of the next, his identification of the present form as *Nephrops rubellus binghami* was published by Bullis & Springer (1956). Still later the two taxa were again considered valid species.

Roe (1966: 97, figs. 4,5) provided length frequency curves of specimens from catches made off South America.

#### *Metanephrops rubellus* (Moreira, 1903)

*Nephrops rubellus* Moreira, 1903: 62; Moreira, 1903a: 7, fig. [3]; Moreira, 1905: 128, pl. 3; Doello-Jurado, 1938: 291, pl. 2; Ramos, 1950: 83, 86, figs. 1-3; Popovici & Angelescu, 1954: 508; Barattini & Ureta, 1960: 49, pl. 15; Holthuis, 1964: 77; Mistakidis, 1964: 11, 19; Jenkins, 1972: 163.

*Metanephrops rubellus*—Jenkins, 1972: 171.

not *Nephrops rubellus*—Glassell, 1934: 454 (= *Metanephrops binghami*); Roe, 1966: 92 (= *Eunephrops bairdii*).

*Material.*—Brazil: E.S.E. of Ilha Rasa near the entrance of Bahia de Rio de Janeiro; depth 50 m; January 1903; C. Moreira, 1 male, 1 ovigerous female syntypes (W: U.S.N.M. no. 29328).—Santos, São Paulo State; May 1960; L. R. Tommasi, 2 males (L).—Uruguay: Off Cabo Santa Maria, Rocha State, 34°38'S 52°15'W; 119-128 m; July 1925; C. Alexanderson, S. S. UNDINE, 2 males (W).

*Description.*—Moreira (1903a, 1905) and Ramos (1950) provided good descriptions of the present species. It is very similar to the previous species and the two at one time have been considered synonymous (Glassell, 1934). The differences between them are the following:

1. In *M. rubellus* there are 3 to 7 spinules in the median area of the carapace behind the gastric tubercle, these are absent in *M. binghami*.
2. Apart from the large metorbital spinule just above the antennal spine, there are no other metorbital spinules, or at most one or two minute ones placed obliquely below the postorbital spine. In *M. binghami* there usually are 4 or 5 metorbital spinules at least one of which is placed above the postorbital.
3. In *M. rubellus* the rows of postcervical and cervical denticles are denser and more regular than in *M. binghami*.
4. In *M. rubellus* the spinules on the posterior median carina are smaller and more numerous than in *M. binghami*.
5. There are no spinules on the intermediate carina of the carapace in *M. rubellus*.
6. The anterior half of the carinae that separate the tergum and the pleura of the third and fourth abdominal somite have a distinct spine in *M. rubellus*, none in *M. binghami*. In the fifth abdominal somite this carina bears two or three spines in *M. rubellus*, none or one in *M. binghami*.
7. The eyes in *M. rubellus* are usually smaller than those of *M. binghami*.
8. The merus of the third maxilliped of *M. rubellus* has more (7 to 9) spines on the posterior margin than in *M. binghami*.
9. The large chelipeds are far less elongate and slender in *M. rubellus* than in *M. binghami* and have the fingers more strongly curved up. The fingers are also shorter in comparison to the palm, being less than half as long as the palm. Also the other segments of these chelipeds are less slender.
10. The upper margin of the dactylus of the large chelipeds shows just before the middle a spine, which is distinctly larger than the spines behind it. In *M. binghami* the dorsal spines of the dactylus do not reach that far forwards and the distal is not larger than the previous.
11. The fifth leg in *M. rubellus* does not reach beyond the scaphocerite, while in *M. binghami* it reaches distinctly beyond that scale.
12. In *M. rubellus* the carapace does not show the white transverse bands that are so conspicuous in *M. binghami*.

*Illustrations.*—Good illustrations are given by Moreira (1905) and Ramos (1950).

*Size.*—The carapace length of the examined specimens varies between 60 and 69 mm, in the ovigerous female it is 60 mm. The diameter of the eggs

varies from 2 to 3 mm. Moreira (1905: 130) gave the carapace length of the largest male syntype as 81 mm (rostrum included) and of the largest ovigerous female syntype as 75 mm. Ramos's (1950) female had a total length of 110 mm.

*Colour.*—Moreira (1905) described the colour as follows: The general colour in both sexes is pink, the spines on the carapace and the chelipeds have the base red, the tip being white. The merus and carpus of the chelipeds show a red spot; the proximal three quarters of the dactylus, the proximal part of the fixed finger, the outer surface of the propodus and the abdominal appendages are red. The eggs are at first green, when the eyes of the embryos are visible they are almost white. Ramos (1950) gave practically the same colour description and provided photographs in which the colour pattern is well shown. In Ramos's specimen the anterior pair of lateral rostral teeth was white.

*Distribution.*—*Metanephrops rubellus* is a more southern species than *M. binghami*. It occurs off the east coast of South America roughly between 23° and 38°S. Records in the literature are: off Rio de Janeiro, Brazil, 30 to 35 miles offshore, 43° to 43.5°W, depth 60 to 100 m (type locality: Moreira, 1903, 1903a, 1905), E.S.E. of Ilha Rasa, entrance of Bahia de Rio de Janeiro, Brazil, 50 m (Holthuis, 1964), Santos, São Paulo State, Brazil (Holthuis, 1964), off Santa Catarina State, Brazil, 50-80 m (Mistakidis, 1964), Ilha Xavier, E. of Santa Catarina, Brazil, 66-132 m (Ramos, 1950), Uruguay (Barattini & Ureta, 1960), between Cabo Polonio and Cabo Santa María, Uruguay (Mistakidis, 1964), off Cabo Santa María, Rocha State, Uruguay, 34°38'S 52°15'W, 119-128 m (Doello-Jurado, 1938; Holthuis, 1964), N.E. of the mouth of the Rio de la Plata, Uruguay, 34°47'S 52°20'W, 34°50'S 52°20'W, 34°39'S 52°40'W, 35°08'S 52°35'W, and 35° 35'S 52°45'W, 110-150 m (Doello-Jurado, 1938), off Quequen, Buenos Aires Province, Argentina, about 38°32'S (Popovici & Angelescu, 1954), off Necochea, Buenos Aires Province, Argentina (Barattini & Ureta, 1960). Roe (1966: 93) stated that the ranges of *M. binghami* and *M. rubellus* overlap and that the latter is found "off the coasts of central and northeastern South America"—however, Dr. Roe informed me in a letter dated 26 May 1972, that the material that he in his 1966 paper had assigned to the present species actually proved to belong to *Eunephrops bairdii* Smith. So far *M. rubellus* is not known north of the equator and *M. binghami* not south of it.

*Habitat.*—The present species has been taken in depths between 50 and 150 m.

*Types.*—The type locality is "á distancia de 30 a 35 milhas da costa entre 43° e 43°, 30', W. Greenwich e á profundidade de 60 a 100 metros", it may be restricted here to E.S.E. of Ilha Rasa, entrance of Bahia de Rio de

Janeiro, Brazil, from which locality two of the examined syntypes originate. Type material is in the Museum Nacional, Rio de Janeiro and in the U.S. National Museum, Washington, D.C., U.S.A.

*Vernacular names.*—The names “Lagostim” and “Lagostinha do Mar” are used for the species in Brazil (Ramos, 1950). Mistakidis (1964: 11) reported the name “Langostinha” for it from Santa Catarina, S. Brazil.

*Eunephrops* Smith, 1885

*Eunephrops* Smith, 1885, Proc. U.S. Nat. Mus., 8: 167. Type species, by monotypy: *Eunephrops bairdii* Smith, 1885, Proc. U.S. Nat. Mus., 8: 167. Gender: masculine.

*Definition.*—The rostrum has lateral and ventral, but no dorsal teeth. The subdorsal carinae are distinct anteriorly, but soon fade out behind the supraorbital spines. The supraorbital spine is well developed and followed by a single slightly smaller postsupraorbital spine. There is no supraorbital carina. A postorbital, but no metorbital spines are present. The antennal spine is strong and is followed by a distinct and high antennal carina which reaches about halfway the distance to the cervical groove. Behind the antennal carina a distinct postantennal spine is present. No other spines are found on the carapace, except in one species a pair of postcervical spines in the submedian region. A gastric and intestinal tubercle are present but not very conspicuous. The dorsomedian groove is distinct and extends over the full length of the body. The postcervical groove is very deep; also the hepatic, the cervical and the antennal grooves are distinct. The antennal groove curves up towards the antennal spine, its forward branch is very indistinct, if visible at all. A buccal groove is sometimes present. The upper cervical and gastro-orbital grooves are faintly marked. Sometimes the urogastric and branchiocardiac grooves may be seen. There are no longitudinal ridges on the posterior half of the carapace. The marginal groove and carina are well pronounced. The carapace is regularly tuberculated. It is naked in the large, pubescent in the small specimens.

The abdominal somites have a distinct carina over the base of the pleura. This carina is interrupted in the posterior part, and sometimes also anteriorly. The tergites of the second to fifth somites have a transverse median groove over the posterior half, which groove usually is interrupted in the middle. The pleura are well developed, that of the second somite covers both those of the first and third. They all show depressions. The telson is about quadrangular. The lateral margins show some irregular serrations and end in a strong posterolateral spine. The posterior margin is broad and only slightly convex. There is a very small median elevation in the basal part of the telson, but no spines are present there.

The eyes are well developed with a rounded pigmented cornea which is somewhat wider, but distinctly shorter than the peduncle.

The stylocerite forms a blunt lobe on the upper surface of the basal segment of the antennular peduncle and extends laterally as a rounded projection before which, on the lateral margin of the segment, there may be a small spinule. The last two segments of the peduncle are of about equal length and measure about half the length of the basal segment.

The scaphocerite is small but well developed. Both the outer and inner margin are convex and fringed with hair, but the inner margin is more strongly convex. The scale ends in a short but distinct spine.

The ridge over the opening of the antennal gland is triangular.

The epistome has a low carina along the anterior margin. The central anterior part is prolonged between the bases of the antennulae and bears two tubercles. The posterior margin is a very high rounded carina, which bears two large rounded submedian teeth. This carina forms the anterior margin of the oral field. The clavicular carinae are high, crenulate and curved, they almost reach the posterior margin of the epistome and form the anterior margin of the efferent branchial opening.

The mandible is heavy with a strong ridge on the anterior surface; it bears a three-segmented palp. The maxillula has the lower endite oval, the upper is somewhat higher; the palp is two-segmented, with the ultimate segment slender and whip-like. The maxilla has the two endites each deeply cleft so that four slender laciniae are formed; the palp is slender and simple; the scaphognathite is large and narrow, ending in a blunt lower angle. The first maxilliped has the two endites distinctly separated; the palp is large and two-segmented; the exopod is slender, with a well-developed multi-articulated flagellum; the epipod is large. The second maxilliped is pediform and slender; the exopod is well developed, with a multi-articulated flagellum; a large epipod and a well developed podobranch are present. The third maxilliped is very slender. The distal three segments are of about the same length; the carpus shows a single anterodistal tooth. The merus and ischium are large and both have the anterior margin bluntly serrate. The inner anterior margin of the ischium is provided with a row of very strong teeth, the distal of which is the strongest and is somewhat curved. A well developed exopod with a multi-articulated flagellum, an epipod and a large podobranch are present.

The branchial formula is as follows:

	Maxillipeds			Pereiopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	—	—	—	—	1	1	1	1
Arthrobranchs	—	—	2	2	2	2	2	—
Podobranchs	—	1	1	1	1	1	1	—
Epipods	1	1	1	1	1	1	1	—
Exopods	1	1	1	—	—	—	—	—

The first pereopods are large and massive chelipeds; the left and right are equal. Tuberculate and spinose ridges are present on all segments from ischium to dactylus. The second and third legs are slender and chelate. The third is more slender than the second. Neither the chela of the second, nor that of the third has a fringe of hairs along the upper and lower margin, and in both the dactylus has on either side an oblique row of closely placed hairs that are directed toward the cutting edge. The fourth and fifth pereopods are simple and slender. The fifth is distinctly shorter than the fourth. Like in all other Nephropidae subchelar pads are present on the dactylus, and the propodus shows a projection touching the pad. The dactylus in both legs has two rows of hairs on the upper surface. The propodus of the fifth leg ends in a tuft of hairs.

The thoracic sternum is rather narrow and visible mostly as one median or two submedian plates. The female has a distinct thelycum between the bases of the fourth legs.

The sternites of the first five abdominal somites bear a sharp median spine in the male and juvenile females, they are unarmed in the adult female, or show at most a trace of a tubercle. The first sternite in the male bears no spines at the bases of the pleopods.

The first pleopods of the male consist of two immovably fused segments, which form a rigid copulatory stylet. The second male pleopod has an elongate appendix masculina. There are no appendices internae on any of the male or female pleopods, although the endopod shows a lobe in the basal part of the inner margin. The first pleopod of the female is two-segmented, very thin and slender.

The exo- and endopod of the uropod are broad, each ends in a posterolateral spine. The endopod bears a single, the exopod two longitudinal ridges. A complete diaeresis is present, with denticles on the anterior margin. The uropodal protopod has both dorsal lobes ending in a spine.

At present three species are known of this genus.

#### KEY TO THE SPECIES OF THE *EUNEPHROPS*

- 1 Carapace with submedian postcervical spines. No spine at the base of the scaphocerite. Second pereopod with the fingers slightly less than half as long as the palm ..... *E. bairdii*
- 1' Carapace without postcervical spines. A spine on the antennal peduncle near the base of the scaphocerite. Second pereopod with the fingers less than  $\frac{1}{2}$  as long as the palm ..... 2
- 2 Abdominal somites with distinct longitudinal median carina. Scaphocerite reaching to the base of the ultimate segment of the antennal peduncle. Third pereopod with the fingers about  $\frac{1}{3}$  of the length of the palm ..... *E. cadenasi*
- 2' Abdominal somites with a single transverse groove, which is inter-

raptured in the middle; no median carina is present. Scaphocerite small, failing to reach the middle of the penultimate segment of the antennal peduncle. Third pereopod with the fingers about  $\frac{1}{2}$  of the length of the palm ..... *E. manningi*

*Eunephrops bairdii* Smith, 1885

Figs. 27, 28, 29

*Eunephrops Bairdii* Smith, 1885: 167; Smith, 1885a: 234; Stebbing, 1893: 202.

*Eunephrops bairdii*—Chace, 1939: 42; Manning, 1969: 308.

*Nephrops rubellus*—Roe, 1966: 92 (not *Nephrops rubellus* Moreira, 1903).

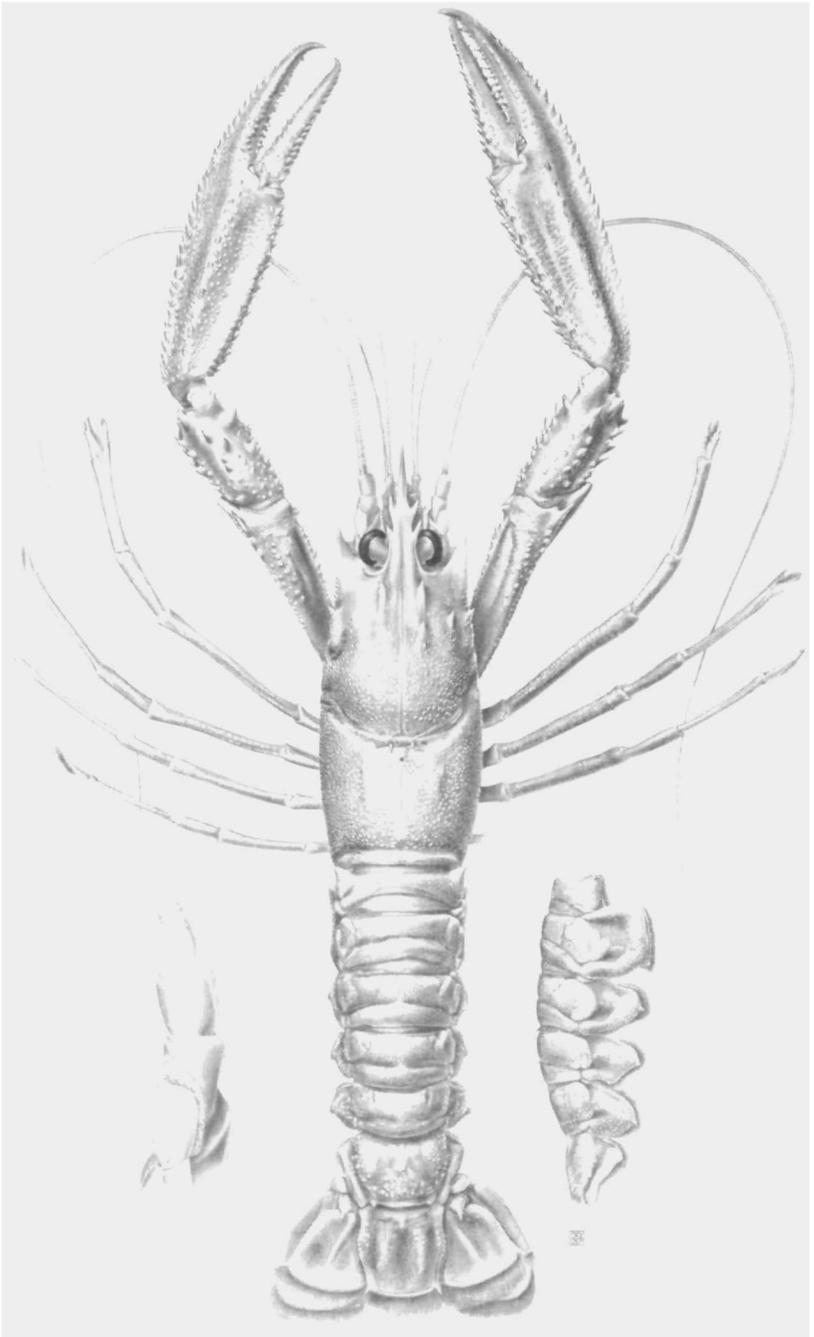
*Material*.—Off the Caribbean coast of Panama: PILLSBURY sta. 340, 304-362 m, 1 juvenile male; sta. 445, 338-342 m, 1 male, 3 females. OREGON sta. 3584, 366 m, 1 male (W); sta. 3590, 229 m, 2 males (L); sta. 3598, 366-402 m, 1 male, 1 female (W).—Off the Caribbean coast of Colombia: ALBATROSS sta. 2143, 284 m, 1 female holotype (W).

*Description*.—The rostrum reaches distinctly beyond the antennular peduncle. It bears two pairs of lateral teeth and one, rarely two small ventral ones; sometimes the ventral margin is minutely serrate and without large teeth. The subdorsal ridges are smooth or granular and usually are provided with a single spinule each. The supraorbital spine is large and sharp. The postsupraorbital spine is smaller and of about the same size as the postorbital and postantennal spines, with which it lies in about a straight line. The antennal spine is very large, the antennal carina bears small granules in the posterior part. Two distinct postcervical spines are present in the median area just behind the postcervical groove. The gastrical tubercle lies slightly behind the postsupraorbital spines. It and the intestinal tubercle are distinct and horn-coloured in old specimens. The grooves are distinct. The surface of the carapace is rather irregularly covered with small granules. In the juveniles the carapace is pubescent, in the older the pubescence is almost entirely confined to the grooves.

The first abdominal somite is minutely granular, especially anteriorly and laterally, with a spine on the anterolateral angle of the pleura; this anterolateral angle is narrowly, the posterolateral is broadly rounded. A groove extends obliquely upward from the posterolateral angle of the first somite and reaches the base of the pleuron. The tergites of abdominal somites 2 to 4 show a distinct transverse hairy groove in the posterior half; this groove is interrupted in the middle, slightly in the second somite, more distinctly so in the following two. In the fifth somite the groove is very ir-

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FIGURE 27. *Eunephrops bairdii* Smith, male from OREGON sta. 3584, dorsal view. Mrs. Carolyn Gast del.  $\times 0.6$ .



regular and often only visible as a series of irregular depressions. A curved longitudinal groove, which shows as a smooth groove-like depression in the pitted surface of the tergites, is visible somewhat above the bases of the pleura in the second to fifth somites. Laterally of this last groove there is a pit, which is deeper in somites 4 and 5 than in somites 2 and 3. A distinct but low and rounded ridge extends over the base of the pleura, being interrupted anteriorly and posteriorly by a groove. These grooves form a U-shaped depression on the pleura of the second somite, while in the following somites this U-shape becomes less and less distinct, the grooves being just linear in somite 5. A deep pit (which is deepest in the posterior somites) is visible in the distal part of the pleura. The pleura of the second somite are large and trapezoid with a distinct posteriorly directed distal tooth. The other pleura are more triangular, ending in a bluntly topped acute point which is directed down and only slightly posteriorly. The surface of the second to fifth tergites is minutely pitted, that of the pleura shows granules. The sixth somite has the dorsal surface irregularly granular with a deep groove over the bases of the pleura and a less distinct one parallel to the posterior margin; there are two submedian depressions in the middle.

The telson is quadrangular, slightly widened in the middle. In this widened part the lateral margin bears some blunt spinules or serrations. The upper surface is granular and hairy with three wide longitudinal grooves. The median groove starts behind a median tubercle in the anterior part of the telson.

The scaphocerite is oval and ends in a small spine; it reaches slightly beyond the middle of the penultimate segment of the antennal peducle. The outer margin is less convex than the inner. No spine is present on the antennal peduncle near the base of the scaphocerite.

The third maxilliped reaches with part of the dactylus beyond the rostrum. The carpus has a blunt spine in the lower part of the distal margin.

The large chelipeds are very strong and usually equal. They reach with the entire carpus or part of it beyond the rostrum. The chela is about four times as long as wide. Either of the lateral surfaces of the palm has a longitudinal carina over the middle, flanked by two depressions. The lower (external) margin of the chela carries two carinae side by side. The upper margin is formed by a single broad carina. All carinae carry rows of rather large and small blunt spines; between the carinae usually small blunt spinules are present. The dactylus carries spines on the upper margin. The cutting edges consist of many small and sharp denticles. In some of the larger males one of the chelae has some of the teeth on the cutting edge widened or enlarged. The carpus is slightly less than half as long as the chela; it carries spines of various sizes which are arranged in more or less distinct longitudinal rows. The upper margin carries two large teeth, the anterior of which is the largest and placed subdistally, just behind the dor-



FIGURE 28. *Eunephrops bairdii* Smith, specimen USNM no. 139624. A, mandible; B, maxillula; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. A-F,  $\times 3$ .

sal articulation lobe with the chela. The outer surface has three rows consisting of one to three large and several small spines. The lower surface has two spines on the lower articulation lobe with the palm, and one or more spines on the anterior margin. The inner surface has a row of spines in the proximal half; of these spines the distal is large. The merus is somewhat more than half as long as the chela. Its inner surface is almost smooth, the ventral surface carries one strong distal spine and numerous spinules, which are concentrated near the margins. The outer surface shows minute granules; a shallow longitudinal groove is present in the lower half. The upper surface bears a sharp and strong distal spine and several spinules or granules.

The second pereopod reaches with the chela beyond the rostrum. The fingers are slightly less than half the length of the palm. The carpus is practically as long as the palm and half as long as the merus. The third leg is more slender than the second and just reaches beyond the rostrum. Its fingers are  $\frac{2}{3}$  as long as the palm. The carpus is half as long as the chela, the merus is as long as the chela.

The fourth pereopod reaches slightly beyond the rostrum. The propodus is about twice as long as the dactylus. The carpus is somewhat longer than the dactylus and the merus is less than twice as long as the carpus. The fifth leg is short and slender and fails to reach the base of the scaphocerite. The ratio between the lengths of the various segments is about as in the fourth leg.

In the male the plates of the thoracic sternite belonging to the second legs are narrow and end in a spinule, those of the third are rounded. The fourth thoracic sternite has the two oblique plates distinct and placed against the bases of the legs. Both the posterior and the anterior end are broadly rounded, the upper margin shows a concavity in the posterior part. All the plates are rather hairy. In the female the plates of the thoracic sternite of the second legs are slender and end in narrow blunt tips, they are followed by a median tubercle. The plates of the next somite are placed close to each other and each ends in a blunt top. Between the fourth legs a distinct thelycum is visible. It is elongate trapezoidal, widening posteriorly. The median slit starts in about the middle of the length of the thelycum, and reaches backward. From the anterior end of the slit four carinae extend to the four corners of the thelycum. Between these ridges the anterior and lateral surfaces of the thelycum are somewhat concave; the anterior surface slopes rather gradually down, the lateral more abruptly. The posterior margin of the thelycum is widely triangularly incised. On either side of the median slit the posterior surface of the thelycum is somewhat convex. An almost vertical obcordate plate, which has the upper margin thickened, lies against the posterior end of the thelycum.

The distal segment of the male first pleopod is elongate, being widest

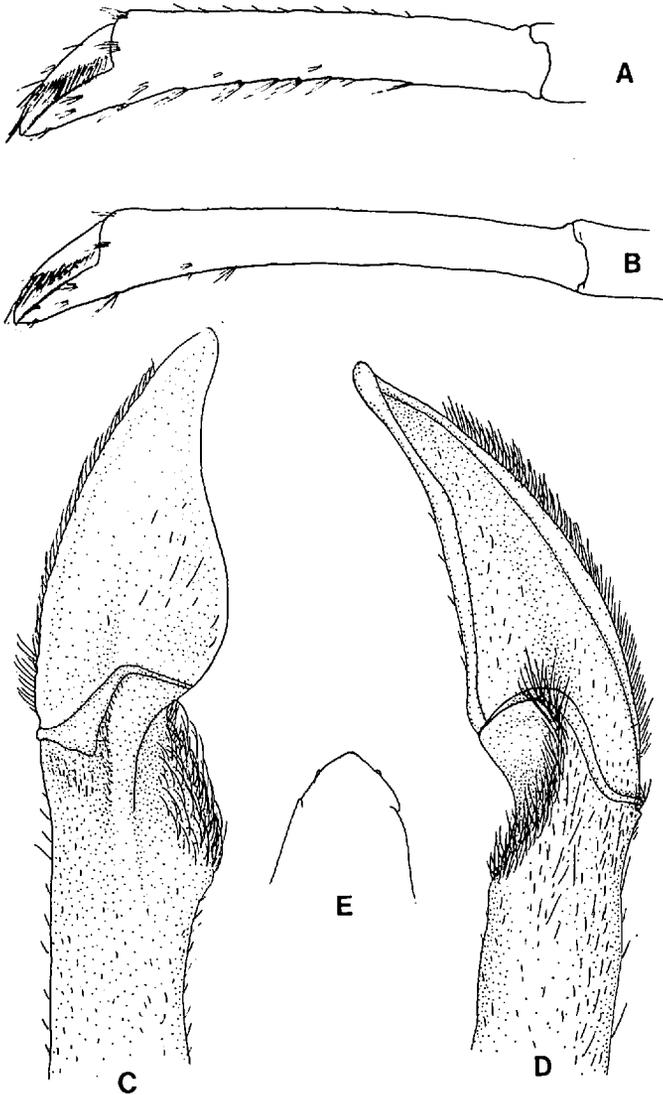


FIGURE 29. *Eunephrops bairdii* Smith. A, chela of second pereiopod; B, chela of third pereiopod; C, D, first male pleopod; E, apex of first male pleopod. C-E, Lilly Manning del. A, B,  $\times 3.4$ .

somewhat above its base and narrowing gradually distally; the anterior margin is slightly concave. The inner surface is somewhat hollowed and communicates with a wide groove on the anterior surface of the basal segment. The appendix masculina of the second male pleopod is slender and elongate, reaching almost to the end of the endopod. It bears short bristles on its lateral margins and long ones in the distal part.

In the juveniles the postcervical spines are more distinct than in the adults, but the spine on the pleuron of the first abdominal somite is less so. Also the juveniles have the whole body covered with a short and soft pubescence. The third maxillipeds fail to reach the end of the rostrum. The second pereiopods just reach the end of the rostrum, the third falling short of it. The spines on the chelae are much smaller than those in the adults, which gives the juveniles a quite different appearance from that of the adults.

*Size*.—The examined males have the carapace length between 44 and 90 mm, the females between 46 and 69 mm. The holotype, a female, has cl. 69 mm.

*Colour*.—Roe (1966: 93), who mentioned the species under the name *Nephrops rubellus* described it as "solid red to orange red". A colour slide was made of one of the specimens taken at PILLSBURY sta. 445, just after it came aboard. This slide gives a general impression of the animal as a pink lobster with red legs. The body is orange-brown with the distal part of the rostrum (the lateral teeth excluded) deep red. A red colour is also noticeable in the median area of the carapace from the supra-orbital spines back. The spines and teeth on the carapace and rostrum are whitish or pink. The abdomen has the same colour as the carapace, but shows reddish bands along the posterior margins of the segments; these bands fade out anteriorly. The entire tailfan is solid pale red. There seems also to be some red colour on the pleura, but this is not quite clear from the slide.

The eyestalk is pink, the cornea black.

The antennulae, antennae, chelipeds and all following pereiopods are uniformly deep red. The hairs on them are yellowish.

*Distribution*.—*Eunephrops bairdii* so far is only known from the south-western Caribbean, being taken there off the coast of Panama and Colombia only. The only definite previous record is that of the type, which was collected off Colombia, 9°30'45"N 76°25'30"W. As shown above, all the material obtained by the PILLSBURY and OREGON originates from off Panama.

*Habitat*.—The depth at which the species was taken varies from 229 to 366 m (actually from 229 to 366-402 m). Of only two stations at which the species was taken the type of bottom is known: green mud (ALBATROSS

sta. 2143) and coralline bottom with shell rubble and plant debris (PILLSBURY sta. 340).

*Vernacular name.*—Roe (1966) proposed the trade name “Red Lobsterette” for this species.

*Eunephrops cadenasi* Chace, 1939

Figs. 30, 31, 32

*Eunephrops cadenasi* Chace, 1939: 40; Holthuis, 1946: 72; Manning, 1969: 308.

*Material.*—Northwest Providence Channel, Bahama Islands, ISELIN sta. 137, 591 m, 1 female (M).—S. of Jamaica, PILLSBURY sta. 1225, 530-558 m, 2 males, 1 female (M,L).—Off Colombia, PILLSBURY sta. 374, 373-434 m, 1 male (L).—Off Dominica, OREGON sta. 5926, 503 m, 1 male (W).

*Description.*—*Eunephrops cadenasi* resembles *E. bairdii* very closely, so that here only the differences between the two species are given:

The rostrum in *E. cadenasi* has the tip curved more strongly upward. No ventral teeth are present in any of the examined specimens. The lateral spines are larger and more spreading; the anterior pair is distinctly larger than the posterior. The median groove of the carapace is narrower and sharper. Also the supraorbital, the postsupraorbital, postorbital, antennal and postantennal spines are stronger and more slender. There are no postcervical spines. In the adult there may be some granulate elevations in the median area behind the postcervical groove, but no spines are present there, either in the juveniles or the adults. The surface of the carapace is more regularly and more distinctly tuberculate than in *E. bairdii* and less hairy, even in the small specimens.

The first abdominal somite, instead having the tergite smooth and pitted, shows a median transverse groove, before which there is a granular transverse ridge. The pleura are coarsely granular. The second to fifth abdominal somites have a distinct longitudinal carina. The transverse groove, which in *E. bairdii* is visible in these somites, is present here also, but widens medially along the median carina. A short longitudinal groove is present above the bases of the pleura of the second to fifth somites, which groove is absent in *E. bairdii*. The pleura are as in the previous species, but are more coarsely tuberculate, show a distinct row of pearly tubercles over the median line, and have the apices less sharply pointed. The sixth somite has the tubercles larger and more numerous. The telson has the posterior margin slightly narrower and the posterolateral spines smaller. The granules of the upper surface are larger and more numerous.

The scaphocerite reaches to the base of the ultimate segment of the antennal peduncle. The lamella more gradually tapers to the tip, which more-

over is sharper and stronger than in *E. bairdii*. A good-sized spine is present on the external side of the base of the scaphocerite.

On the median ridge of the inner (= lower) surface of the palm of the large first chelipeds, the distal spine, although bluntly topped, is strikingly longer than the others, which are low and rounded. On the inner surface of the dactylus a similarly bluntly topped spine is present. In *E. bairdii* these spines are smaller and less conspicuous. The segments of the cheliped show many more small granular tubercles than in *E. bairdii*.

In the second cheliped the fingers measure  $\frac{1}{3}$  of the length of the palm and are conspicuously shorter than in *E. bairdii*. The carpus is about  $\frac{2}{3}$  as long as the palm and half as long as the merus. The third leg reaches with part of the chela beyond the scaphocerite. The palm is three times as long as the fingers. The carpus is half as long as the chela and half as long as the merus.

The fourth leg reaches with the dactylus beyond the rostrum. The propodus is about three times as long as the dactylus, about twice as long as the carpus, and as long as the merus. The last leg reaches about to the base of the scaphocerite.

The pleopods are much the same in the two species.

*Size.*—The carapace length of the examined males lies between 46 and 135 mm, those of the females are 40 and 50 mm.

*Colour.*—Chace (1939: 42) described the colour in preserved specimens as "a salmon pink on the dorsal surface of the carapace and rostrum, fingers and distal portions of the hands of the large chelae, the dactyls and the distal portions of the propodi of the remaining legs. Except for the tips of some of the larger spines on the chelipeds which are also salmon pink, the animal elsewhere is white". Colour slides have been made of the specimens of PILLSBURY sta. 374 and 1225, and of OREGON sta. 5926, immediately after the material came on board. The general colour impression of the animal is that of a lobster with a brick red body, the abdomen being lighter than the carapace, with the legs, including the chelae pink or reddish, but with the distal parts far deeper red than the rest.

The carapace is of a red colour dorsally throughout, only the post-cervical groove shows as a narrow pale line. The entire rostrum, including the anterior median part of the carapace is deep red, as are also the antennal and other spines. The entire lateral part of the carapace, including a narrow region above the antennal spine is very pale pink, being practically white. The posterior margin of the carapace often is of a darker red than the part anterior to it. The abdomen is rather pale brownish red, with a narrow, often not very distinct red line along the posterior margins of the somites. This red line is most conspicuous near the articulations between the somites. The telson is like the rest of the abdomen, but shows a trans-

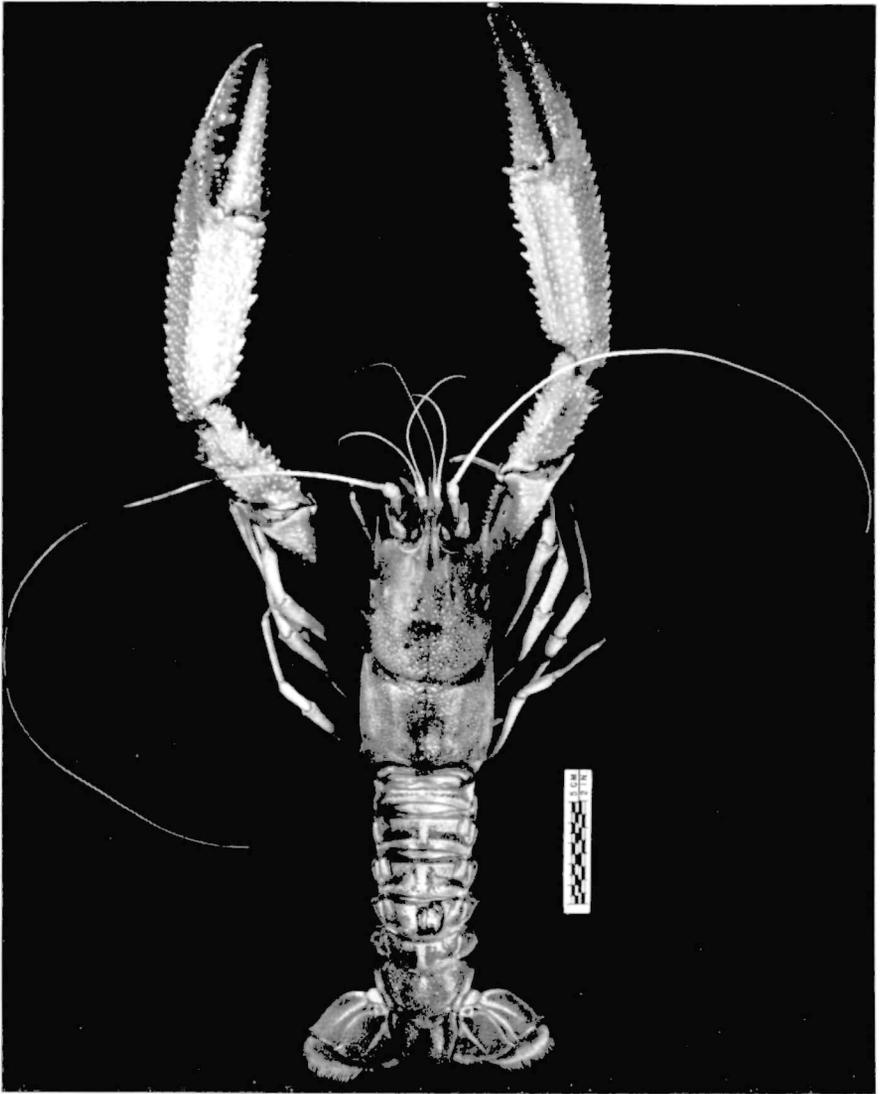


FIGURE 30. *Eunephrops cadenasi* Chace, male from PILLSBURY sta. 374. Animal in dorsal view.  $\times 0.25$ .

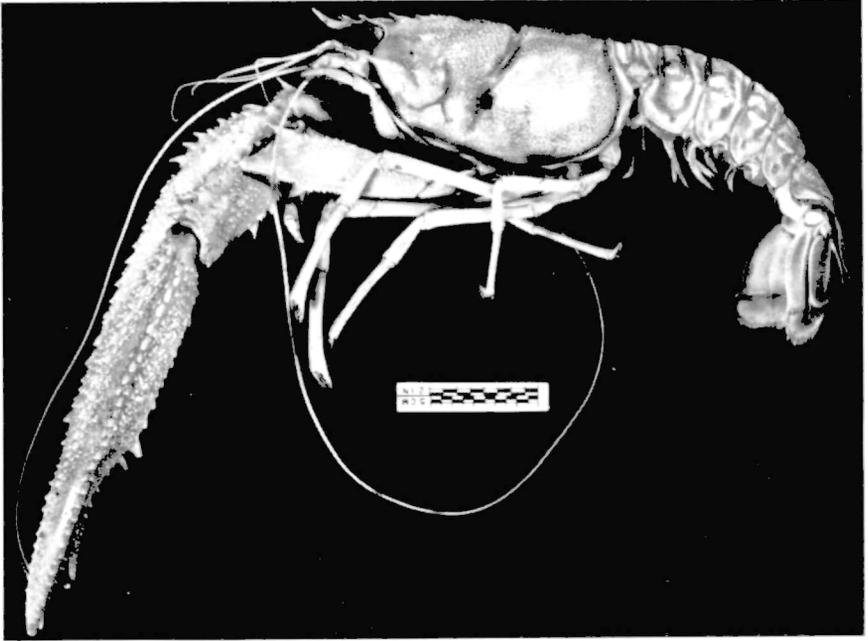


FIGURE 31. *Eunephrops cadenasi* Chace, male from PILLSBURY sta. 374. Animal in lateral view.  $\times 0.3$ .

verse white or pale pink area in the basal part. The uropodal exo- and endopods have the inner half pink or red, the outer half whitish.

The eyes have a pink peduncle and a black cornea.

The antennular and antennal peduncles have the margins of the segments red. The flagella are uniformly red.

The large chelipeds in most specimens are very pale pink or whitish with the fingers and some of the spines deep red. Only in the specimen from PILLSBURY sta. 374 the entire cheliped is red, although the fingers are of a conspicuously deeper red colour. In the following legs (in all specimens) the ischium, merus, carpus and a larger or smaller part of the propodus are pink or whitish, while the remaining part of the propodus and the entire dactylus are deep red; a pink spot may be present in the extreme distal part of the ischium. The pleopods are whitish or pale pink.

The colour of this species seems to differ from that of *E. bairdii* (if the specimens examined are typical for the species) in that the red of the rostrum extends farther back, by that the spines on the carapace are red, by having only half of the uropodal endo- and exopods coloured red, by the more striking colour difference between the fingers and the rest of the

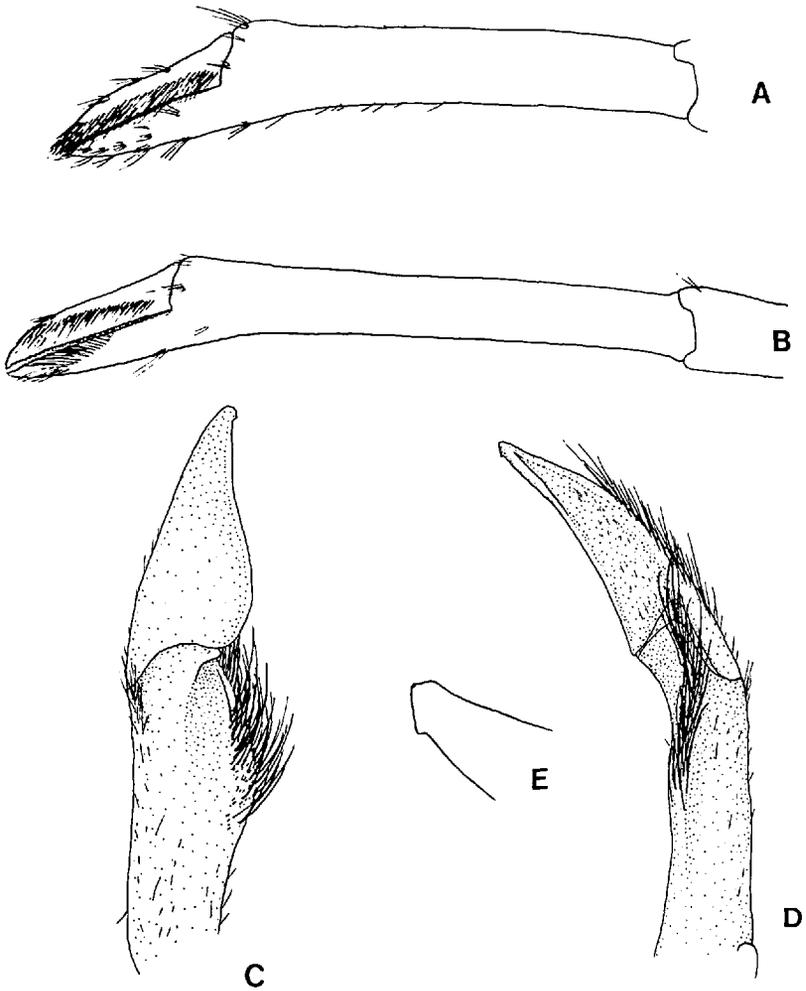


FIGURE 32. *Eunephrops cadenasi* Chace. A, chela of second pereiopod; B, chela of third pereiopod; C, D, male first pleopod; E, apex of male first pleopod. A, B,  $\times 4.2$ . C-E, Lilly Manning del.

large chelipeds, and by having the second to fifth pereiopods not uniformly red, but with the proximal part whitish or pale pink.

*Distribution.*—So far *Eunephrops cadenasi* was only known from the type locality: "Nicholas Channel south of Cay Sal Bank, Lat.  $23^{\circ}21'N.$ , Long.  $79^{\circ}58'W.$ , 300-315 fathoms". The present material shows that the species

occurs both in the Caribbean Sea (S. of Jamaica and off Colombia) and outside the Caribbean Arc (Bahama Islands and off Dominica).

*Habitat*.—The species has been found in depths between 434 and 591 m (actually between 373-434 and 591 m). The bottom configuration of none of the stations where it has been taken has been noted.

*Remarks*.—The female from PILLSBURY sta. 1225 is abnormal in having the rostrum short, not reaching beyond the second segment of the antennular peduncle. It probably has been broken and subsequently regenerated. This same specimen carries a small third lateral tooth just in front of the posterior of the lateral teeth of the left side of the rostrum.

***Eunephrops manningi*, new species**

Figs. 33, 34, 35

*Material*.—Florida Straits, 550 m, SILVER BAY sta. 2483, 1 male holotype (W).—Near Anguilla, 393-451 m, PILLSBURY sta. 984, 2 males (M,L).

*Description*.—The rostrum reaches distinctly beyond the end of the antennular peduncle. The lower margin in the holotype shows one tooth and some fine serrations; in the two paratypes no ventral teeth are present, only some fine serrations are visible. The lateral rostral teeth resemble those of *E. cadenasi*, but the posterior is only slightly smaller than the anterior. In the smaller of the two paratypes a third, still smaller, pair of lateral teeth is present behind the posterior pair, in the larger paratype the right side of the rostrum shows three, the left side two lateral teeth. The postsupraorbital spines are small and placed close to the supraorbital, they are situated distinctly before the postorbital and postantennal spines. Behind the post-cervical groove there is no trace of spines. The carapace is almost entirely without pubescence. The granules are smaller than in *E. cadenasi*.

The first abdominal somite has a very faint transverse groove. The anterior angle of the pleuron is acute but not spiniform. In the following somites there is no dorsal median carina. The transverse grooves are of equal width throughout and do not widen towards the middle. The longitudinal groove over the base of the pleura is very faint. The pleura resemble those of *E. bairdii*.

The scaphocerite is very minute and fails by far to reach the middle of the penultimate segment of the antennal peduncle. It is oval and has a rounded or blunt top. A distinct spine is placed at the base of the scaphocerite on the antennal peduncle.

The first chelipeds are slightly unequal in the PILLSBURY specimens, in the specimen collected by the SILVER BAY one of the chelipeds is missing. In the PILLSBURY specimens the right cheliped, although about as long as the left, is slightly wider. Both chelipeds in the new species are distinctly



FIGURE 33. *Eunephrops manningi* new species, holotype. A, frontal part of animal in oblique dorsal view; B, chela of second pereiopod; C, chela of third pereiopod. A-C,  $\times 3.6$ .

wider than those of *E. cadenasi*; they are about 2.5 times rather than 3 times as long as wide. The palms in *E. manningi* are also more swollen, so that the median longitudinal ridges on both the dorsal and ventral surfaces are far less conspicuous. The strong spine at the anterior end of the ventral ridge is very distinct and sharp, on the rest of the ridge only inconspicuous

tubercles are noticeable, the basal one of these being largest. The basal part of the ventral surface of the dactylus shows a large blunt spine, which is directed somewhat towards the fixed finger. The cutting edges of the fingers of the left chela are straight and evenly crenulated. In the right cheliped this crenulation is coarser, and the cutting edges show three large bluntly triangular low teeth, one of which is placed in the proximal part of the edge of the fixed finger, fitting between the other two which are situated on the cutting edge of the dactylus. The upper margin of the dactylus in both chelae shows three or four large blunt spines in the extreme proximal part, the rest of that margin being finely serrate. The carpus and merus of the large chelipeds are about similarly armed as in *E. cadenasi*, but the larger spines are stronger and the small ones are less well developed than in that species. The upper anterior margin of the carpus shows two very strong spines, one just to the outside of the inner articulation with the palm, the outer near the outer margin. Behind the latter spine there is a row of one strong and one or two very small spines. Parallel and more mediad of this row there is a row consisting of two strong and one small spines, the anterior of these spines is the strongest and is placed a slight distance behind the anterior margin of the carpus. The inner margin of the carpus bears one strong and one small spine. A few scattered small spinules are visible on the rest of the upper surface. The lower surface shows only small tubercles with one or two spinules. The merus has a strong anterodorsal and anteroventral spine; its lower surface bears some small spinules, its upper margin shows some small coarse tubercles in the anterior part.

The second leg reaches with the larger part of the chela beyond the rostrum. The fingers are  $\frac{1}{3}$  to  $\frac{1}{4}$  of the length of the palm, being distinctly shorter than in both *E. bairdii* and *E. cadenasi*. The carpus measures  $\frac{3}{4}$  of the length of the palm and is half as long as the merus.

The third leg reaches with half or more than half of the chela beyond the rostrum. The fingers are about  $\frac{2}{3}$  of the length of the palm. The chela is twice as long as the carpus and as long as the merus.

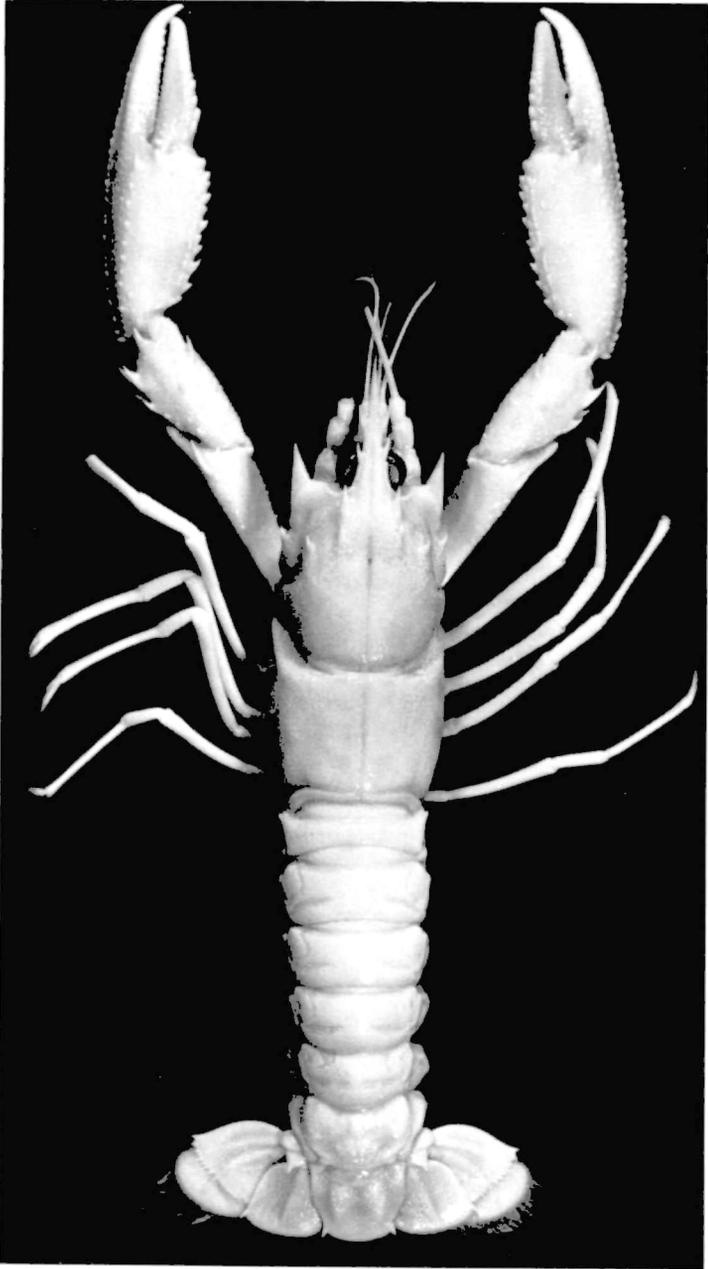
The fourth legs reach with part of the propodus beyond the rostrum. The propodus is about three times as long as the dactylus, almost twice as long as the carpus, and as long as the merus. The fifth leg reaches with the dactylus beyond the eye.

The pleopods and uropods do not show any appreciable difference from those of *E. cadenasi*.

*Size*.—The carapace length of the holotype is 70 mm, that of the two paratypes is 40 and 62 mm.

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FIGURE 34. *Eunephrops manningi* new species, paratype male from PILLSBURY sta. 984, in dorsal view.  $\times 0.95$ .



*Colour.*—The following colour description is made after colour slides taken of the two specimens from PILLSBURY sta. 984 right after the catch was brought aboard. The general impression of the species is that of a bright red and white banded lobster, which by this pattern alone is already strikingly different from the two other species of this genus which are more uniformly coloured.

The part of the carapace before the postcervical groove is deep carmine red all over, except for a central white spot at the base of the rostrum, and one at the base of the antennal spine. A broad white area extends behind the postcervical groove over more than halfway the distance to the posterior margin. Behind this white area the carapace is again red. In the white area there are two very small submedian brownish spots just behind the postcervical groove and a short brownish longitudinal median line in the posterior part.

The tergum of the abdomen is white with rather narrow red bands along the posterior margins of the somites. The pleura are red with a whitish spot in the middle of the anterior half. The telson is red except for an elongate white spot in the middle of each basal half; these spots are fused anteriorly. The endopod and the inner half of the exopod of the uropods are red, the outer half of the exopod and the protopod are white.

The eyestalks are red, the cornea is black.

The antennulae and antennae, inclusive of the flagella, are red. There is a whitish spot in the basal part of the antennal peduncle.

The large chelipeds in the larger specimen are carmine red but for the tips of the fingers, which are white, and some large white spots on the carpus. In the smaller specimen the fingers are almost entirely white, while the carpus is white with two red dorsal spots, the merus shows a white distal margin. In the larger specimen all the following legs are entirely red (except for the left fifth leg, which has the carpus and propodus white, the dactylus pink; the right fifth leg is uniformly red). In the small specimen all the legs are red, but for the carpus which is pink.

*Distribution and habitat.*—So far the species is only known from the type localities, Florida Straits and N.W. of Anguilla, in depths of 430 and 550 m. The holotype was taken from a muddy bottom, the bottom at PILLSBURY sta. 984 was given as brown mud.

*Types.*—The holotype, a damaged male, is preserved in the U.S. National Museum, Smithsonian Institution, Washington, D.C. under no. 139626. The paratypes are in the Institute of Marine and Atmospheric Science, University of Miami, Miami and the Rijksmuseum van Natuurlijke Historie, Leiden (no. Crust. D. 29288).

*Remarks.*—The species is remarkable by its small scaphocerite and the short fingers of the second and third pereopods. In the absence of post-



FIGURE 35. *Eunephrops manningi* new species, paratype male from PULLSBURY sta. 984, in lateral view.  $\times 1.2$ .

cervical spines it resembles *E. cadenasi*, but the structure of the abdomen resembles more that of *E. bairdii*. The colour pattern is strikingly different from that of both other species.

*Name*.—It is a pleasure to name this species for Dr. Raymond B. Manning, who in various publications has greatly furthered our knowledge of the Nephropidae. I am especially grateful to Dr. Manning for his generous permission to let me study the present *Eunephrops* material, of which he himself had planned to undertake the investigation.

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## APPENDIX

The following list contains the data for the stations of the expeditions of the ALBATROSS, ANTILLAS, BLAKE, COMBAT, ELTANIN, FISH HAWK, GERDA, GERONIMO, GRAMPUS, ISELIN, LUYMES, MICHAEL SARS 1910, OREGON, PILLSBURY, SILVER BAY, TALISMAN 1883, WALTER HERWIG, mentioned in the present paper. As far as possible the station number, position, depth, bottom, date and species of Nephropidea taken in it are mentioned for every station. The following abbreviations are used to indicate the bottom: bk., black; br., brown; bu., blue; cl., clay; cly., clayey; co., coral; cr., coralline; d., dead; db., debris; dk., dark; fn., fine; gn., green; gy., gray; lt., light; m., mud; o., ooze; pl., plant; pt., pteropod; rb., rubble; rk., rock; s., sand; sh., shell; sp., specks; st., soft; stk., sticky; w., wood; yl., yellow. In the column "Date" the day, month and year are given in this order; the month indicated in Roman, the day and year in Arabic numerals. In the last column the species of Nephropidea represented in the samples are listed by number: 1, *Thaumastocheles zaleucus*; 2, *Acanthacaris caeca*; 3, *Thymopsis nilenta*; 4, *Thymops birsteini*; 5, *Nephropsis aculeata*; 6, *N. rosea*; 7, *N. neglecta*; 8, *N. agassizii*; 9, *N. atlantica*; 10, *Nephropides caribaeus*; 11, *Metanephrops binghami*; 12, *Eunephrops bairdii*; 13, *E. cadenasi*; 14, *E. manningi*.

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
ALBATROSS					
Near Curacao:					
2125	11°43'N, 69°09.5'W	380	yl.m.,s. bk.sp.	18.II.1884	5
Off Colombia:					
2143	9°30.75'N, 76°25.5'W	284	gn.m.	23.III.1884	12
Bahama Islands:					
2655	27°22'N, 78°07.5'W	619	gy.s.	2.V.1886	5,11
ANTILLAS					
Upper Gulf of Mexico:					
53		402		1952	5
78		457	gy.m.	IX-X.1952	5
BLAKE					
Off Nevis:					
151	17°08'21"N, 62°42'W	651		15.I.1879	2
Off Dominica:					
185	15°24'55"N, 61°27'10"W	609	fn.s.,m.	27.I.1879	6
188	15°16'15"N, 61°24'40"W	681	fn.s.,m.	28.I.1879	6
Off Martinique:					
195	14°42'35"N, 61°13'15"W	918	fn.s.,o., bk.sp.	5.II.1879	7
200	14°31'55"N, 61°07'28"W	864	s.	7.II.1879	7
Off St. Lucia:					
222	13°58'37"N, 61°04'45"W	772	s.,o.	16.II.1879	6
Off St. Vincent:					
226	13°09'05"N, 61°16'20"W	776	fn.dk.s.	19.II.1879	6
227	13°10'10"N, 61°18'15"W	1046	s.,o.	19.II.1879	7
Off Grenada:					
264	12°03'15"N, 61°48'30"W	761	gy.o.	1.III.1879	6
COMBAT					
East of Florida:					
185	29°55'N, 80°10'W	338	gn.m.	5.XII.1956	5
226	28°02'N, 79°50'W	329	m.	31.I.1957	5
Straits of Florida:					
281	24°17'N, 82°47'W	393		14.III.1957	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
E. of Florida:					
329	29°15'N, 80°05'W	384		31.V.1957	5
Straits of Florida:					
447	25°07'N, 79°15'W	549		23.VII.1957	11
East of Florida:					
469	29°07'N, 80°01'W	366		30.VII.1957	5
486	29°29'N, 80°08'W	384		18.VIII.1957	5
499	29°50'N, 80°10'W	366		12.IX.1957	5

## ELTANIN

S.E. of Falkland Islands:					
1537	55°01'S, 39°55'W	2886-3040		8.II.1966	3
S. of South Georgia:					
1555	60°04'S, 35°59'W	1976-2068		15.II.1966	3

## FISH HAWK

Off New Jersey, U.S.A.:					
873	40°02'N, 70°57'W	183	st.stk.m.13.IX.1880		5
876	39°57'N, 70°56'W	220	st.stk.m.13.IX.1880		5
1148	39°54'N, 71°22'W	183-229		23.IX.1882	5
Straits of Florida:					
7281	24°13'45"N, 81°58'15"W	554			5

## GERDA

Straits of Florida:					
15	25°45'N, 80°00'W	275-302		30.V.1962	5
66	25°25.5'N, 79°59'W	366		26.IX.1962	5
67	25°31'N, 79°57'W	351		26.IX.1962	5
76	25°28'N, 80°00'W	344-348		28.IX.1962	5
77	25°29'N, 79°54.5'W	329-339		28.IX.1962	5
91	25°21'N, 79°41'W	605-648		18-19.IV.1963	2
93	25°03'N, 79°45'W	733		19.IV.1963	2,6
94	25°08'N, 79°44'W	733		19.IV.1963	6
122	24°02.5'N, 82°03.5'W	686-715		19.VI.1963	5
131	24°11'N, 80°57'W	733-787		21.VI.1963	2,6
144	24°38'N, 80°15'W	751		23.VI.1963	7
152	26°20'N, 79°39'W	641		24.VI.1963	6
161	26°37'N, 79°50'W	412-421		26.VI.1963	5,6
172	27°25'N, 79°56'W	183		29.VI.1963	5
173	27°08'N, 79°53'W	200-220		30.VI.1963	5
175	27°19'N, 79°44'W	421-430		30.VI.1963	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Bahama Islands:					
190	25°57'N, 78°07'W	733-897		4.VII.1963	6
191	26°02'N, 78°10'W	824-860		4.VII.1963	5
Straits of Florida:					
197	25°30'N, 79°58'W	329		10.IX.1963	5
222	24°23'N, 80°28'W	824		22.I.1964	1,6
225	24°24'N, 80°22'W	805		23.I.1964	6,7
226	24°28'N, 80°16'W	802-805		23.I.1964	1,6
228	25°04'N, 80°03'W	320		24.I.1964	5
Bahama Islands:					
251	27°25'N, 78°41'W	293-311		5.II.1964	5
256	27°37'N, 78°56'W	467-494		6.II.1964	5,11
260	27°47'N, 79°14'W	549-567		7.II.1964	5
Straits of Florida:					
265	25°39'N, 80°01'W	329-335		29.III.1964	5
362	24°10'N, 81°42'W	631		15.IX.1964	2
368	24°03'N, 81°10'W	961-1016		15.IX.1964	7
435	24°17'N, 82°26'W	384-417		28.XI.1964	5
437	24°17'N, 82°17'W	362-384		28.XI.1964	5
439	24°14'N, 82°29'W	566-584		29.XI.1964	2,5,6
440	24°14'N, 82°21'W	549-567		29.XI.1964	5
442	24°05'N, 82°33'W	742-753		29.XI.1964	6
443	24°05'N, 82°21'W	792-829		29.XI.1964	2
460	24°19'N, 82°48'W	207-247		25.I.1965	5
462	24°20'N, 82°46'W	174-201		25.I.1965	5
464	24°18'N, 83°00'W	357-370		25.I.1965	5
465	24°18'N, 82°56'W	403		25.I.1965	5
467	24°18'N, 82°56'W	348-370		25.I.1965	5
469	24°17'N, 82°48'W	357-384		25.I.1965	5
475	24°14'N, 82°39'W	550		26.I.1965	5
Bahama Islands:					
524	26°17'N, 78°41'W	513-715		3.III.1965	5
Straits of Florida:					
649	26°34'N, 79°43'W	494		15.VII.1965	5
652	27°07'N, 79°46'W	393-403		16.VII.1965	5
654	27°16'N, 79°49'W	324		16.VII.1965	5
655	27°00'N, 79°49'W	262-287		16.VII.1965	5
657	27°08'N, 79°49'W	200-216		16.VII.1965	5
658	27°15'N, 79°44'W	310-320		16.VII.1965	5
659	27°20'N, 79°40'W	366		16.VII.1965	5
East of Florida:					
672	27°53'N, 79°03'W	796		18.VII.1965	6

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Bahama Islands:					
709	26°26'N, 78°39'W	724		22.VII.1965	5
Straits of Florida:					
766	25°39'N, 80°00'W	297-309		16.IX.1965	5
830	25°40'N, 79°59'W	342		7.VII.1967	5
834	25°15'N, 80°10'W	79-86		10.VII.1967	5
845	25°36'N, 80°01'W	296-318		12.VII.1967	5
847	25°49'N, 80°03.5'W	137-201		2.VIII.1967	5
848	25°53'N, 80°03'W	201		2.VIII.1967	5
851	25°49'N, 80°03'W	210-214		2.VIII.1967	5
855	25°21'N, 80°01'W	207-247		25.VIII.1967	5
860	24°05'N, 81°46'W	722-754		29.VIII.1967	1
870	24°10'N, 81°07'W	754-807		30.VIII.1967	6
Bahama Islands:					
918	26°03'N, 78°05'W	805-823		26.IX.1967	6
925	25°58'N, 78°29'W	439-457		29.IX.1967	11
Straits of Florida:					
960	23°30'N, 82°26'W	1692-1697		31.I.1968	5
968	24°17'N, 82°34'W	320-437		2.II.1968	5
969	24°18'N, 82°33'W	269-402		2.II.1968	5
970	24°24'N, 82°08'W	512		2.II.1968	5
997	27°01'N, 79°51'W	285-302		21.V.1968	5
998	27°10'N, 79°43'W	366-375		21.V.1968	5
1096	24°19'N, 82°55'W	329-366		28.IV.1969	5
1098	24°15.5'N, 82°50'W	459-494		28.IV.1969	5
GERONIMO					
Off Gabon:					
206	02°00'S, 08°46'E	455-610		4.IX.1963	9
223	03°05'S, 09°15'E	604		6.IX.1963	9
GILLISS					
S. of Jamaica:					
31	16°58.0'N, 79°28.1'W	1088-1116	m., co.rb., pt.sh.	28.VII.1972	7
GRAMPUS					
E. of New Jersey, U.S.A.:					
5005		190			5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
ISELIN					
Tongue of the Ocean, Bahama Islands:					
21	24°27.75'N, 77°25'W	1545-1573		6.VII.1972	8
57	24°05'N, 77°23.2'W	1391-1408		27.II.1973	8
58	24°14.25'N, 77°17.7'W	1390-1426		27.II.1973	8
59	24°14.2'N, 77°24.8'W	1435-1455		27.II.1973	8
101	24°27'N, 77°27.9'W	1604		20.IX.1973	8
103	24°07.15'N, 77°21.15'W	1450		21.IX.1973	8
105	23°47.9'N, 77°04.3'W	1370		21.IX.1973	8
107	23°43.5'N, 76°44'W	1311		22.IX.1973	8
125	24°30.3'N, 77°21.9'W	1485		25.IX.1973	8
Northwest Providence Channel, Bahama Islands:					
137	26°07'N, 78°34.1'W	591		27.IX.1973	13
Tongue of the Ocean, Bahama Islands:					
144	24°30.35'N, 77°22.2'W	1483-1506	silty m.	3.II.1974	8
145	24°15.6'N, 77°18.76'W	1430-1447	silty fn. pale gy.cl.	3.II.1974	8
164	23°44.75'N, 77°13'W	1372	white pt.m.	6.II.1974	8
Exuma Sound, Bahama Islands:					
193	24°24.8'N, 76°11.4'W	1739-1756		13.II.1974	8
LUYMES					
Saba Bank:					
141	17°13'N, 63°42'W	300-600	m.	14.VI.1972	6
MICHAEL SARS, 1910					
Off S.W. Ireland:					
4	49°38'N, 11°35'W	923		10-11.IV.1910	9
W. of Gibraltar:					
24	35°34'N, 7°35'W	1615		6-7.V.1910	9
OREGON					
Off Mississippi:					
127	29°02'N, 88°34'W	424-472	bk.m.	23.XI.1950	5
260	29°42'N, 88°25.5'W	38	s.,m.	14.II.1951	5
307	29°00'N, 88°35'W	402	m.	22.IV.1951	5
Off Alabama:					
319	29°20'N, 87°25'W	576-622		28.IV.1951	2

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Off Mississippi:					
481	28°57'N, 88°40.5'W	384		7.IX.1951	5
Off W. Florida:					
489	27°44'N, 85°09'W	465	bu.m.	29.IX.1951	5
491	27°49'N, 84°59'W	366	br.m.	29.IX.1951	5
Off Texas:					
503	27°48.5'N, 94°39'W	366	m.	18.XI.1951	5
Off Louisiana:					
532	27°34.3'N, 93°10.2'W	402-549	m.,s.	4.XI.1951	5
Off Texas:					
542	27°41'N, 94°59'W	457-549	gy.m.	16.IV.1952	5
543	27°38.2'N, 94°59.4'W	640-732	gy.m.	16.IV.1952	6
549	26°58.5'N, 96°06.7'W	549-732	gy.m.sh.	18.IV.1952	2,6
Off W. Florida:					
984	26°23'N, 82°44'W	27	co.,sh.	7.IV.1954	2
Near Dry Tortugas, Florida:					
1005	24°20'N, 83°20'W	348	gn.cl., m.	13.IV.1954	5
1006	24°20'N, 83°20'W	348	co.,m.	13.IV.1954	5
1007	24°26'N, 83°24'W	329	gn.cl., m.	13.IV.1954	5
1010	24°35'N, 83°40'W	412	co.,m.	14.IV.1954	5
Off Alabama:					
1283	29°06'N, 88°19'W	476		13.III.1955	5
Near Dry Tortugas, Florida:					
1321	24°49'N, 84°06'W	311-366		7.VII.1955	5
1326	24°31'N, 83°35'W	366-412		8.VII.1955	5
N. of Cuba:					
1340	22°55'N, 79°27'W	457		15.VII.1955	11
1341	22°55'N, 79°16'W	439		16.VII.1955	11
1343	22°59'N, 79°17'W	457		16.VII.1955	11
Off Mississippi:					
1380	28°17'N, 88°37'W	1719		25.VIII.1955	11
Off Louisiana:					
1407	28°07'N, 89°59'W	472	m.	20.IX.1955	5
Off Alabama:					
1450	29°17'N, 87°41'W	439		18.II.1956	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Off Texas:					
1506	27°40'N, 94°58'W	503		6.V.1956	5
Near Dry Tortugas, Florida:					
1539	24°28'N, 83°30'W	402	lt.gy.m.	15.VI.1956	5
1550	24°28'N, 83°29'W	388		18.VI.1956	5
Off Honduras:					
1868	16°36'N, 82°37'W	320	gy.m.	21.VIII.1957	11
1871	16°39'N, 82°26'W	457	gy.m.	22.VIII.1957	5
Off Nicaragua:					
1900	10°40'N, 82°50'W	2067		8.IX.1957	11
1906	12°19'N, 82°27'W	594		11.IX.1957	6
1908	12°33'N, 82°20'W	641		11.IX.1957	1,2,6, 10
1909	12°35'N, 82°19'W	641		11.IX.1957	6,10
1910	12°40'N, 82°18'W	641	gy.m.	11.IX.1957	6
1911	12°44'N, 82°14'W	641		11.IX.1957	6,10
1915	13°13'N, 82°13'W	641	yl.m.	12.IX.1957	6,10
1918	13°25'N, 82°01'W	549		12.IX.1957	10
1919	13°30'N, 82°00'W	503-549		12.IX.1957	6
Off Honduras:					
1947	16°42'N, 82°33'W	549		17.IX.1957	10
1949	16°45'N, 82°25'W	549		17.IX.1957	6
1952	16°46'N, 82°16'W	549		17.IX.1957	2
E. of Trinidad:					
1980	10°10'N, 59°54'W	640	bu.m.	3.XI.1957	6
1983	09°53'N, 59°53'W	229		3.XI.1957	11
1985	09°41'N, 59°47'W	274	bu.m.	3.XI.1957	5,11
Off Surinam:					
2005	07°34'N, 54°50'W	366		6.XI.1957	5
2006	07°36'N, 54°42'W	412	bu.m.	7.XI.1957	5
Off Venezuela:					
2351	11°31'N, 62°24'W	338-366	m.	23.IX.1958	5,11
2353	11°35'N, 62°41'W	388-457	m.	23.IX.1958	5
Near Virgin Islands:					
2606	18°37.5'N, 64°57'W	384	s.,sh.	26.IX.1959	5
W. of Saba:					
2637	17°40'N, 63°40'W	659-695	s.,m.	30.IX.1959	2
Near Puerto Rico:					
2639	17°47'N, 66°04'W	412-439		4.X.1959	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Near Grenada:					
2770	11°40'N, 62°40'W	393		15.IV.1960	5
2772	11°30'N, 62°29'W	329		18.IV.1960	5,11
2774	11°32'N, 62°40'W	357-388		19.IV.1960	5
2780	11°36'N, 62°52'W	393-421		20.IV.1960	5
Off Mississippi:					
2820	28°23'N, 88°21.5'W	1829		15.VII.1960	8
Off Alabama:					
2824	29°7.5'N, 88°04'W	668-722		17.VII.1960	6
Off Louisiana:					
3296	28°36'N, 89°48'W	446-951		21.VIII.1969	5
Off Nicaragua:					
3565	14°10'N, 81°55'W	440-457		21.V.1962	2,11
3566	14°10'N, 81°58'W	275-293		21.V.1962	2,11
3570	14°08'N, 81°55'W	366-439		21.V.1962	5,11
3571	14°10'N, 81°50'W	549-604		21.V.1962	2,5,6, 10
3574	12°31'N, 82°21'W	366		23.V.1962	5,11
3575	12°35'N, 82°19'W	457		23.V.1962	2,5,11
3576	12°25'N, 82°15'W	549-585		23.V.1962	6,10
Off Panama:					
3583	9°16'N, 81°37'W	512		25.V.1962	5
3584	9°13'N, 81°30'W	366		25.V.1962	11,12
3585	9°12'N, 81°30'W	247-256		25.V.1962	11
3590	9°18'N, 80°22'W	229		29.V.1962	11,12
3598	9°03'N, 81°22'W	366-402		31.V.1962	5,11,12
3599	9°00'N, 81°23'W	457		31.V.1962	2,5
Off Nicaragua:					
3609	12°26'N, 82°24'W	503		2.VI.1962	2,5,10
3610	12°23'N, 82°29'W	365		2.VI.1962	5,11
Off Honduras:					
3627	16°50'N, 81°21'W	366		7.VI.1962	11
3628	16°57'N, 81°19'W	457		7.VI.1962	2,5
Off British Honduras:					
3634	16°44'N, 87°55'W	348		9.VI.1962	5,11
3635	16°58'N, 87°53'W	457-732		10.VI.1962	2,5,6, 10
3637	17°13'N, 87°55'W	220-311		10.VI.1962	11
Off Alabama:					
3651	29°12'N, 88°03'W	457-549		25.VII.1962	5
3652	29°12.5'N, 87°56.5'W	457		25.VII.1962	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
3655	29°10.5'N, 87°56'W	641-695		26.VII.1962	2,6
3660	29°10'N, 87°57'W	658-732		27.VII.1962	2,6
3676	29°10'N, 88°10'W	366		7.VIII.1962	5
3739	29°12'N, 87°58'W	494		26.VIII.1962	5
Off W. Florida:					
4082	27°54'N, 85°09'W	366		4.XII.1962	5
Off French Guiana:					
4293	7°14'N, 52°55'W	732		21.III.1963	6
4294	7°21'N, 53°15'W	549		21.III.1963	5,6
Off Colombia:					
4902	09°02.4'N, 76°31.5'W	731		28.V.1964	10
5926	15°36'N, 61°13'W	503		4.III.1966	13
Near St. Christopher:					
6721	17°37.5'N, 62°48'W	622-695		5.VI.1967	6
Off Colombia:					
11248	11°18'N, 74°44'W	610		9.XI.1970	2
PELICAN					
East of Florida:					
13	28°22'N, 79°53'W	329	bu.m.	11.III.1956	5
Straits of Florida:					
17	26°18'N, 79°51'W	263-366	gy.m.	29.III.1956	5
18	26°31'N, 79°46'W	430	gy.s.	29.III.1956	5
East of Florida:					
25	28°03'N, 79°52'W	274-320	bu.m.	8.IV.1956	5
31	29°36'N, 80°06'W	329-384	gy.m.	10.IV.1956	5
41	29°56'N, 80°09'W	339-344	gy.m.	1.V.1956	5
42	30°02'N, 80°05'W	375	gy.m.	1.V.1956	5
43	30°03'N, 80°03'W	408-443	rk.	2.V.1956	5
46	29°54'N, 80°10'W	317-329	gy.m.	2.V.1956	5
53	29°48'N, 80°12'W	293	gy.m.	22.V.1956	5
PILLSBURY					
Off Ivory Coast:					
41	4°47'N, 3°33'W	641-842		30.V.1964	9
Off Liberia:					
74	4°20'N, 9°26'W	641-733		4.VI.1964	9
Off Nigeria:					
256	3°45'N, 8°03'E	409-485		14.V.1965	9

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Off Panama:					
340	9°13.5'N, 77°46'W	304-362	cr., sh.rb., pl.db.	9.VII.1966	5,11,12
Off Colombia:					
374	9°57'N, 76°10.6'W	373-434		14.VII.1966	2,5,13
381	10°17'N, 75°59.9'W	597-724	m.	14.VII.1966	6
388	10°16'N, 76°03'W	814-1050	br.cl.	15.VII.1966	6,7
391	10°03'N, 76°27'W	1222-1748	br.m., d.sh.	16.VII.1966	7
394	9°28.6'N, 76°26.3'W	416-634		16.VII.1966	5,6
Off Panama:					
445	9°02.3'N, 81°23.8'W	338-342		21.VII.1966	5,11,12
446	8°58.1'N, 81°26.3'W	109-295	st.cly.m.	21.VII.1966	11
447	9°07.4'N, 81°11.8'W	657-673		21.VII.1966	2,6
Near Grenada:					
478	11°34.4'N, 62°10.7'W	576-598		2.VIII.1966	6
Straits of Florida:					
586	23°32'N, 82°33'W	1682-1737		24.V.1967	8
Off Yucatan, Mexico:					
607	18°30'N, 87°37'W	713-786		17-18.III.1968	6
Straits of Florida:					
634	23°33'N, 82°47'W	1638-1757	m.,r.	25.III.1968	8
Off Surinam:					
673	07°56.5'N, 54°39'W	1042-1070		11.VII.1968	7
675	08°26'N, 54°17'W	1234-1271		12.VII.1968	7
Off Venezuela:					
741	11°47.8'N, 66°06.8'W	1052-1067		23.VII.1968	7
748	11°24.8'N, 67°10.1'W	1784-1958		25.VII.1968	8
753	11°18.8'N, 68°22.0'W	384-607	sh., co.rb.	26.VII.1968	5,6,11
754	11°36.9'N, 68°42.0'W	684-1574		26.VII.1968	7
Off Colombia:					
776	12°13.3'N, 72°50.0'W	408-576		29.VII.1968	2,5,6
781	11°30.1'N, 73°26.5'W	530-567	m., pt.sh., w.,pl.	30.VII.1968	5,6
784	11°26.5'N, 74°10'W	567-713		31.VII.1968	6

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Near Tobago:					
844	11°30'N, 60°14.5'W	1464-1848		1.VII.1969	8
846	11°37.8'N, 60°37.4'W	659-1126		2.VII.1969	7
847	11°37.3'N, 60°59.4'W	733-1281		2.VII.1969	6,7
Off St. Vincent:					
861	12°42'N, 61°05.5'W	357-658	m.,co.	4.VII.1969	6
Off Martinique:					
892	14°17'N, 60°45.2'W	1116-1354		7.VII.1969	7
Off Guadeloupe:					
918	16°04.1'N, 61°25.7'W	399-497		11.VII.1969	5
920	16°05.8'N, 61°18.7'W	531-733		12.VII.1969	2
946	16°43.5'N, 61°57.0'W	733-833		17.VII.1969	2,6,7
Near Anguilla:					
984	18°26.4'N, 63°12.6'W	393-451	br.m.	22.VII.1969	14
988	18°29.3'N, 63°24.6'W	686-724		23.VII.1969	2,6
989	18°30'N, 63°23.7'W	664-706		23.VII.1969	2,6
Near Haiti:					
1178	19°14'N, 73°14'W	1765-1902	yl.cly. m.,w.db.	30.VI.1970	8
1187	18°17'N, 75°07'W	1034		2.VII.1970	7
S. of Jamaica:					
1197	17°33.5'N, 76°08.5'W	1481-1504		3.VII.1970	8
1224	17°31.2'N, 77°49.2'W	878-906	m.	6.VII.1970	2
1225	17°42.5'N, 77°58.0'W	530-558		6.VII.1970	5,13
1235	17°54'N, 78°25.3'W	1362-1586	st.m.	7.VII.1970	8
1238	18°16.0'N, 78°31.1'W	1591-1829	pl.db.	8.VII.1970	8
1256	17°27'N, 78°10'W	603-655		14.VII.1970	6,7
1261	17°13'N, 77°50'W	723-767		15.VII.1970	2
1262	17°21.4'N, 77°34.8'W	914-1065		15.VII.1970	7
Straits of Florida:					
1309	25°44'N, 79°50'W approx.	310			5
Off Nicaragua:					
1355	14°40'N, 81°33'W	450-576		31.I.1971	2,6
1356	14°53.9'N, 81°23.2'W	296-375	cl.	31.I.1971	11
SILVER BAY					
East of Florida:					
449	28°42'N, 79°48'W	512-576	gy.m.	11.VI.1958	5

## STATION DATA

Sta.	Position	Depth (m)	Bottom	Date	Species
Straits of Florida:					
1195	24°26'N, 83°33'W	641	m.,s.	8.VI.1959	2
1196	24°11'N, 83°21.5'W	732	m.,s.	8.VI.1959	6
East of Florida:					
1606	29°40'N, 80°12.5'W	329-366	m.	26.I.1960	5
Straits of Florida:					
2483	26°25.5'N, 79°01'W	550	m.	9.XI.1960	14
East of Florida:					
2725	28°23'N, 79°56'W	172		1.II.1961	5
3080	29°58'N, 80°07'W	348		30.IV.1961	5
TALISMAN, 1883					
Off Morocco:					
13	35°7'N, 9°38'W	1216	m.co.	11.VI.1883	9
Near Canary Islands:					
48	29°1'N, 14°51'W	1180	m.	26.VI.1883	9
51	28°35'N, 15°36'W	1238	yl.m.	27.VI.1883	9
WALTER HERWIG					
Off São Paulo, Brazil:					
85	25°13'S, 44°33'W	-		1968	8
Off Chubut Province, Argentina:					
191	46°13'S, 59°49'W	805		17.I.1971	4
N.E. of Falkland Islands:					
227	52°05'S, 55°20'W	1200		25.I.1971	4
Off Buenos Aires Province, Argentina:					
269	39°56'S, 55°54'W	800		19.VI.1966	4
Off Chubut Province, Argentina:					
305	45°15'S, 59°54'W	600		24.VI.1966	4