The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 4: Families Oplophoridae and Nematocarcinidae

FENNER A. CHACE, JR.

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 432

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SMITHSONIAN INSTITUTION PRESS
City of Washington
1986

ABSTRACT

Chace, Fenner A., Jr. The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 4: Families Oplophoridae and Nematocarcinidae. *Smithsonian Contributions to Zoology*, number 432, 82 pages, 42 figures, 1986.—Keys are offered for identifying all of the taxa currently recognized in the family Oplophoridae, including three new monotypic genera: *Heterogenys* for *Acanthephyra microphthalma, Janicella* for *Oplophorus spinicauda,* and *Kemphyra* for *Notostomus corallinus.* Of the 27 species remaining in the genus *Acanthephyra*, 14 are now known from the Philippine-Indonesian region. One new species is proposed in the genus *Ephyrina; E. childressi* was collected in the Halmahera Sea by the *Alpha Helix* in 1975, bringing to six the number of species recognized in that genus; two of the three species encountered in the Philippine-Indonesian region—*E. figueirai* and *E. ombango*—were originally described from the eastern Atlantic. Four species are currently recognized in the genus *Hymenodora,* but none of them have been definitely recorded from the Philippines or Indonesia. Five species are represented in the genus *Meningodora,* but some doubt is expressed about the inclusion of other than the type-species, *M. mollis.* The eight species recognized in the genus *Notostomus* are distinguished in a distinctly provisional key. Four species remain in the genus *Oplophorus* after the removal of *O. spinicauda.* All five species currently known in the genus *Systellaspis* are recorded from the Philippine-Indonesian region. Illustrations are offered of as many oplophorid species as possible, especially of the mandibles, first and second maxillipeds, endopods of the first male pleopods, and the appendices internae and masculinae, all of which proved to be variably significant as diagnostic generic and/or specific characters. Seven species are covered in a key to the Philippine-Indonesian species of the genus *Nematocarcinus,* including a new species, *N. bituberculatus* from Lagonoy Gulf, southeastern Luzon, and off the west coast of Halmahera.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year.* SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress Cataloging in Publication Data
(Revised for Pt. 4)
Chace, Fenner Albert.
The caridean shrimps (Crustacea—Decapoda) of the Albatross Philippine Expedition, 1907–1910.
(Smithsonian contributions to zoology ; no. 381–)
Includes bibliographies.
Supt. of Docs. no.: SI 1.27:432
Contents: pt. 1. Family Stylodactylidae—[etc.]—pt. 3. Families Thalassocarididae and Pandalidae—pt. 4. Families Oplophoridae and Nematocarcinidae.
1. Shrimps—Philippines—Classification—Collected works. 2. Crustacea—Classification—Collected works. 3. Crustacea—Philippines—Classification—Collected works. I. Title. II. Series
QL1.S54 no. 381, etc. 591 s [595.3'843] 83-600061 [QL444.M33]

Contents

The Caridean Shrimps (Crustacea: Decapoda) of the *Albatross* Philippine Expedition, 1907–1910, Part 4: Families Oplophoridae and Nematocarcinidae

Fenner A. Chace, Jr.

Introduction

General considerations about the *Albatross* Philippine Expedition and its collections have been presented in Part 1 of this series (Chace, 1983). Repeated below are those format particulars that are common to all of the parts.

The genera and species itemized following the keys are those known from the Philipppines and Indonesia, whether or not they are represented in the *Albatross* collections; those taken by that expedition are indicated by an asterisk (*). The genera and species are arranged alphabetically, and the latter are numbered sequentially by order of appearance in the taxonomic portion of the report. The generic entries comprise at least the original reference, followed by designation of the type-species and of the gender of the generic name, a diagnosis, and the geographic and bathymetric ranges of the genus. The original reference and range are given in the keys for each extraterritorial species or subspecies cited. There has been no attempt to list all references or even all synonyms under the taxa headings in the text. Usually the species and subspecies entries are limited to (1) the original reference and type-locality of both senior and junior synonyms mentioned; (2) a reference to a published illustration, if possible; (3) a diagnosis; and (4) the range of the taxon. Under "Material" of species and subspecies represented in the *Albatross* collections are listed the following particulars when known: (1) general locality; (2) station number; (3) latitude and longitude; (4) depth in meters (in brackets when estimated); (5) character of bottom; (6) bottom temperature in degrees Celsius; (7) date and astronomical time intervals (hours between midnight and midnight) that the gear operated at the indicated depth; (8) gear used; and (9) the number and sex of the specimens, with minimum and maximum postorbital carapace lengths in millimeters, in brackets (the numbers and size ranges of ovigerous females are included in the female totals, as well as separately). Additional station data may be available in Anonymous (1910).

Inasmuch as most of the available study material was not collected with closing nets and as many of the pelagic oplophorids are believed to

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migrate diurnally over a considerable bathymetric distance, it has been impossible to indicate accurate depth ranges for most of those species. In general, those that are collected most commonly above 1000 meters have been called "mesopelagic," and those that seem to occur below 1000 meters and that probably do not approach the surface at night are referred to as "bathypelagic."

ACKNOWLEDGMENTS.—At least a half dozen biologists in other institutions have contributed importantly to the preparation of this fourth part of the report on the Caridea of the *Albatross* Philippine Expedition. James J. Childress of the Marine Science Institute at the University of California, Santa Barbara, induced me to abandon my determination to shun involvement with any but the *Albatross* collections by donating unexpectedly titillating pelagic oplophorid material collected by the *Alpha Helix* Southeast Asian Expedition in the Banda, Halmahera, and Sulu seas in 1975. Early in the project, Alain Crosnier of the Muséum National d'Histoire Naturelle in Paris made available various parts of the manuscript by him and J. Forest, which was subsequently published in 1973, and he later reviewed the manuscript of this report with his usual competence and tact. Also at an early stage, Ken-Ichi Hayashi, then at the Marine Parks Center of Japan, in Tokyo, provided welcome information about the identity of the genus *Hoplopasiphaea*. The penultimate draft of the manuscript was reviewed by L.B. Holthuis of the Rijksmuseum van Natuurlijke Historie in Leiden with his usual promptness and attention to detail. The abundant collections of mesopelagic shrimps received from the Woods Hole Oceanographic Institution, through the kind cooperation of David C. Judkins, furnished invaluable comparative study material. W.G. Pearcy of the School of Oceanography, Oregon State University, loaned material of *Hymenodora acanthitelsonis*. Mrs. M.G. van der Merwe of the South African Museum in Cape Town sent unusually fine specimens of the rare *Kemphyra*. A.L. Rice examined the holotype of *Acanthephyra kingsleyi* in the British Museum (Natural History) for me. Robert A. Wasmer of Columbia Union College, Takoma Park, Maryland, suggested the means of obtaining an adult male of the uncommon *Hymenodora acanthitelsonis* and reviewed the entire manuscript, which resulted in the gain of valuable knowledge about range extensions and other aspects of the report gleaned from the study of northeastern Pacific material. Among my Smithsonian colleagues, my thanks go to Roger F. Cressey, Jr., for preliminary arrangements leading to the examination of the holotype of *Acanthephyra kingsleyi*, to Brian Kensley for his assistance in expediting the opportunity to study the exceptional material of *Kemphyra* in the South African Museum and for reviewing the manuscript, to Lilly King Manning for assistance with the preparation of the illustrations in this report, to Marian H. Pettibone for translating Russian literature on the Oplophoridae, and, finally, to Horton H. Hobbs, Jr., Raymond B. Manning, and Austin B. Williams for continuing technical assistance and encouragement.

*OPLOPHORIDAE Dana, 1852

OPLOPHORINAE Dana, 1852:18, 27.

DIAGNOSIS.—Rostrum immovably attached to remainder of carapace, otherwise variable; antennular flagella simple, without accessory branches; mandible with palp, molar and incisor processes not deeply separated; 3rd maxilliped elongate, not unusually expanded, 5-segmented, bearing well-developed exopod; all pereopods with well-developed exopod, 3 anterior pairs, at least, bearing straplike epipod with endpiece extending perpendicularly into branchial chamber, 2 anterior pairs with well-developed chela and undivided carpus, 3 posterior pairs not unusually long, carpus shorter than propodus; pleopods bearing appendices interna; probably all species capable of some form of bioluminescence (Herring, 1976:1041).

RANGE.—Cosmopolitan; usually mesopelagic, with nocturnal migration toward surface, except

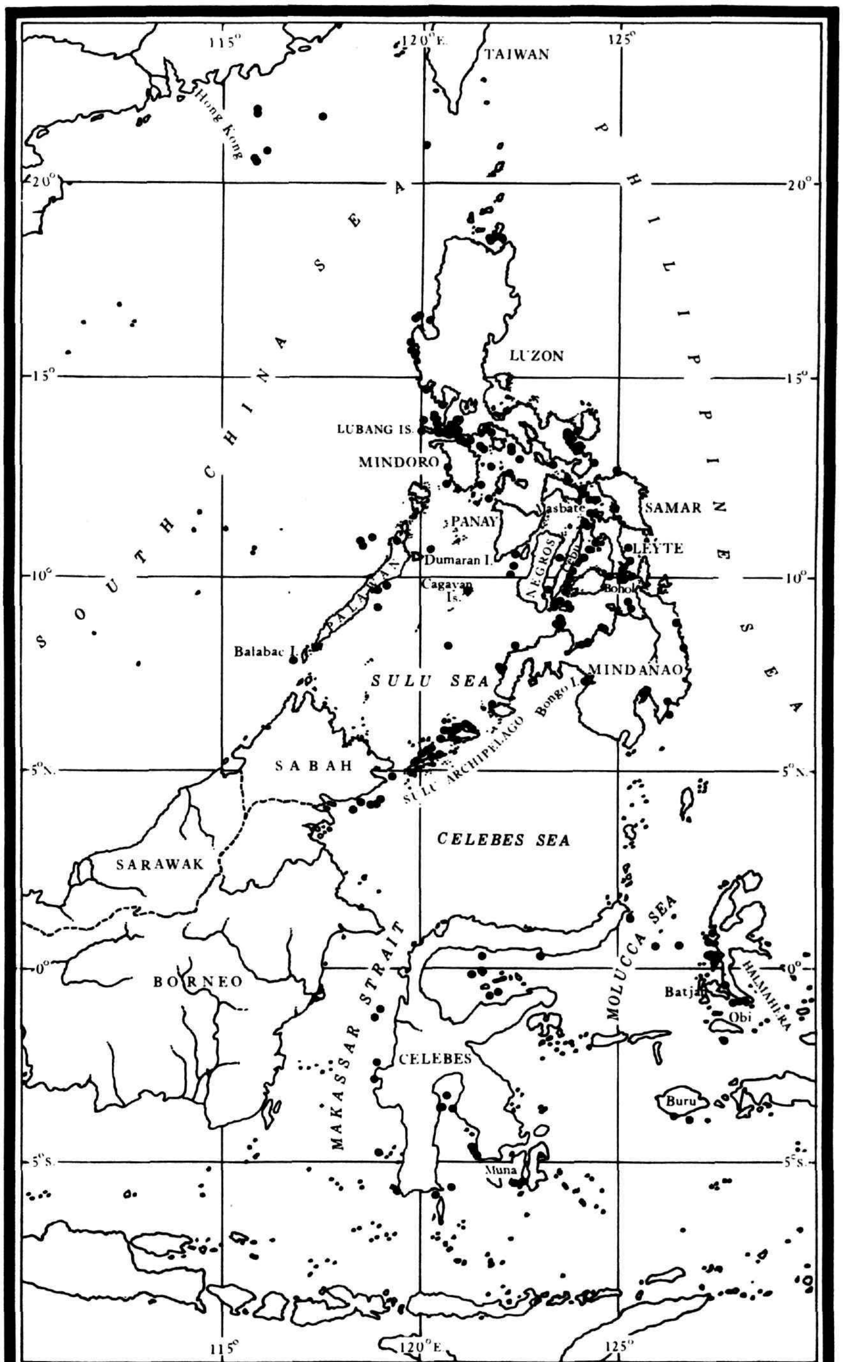

FIGURE 1.—The Philippines and central Indonesia, showing the positions of the more than 330 *Albatross* offshore stations at which caridean shrimps were collected.

5–7 species apparently benthic as adults in 315–5300 m.

CLASSIFICATION.—Keys to all of the approximately 61 oplophorid species currently recognized represent one final attempt to understand the relationships in this family that has held my attention sporadically for more than 50 years. In that endeavor, I have concentrated on features that were found to be somewhat variable during that study. The characters that seemed most promising generically were (1) the somital distribution of dorsomesial carinae on the abdomen, (2) the form of the posterior extremity of the telson, (3) the form of the eye, especially the comparative diameter of the cornea, (4) the structure and bilateral symmetry of the incisor and molar processes of the mandibles, (5) the form of the proximal endite of the second maxilla, (6) the configuration of the lateral lobe and the segmentation of the slender central lobe of the first maxilliped, (7) the shape of the terminal segment of the second maxilliped, (8) the width and flexibility of the exopod on the third maxilliped and anterior pairs of pereopods, (9) the number of pairs of pereopods with a straplike epipod, (10) the presence or absence, comparative length, and setation of the appendix masculina on the second pleopod of the male, and (11) the size and number of eggs produced by the female.

The unusual construction of the molar process of the mandibles in *Oplophorus* and *Systellaspis* suggested the possibility of restricting the earliest family name to these two genera and restoring the name Acanthephyridae Bate, 1888, for the other genera, but it seems unlikely that this one character is more important than any of the others that are shared with one or more of the remaining genera, such as the absence of a dorsal carina and posteromesial tooth on the sixth abdominal somite, a nearly complete epipod on the fourth pair of pereopods, and eggs of large size and few in number. Also, one wonders if the unusual form of the molar process of the mandible is more important than the similarly unusual partially unarmed incisor process, a character that is restricted to *Ephyrina*, *Meningodora*, and *Notostomus*. The nonexistence of a deep separation between the incisor and molar processes of the mandible, the presence of well-developed exopods on all of the pereopods, and the perpendicular terminal extension of the epipods combine to distinguish the genera here assigned to the Oplophoridae from all other caridean shrimps except for the genus *Procaris* Chace and Manning, 1972 (the Procarididae differ from the Oplophoridae and all other caridean families by having the third maxilliped composed of seven distinct segments and none of the pereopods chelate or subchelate). It hardly seems desirable to consider the establishment at this time of other supergeneric categories within or collateral with such a tenable grouping as this family.

The analysis here attempted failed to indicate the feasibility of subdividing the possibly polyphyletic genus *Acanthephyra*. I had hoped that it might support the restoration of *Bentheocaris* Bate, 1888, for those species of *Acanthephyra* that resemble *Meningodora* in having a thin, sometimes membranous integument and a sharp lateral carina extending onto the posterior half of the carapace but that differ from the latter genus in having the incisor process of the mandible dentate throughout the extent of the opposable margin. There was no evidence from the survey of the other characters, however, that the species considered for transfer from *Acanthephyra* to *Bentheocaris* represent a homogeneous assemblage.

The study did suggest, however, that three species—*Acanthephyra microphthalma*, *Notostomus corallinus* (= *Acanthephyra valdiviae*), and *Oplophorus spinicauda* (= *O. foliaceus* and *Acanthephyra anomala*)—are so different from other members of the genera to which they have been assigned that a more logical arrangement could be achieved by transferring those species to three new monotypic genera, thereby raising the count of oplophorid genera to 10. Some consideration was also given to the possibility of restoring *Meningodora* to its original monotypic status and proposing a distinct genus for the four species presumably incorporated in *Meningodora* by Holthuis (1955:13) and Sivertsen and Holthuis (1956:12), but that idea has been abandoned for the time being (see "Classification" under *Meningodora* below).

Key to the Genera of Oplophoridae

1. Abdomen carinate in dorsal midline of 4 posterior somites at least; eggs small to medium-sized and numerous (more than 80) 2
   Abdomen not carinate in dorsal midline of 6th somite; eggs large and few (less than 50) 6
2. Carapace usually without uninterrupted lateral carina extending from near orbit to near posterior margin, posterior margin of hepatic furrow usually not abruptly delimited by oblique carina; mandible with incisor process dentate over entire extent of opposable margin 3
   Carapace with continuous lateral carina extending from near orbit to near posterior margin, posterior margin of hepatic furrow abruptly delimited by oblique carina; mandible with incisor process unarmed for about ½ of opposable margin nearest palp.......................... 5
3. Carapace bearing hepatic spine and 3 sharp carinae on posterior ½ of lateral surface .... ***Kemphyra***
   Carapace without hepatic spine, with only 2 carinae, at most, on posterior ½ of lateral surface 4
4. Rostrum with at least as many dorsal as ventral teeth; abdomen with 4th and 5th somites usually armed with posteromesial tooth (if not, tooth on 3rd somite less than ¼ as long as 4th somite and cornea wider than eyestalk in lateral aspect, not including papilla); left mandible with incisor process not tapering sharply toward opposable margin, armed with 9–14 subacute teeth .... ***Acanthephyra***
   Rostrum with fewer dorsal than ventral teeth; abdomen wtih posteromesial tooth on 3rd somite slender and overreaching 4th somite, 4th and 5th somites without posteromesial tooth; cornea little more than ½ as wide as maximum width of eyestalk; left mandible with incisor process tapering sharply toward opposable margin, armed with 6 blunt teeth .... ***Heterogenys***
5. Carapace with single lateral longitudinal carina, dorsal margin not denticulate on posterior ¾ of length; abdomen without median dorsal carina on 1st somite .... ***Meningodora***
   Carapace with more than 1 lateral longitudinal carina, dorsal margin denticulate over nearly entire length; abdomen dorsally carinate in midline on every somite .... ***Notostomus***
6. Fourth pereopod with epipod vestigial or absent 7
   Fourth pereopod with epipod well-developed except for vertical component 8
7. Rostrum laterally compressed into anteriorly truncate, dorsally unarmed crest; cornea at least as wide as eyestalk, darkly pigmented; 1st maxilliped with slender central lobe subdivided by 2 distinct transverse

sutures; pereopods with ischium and merus unusually wide and compressed . . . . *Ephyrina*

Rostrum not forming thin, high crest, armed with dorsal teeth; cornea narrower than eyestalk, lightly pigmented; 1st maxilliped with slender central lobe subdivided by only 1 distinct transverse suture; pereopods not usually wide or compressed . . . . *Hymenodora*

8. Abdomen with 2nd somite armed with long, carinate posteromesial spine, 5th somite unarmed; mandibles with molar process reduced to small, subtriangular excavation on proximal margin of appendage, not opposing nearly identical structure on other member of pair; 1st maxilliped with slender central lobe subdivided by only 1 transverse suture; no appendix masculina on 2nd pleopod of male . . . . *Janicella*

Abdomen with 2nd somite unarmed, 5th somite with posteromesial tooth, sometimes small; mandibles with molar process composed of deep channel flanked by rather high, thin walls opposing similar structure on other member of pair; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; appendix masculina on 2nd pleopod of male much longer than appendix interna 9

9. Abdomen with 6th somite shorter than 5th (not including posteromesial spine); telson simply pointed posteriorly, not terminating in spinose endpiece; 3rd maxilliped and 1st pereopod with broadly compressed, rigid exopods . . . . *Oplophorus*

Abdomen with 6th somite nearly twice to more than twice as long as 5th (not including posteromesial spine); telson terminating posteriorly in spinose endpiece flanked at base by pair of long lateral spines; 3rd maxilliped and 1st pereopod with exopods neither broadly compressed nor rigid . . . . *Systellaspis*

Acanthephyra* A. Milne-Edwards, 1881

FIGURES 2–14

Acanthephyra A. Milne-Edwards, 1881b:12. [Type-species, by original designation: *Acanthephyra armata* A. Milne-Edwards, 1881b:12; gender: feminine.]

DIAGNOSIS.—Rostrum with at least as many dorsal as ventral teeth; carapace not denticulate dorsally, usually without uninterrupted lateral carina extending from near orbit to near posterior margin, without hepatic spine, posterior slope of hepatic furrow usually not abruptly delimited by oblique carina; abdomen dorsally carinate on at least 3rd through 6th somites; telson superficially blunt or subtruncate posteriorly, not tapering regularly to sharply acute posterior end, without spinose endpiece; antennal scale without lateral teeth proximal to distolateral spine; mandibles dissimilar, molar process with transverse distal surface triangular on right member, compressed, sub-bilinear on left, incisor process toothed along entire opposable margin; 2nd maxilla with proximal endite bearing papilla and submarginal lamina; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment subtriangular, attached diagonally to preceding joint; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with ischium and merus not broadly compressed, 4th pair with epipod vestigial or absent; appendix masculina present on 2nd pleopod of males; eggs small to medium-sized and numerous (more than 80).

RANGE.—Like that of the family, all tropical and temperate seas and some subarctic and subantarctic regions; usually mesopelagic, with nocturnal migration toward the surface, except for four to six species that are apparently benthic as adults in 315–5300 m.

CLASSIFICATION.—As understood herein, the probably polyphyletic genus *Acanthephyra* currently encompasses the 27 species incorporated in the following key; 14 of the species are now known from the Philippine-Indonesian region.

Key to the Species of *Acanthephyra*

1. Carapace without strong longitudinal ridge or carina on posterior ½ of lateral surface 2
   Carapace with at least 1 well-marked ridge or sharp carina on posterior ½ of lateral surface 20
2. Carapace strongly carinate throughout length of dorsal midline 3
   Carapace without prominent carina on at least posterior ⅓ of dorsal midline 5
3. Carapace dorsally sinuous in lateral aspect; abdomen without carina in dorsal midline of 1st somite . . . . *6. ***A. eximia***
   Carapace regularly slightly convex in lateral aspect; abdomen carinate in at least posterior ½ of dorsal midline of 1st somite 4
4. Rostrum not extending anteriorly as far as distal end of antennal scale; abdomen carinate in entire dorsal midline of 1st somite; telson sulcate in dorsal midline . . . . 1. ***A. acutifrons***
   Rostrum usually overreaching antennal scale; abdomen with carina in dorsal midline of 1st somite restricted to posterior ½; telson with indistinct ridge in dorsal midline, not sulcate . . . . *3. ***A. carinata***
5. Telson with blunt ridge in anterior part of dorsal midline 6
   Telson flattened or sulcate in dorsal midline 7
6. Carapace without carina supporting branchiostegal spine; abdomen with posterior margin of 3rd somite distinctly excavate either side of posteromedian tooth . . . . *2. ***A. armata***
   Carapace with strong carina extending from branchiostegal spine to branchial region; abdomen with posterior margin of 3rd somite not distinctly excavate either side of posteromedian tooth . . . . *7. ***A. fimbriata***
7. Integument thin, body consequently soft; rostrum unarmed ventrally 8
   Integument not very thin, body firm; rostrum with 1 or more teeth on ventral margin 10
8. Carapace with branchiostegal spine buttressed by long, carina-like ridge; abdomen without posteromedian tooth on 3rd somite . . . . 11. ***A. rostrata***
   Carapace without carina-like ridge supporting branchiostegal spine; abdomen with posteromedian tooth on 3rd somite 9
9. Carapace dorsally sinuous in lateral aspect; abdomen with large, fleshy

posteromedian tooth on 3rd somite overreaching 4th somite ....
.... ***A. brevirostris*** Smith, 1885:504
(Southwestern Indian Ocean, eastern
tropical Pacific, and North and
South Atlantic; 1200–5300 m)

Carapace nearly straight dorsally in lateral aspect; abdomen with posteromedian tooth on 3rd somite short, not large and fleshy ....
.... ***A. tenuipes*** (Bate, 1888:836)
(Western Indian Ocean and Coral
Sea; probably mesopelagic)

10. Rostrum armed ventrally with 1 or 2 teeth; carapace with strong carina extending at least halfway from branchiostegal spine to branchial region 11

Rostrum armed ventrally with more than 2 teeth; carapace with branchiostegal spine buttressed, if at all, by short carina extending less than halfway to branchial region 13

11. Branchiostegal spine buttressed by carina reaching posteriorly no more than 3/5 of distance to end of hepatic groove ....
.... ***A. brevicarinata*** Hanamura, 1984
(Eastern Pacific from Gulf of California to Golfo
de Panama and westward to 120° W; mesopelagic)

Branchiostegal spine buttressed by carina reaching posteriorly to end of hepatic groove 12

12. Rostrum less than 1/2 as long as carapace, armed dorsally with 6–10 teeth .... *5. ***A. curtirostris***

Rostrum more than 3/4 as long as carapace, armed dorsally with 11–13 teeth .... *9. ***A. media***

13. Carapace with short, sharp carina supporting branchiostegal spine .. 14

Carapace with branchiostegal spine supported, if at all, by rounded ridge 17

14. Telson armed with 4 pairs of dorsolateral spines 15

Telson armed with 7–19 pairs of dorsolateral spines 16

15. Abdomen with posteromedian tooth on 4th somite ....
.... *10. ***A. quadrispinosa***

Abdomen lacking posteromedian tooth on 4th somite..............
.... ***A. purpurea*** A. Milne-Edwards, 1881a:933
(North Atlantic north of 20°N; mesopelagic)

16. Telson armed with 7–11 pairs of dorsolateral spines ....
.... ***A. pelagica*** (Risso, 1816:91)

It is possible that Risso's name should be assigned to the other Mediterranean species of the genus (see *A. eximia*, "Remarks"); if so, this species should be known as *A. haeckelii* (Von Martens, 1868).]
(North Atlantic north of 13°N, Mediterranean, and, perhaps, panantarctic north to 24°S; mesopelagic) [The name *A. sica* Bate, 1888, has been restored by Burukovsky and Romensky (1982:1799) for the southern form of this shrimp, in which the carapace may be

more distinctly and extensively carinate in the dorsal midline than it is in the North Atlantic variety.]

Telson armed with 13–19 pairs of dorsolateral spines . . . . ***A. acanthitelsonis*** Bate, 1888:745 (Central and South Atlantic between 14°N and 28°S; mesopelagic)

17. Telson armed with 3 pairs of dorsolateral spines 18
    Telson armed with 4–6 pairs of dorsolateral spines 19
18. Abdomen with posteromedian tooth of 3rd somite much larger than that of 4th, 6th somite twice as long as posterior height . . . . ***A. trispinosa*** Kemp, 1939:577 (Eastern Pacific between 7°N and 4°S, westward to 116°W; mesopelagic)
    Abdomen with posteromedian tooth of 3rd somite not much larger than that of 4th, 6th somite no more than 1½ times as long as posterior height . . . . 14. ***A. smithi***
19. Abdomen with posteromedian tooth on 4th and 5th somites; telson armed with 4 pairs of dorsolateral spines . . . . *12. ***A. sanguinea***
    Abdomen with 4th and 5th somites unarmed posteriorly; telson armed with 5 or 6 pairs of dorsolateral spines . . . ***A. kingsleyi*** Bate, 1888:751 (Central Atlantic from 17°N to 18°S; mesopelagic)
20. Carapace carinate on posterior ¼ of dorsal midline 21
    Carapace rounded, not carinate, on posterior ¼ of dorsal midline . . 23
21. Carapace with dorsal carina interrupted by cervical groove; abdomen without posteromedian tooth on 3rd somite . . . . 13. ***A. sibogae***
    Carapace without distinct cervical groove, dorsal carina continuous; abdomen with posteromedian tooth on 3rd somite 22
22. Rostrum not nearly overreaching antennal scale, armed ventrally with 1 (rarely 2) teeth; abdomen rounded, not carinate, in dorsal midline of 2nd somite . . . . ***A. chacei*** Krygier and Forss, 1981:96 (Northeastern Pacific between 44° and 46°N; mesopelagic between 1500 and 2400 meters)
    Rostrum overreaching antennal scale, armed ventrally with 4–7 teeth; abdomen sharply carinate on dorsal midline of 2nd somite . . . . ***A. faxoni*** Calman, 1939:191 (Western Indian Ocean and eastern tropical Pacific; probably mesopelagic)
23. Carapace without carina supporting branchiostegal spine 24
    Carapace with strong carina extending from branchiostegal spine to posterior branchial region 25
24. Abdomen without carina on dorsal midline of 2nd somite, posterodorsal tooth on 3rd somite low and offset to left . . . . ***A. gracilipes*** Chace, 1940:149 (North Atlantic between 28° and 32°N; mesopelagic)
    Abdomen carinate in dorsal midline of 2nd somite, posterodorsal tooth on 3rd somite high and not offset to either side . . . .

. . . . **A. prionota** Foxton, 1971:35
(Probably pantropical between 23°N and 18°S; mesopelagic in 700–1300 meters)

25. Carapace with 2 lateral carinae, one (interrupted) originating posterior to orbit, other at branchiostegal spine; eyestalk bearing bluntly triangular papilla directed dorsomesially, not reaching nearly as far as distal surface of cornea . . . . *8. ***A. indica***

Carapace with single lateral carina originating at branchiostegal spine; eyestalk bearing elongate dorsomesial papilla directed distally, reaching nearly as far as distal surface of cornea 26

26. Rostrum with "ventral" margin vertical except for horizontal acuminate tip; telson armed with 4 pairs of dorsolateral spines . . . . *4. ***A. cucullata***

Rostrum with "ventral" margin oblique except for acuminate tip directed anteroventrad; telson armed with 3 pairs of dorsolateral spines . . . . **A. stylorostratis** (Bate, 1888:729)
(Off South Africa, central South Pacific, and North Atlantic, including Gulf of Mexico, between 0° and 40°N; mesopelagic)

1. *Acanthephyra acutifrons* Bate, 1888

FIGURES 2*b*, 4*b*, 5*b*

Acanthephyra acutifrons Bate, 1888:749 [in part], pl. 126: fig. 3 [type-locality, restricted by Kemp (1906:20): off Kepulauan Aru, Indonesia; 5°41'S, 134°04'30"E; 1463 m].—Chace, 1940:146, fig. 23.

DIAGNOSIS.—Integument thin but not membranous; rostrum slightly less than ½ as long as carapace, not reaching level of distal end of antennal scale, ventral margin oblique, armed with 1 tooth; carapace with dorsal margin carinate over nearly entire length, nearly straight, not interrupted by cervical groove, branchiostegal spine buttressed by very short, blunt carina, suprabranchial ridge perceptible but little elevated; abdomen dorsally carinate on all 6 somites, with posteromesial tooth on posterior 4, 3rd somite with posterior margin rather deeply excavate either side of median tooth, 6th somite about 1½ times as long as posterior height; telson shallowly sulcate in dorsal midline, with 5 or 6 pairs of inconspicuous dorsolateral spines; eyestalk bearing small papilla barely reaching juncture with cornea; maximum carapace length 55 mm.

RANGE.—Material in the Smithsonian collections (USNM) indicates that *A. acutifrons* occurs in the Indian Ocean and Indonesia and in the tropical and subtropical Atlantic, both western and eastern; both adults and juveniles are mesopelagic, at least part of the time.

*2. *Acanthephyra armata* A. Milne-Edwards, 1881

FIGURES 2*c*, 4*c*, 5*b*, 6*b*, 8*b*, 11

Acanthephyra armata A. Milne-Edwards, 1881b:12 [type-locality: off St. Lucia, Lesser Antilles, 772 m].—Bate, 1888:744, pl. 125: fig. 2.

DIAGNOSIS.—Integument firm; rostrum ¾–1½ times as long as carapace, overreaching antennal scale, ventral margin convex, armed with 1 tooth; carapace with dorsal margin carinate, very obscurely so on posterior ¼, nearly straight, not interrupted by cervical groove, branchiostegal spine buttressed by variably sharp carina extending posteriorly little more than length of spine, suprabranchial ridge distinct, sharp subbranchial carina near ventral margin of carapace;

FIGURE 2.—Extensor (ventral) surfaces of incisor and molar processes of right mandibles of species of *Acanthephyra: a, A. acanthitelsonis*, male [25.1 mm], *Pillsbury* sta 21, off Ghana; *b, A. acutifrons*, ovigerous female [48.0 mm], *Albatross* sta 2384, Gulf of Mexico; *c, A. armata*, male [30.0 mm], *Oregon* sta 640, Gulf of Mexico; *d, A. brevicarinata*, male [22.0 mm], *Albatross* sta 3010, Gulf of California; *e, A. brevirostris*, male [23.7 mm], *Albatross* sta 2566, east of Chesapeake Bay; *f, A. carinata*, male [36.2 mm], *Albatross* sta 5524, Mindanao Sea; *g, A. chacei*, male paratype [25.2 mm], *Wecoma* cruise 7606B, sta NH65, haul 2361, bkt 3, west of Yaquina Head, Oregon; *h, A. cucullata*, male [14.0 mm], *Alpha Helix* sta 71, Banda Sea; *i, A. curtirostris*, male [17.0 mm], *Alpha Helix* sta 61, Banda Sea; *j, A. eximia*, male [39.2 mm], *Albatross* sta 5603, Teluk Tomini, Celebes; *k, A. faxoni*, male [13.4 mm], *Albatross* sta 4653, off Peru; *l, A. fimbriata*, male [37.2 mm], *Albatross* sta 5495, Mindanao Sea.

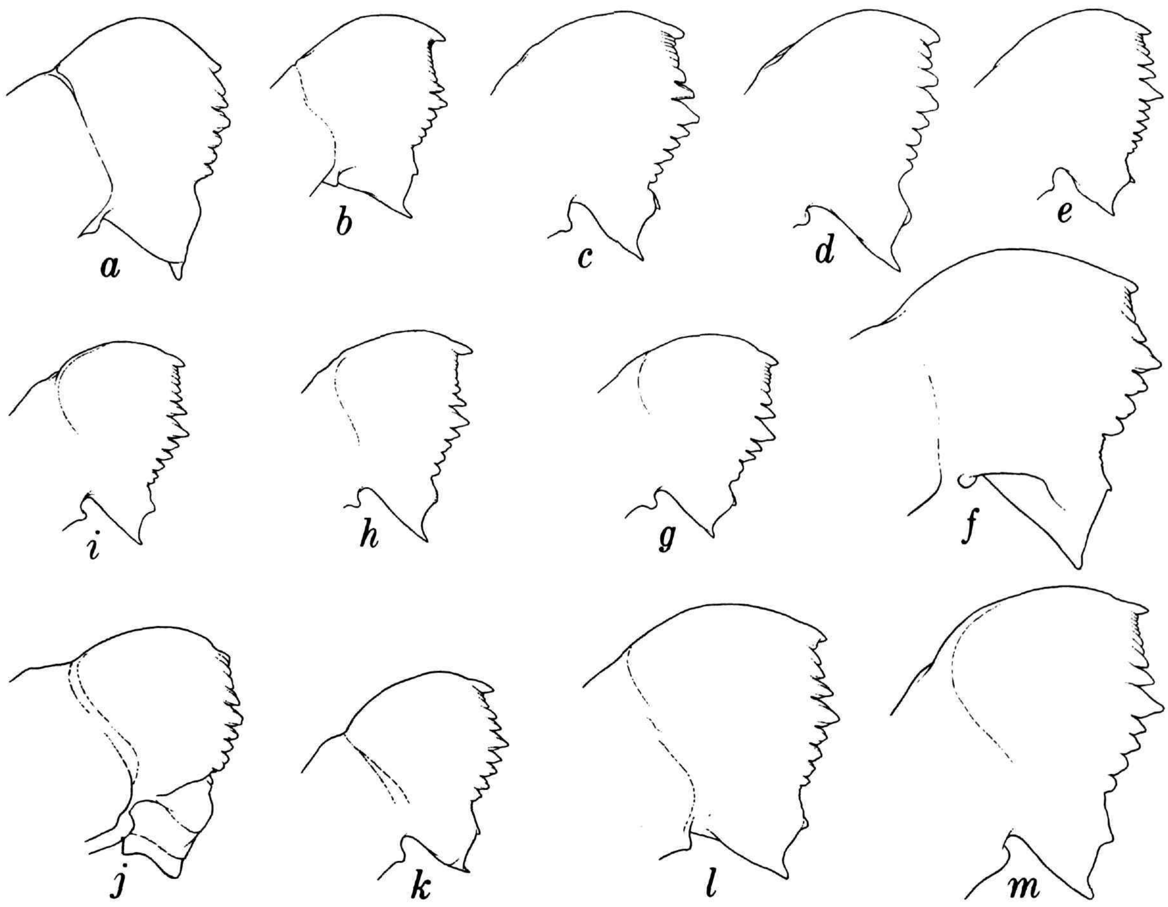

FIGURE 3.—Extensor (ventral) surfaces of incisor and molar processes of right mandibles of species of *Acanthephyra: a, A. gracilipes,* female [13.0 mm], *Atlantis II* sta RHB1421, east of Bahia, Brazil; *b, A. indica,* male [8.0 mm], *Alpha Helix* sta 87, Banda Sea; *c, A. kingsleyi,* male [19.7 mm], *Pillsbury* sta 265, Gulf of Guinea; *d, A. media,* male [21.0 mm], *Albatross* sta 5628, Selat Patinti, Halmahera; *e, A. pelagica,* male [18.0 mm], off Messina, Sicily (R.B. Manning); *f, A. prionota,* male paratype [6.2 mm], *Discovery* sta 7089#32, north of Cape Verde Islands; *g, A. purpurea,* male [17.5 mm], *Chain* sta RHB2574, northeast of Madeira Islands; *h, A. quadrispinosa,* male [16.9 mm], *Albatross* sta 5618, west of Halmahera; *i, A. sanguinea,* male [16.0 mm], *Albatross* sta 5287, Verde Island Passage, Philippines; *j, A. sibogae,* male [14.0 mm], *Alpha Helix* sta 110, Banda Sea; *k, A. smithi,* male [17.0 mm], *Te Vega* sta 189, southwest of Maldive Islands; *l, A. stylorostratis,* male [10.8 mm], *Knorr* sta 3126, east of Bermuda; *m, A. trispinosa,* male [13.8 mm], *Albatross* sta 3398, off Ecuador.

abdomen dorsally carinate on 5 posterior somites, rarely with faint ridge on anteriormost, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin rather deeply excavate either side of median tooth, 6th somite abut 1½ times as long as posterior height; telson with strong rounded ridge in anterior ½ of dorsal midline, with 3, rarely 4, pairs of small dorsolateral spines; eyestalk with slight elevation, but no true papilla, on mesial surface near juncture with cornea; maximum carapace length 44 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde*

Island Passage, east of Lubang Islands: sta 5119; 13°45′05″N, 120°30′30″E; 720 m; green mud, sand; 6.5°C; 21 Jan 1908 (1324–1356); 12′ Tanner beam trawl: 1♂ [30.0]. *Lagonoy Gulf, east of southern Luzon:* sta 5447; 13°28′N, 123°46′18″E; 567 m; green mud; 7.4°C; 4 Jun 1909 (0614–0635); 12′ Agassiz beam trawl: 1♀ [42.8]; sta 5463; 13°40′57″N, 123°57′45″E; [549 m]; [sand]; 16 Jun 1909 (1028–1044); 12′ Agassiz beam trawl, mud bag: 7♂ [14.1–40.8] 10♀ [11.9–36.0], 2 ovig [28.2, 36.0]. *North of Samar:* sta 5445; 12°44′42″N, 124°59′50″E; 700 m; green mud, sand; 6.8°C; 3 Jun 1909 (1201–1238); 12′ Agassiz beam trawl: 1♀ [30.0]. *Northern Palawan Passage:* sta 5348; 10°57′45″N, 118°38′15″E; 686 m; coral, sand; 13.6°C; 27 Dec 1908 (1009–1029); 12′ Tanner beam trawl, mud bag: 1♂ [38.5] 1♀ [24.2].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5586; 4°06′50″N, 118°47′20″E; 635 m; gray mud; 6.7°C; 28 Sep 1909 (1144–1217); 9′ Tanner beam trawl, mud bag: 1♂ [25.3] 3♀ [26.8–30.9]; sta 5587; 4°10′35″N, 118°-37′12″E; 759 m; green mud, sand, coral; 5.7°C; 28 Sep 1909 (1511–1532); 9′ Tanner beam trawl, mud bag: 1♂ [30.1] 1 ovig ♂ [40.0]. *Makassar Strait west of Celebes:* sta 5667; 2°56′00″S, 118°47′30″E; 671 m; gray sand, mud; 5.4°C; 29 Dec 1909 (0955–1025); 12′ Agassiz beam trawl: 1♂ [27.9] 1 ovig ♀ [35.0]. *Teluk Bone, Celebes:* sta 5656; 3°17′40″S, 120°36′45″E; 885 m; gray mud; 5.1°C; 19 Dec 1909 (0837–1842); 12′ Agassiz beam trawl: 1♂ [30.0]. *South of Pulau Muna, Celebes:* sta 5646; 5°31′30″S, 122°-22′40″E; 834 m; green mud; 16 Dec 1909 (1210–1230); 12′ Agassiz beam trawl: 1♂ [38.9] 1 ovig ♀ [36.1]. *Selat Butung, Celebes:* sta 5648; 5°35′00″S, 122°20′00″E; 1023 m; green mud; 4.0°C; 16 Dec 1909 (1629–1652); 12′ Agassiz beam trawl: 1♂ [43.5]. *West of Halmahera:* sta 5618; 0°37′00″N, 127°15′00″E; 763 m; gray mud; 27 Nov 1909 (1444–1504); 12′ Agassiz beam trawl: 1♂ [34.8]; sta 5619; 0°35′00″N, 127°14′40″E; 795 m; fine gray sand, mud; 27 Nov 1909 (1612–1641); 12′ Agassiz beam trawl: 5♂ [27.8–32.0]; sta 5620; 0°21′30″N, 127°16′45″E; 655 m; gray mud; 28 Nov 1909 (0624–0645); 12′ Agassiz beam trawl: 6♀ [21.1–35.0], 3 ovig [33.7–35.0].

RANGE.—This species seems to have been recorded from only three major parts of the world: the southwestern Indian Ocean off Zululand (Kensley, 1977:31), the Philippines and Indonesia, and the Gulf of Mexico and the West Indies. There is little doubt that it is a benthic species living on continental and, especially, insular slopes from 365–1570 meters.

*3. *Acanthephyra carinata* Bate, 1888

FIGURES 2*f*, 4*f*, 5*f*, 6*e*, 8*e*

Acanthephyra carinata Bate, 1888:748, pl. 126: fig. 2 [type-locality: Estrecho Sarmiento, southern Chile; 51°27′30″S, 74°03′00″W; 732 m].

Acanthephyra approxima Bate, 1888:755, pl. 126: fig. 8 [type-locality: same as above].

DIAGNOSIS.—Integument firm; rostrum variable in length, slightly more than ½ as long as carapace and slightly overreaching antennal scale in adults, ventral margin convex, armed with 1 tooth; carapace with dorsal margin sharply carinate throughout most of length, nearly straight, not interrupted by cervical groove, branchiostegal spine buttressed by variably sharp carina extending posteriorly little more than length of spine, suprabranchial ridge discernible but not prominent, 2 submarginal carinae below and extending somewhat beyond branchial region longitudinally; abdomen dorsally carinate on posterior ½ of 1st somite and on all 5 posterior somites, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin very little excavate either side of median tooth, 6th somite about 1¼ times as long as posterior height; telson with strong rounded ridge on anterior ½ of dorsal midline, with 3 barely visible pairs of dorsolateral spines; eyestalk with subrectangular prominence on mesial margin, but no true papilla; maximum carapace length 42 mm.

MATERIAL.—PHILIPPINES. *Batangas Bay, southern Luzon:* sta 5289; 13°41′50″N, 120°58′30″E; 315 m; broken shells, sand; 22 Jul 1908 (0925–

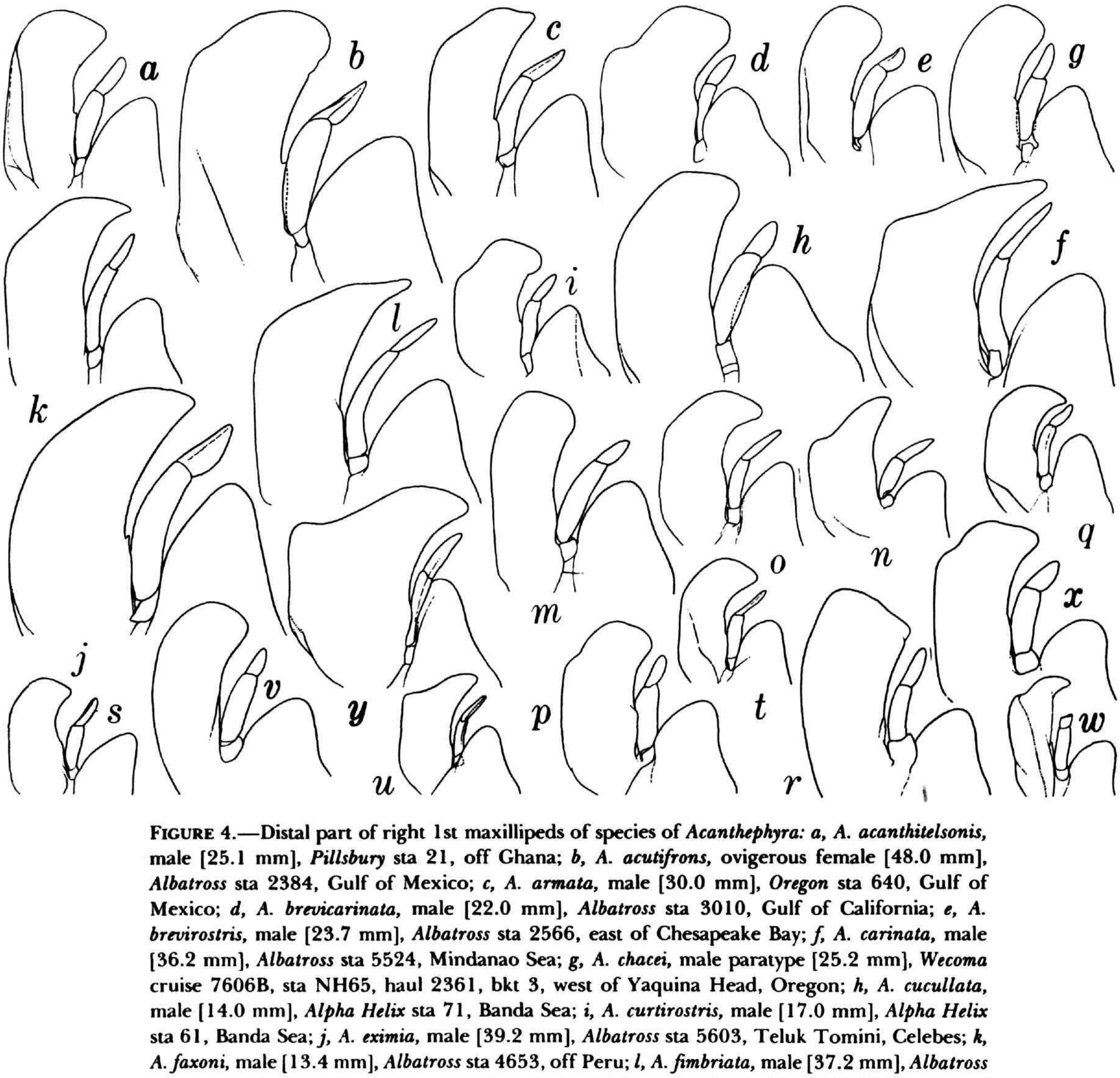

FIGURE 4.—Distal part of right 1st maxillipeds of species of *Acanthephyra: a, A. acanthitelsonis,* male [25.1 mm], *Pillsbury* sta 21, off Ghana; *b, A. acutifrons,* ovigerous female [48.0 mm], *Albatross* sta 2384, Gulf of Mexico; *c, A. armata,* male [30.0 mm], *Oregon* sta 640, Gulf of Mexico; *d, A. brevicarinata,* male [22.0 mm], *Albatross* sta 3010, Gulf of California; *e, A. brevirostris,* male [23.7 mm], *Albatross* sta 2566, east of Chesapeake Bay; *f, A. carinata,* male [36.2 mm], *Albatross* sta 5524, Mindanao Sea; *g, A. chacei,* male paratype [25.2 mm], *Wecoma* cruise 7606B, sta NH65, haul 2361, bkt 3, west of Yaquina Head, Oregon; *h, A. cucullata,* male [14.0 mm], *Alpha Helix* sta 71, Banda Sea; *i, A. curtirostris,* male [17.0 mm], *Alpha Helix* sta 61, Banda Sea; *j, A. eximia,* male [39.2 mm], *Albatross* sta 5603, Teluk Tomini, Celebes; *k, A. faxoni,* male [13.4 mm], *Albatross* sta 4653, off Peru; *l, A. fimbriata,* male [37.2 mm], *Albatross* sta 5495, Mindanao Sea; *m, A. gracilipes,* male [13.0 mm], *Atlantis II* sta RHB1421, east of Bahia, Brazil; *n, A. indica,* male [8.0 mm], *Alpha Helix* sta 87, Banda Sea; *o, A. kingsleyi,* male [19.7 mm], *Pillsbury* sta 265, Gulf of Guinea; *p, A. media,* male [21.0 mm], *Albatross* sta 5628, Selat Patinti, Halmahera; *q, A. pelagica,* male [18.0 mm], off Messina, Sicily (R.B. Manning); *r, A. prionota,* male paratype [6.2 mm], *Discovery* sta 7089#32, north of Cape Verde Islands; *s, A. purpurea,* male [17.7 mm], *Chain* sta RHB2574, northeast of Madeira Islands; *t, A. quadrispinosa,* male [16.9 mm], *Albatross* sta 5618, west of Halmahera; *u, A. sanguinea,* male [16.0 mm], *Albatross* sta 5287, Verde Island Passage, Philippines; *v, A. sibogae,* male [14.0 mm], *Alpha Helix* sta 110, Banda Sea; *w, A. smithi,* male [17.0 mm], *Te Vega* sta 189, southwest of Maldive Islands; *x, A. stylorostratis,* male [10.8 mm], *Knorr* sta 3126, east of Bermuda; *y, A. trispinosa,* male [13.8 mm], *Albatross* sta 3398, off Ecuador.

0945); 12′ Agassiz beam trawl, mud bag: 1 juv [14.3]. *Verde Island Passage:* sta 5296; 13°40′09″N, 120°57′45″E; [384 m]; [mud, sand]; 24 Jul 1908 (1247–1307); 12′ Agassiz beam trawl, mud bag: 2♂ [15.2, 34.5] 1 juv [13.8]. *Tayabas Bay, southern Luzon:* sta 5373; 13°40′N, 121°31′10″E; 618 m; soft mud; 11.0°C; 2 Mar 1909 (1015–1035); 12′ Tanner beam trawl, mud bag: 1♂ [31.2]. *Tablas Strait, east of Mindoro:* sta 5124; 12°52′N, 121°48′30″E; 514 m; soft green mud; 2 Feb 1908 (1738–1755); 12′ Tanner beam trawl, mud bag: 2♀ [34.0, 38.4]. *Masbate Pass, east of Masbate:* sta 5215; 12°31′30″N, 123°35′24″E; 1104 m; green mud; 10.3°C; 21 Apr 1908 (1027–1132); 12′ Agassiz beam trawl, mud bag: 1♂ [37.9]. *Sogod Bay, southern Leyte:* sta 5202; 10°12′N, 125°04′10″E; 918 m; gray mud; 10 Apr 1908 (1107–1127); 12′ Agassiz beam trawl, 3 mud bags: 1♀ [31.0] 1 juv [12.5]; sta 5488; 10°N, 125°06′45″E; 1412 m; green mud; 11.3°C; 31 Jul 1909 (1652–1738); 12′ Agassiz beam trawl, 1♂ [39.8]. *Between Bohol and Siquijor Island:* sta 5527; 9°22′30″N, 123°42′40″E; 719 m; globigerina ooze; 11.8°C; 11 Aug 1909 (1338–1358); 12′ Tanner beam trawl: 3♂ [33.8–39.0]. *North of Siquijor Island:* sta 5528; 9°24′45″N, 123°39′15″E; 803 m; globigerina ooze; 11.8°C; 11 Aug 1909 (1542–1611); 12′ Tanner beam trawl: 1♂ [35.9] 1 ovig ♀ [32.9]; sta 5529; 9°23′45″N, 123°39′30″E; 807 m; gray mud, globigerina; 11.7°C; 11 Aug 1909 (1644–1719); 12′ Tanner beam trawl, mud bag: 3♂ [20.0–33.0]. *Western Mindanao Sea:* sta 5524; 8°58′07″N, 123°32′45″E; 658 m; sand; 11.6°C; 10 Aug 1909 (1306–1351); 12′ Tanner beam trawl: 1♂ [36.2]. *Iligan Bay, Northern Mindanao:* sta 5511; 8°15′20″N, 123°57′E; 750 m; gray mud, sand; 11.7°C; 7 Aug 1909 (1218–1238); 12′ Tanner beam trawl: 2 ovig ♀ [37.0, 38.8]. *Cagayan Islands, Sulu Sea:* sta 5423; 9°38′30″N, 121°11′E; 929 m; gray mud, coral sand; 9.9°C; 31 Mar 1909 (0955–1022); 12′ Agassiz beam trawl, mud bag: 1♀ [19.3].

INDONESIA. *Teluk Tomini, Celebes:* sta 5603; 0°24′00″N, 123°03′45″E; 1469 m; sand; 15 Nov 1909 (1312–1437); 12′ Agassiz beam trawl: 1♂ [40.7].

RANGE.—Except for the holotypes of *A. carinata* and *A. approxima,* which were taken at the same *Challenger* station near the Pacific end of the Straits of Magellan, this species is known only from the Philippines and Indonesia, including the female with a carapace length of 29 mm taken west of Sumatra by the *Valdivia* (Balss, 1925:257). It is evidently a benthic species living in depths of 315–1469 meters.

REMARKS.—Calman (1939:193) was almost certainly correct in believing that *A. approxima* was described from an immature specimen of *A. carinata.* Such specimens as the former have a very different appearance from the adults because of the longer rostrum, but they agree in all other characters. In the smallest recognizable male in the *Albatross* collections, with a carapace length of 15.2 mm, the appendix masculina is little more than a bud; all specimens smaller than this have therefore been designated as juveniles.

*4. *Acanthephyra cucullata* Faxon, 1893

FIGURES 2*h*, 4*h*, 5*h*, 8*g*

Acanthephyra cucullata Faxon, 1893:206 [type-locality: northeast of Isla de Malpelo, Colombia; 4°56′00″N, 80°52′30″W; 3241 m]; 1895:167, pl. 44: figs. 1–16.

DIAGNOSIS.—Integument soft and membranous; rostrum very short, about 1/8 as long as carapace, slightly overreaching anteriorly extended eyes, ventral margin nearly vertical, unarmed; carapace with high, sharp keel anteriorly becoming indistinct posteriorly and disappearing on posterior 1/4 just behind cervical groove, nearly straight, with hardly perceptible depression at cervical groove, branchiostegal spine buttressed by long, sharp carina extending posteriorly to posterior branchial region, suprabranchial ridge fairly distinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin very little excavate either side of median tooth, 6th somite about 2½ times

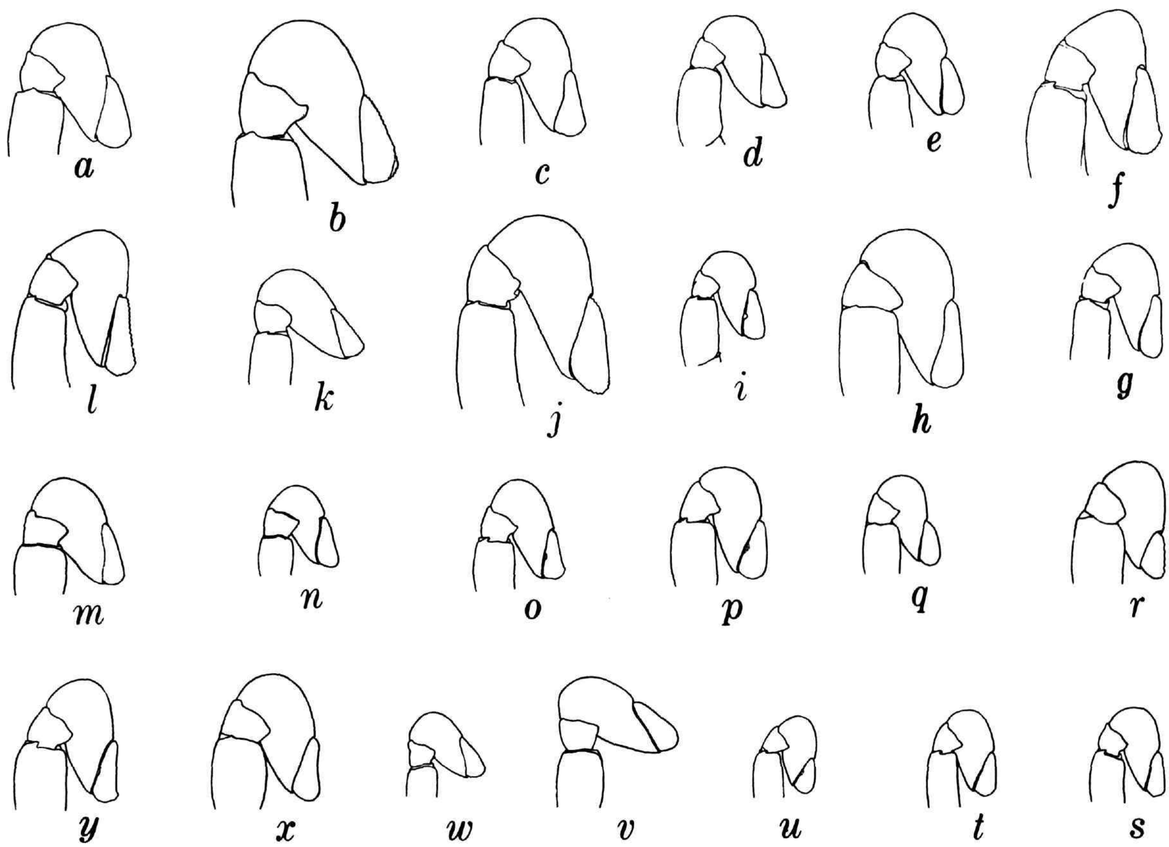

FIGURE 5.—Terminal segments of right 2nd maxillipeds of species of *Acanthephyra: a, A. acanthitelsonis,* male [25.1 mm], *Pillsbury* sta 21, off Ghana; *b, A. acutifrons,* ovigerous female [48.0 mm], *Albatross* sta 2384, Gulf of Mexico; *c, A. armata,* male [30.0 mm], *Oregon* sta 640, Gulf of Mexico; *d, A. brevicarinata,* male [22.0 mm], *Albatross* sta 3010, Gulf of California; *e, A. brevirostris,* male [23.7 mm], *Albatross* sta 2566, east of Chesapeake Bay; *f, A. carinata,* male [36.2 mm], *Albatross* sta 5524, Mindanao Sea; *g, A. chacei,* male paratype [25.2 mm], *Wecoma* cruise 7606B, sta NH65, haul 2361, bkt 3, west of Yaquina head, Oregon; *h, A. cucullata,* male [14.0 mm], *Alpha Helix* sta 71, Banda Sea; *i, A. curtirostris,* male [17.0 mm], *Alpha Helix* sta 61, Banda Sea; *j, A. eximia,* male [39.2 mm], *Albatross* sta 5603, Teluk Tomini, Celebes; *k, A. faxoni,* male [13.4 mm], *Albatross* sta 4653, off Peru; *l, A. fimbriata,* male [37.2 mm], *Albatross* sta 5495, Mindanao Sea; *m, A. gracilipes,* female [13.0 mm], *Atlantis II* sta RHB1421, east of Bahìa, Brazil; *n, A. indica,* male [8.0 mm], *Alpha Helix* sta 87, Banda Sea; *o, A. kingsleyi,* male [19.7 mm], *Pillsbury* sta 265, Gulf of Guinea; *p, A. media,* male [21.0 mm], *Albatross* sta 5628, Selat Patinti, Halmahera; *q, A. pelagica,* male [18.0 mm], off Messina, Sicily (R.B. Manning); *r, A. prionota,* male paratype [6.2 mm], *Discovery* sta 7089#32, north of Cape Verde Islands; *s, A. purpurea,* male [17.7 mm], *Chain* sta RHB2574, northeast of Madeira Islands; *t, A. quadrispinosa,* male [16.9 mm], *Albatross* sta 5618, west of Halmahera; *u, A. sanguinea,* male [16.0 mm], *Albatross* sta 5287, Verde Island Passage, Philippines; *v, A. sibogae,* male [14.0 mm], *Alpha Helix* sta 110, Banda Sea; *w, A. smithi,* male [17.0 mm], *Te Vega* sta 189, southwest of Maldive Islands; *x, A. stylorostratis,* male [10.8 mm], *Knorr* sta 3126, east of Bermuda; *y, A. trispinosa,* male [13.8 mm], *Albatross* sta 3398, off Ecuador.

as long as posterior height; telson sulcate in dorsal midline, with 4 pairs of dorsolateral spines; eyestalk with cylindrical papilla arising from mesial margin at juncture with cornea and extending distally nearly to level of distal surface of cornea; maximum carapace length 27 mm.

MATERIAL.—INDONESIA. *Teluk Bone, Celebes:* sta 5660; 5°36′30″S, 120°49′00″E; 1266 m; gray mud, sand; 4.0°C; 20 Dec 1909 (0914–1005); 12′ Agassiz beam trawl: 1♀ [9.9].

RANGE.—Off eastern Africa, Maldive Islands, Indonesia, and tropical American Pacific; mesopelagic.

*5. *Acanthephyra curtirostris* Wood-Mason, 1891

FIGURES 2*i*, 4*i*, 5*i*, 6*g*, 8*h*

Acanthephyra acutifrons Bate, 1888:749 [in part].
Acanthephyra curtirostris Wood-Mason, in Wood-Mason and Alcock, 1891:195 [type-locality: the type-series came from two localities in the Indian Ocean: Bay of Bengal off Andhra Pradesh; 16°55′41″N, 83°21′18″E, 1536 m; and Laccadive Sea off Elicalpeni Bank; 11°12′47″N, 74°25′30″E, 1829 m].—Wood-Mason and Alcock, 1892:364, fig. 5.

DIAGNOSIS.—Integument reasonably firm; rostrum less than ½ as long as carapace, not

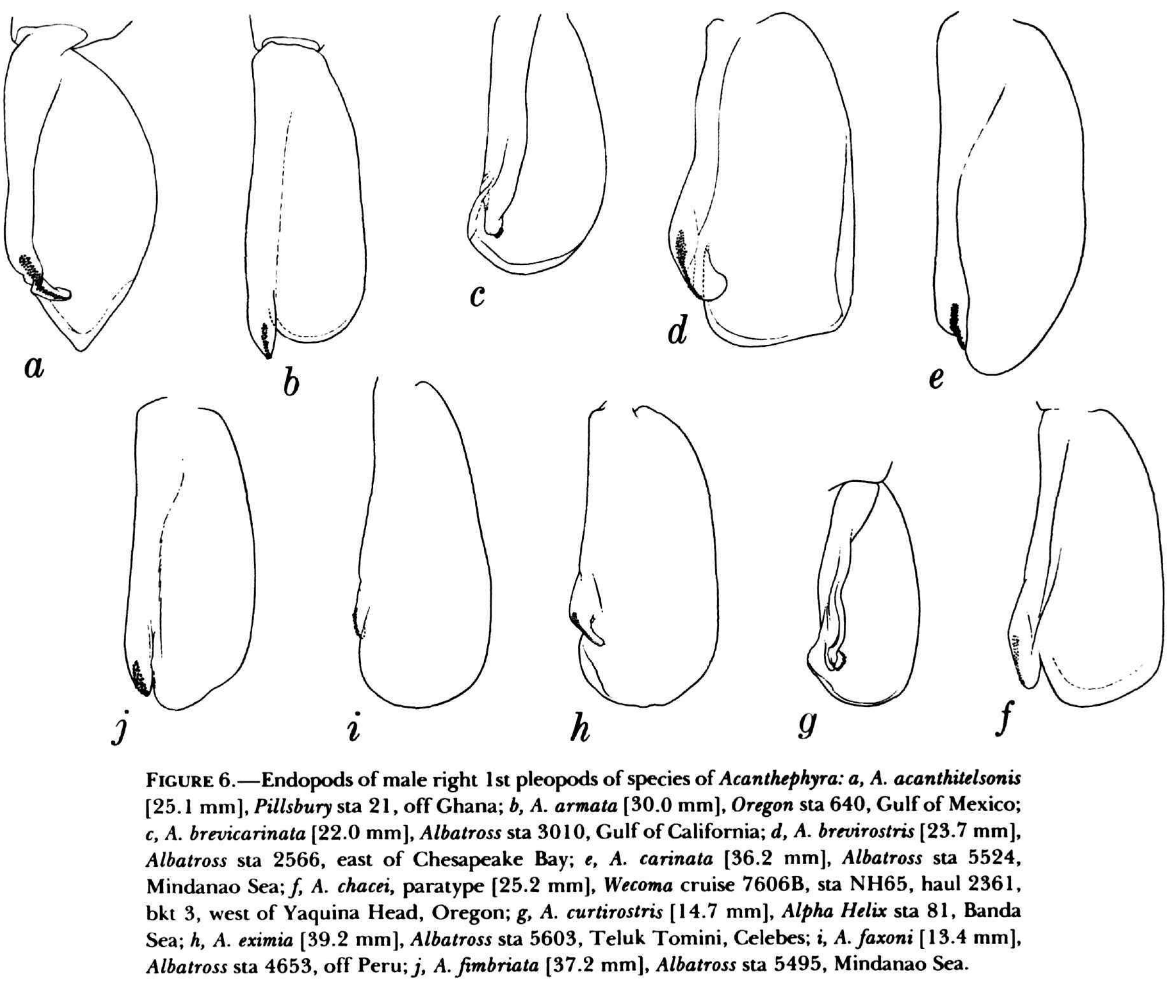

FIGURE 6.—Endopods of male right 1st pleopods of species of *Acanthephyra: a, A. acanthitelsonis* [25.1 mm], *Pillsbury* sta 21, off Ghana; *b, A. armata* [30.0 mm], *Oregon* sta 640, Gulf of Mexico; *c, A. brevicarinata* [22.0 mm], *Albatross* sta 3010, Gulf of California; *d, A. brevirostris* [23.7 mm], *Albatross* sta 2566, east of Chesapeake Bay; *e, A. carinata* [36.2 mm], *Albatross* sta 5524, Mindanao Sea; *f, A. chacei*, paratype [25.2 mm], *Wecoma* cruise 7606B, sta NH65, haul 2361, bkt 3, west of Yaquina Head, Oregon; *g, A. curtirostris* [14.7 mm], *Alpha Helix* sta 81, Banda Sea; *h, A. eximia* [39.2 mm], *Albatross* sta 5603, Teluk Tomini, Celebes; *i, A. faxoni* [13.4 mm], *Albatross* sta 4653, off Peru; *j, A. fimbriata* [37.2 mm], *Albatross* sta 5495, Mindanao Sea.

nearly reaching end of antennal scale, ventral margin oblique, armed with 1 tooth; carapace rounded, not carinate, on posterior 1/2 of dorsal midline, nearly straight, with hardly perceptibe depression at cervical groove, branchiostegal spine buttressed by carina extending posteriorly to branchial region, suprabranchial ridge fairly distinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin slightly excavate either side of median tooth, 6th somite about 2 1/3 times as long as posterior height; telson slightly sulcate in anterior 1/2 of dorsal midline, with 6 or more pairs of dorsolateral spines; eyestalk with acute papilla arising from mesial margin at juncture with cornea and directed distad but not nearly reaching level of distal surface of cornea; maximum carapace length about 20 mm.

MATERIALS.—PHILIPPINES. *South China Sea off western Luzon:* sta 5437; 15°45'54"N, 119°42'45"E; 8 May 1909 (1207–1256); 3-meter open net towed horizontally at 823 m: 1y♂ [7.8]. *Lagonoy Gulf, east of southern Luzon:* sta 5471; 13°34'57"N, 123°47'06"E; 1039 m; 19 Jun 1909 (0917–0946); 12' Agassiz beam trawl: 1♂ [19.8] 1♀ [16.3]. *Northern Palawan Passage:* 10°46'40"N, 118°29'E; 942 m; gray mud; 27 Dec 1908 (1610–1714); 12' Tanner beam trawl: 1♀ [11.0].

INDONESIA. *Teluk Tomini, Celebes:* sta 5607; 0°04'00"S, 121°36'00"E; 1392 m; fine sand; 18 Nov 1909 (0920–0940); 12' Agassiz beam trawl: 1♀ [19.0]. *Off southern Buru:* sta 5638; 3°47'15"S, 126°23'40"E; 946 m; fine gray sand; 10 Dec 1909 (1400–1436); 12' Agassiz beam trawl: 1♀ [13.3].

RANGE.—*Acanthephyra curtirostris* has been recorded from lower latitudes around the world to nearly 51°N in the eastern Pacific (Butler, 1980:62), but the recognition by Hanamura (1984) of a distinct species (*A. brevicarinata*) in the eastern tropical Pacific and that author's observation (1984:69) that specimens recorded from the northeastern Pacific are larger and produce more than three times as many eggs than specimens of *A. curtirostris* from Hawaii may suggest the existence of a species complex, similar to the one centered about *A. purpurea*, of which typical *A. curtirostris* and *A. media* may represent the extremes. It is not clear from Hanamura (1983:53, 54, 74) whether he believes that the true *A. curtirostris*, as well as *A. brevicarinata*, occurs in the far eastern Pacific, but it would seem that he does. Although only one of the *Albatross* specimens was taken in a midwater net, the species is almost certainly mesopelagic, probably in depths of 190 to more than 1500 m; Krygier and Pearcy (1981:81) noted that there was no indication of diurnal vertical migration in the northeastern Pacific population.

*6. *Acanthephyra eximia* Smith, 1884

FIGURES 2*j*, 4*j*, 5*j*, 6*h*, 9*a*

[?] *Alpheus Pelagicus* Risso, 1816:91, pl. 2: fig. 7 [type-locality: "sur le grand banc de calcaire compacte, qui traverse, de l'est à l'ouest, la mer de Nice ... dans les grande profondeur de notre mer."].

Acanthephyra eximea Smith, 1884:376 (*eximia* on p. 377) [type-locality: off Cape Hatteras, North Carolina; 35°09'50"N, 74°57'40"W; 1716 m]; 1886b:63[667], pl. 14: fig. 1.

Acanthephyra angusta Bate, 1888:737, pl. 124: fig. 6 [type-locality: off Kepulauan Banda, Indonesia; 4°34'00"S, 129°57'30"E; 366 m].

Acanthephyra edwardsii Bate, 1888:747, pl. 126: fig. 1 [type-locality: off Aracaju, Brazil; 10°46'S, 36°08'W; 1408 m].

Acanthephyra brachytelsonis Bate, 1888:753, pl. 126: fig. 7 [type-locality: the *Challenger* material was taken at eight widely separate stations: near Kepulauan Talaud, 914 m, and off Kepulauan Banda, 366 m, Indonesia; Sagami Nada, Japan, 631 and 1417 m; off the Kermadec Islands, South Pacific, 951, 1097, and 1152 m; and the western South Atlantic east of Península Valdís, Argentina, 3731 m].

[?] *Acanthephyra pulchra* A. Milne-Edwards, 1890:163 [type-locality: off Monaco (1650 m)].

Acanthephyra eximia.—Crosnier and Forest, 1973:34, fig. 7*c–d*.

DIAGNOSIS.—Integument reasonably firm; rostrum very variable in length, in adults usually about 4/5 as long as carapace and often overreaching antennal scale, ventral margin convex, armed

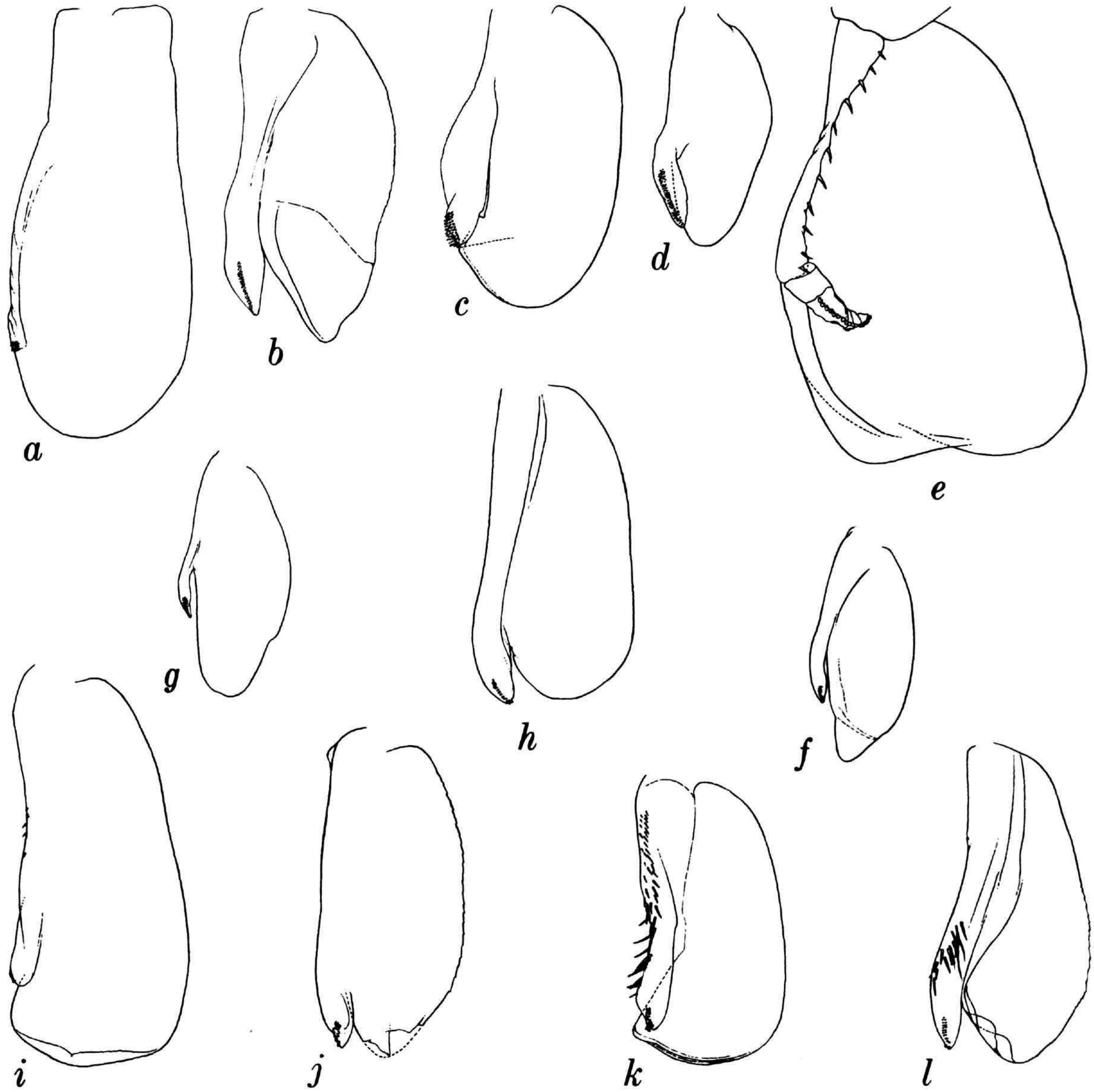

FIGURE 7.—Endopods of male right 1st pleopods of species of *Acanthephyra: a, A. indica* [8, 0 mm], *Alpha Helix* sta 87, Banda Sea; *b, A. kingsleyi* [18.0 mm], *Pillsbury* sta 269, Gulf of Guinea; *c, A. media* [21.0 mm], *Albatross* sta 5628, Selat Patinti, Halmahera; *d, A. pelagica* [19.2 mm], *Atlantis II* sta RHB1859, Mediterranean Sea; *e, A. prionota* paratype [6.2 mm], *Discovery* sta 7089#32, north of Cape Verde Islands; *f, A. purpurea* [17.7 mm], *Chain* sta RHB2574, northeast of Madeira Islands; *g, A. quadrispinosa* [16.9 mm], *Albatross* sta 5618, west of Halmahera; *h, A. sanguinea* [16.8 mm], *Te Vega* sta 189, southwest of Maldive Islands; *i, A. sibogae* [14.0 mm], *Alpha Helix* sta 110, Banda Sea; *j, A. smithi* [17.0 mm], *Te Vega* sta 189, southwest of Maldive Islands; *k, A. stylorostratis* [10.8 mm], *Knorr* sta 3126, east of Bermuda; *l, A. trispinosa* [13.8 mm], *Albatross* sta 3398, off Ecudaor.

with 1–5, usually 3, teeth; carapace with dorsal margin sharply carinate throughout most of length, usually distinctly sinuous in lateral aspect, branchiostegal spine without distinct buttress, suprabranchial ridge distinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin slightly excavate either side of median tooth, 6th somite at least 1½ times as long as posterior height; telson with moderate ridge in anterior ⅓ of dorsal midline, with 3–5, usually 4, pairs of dorsolateral spines; eyestalk with blunt projection arising from mesial margin; maximum carapace length 41 mm.

MATERIAL.—SOUTH CHINA SEA. *Southeast of Hong Kong:* sta 5299; 20°05′N, 116°05′E; 958 m; gray mud, sand; 5.8°C; 8 Aug 1908 (0853–0915); 12′ Agassiz beam trawl, mud bag: 2♂ [17.0, 21.8].

PHILIPPINES. *Off western Lubang Islands:* sta 5274; 13°57′30″N, 120°03′25″E; 960 m; gray mud, sand; 5.2°C; 16 Jul 1908 (0959–1029); 12′ Agassiz beam trawl: 1♂ [25.0]. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5119; 13°45′05″N, 120°30′30″E; 720 m; green mud, sand; 6.5°C; 21 Jan 1908 (1324–1356); 12′ Tanner beam trawl: 1♀ [20.0]. *Western end of Verde Island Passage, north of Mindoro;* sta 5286; 13°38′15″N, 120°34′20″E, 823 m; gray sand, mud; 5.8°C; 20 Jul 1908 (1231–1309); 12′ Agassiz beam trawl, mud bag: 2♂ [21.2, 28.0]. *Verde Island Passage, north of Mindoro:* sta 5114; 13°36′11″N, 120°45′26″E; 622 m; fine sand; 20 Jan 1908 (1049–1117); 12′ Tanner beam trawl, mud bag: 1♀ [27.0]; sta 5115; 13°37′11″N, 120°43′40″E; 622 m; 20 Jan 1908 (1341–1401); 12′ Tanner beam trawl, mud bag: 1♀ [27.0].

Lagonoy Gulf, east of southern Luzon: sta 5465; 13°39′42″N, 123°40′39″E; [914 m]; gray mud; 17 Jun 1909 (0839–0859); 12′ Agassiz beam trawl, mud bag: 1♂ [26.8] 2♀ [28.1, 28.4]; sta 5466; 13°38′36″N, 123°41′45″E; [988 m]; gray mud; 17 Jun 1909 (1040–1102); 12′ Agassiz beam trawl, mud bag: 3♂ [21.7–23.1]; sta 5467; 13°35′27″N, 123°37′18″E; [878 m]; gray mud; 18 Jun 1909 (0752–0834); 12′ Agassiz beam trawl, mud bag: 6♂ [12.3–27.5] 3♀ [13.1–22.2]; sta 5468; 13°35′39″N, 123°40′28″E; 1041 m; green mud; 18 Jan 1909 (0958–1031); 12′ Agassiz beam trawl, mud bag: 4♂ [16.0–23]; sta 5469; 13°36′48″N, 123°38′24″E; [914 m]; green mud; 18 Jun 1909 (1329–1411); 12′ Agassiz beam trawl: 5♂ [13.9–23.8] 4♀ [17.3–24.9]; sta 5470; 13°37′30″N, 123°41′09″E; [1024 m]; [mud]; 18 Jun 1909 (1526–1600); 12′ Agassiz beam trawl: 1♂ [23.4]. *Off Arangasa Islands, eastern Mindanao:* sta 5236; 8°50′45″N, 126°26′52″E; 903 m; fine gray sand; 5.1°C; 11 May 1908 (1027–1102); 12′ Agassiz beam trawl, 3 mud bags: 1♀ [22.9].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5585; 4°07′00″N, 118°49′54″E; 871 m; gray mud; 5.1°C; 28 Sep 1909 (0931–0951); 9′ Tanner beam trawl, mud bag: 1♂ [16.8]. *Makassar Strait west of Celebes:* sta 5666; 2°54′30″S, 118°47′00″E; 497 m; green mud; 8.6°C; 29 Dec 1909 (0839–0918); 12′ Agassiz beam trawl: 1♂ [22.0] 1♀ [20.2]; sta 5667; 2°56′00″S, 118°47′30″E; 671 m; gray sand, mud; 5.4°C; 29 Dec 1909 (0955–1025); 12′ Agassiz beam trawl: 11♂ [17.0–24.0] 4♀ [15.8–23.9], 1 ovig [23.9], 3 juv [8.6–11.2]. *Makassar Strait off southwestern Celebes:* sta 5664; 4°43′22″S, 118°53′18″E; 732 m; hard bottom; 6.3°C; 28 Dec 1909 (0943–1004); 12′ Agassiz beam trawl: 1♀ [21.6]. *Teluk Bone, Celebes:* sta 5651; 4°43′50″S, 121°23′24″E; 1280 m; green mud; 3.7°C; 17 Dec 1909 (1432–1452); 12′ Agassiz beam trawl: 1 juv [?]; sta 5655; 3°34′10″S, 120°50′30″E; 1112 m; gray mud, fine sand; 4.0°C; 18 Dec 1909 (1100–1120); 12′ Agassiz beam trawl: 1♂ [25.0] 2 juv [8.2, 9.2]; sta 5656; 3°17′40″S, 120°36′45″E; 885 m; gray mud; 5.1°C; 19 Dec 1909 (0837–0842); 12′ Agassiz beam trawl: 1 ovig ♀ [23.0]; sta 5657; 3°19′40″S, 120°36′30″E; 900 m; gray mud; 5.2°C; 19 Dec 1909 (1108–1128); 12′ Agassiz beam trawl: 1♂ [22.9]; sta 5658; 3°32′40″S, 120°31′30″E; 933 m; gray mud; 5.1°C; 18 Dec 1909 (1423–1443); 12′ Agassiz beam trawl: 2♀ [15.9, 23.9].

Selat Butung, Celebes: sta 5646; 5°31′30″S, 122°22'40"E; 834 m; green mud; 16 Dec 1909 (1210–1230); 12' Agassiz beam trawl: 1♂ [15.7] 2♀ [14.2, 19.8] 4 juv [10.5–13.3]; sta 5647; 5°34'00"S, 122°18'15"E; 950 m; green mud; 16 Dec 1909 (1444–1504); 12' Agassiz beam trawl: 3y♂ [12.9–15.0]. *Teluk Tomini, Celebes:* sta 5603; 0°24'00"N, 123°03'45"E; 1469 m; sand; 15 Nov 1909 (1312–1437); 12' Agassiz beam trawl: 1♂ [39.2] 1♀ [21.0]; sta 5605; 0°21'33"N, 121°34'10"E; 1183 m; 16 Nov 1909 (1025–1046); 12' Agassiz beam trawl: 1♂ [23.8]; sta 5607; 0°04'00"S, 121°36'00"E; 1392 m; fine sand; 18 Nov 1909 (0920–0940); 12' Agassiz beam trawl: 1y♂ [13.6]; sta 5610; 0°36'00"S, 122°01'00"E; 1240 m; gray mud; 19 Nov 1909 (1650–1717); 12' Agassiz beam trawl: 2♂ [19.0, 20.0] 4♀ [15.1–25.2]. *Molucca Sea:* sta 5601; 1°13'10"N, 125°17'05"E; 1399 m; sand, globigerina, pteropods; 13 Nov 1909 (1418–1439); 12' Agassiz beam trawl, mud bag: 2♂ [13.9, 20.1] 1 juv [9.1]. *West of Halmahera:* sta 5618; 0°37'00"N, 127°15'00"E; 763 m; gray mud; 27 Nov 1909 (1444–1504); 12' Agassiz beam trawl: 1♀ [18.9]; sta 5619; 0°35'00"N, 127°14'40"E; 795 m; fine gray sand, mud; 27 Nov 1909 (1612–1641); 12' Agassiz beam trawl: 5♂ [14.2–25.2] 4♀ [18.4–27.2], 2 ovig [25.8, 27.2].

Southern end of Selat Patinti, southern Halmahera: sta 5630; 0°56'30"S, 128°05'00"E; 1041 m; coral sand, mud; 2 Dec 1909 (0936–1000); 12' Agassiz beam trawl: 2♀ [20.8, 29.8], 1 ovig [29.8]; sta 5631; 1°53'30"S, 127°39'00"E; 732 m; coral rock, soapstone; 3 Dec 1909 (0956–1001); 12' Agassiz beam trawl: 1y♀ [12.9]. *Ceram Sea south of Pulau Obi:* sta 5635; 1°53'30"S, 127°39'00"E; 732 m; coral rock, soapstone; 3 Dec 1909 (0956–1001); 12' Agassiz beam trawl: 1♂ [22.6]. *Off southern Buru:* sta 5638; 3°47'15"S, 126°23'40"E; 946 m; fine gray sand; 10 Dec 1909 (1400–1436); 12' Agassiz beam trawl: 2♂ [13.0, 39.3].

RANGE.—This species has been recorded off most tropical and temperate coasts of the world. It is widespread in the Indo-Pacific region from South and eastern Africa to Japan, Hawaii, and the Erben Seamount about 650 miles off California. Although juvenile specimens have been taken in midwater nets on a few occasions, adults probably live on or near the bottom in depths of 200 to more than 4700 m.

REMARKS.—Although most of his colleagues have understandably accepted the opinion of Holthuis (1947:315; 1977:46, pl. 2: fig. c) that the species called *Alpheus Pelagicus* by Risso (1816:91, pl. 2: fig. 7) is the one referred to *Acanthephyra haeckeli* (Von Martens, 1868) by Kemp (1939:575), it seems possible to me that Risso's species could just as well be a senior synonym of *Acanthephyra pulchra* A. Milne-Edwards, 1890, which may or may not be a junior synonym of *A. eximia*. As noted by Holthuis (1947), the identity of the species cannot be determined from Risso's original description and illustration, the latter apparently based on a specimen with an incomplete rostrum. The much superior rendition of a specimen of "*Ephyra Pelagica*" retrieved from Risso's unpublished manuscripts by Monod (1931: fig. 1) and republished by Holthuis (1977) leaves little doubt that the species is assignable to *Acanthephyra* but, in my opinion, it does not satisfactorily indicate which of the two known Mediterranean species is represented. The rostrum depicted in Risso's manuscript illustration fails to agree with that of either of the species, but its length—greater than is typical of *A. eximia*—is not incompatible with the statement by Crosnier and Forest (1973:36) that the rostrum in the type-series of *A. pulchra* and in other Mediteranean examples assigned to *A. eximia* is unusually long. They noted, "Il semble donc qu'il existe, en Méditerranée et au voisinage, une population d'*A. eximia* homogène quant aux caractères du rostre." [It seems that a population of *A. eximia,* consistent in the characters involving the rostrum, exists in and near the Mediteranean.] The abdomen shown in Risso's manuscript figure could represent either species; unfortunately we cannot determine whether the telson was sulcate in the dorsal midline, as in *A. haeckelii*, or ridged, as in *A. eximia*. Only the carapace remains, therefore, as the last clue to the identity of Risso's species, and it seems to me that it may be significant. Virtually the only feature common to both of Risso's illustrations (the one that accompanied his published description of *Alpheus Pelagicus* and the one retrieved later by Monod and Holthuis) is the sinuous dorsal profile of the carapace, a character that is distinctive of nearly all specimens of *Acanthephyra eximia* wherever it occurs in the world. It may be desirable, for the sake of nomenclatural stability, to continue recognition of the Holthuis concept of Risso's species, but it may also be beneficial to mention here the possible alternative.

*7. *Acanthephyra fimbriata* Alcock and Anderson, 1894

FIGURES 2*l*, 4*l*, 5*l*, 6*j*, 9*c*

Acanthephyra armata.—Wood-Mason and Alcock, 1892:359, fig. 2 [not *A. armata* A. Milne-Edwards].

Acanthephyra armata var.—Wood-Mason, 1892, pl. 3: fig. 1.

Acanthephyra armata var. *fimbriata* Alcock and Anderson, 1894: 156 [type-locality: the original specimen, described and illustrated but not named in 1892, was taken in the Andaman Sea off Little Andaman; 11°25′05″N, 92°27′06″E, 741 m; the two additional specimens reported in 1894 came from the Bay of Bengal off Madras; 12°50′N, 81°30′E, 869 m and the Arabian Sea off Goa; 15°29′N, 72°41′E, 1023 m].

A[canthephyra] fimbriata.—Chace, 1936:27.

DIAGNOSIS.—Integument firm; rostrum 1–1½ times as long as carapace, overreaching antennal scale, ventral margin convex, armed with 1 tooth; carapace with dorsal margin carinate, very obscurely so on posterior ¼, nearly straight, not interrupted by cervical groove, branchiostegal spine buttressed by strong, sharp carina extending posteriorly nearly to branchial region, suprabranchial ridge distinct, sharp subbranchial carina near ventral margin of carapace; abdomen

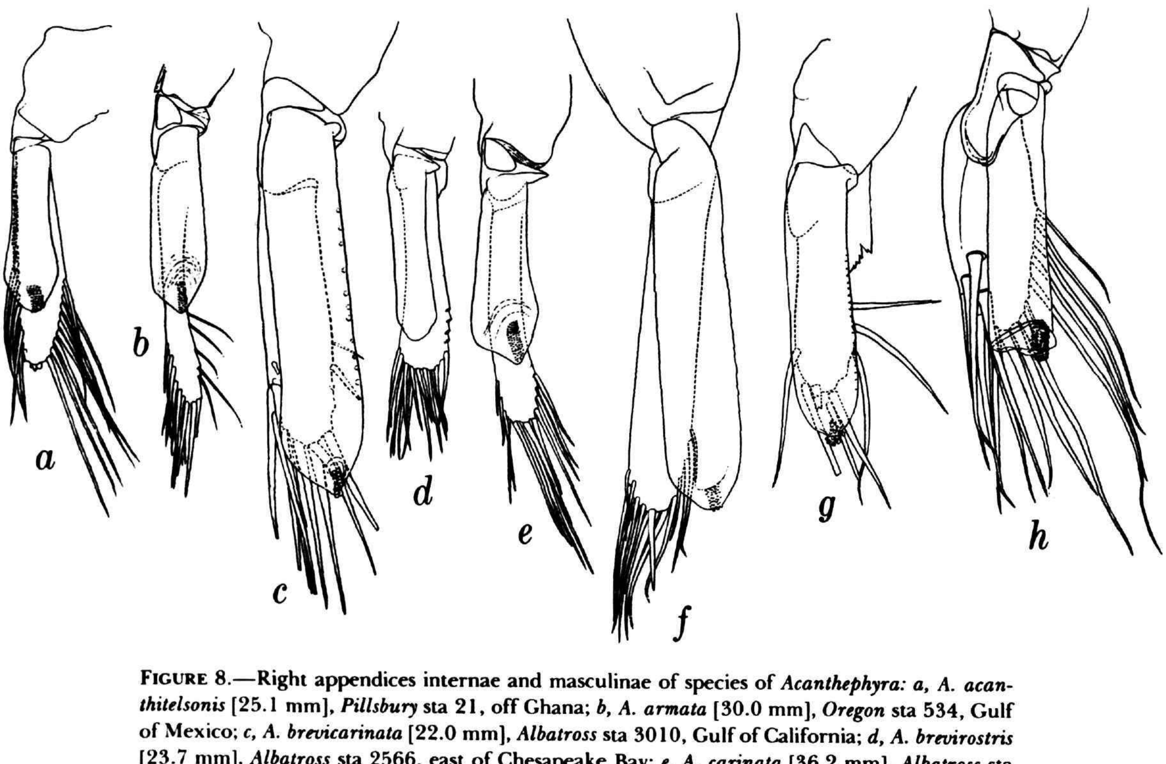

FIGURE 8.—Right appendices internae and masculinae of species of *Acanthephyra: a, A. acanthitelsonis* [25.1 mm], *Pillsbury* sta 21, off Ghana; *b, A. armata* [30.0 mm], *Oregon* sta 534, Gulf of Mexico; *c, A. brevicarinata* [22.0 mm], *Albatross* sta 3010, Gulf of California; *d, A. brevirostris* [23.7 mm], *Albatross* sta 2566, east of Chesapeake Bay; *e, A. carinata* [36.2 mm], *Albatross* sta 5524, Mindanao Sea; *f, A. chacei* paratype [25.2 mm], *Wecoma* crusie 7060B, sta NH65, haul 2361, bkt 3, west of Yaquina Head, Oregaon; *g, A. cucullata* [14.0 mm], *Alpha Helix* sta 71, Banda Sea; *h, A. curtirostris* [17.0 mm], *Alpha Helix* sta 61, Banda Sea.

dorsally carinate on 5 posterior somites, 4 posterior somites with posteromesial tooth, 3rd somite not deeply excavate either side of median tooth, 6th somite about 1½ times as long as posterior height; telson with strong rounded ridge in anterior ½ of dorsal midline, with 3, rarely 4, pairs of small dorsolateral spines; eyestalk with strong, subquadrate elevation on mesial surface near junction with cornea; maximum carapace length 44 mm.

MATERIAL.—PHILIPPINES. *Mompog Pass east of Marinduque:* sta 5219; 13°21′N, 122°18′45″E; 969 m; green mud; 10.4°C; 23 Apr 1908 (1357–1437); 12′ Agassiz beam trawl, mud bag: 2♂ [26.0, 26.8]. *Sogod Bay, southern Leyte:* sta 5488; 10°N, 125°06′45″E; 1412 m; green mud; 11.3°C; 31 Jul 1909 (1652–1738); 12′ Agassiz beam trawl: 1y♂ [18.0]. *Between Bohol and Siquijor Island:* sta 5527; 9°22′30″N, 123°42′40″E; 719 m; globigerina ooze; 11.8°C; 11 Aug 1909 (1338–1358); 12′ Tanner beam trawl: 3♀ [30.5–40.2], 2 ovig [37.1, 40.2]. *North of Siquijor Island:* sta 5526; 9°12′45″N, 123°45′30″E; 1472 m; green mud, globigerina; 11.3°C; 11 Aug 1909 (0929–1036); 12′ Tanner beam trawl: 1 ovig ♀ [43.7]; sta 5528; 9°24′45″N, 123°39′15″E; 803 m; globigerina ooze; 11.8°C; 11 Aug 1909 (1542–1611); 12′ Tanner beam trawl: 3 ovig ♀ [41.4–42.7]; sta 5529; 9°23′45″N, 123° 39′30″E; 807 m; gray mud, globigerina; 11.7°C; 11 Aug 1909 (1644–1719); 12′ Tanner beam trawl, mud bag: 1♀ [19.7]. *Eastern Mindanao Sea:* sta 5494; 9°06′30″N, 125°18′40″E; 1240 m; green mud, sand; 11.8°C; 2 Aug 1909 (0917–0952); 12′ Agassiz beam trawl: 1♀ [32.1]; sta 5495; 9°06′30″N, 125°00′20″E; 1785 m; gray mud; 11.3°C; 2 Aug 1909 (1244–1354); 12′ Agassiz beam trawl: 3♂ [28.2–37.2] 1 ovig ♀ [39.1]. *Iligan Bay, northern Mindanao:* sta 5511; 8°15′20″N, 123°57′E; 750 m; gray mud, sand; 11.7°C; 7 Aug 1909 (1218–1238); 12′ Tanner beam trawl: 3♀ [30.7–40.0], 2 ovig [32.0, 40.0]; sta 5512; 8°16′02″N, 123°58′26″E, 814 m; gray mud, fine sand; 11.6°C; 7 Aug 1909 (1309–1346); 12′ Tanner beam trawl: 3 ovig ♀ [37.8–38.5]; sta 5513; 8°16′45″N, 124°02′ 48′E; 923 m; gray mud, fine sand; 11.6°C; 7 Aug 1909 (1507–1553); 12′ Tanner beam trawl: 1♀ [37.2]. *Cagayan Islands, Sulu Sea:* sta 5423; 9°38′30″N, 121°11′E; 929 m; gray mud, coral sand; 9.9°C; 31 Mar 1909 (0955–1022); 12′ Agassiz beam trawl, mud bag: 1♀ [42.7]; sta 5424; 9°37′05″N, 121°12′37″E; 622 m; coral sand; 10.2°C; 31 Mar 1909 (1324–1344); 12′ Agassiz beam trawl, mud bag: 3♀ [28.8–37.6].

RANGES.—Gulf of Aden, Arabian Sea, Laccadive Sea, Bay of Bengal, Andaman Sea, and the Philippines. This is a benthic species that lives in depths of 412–1785 meters. Although both *A. fimbriata* and the closely related *A. armata* occur in similar situations in the Philippines—perhaps the only region shared by the two species—it may be significant that they were never taken at the same station by the *Albatross*.

*8. *Acanthephyra indica* Balss, 1925

FIGURES 3*b*, 4*n*, 5*n*, 7*a*, 9*d*

Acanthephyra sp.—De Man, 1920:68, pl. 6: fig. 16.
Acanthephyra indica Balss, 1925:264, figs. 34, 35 [type-locality: Indian Ocean east of Sri Lanka; 7°01′N, 85°56′E; 0–2500 m].
Acanthephyra cucullata.—Balss, 1927:268 [in part].

DIAGNOSIS.—Integument soft and membranous; rostrum triangular, little more than ⅓ as long as carapace, not overreaching antennular peduncle, ventral margin oblique, unarmed; carapace with sharp carina in dorsal midline disappearing on posterior ¼ behind cervical groove, nearly straight with faint notch at cervical groove, branchiostegal spine buttressed by sharp carina extending posteriorly nearly to posterior margin of branchial region, second carina (interrupted) extending posteriorly from near orbit nearly to posterior margin; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin not excavate either side of median tooth, 6th somite about 3½ times as long as posterior height; telson faintly sulcate in dorsal midline, armed with 4 pairs of dorsolateral spines; eyestalk with bluntly triangular papilla arising from mesial margin at juncture with cor-

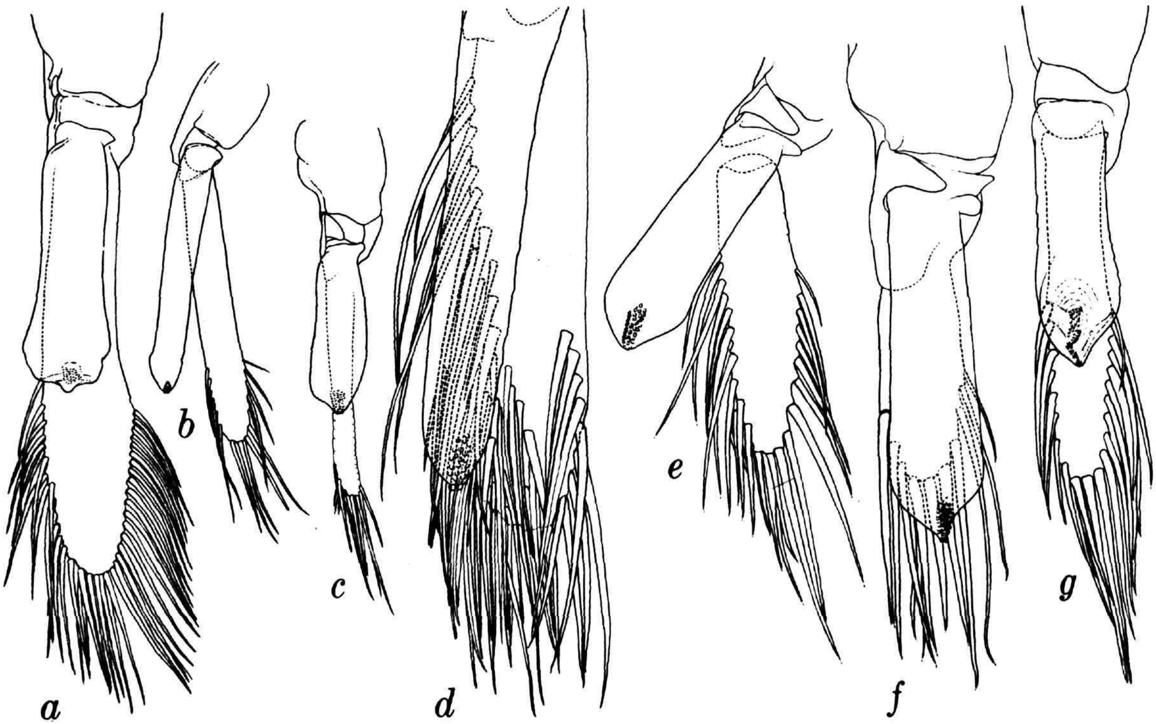

FIGURE 9.—Right appendices internae and masculinae of species of *Acanthephyra: a, A. eximia* [39.2 mm], *Albatross* sta 5603, Teluk Tomini, Celebes; *b, A. faxoni* [13.4 mm], *Albatross* sta 4653, off Peru; *c, A. fimbriata* [37.2 mm], *Albatross* sta 5495, Mindanao Sea; *d, A. indica* [8.0 mm], *Alpha Helix* sta 87, Banda Sea; *e, A. kingsleyi* [19.7 mm], *Pillsbury* sta 265, Gulf of Guinea; *f, A. media* [21.0 mm], *Albatross* sta 5628, Selat Patinti, Halmahera; *g, A. pelagica* [18.0 mm], off Messina, Sicily (R.B. Manning).

nea and directed dorsomesially, not nearly reaching level of distal surface of cornea; maximum carapace length 9 mm.

MATERIAL.—PHILIPPINES. *Northern Palawan Passage:* sta 5350; 10°46′40″N, 118°29′E; 942 m; gray mud; 27 Dec 1908 (1610–1714); 12′ Tanner beam trawl, mud bag: 1 ovig ♀ [8.9].

RANGE.—Indian Ocean, Indonesia, and the Philippines; mesopelagic.

REMARKS.—Comparison of specimens of *A. indica* with material of *A. cucullata* fails to support Balss (1927) in his belief that the former species is a junior synonym of the latter. Not only does *A. indica* have two, rather than one, lateral carinae on the carapace, the "ventral" margin of the rostrum oblique rather than vertical, and a cornea and eyestalk very unlike those of *A. cucullata*, but the dentition on the incisor process of the mandible is different in the two forms (Figures 2*h*, 3*b*).

*9. *Acanthephyra media* Bate, 1888

FIGURES 3*d*, 4*p*, 5*p*, 7*c*, 9*f*

Acanthephyra media Bate, 1888:736, pl. 124: fig. 5 [type-locality: between Tablas and Sibuyan islands, Philippines; 12°21′N, 122°15′E; 1280 m total depth].

Acanthephyra media var. *obliquirostris* De Man, 1916:150 [type-locality: Halmahera Sea, Indonesia; 0°17.6′S, 129°14.5′E; 1855 m total depth].

DIAGNOSIS.—Integument reasonably firm;

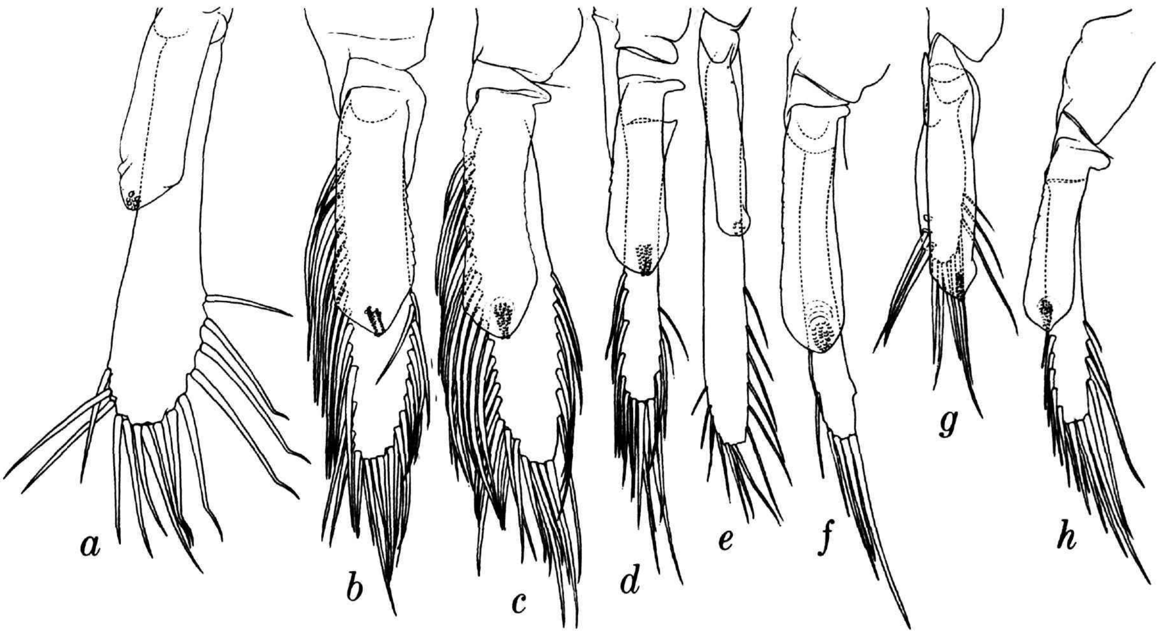

FIGURE 10.—Right appendices internae and masculinae of species of *Acanthephyra: a, A. prionota*, paratype [6.2 mm], *Discovery* sta 7089 32, north of Cape Verde Islands; *b, A. quadrispinosa* [16.9 mm], *Albatross* sta 5618, west of Halmahera; *d, A. sanguinea* [16.0 mm], *Albatross* sta 5287, Verde Island Passage, Philippines; *e, A. sibogae* [14.0 mm], *Alpha Helix* sta 110, Banda Sea; *f, A. smithi* [17.0 mm], *Te Vega* sta 189, southwest of Maldive Islands; *g, A. stylorostratis* [10.8 mm], *Knorr* sta 3126, east of Bermuda; *h, A. trispinosa* [13.8 mm], *Albatross* sta 3398, off Ecuador.

rostrum more than ¾ as long as carapace, extending nearly as far as or beyond end of antennal scale, ventral margin oblique posteriorly, armed with 1 or 2 long spines; carapace rounded, not carinate, on posterior ½ of dorsal midline, nearly straight, branchiostegal spine buttressed by carina extending posteriorly to branchial region, suprabranchial ridge fairly distinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin not clearly excavate either side of median tooth, 6th somite fully twice as long as posterior height; telson slightly sulcate in anterior ½ of dorsal midline, with 6 or more pairs of dorsolateral spines; eyestalk with blunt papilla arising from mesial surface at junction with cornea and directed slightly obliquely distad but not nearly reaching level of distal surface of cornea; maximum carapace length 21 mm.

MATERIAL.—PHILIPPINES. *Panay Gulf northwest of Sojoton Point, Negros:* sta 5185; 10°05′45″N, 122°18′30″E; 1167 m; green mud; 9.8°C; 30 Mar 1908 (1726–1834); 3-meter open net towed horizontally at 1000 m for 20 minutes, then raised vertically to surface in 48 minutes: 1♀ [15.6]. *Eastern Mindanao Sea:* sta 5497; 9°07′15″N, 124°59′30″E; 1756 m; green mud, fine sand; 11.3°C; 3 Aug 1909 (0955–1059); 3-meter open net towed horizontally at 1463 m: 1♂ [15.8] 1♀ [11.9]. *Sulu Sea northwest of Mindanao:* sta 5544; 8°16′30″N, 122°26′30″E; 1389 m; green mud, fine sand; 9.9°C; 6 Sep 1909 (1034–1117); 3-meter open net towed horizontally at 1097 m: 1y♂ [8.3].

INDONESIA. *Selat Patinti, Halmahera:* sta 5628; 0°28′30″S, 127°45′00″E; 2361 m; gray mud;

30 Nov 1909 (1122–1245); 12′ Agassiz beam trawl: 1♂ [21.0].

RANGE.—Philippines and off Halmahera, Indonesia; mesopelagic.

REMARKS.—This species is obviously closely related to *A. curtirostris* but its elongate rostrum gives it a very different appearance (see "Range" under that species).

*10. *Acanthephyra quadrispinosa* Kemp, 1939

FIGURES 3*h*, 4*t*, 5*t*, 7*g*, 10*c*, 14

Acanthephyra batei Stebbing, 1905:107, pl. 24B [type-locality: Cape Point Lighthouse, South Africa, S 83°E, 35½ miles; 659 m; not *A. batei* Faxon, 1895].

Acanthephyra quadrispinosa Kemp, 1939:571, 572, 576, 578 [type-locality: Indo-Pacific from South and eastern Africa to 163°W, and from 25°N to 42°S; South Atlantic from 32°S to 40°S; mesopelagic between about 1500 m and the surface].

DIAGNOSIS.—Integument firm; rostrum in adults usually longer than carapace and usually overreaching antennal scale, ventral margin slightly convex, armed with 3–7 teeth; carapace with dorsal margin consisting of low, blunt ridge anteriorly, broadly rounded posteriorly, nearly level, branchiostegal spine buttressed by sharp carina usually extending posteriorly about twice length of spine, suprabranchial ridge indistinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin excavate either side of median tooth, 6th somite at least 2½ times as long as posterior height; telson sulcate in dorsal midline, with 4 pairs of dorsolateral spines; eyestalk with bluntly triangular projection directed anteromesially from mesial margin; maximum carapace length 23 mm.

MATERIAL.—PHILIPPINES. *Luzon Strait west of Batan Islands:* sta 5320; 20°58′N, 120°03′E; 3300 m; gray mud; 2.3°C; 6 Nov 1908 (1518–1551); 3-meter open net or ⅓ meter plankton net towed horizontally at 914 m: 1 juv [5.0]. *South China Sea off western Luzon:* sta 5437; 15°45′54″N, 119°42′45″E; 8 May 1909 (1207–1256); 3-meter open net towed horizontally at 823 m: 1♂ [12.5] 1♀ [14.7]. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5120; 13°45′30″N, 120°30′15″E; 719 m; green mud, sand; 6.5°C; 21 Jan 1908 (1441–1510); 3-meter open net towed horizontally at 640 m: 1 ovig ♀ [14.8]. *Verde Island Passage, north of Mindoro:* sta 5287; 13°37′40″N, 120°39′E; 694 m; gray mud; 6.3°C; 20 Jul 1908 (1458–1542); 3-meter open net towed horizontally at 567 m for 20 minutes, then raised vertically to surface in 24 minutes: 3♂ [7.0–10.0] 1♀ [12.0]. Tayabas Bay, southern Luzon: sta 5373; 13°40′N, 121°31′10″E; 618 m; soft mud; 11.0°C; 2 Mar 1909 (1015–1035); 12′ Tanner beam trawl, mud bag: 1♂ [10.8]. *Lagonoy Gulf, east of southern Luzon:* sta 5463; 13°40′57″N, 123°57′45″E; [549 m]; [sand]; 16 Jun 1909 (1028–1044); 12′ Agassiz beam trawl, mud bag: 1♀ [13.0]. *Mompog Pass east of Marinduque:* sta 5219; 13°21′N,

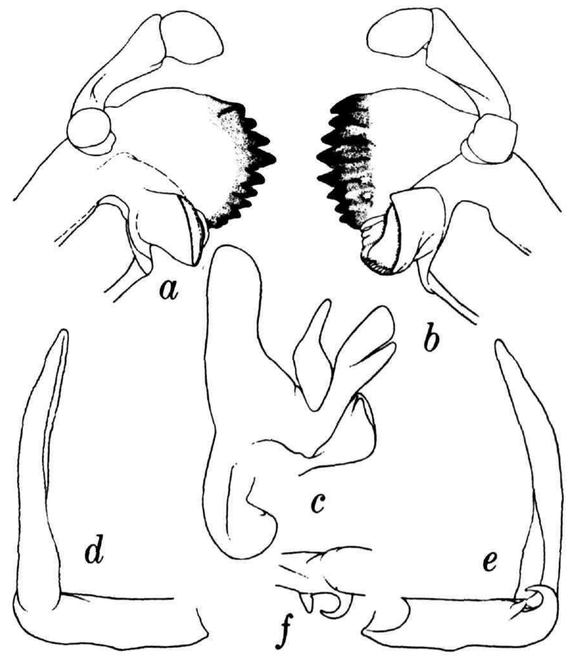

FIGURE 11.—*Acanthephyra armata: a,* left mandible (flexor or dorsal surface) of male [43.5 mm], *Albatross* sta 5648, Selat Butung, Celebes; *b,* right mandible of same specimen; *c,* right 2nd maxilla of male [30.0 mm], *Oregon* sta 640, Gulf of Mexico; *d,* epipod (lateral aspect) from right 2nd pereopod of same specimen; *e,* same (mesial aspect); *f,* same, mesial teeth (dorsal aspect).

122°18'45"E; 969 m; green mud; 10.4°C; 23 Apr 1908 (1357–1437); 12' Agassiz beam trawl, mud bag: 1♀ [15.1]. *Camotes Sea east of Cebu:* sta 5410; 10°28'45"N, 124°05'30"E; 704 m; green mud; 18 Mar 1909 (1156–1210); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [14.0].

Canigao Channel between Leyte and Bohol: sta 5233; 10°00'22"N, 124°45'06"E; 7 May 1908 (2100–2129); 3-meter open net towed horizontally at 183 m: 6♂ [10.9–13.3] 10♀ [9.0–14.7], 3 ovig [11.8–14.7]; sta 5234; 10°N, 124°46'06"E; 7 May 1908 (2142–2204); 3-meter open net towed horizontally at 27 m: 1♂ [11.0] 2♀ [11.1, 11.2]. *Sogod Bay, southern Leyte:* sta 5487; 10°02'45"N, 125°05'33"E; 1339 m; green mud; 11.3°C; 31 Jul 1909 (1403–1426); 12' Agassiz beam trawl: 1♂ [13.8]; sta 5488; 10°N, 125°06'45"E; 1412 m; green mud; 11.3°C; 31 July 1909 (1652–1738); 12' Agassiz beam trawl: 1 ovig ♀ [13.2]. *Surigao Strait off Panaon Island:* sta 5486; 10°02'N, 125°19'20"E; 1070 m; 11.2°C; 31 Jul 1909 (0837–0920); 12' Agassiz beam trawl: 1♂ [11.8].

Eastern Mindanao Sea: sta 5491; 9°24'N, 125°12'E; 1346 m; green mud, coral; 11.3°C; 1 Aug 1909 (1012–1043); 12' Agassiz beam trawl: 1♂ [13.0]; sta 5494; 9°06'30"N, 125°18'40"E; 1240 m; green mud, sand; 11.8°C; 2 Aug 1909 (0917–1052); 12' Agassiz beam trawl: 1♂ [14.0]; sta 5495; 9°06'30"N, 125°00'20"E; 1785 m; gray mud; 11.3°C; 2 Aug 1909 (1244–1354); 12' Agassiz beam trawl: 1♀ [11.7]; sta 5497; 9°07'15"N, 124°59'30"E; 1756 m; green mud, fine sand; 11.3°C; 3 Aug 1909 (0955–1059); 3-meter net towed horizontally at 1463 m: 8♂ [8.4–15.1] 4♀ [11.9–13.0], 2 ovig [11.9, 13.0]. *Iligan Bay, northern Mindanao:* sta 5507; 8°21'12"N, 124°12'06"E; 777 m; green mud, fine sand; 11.6°C; 5 Aug 1909 (1309–1344); 12' Tanner beam trawl: 1♂ [13.8] 1 juv [6.8]; sta 5511; 8°15'20"N, 123°57'E; 750 m; gray mud, sand; 11.7°C; 7 Aug 1909 (1218–1238); 12' Tanner beam trawl: 1 ovig ♀ [12.1]. *East of Siquijor Island:* sta 5525; 9°12'30"N, 123°44'07"E; 741 m; gray mud; 11.8°C; 11 Aug 1909 (0828–0850); 12' Tanner beam trawl: 1♂ [13.1]. *North of Siquijor Island:* sta 5528; 9°24'45"N, 123°39'15"E; 803 m; globigerina ooze; 11.8°C; 11 Aug 1909 (1542–1611); 12' Tanner beam trawl: 1 ovig ♀ [12.0]. *Southeast of Cebu:* sta 5534; 9°26'00"N, 123°26'37"E; 609 m; gray globigerina ooze; 11.8°C; 19 Aug 1909 (0823–0853); 12' Tanner beam trawl: 4♂ [13.0–14.1] 1 ovig ♀ [14.2]. *Panay Gulf northwest of Sojoton Point, Negros:* sta 5185; 10°05'45"N, 122°18'30"E; 1167 m; green mud; 9.9°C; 30 Mar 1908 (1726–1814); 3-meter open net towed horizontally at 1000 m for 20 minutes, then raised vertically to surface in 48 minutes: 1♂ [11.6]. *Sulu Sea, northwest of Mindanao:* sta 5544; 8°16'30"N, 122°26'30"E; 1389 m; green mud, fine sand; 9.9°C; 6 Sep 1909 (1034–1117); 3-meter open net towed horizontally at 1097 m: 1 juv [6.1]. *Cagayan Islands, Sulu Sea:* sta 5424; 9°37'05"N, 121°12'37"E; 622 m; coral sand; 10.2°C; 31 Mar 1909 (1324–1344); 12' Agassiz beam trawl, mud bag: 1♂ [10.8]; sta 5425; 9°37'45"N, 121°11'E; 905 m; gray mud, coral sand; 9.7°C; 31 Mar 1909 (1420–1457); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [14.1]. *Central Sulu Sea:* sta 5359; 8°12'45"N, 120°37'15"E; 4160 m; 9 Jan 1909 (1531–?); 12' Agassiz beam trawl, reversible net (longitude and latitude approximate): 1♂ [15.4]. *Sulu Sea off Honda Bay, Palawan:* sta 5430; 9°49'40"N, 119°03'20"E; 848 m; globigerina ooze; 10.0°C; 6 Apr 1909 (1007–1054); 12' Agassiz beam trawl: 1♀ [11.0]. *Sulu Sea off Puerto Princesa, Palawan:* sta 5429; 9°41'30"N, 118°50'22"E; 1401 m; green mud; 5 Apr 1909 (0814–0832); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [15.0].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5583; 4°19'00"N, 118°56'20"E; 818 m; fine sand; 4.6°C; 27 Sep 1909 (1348–1433); 9' Tanner beam trawl, mud bag: 1♂ [13.1]. Molucca Sea: sta 5601; 1°13'10"N, 125°17'05"E; 1399 m; sand, globigerina, pteropods; 13 Nov 1909 (1418–1439); 12' Agassiz beam trawl, mud bag: 1♂ [13.7]. *West of Halmahera:* sta 5618; 0°37'00"N, 127°15'00"E; 763 m; gray mud; 27 Nov 1909 (1444–1504); 12' Agassiz beam trawl: 1♂ [16.9]. *Makassar Strait off southwestern Celebes:*

sta 5664; 4°43′22″S, 118°53′18″E; 732 m; hard bottom; 6.3°C; 18 Dec 1909 (0943–1004); 12′ Agassiz beam trawl: 1♀ [15.1]. *Southwest of Makassar, Celebes:* sta 5662; 5°43′00″S, 119°-18′00″E; 386 m; (no bottom specimen); 9.3°C; 21 Dec 1909 (0612–0632); 12′ Agassiz beam trawl: 1♀ [11.8].

RANGE.—From the uniquely vast collections available to Kemp (1939) from the *Discovery, Dana,* and other vessels, he determined that *A. quadrispinosa*—which differs from the North Atlantic *A. purpurea* in having a posterodorsal tooth on the fourth abdominal somite—is widespread in the Indo-Pacific region from eastern Africa to the mid-Pacific at 163°W longitude, between 25°N latitude and 42°S latitude; the apparent latitudinal disparity between its distribution in the North and South Pacific was dispelled by Aizawa (1974:32), who extended the known northern limit to "nearly 44°N" in the northwestern Pacific. This species and *A. pelagica* (or *A. sica*) are the only members of the *A. purpurea* group that are known from both the Pacific and the Atlantic oceans. Until recently, the evidence indicated that the northeastern Pacific was the only part of the world ocean where that group is not represented, especially after the specimen from off Vancouver Island, British Columbia, originally identified by Butler (1971:1616) as *A. quadrispinosa,* was subsequently determined by the same author (1980:68) to be *Systellaspis cristata.* That area has now been narrowly reclaimed by Krygier and Pearcy (1981:83), however, who recorded a single specimen of *A. quadrispinosa* from west of Oregon.

Although *A. quadrispinosa* was taken in bottom trawls at no less than 25 *Albatross* stations, in total depths of 386–4160 m, there is little doubt that the species is invariably pelagic. Thirty specimens were collected at the 25 stations with bottom trawls, whereas 50 specimens were taken at only nine stations with less frequently used midwater nets towed horizontally at depths of 27–1463 m. The documentation on the two largest lots strongly supports the belief that the species migrates toward the surface at night and toward the bottom during daylight: one lot of 16 specimens was found in 183 m at 2100 hrs (sta 5233), whereas a lot of 21 specimens was taken in 1463 m (300 m above the bottom) between 1000 and 1100 hrs (sta 5497). During the daytime, no specimens were found at depths shallower than 567 m, but, on one occasion at nearly 2200 hrs (sta 5234), three specimens were collected in 27 m, the shallowest depth at which the species was recorded during the Expedition.

11. *Acanthephyra rostrata* (Bate, 1888)

Hymenedora rostrata Bate, 1888:846, pl. 136: fig. 4 [type-locality: the type-series of 3 specimens came from 3 different localities: northern Coral Sea southeast of Torres Strait; 12°08′S, 145°10′E, 2561 m; South China Sea off Lingayen Gulf, Luzon, Philippines; 16°42′N, 119°22′[E], 1920 m; and North Pacific Ocean northwest of Midway Islands; 36°23′N, 174°31′E, 0–3110 m in total depth of 5075 m].

Acanthephyra rostrata.—Kemp, 1906:19, 20, 23.

DIAGNOSIS.—Integument soft and membranous; rostrum triangular, less than ½ as long as carapace, not overreaching antennular peduncle, ventral margin oblique, unarmed; carapace not dorsally carinate posteriorly, dorsal profile slightly convex, not noticeably depressed at cervical groove, branchiostegal spine buttressed by long, carina-like ridge; abdomen somewhat carinate dorsally on 4 posterior somites, 4th and 5th somites, only, with posteromesial tooth, 6th somite about twice as long as posterior height; maximum carapace length 12 mm.

RANGE.—Known only from the three syntypes from the northern Coral Sea, South China Sea off Luzon, and North Pacific Ocean in the Emperor Seamount Chain northwest of the Midway Islands; the specimen from the last station was collected in a tow-net between the surface and 3110 m in a total depth of 5075 m.

REMARKS.—The disturbing note by Kemp (1906:20) that the type-series of *Hymenodora rostrata* is "in an extremely bad state of preservation" suggests that the species may remain enigmatic indefinitely.

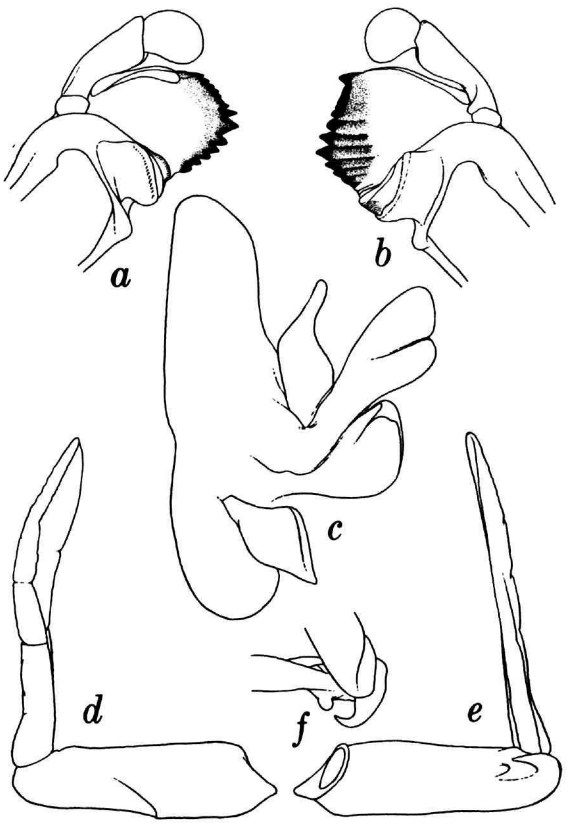

FIGURE 12.—*Acanthephyra purpurea*, male [17.7 mm], *Chain* sta RHB2574, northeast of Madeira Islands: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pereopod; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

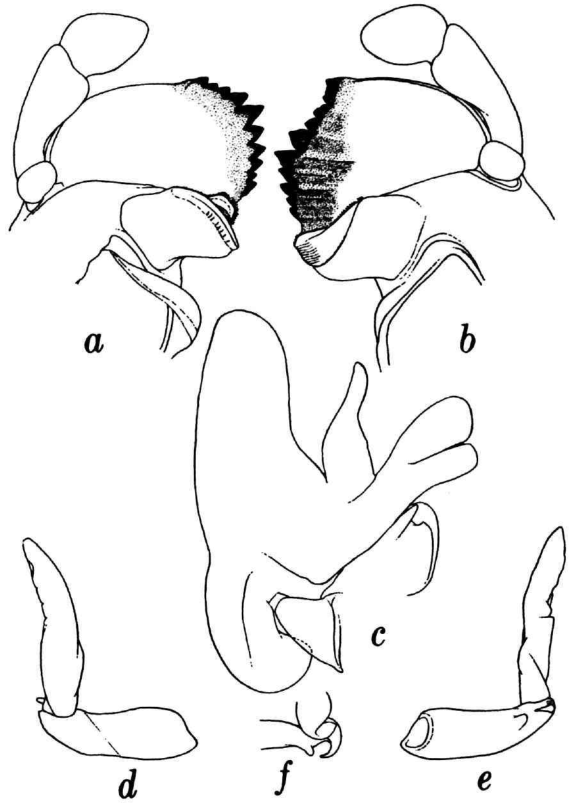

FIGURE 13.—*Acanthephyra stylorostratis*: *a*, left mandible (flexor or dorsal surface) of male [10.8 mm], *Knorr* sta 3126, east of Bermuda; *b*, right mandible of same specimen; *c*, right 2nd maxilla of male [14.8 mm], *Knorr* sta RHB3114-3115, east of Bermuda; *d*, epipod (lateral aspect) from right 2nd pereopod of male [10.8 mm], *Knorr* sta 3126; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

*12. *Acanthephyra sanguinea* Wood-Mason and Alcock, 1892

FIGURES 3*i*, 4*u*, 5*u*, 7*h*, 10*d*

Acanthephyra sanguinea Wood-Mason and Alcock, 1892:358, fig. 1 [type-locality: the type-series consists of four specimens, each from a different *Investigator* station: 2 from the Laccadive Sea off Kerala State, India, 1995 and 1350 m; the Bay of Bengal west of the Andaman Islands, 3197 m; and the Andaman Sea off North Cinque Island, 896 m].—Wood-Mason, 1892: pl. 3: fig. 3.—Kemp, 1939: 576.

Acanthephyra kempii Balss, 1914:595 [type-locality: extreme southern part of Bay of Bengal; 70°01′N, 85°56′E; 0–2500 m].

Acanthephyra Kempi.—Balss, 1925:259, pl. 22.

DIAGNOSIS.—Integument firm; rostrum in adults usually longer than carapace and usually overreaching antennal scale, ventral margin convex, armed with several teeth; carapace with dorsal margin rounded, broadly so posteriorly, nearly level, branchiostegal spine buttressed, if at all, by very short, inconspicuous carina, suprabranchial ridge indistinct; abdomen dorsally carinate on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin somewhat excavate either side of median tooth, 6th somite barely twice as long as posterior height; telson faintly sulcate anteriorly in dorsal midline, with 4 pairs of dorsolateral spines; eyestalk with bluntly triangular projection directed anteromesially from mesial margin; maximum carapace length 26 mm.

MATERIAL.—PHILIPPINES. *Off western Lubang Islands:* sta 5274; 13°57'30"N, 120°03'25"E; 960 m; gray mud, sand; 5.2°C; 16 Jul 1908 (0959–1029); 12' Agassiz beam trawl: 1♀ [13.6]. *Verde Island Passage, north of Mindoro:* sta 5287; 13°37'40°N, 120°39'E; 694 m; gray sand; 20 Jul 1908 (1458–1548); 3-meter open net towed horizontally at 567 m for 20 minutes, then raised vertically to surface in 24 minutes: 1♂ [16.0].

INDONESIA. *Makassar Strait, off northwestern Celebes:* sta 5671; 1°05'00"S, 118°56'00"E; 1756 m; gray mud; 3.4°C; 30 Dec 1909 (1241–1345); 12' Agassiz beam trawl: 1 ovig ♀ [12.0]. *Makassar Strait, off southwestern Celebes:* sta 5664; 4°43'22"S, 118°53'18"E; 732 m; hard bottom; 6.3°C; 28 Dec 1909 (0943–1004); 12' Agassiz beam trawl: 1♂ [12.2].

RANGE.—Indopacific region from eastern Africa to 138°E longitude, between 18°N latitude and 12°S latitude; mesopelagic.

REMARKS.—Kemp (1939:577) was probably correct in believing that the unique holotype of *A. kempii* is an ovigerous female of this species with a curiously deformed rostrum.

13. *Acanthephyra sibogae* De Man, 1916

FIGURES 3*j*, 4*v*, 5*v*, 7*i*, 10*e*

Acanthephyra (Meningodora) Sibogae De Man, 1916:149 [type-locality: entrance to Teluk Bone, Celebes, Indonesia; 5°S, 121°18'E, 1944 m]; 1920:69, pl. 7.

DIAGNOSIS.—Integument soft and membranous; rostrum triangular, about ⅕ as long as carapace, not overreaching antennular peduncle, ventral margin oblique, usually unarmed; carapace sharply carinate in dorsal midline throughout most of length, faintly notched at cervical

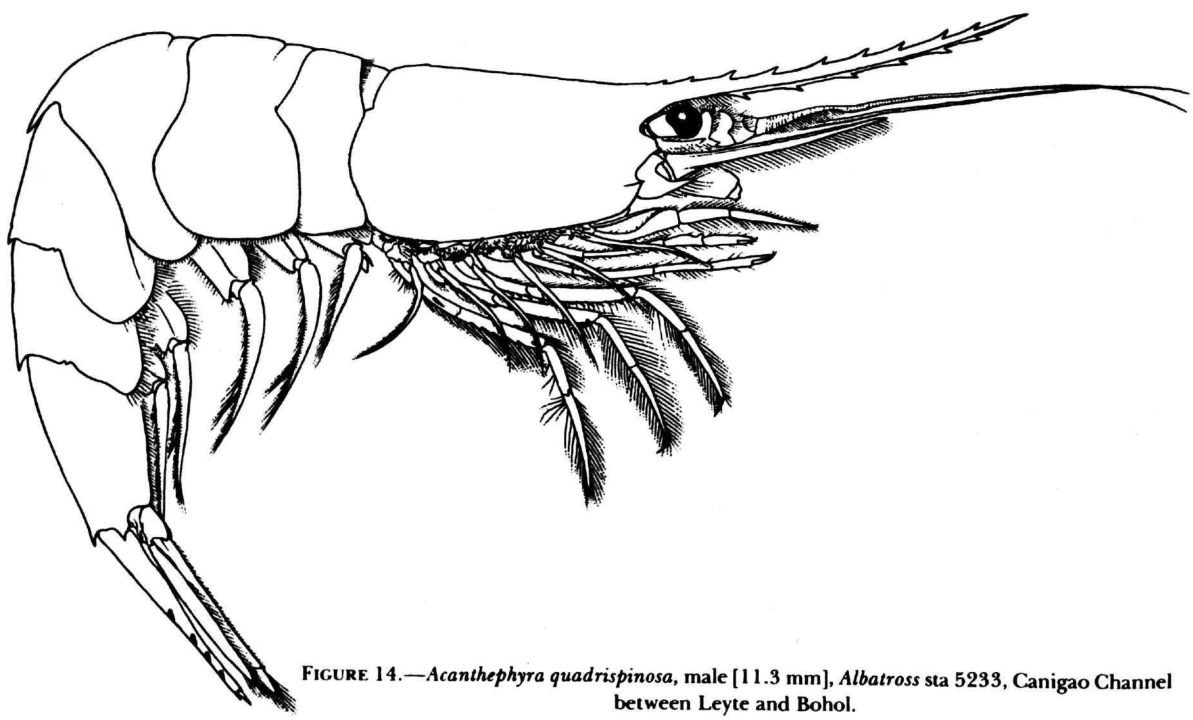

FIGURE 14.—*Acanthephyra quadrispinosa*, male [11.3 mm], *Albatross* sta 5233, Canigao Channel between Leyte and Bohol.

groove, branchiostegal spine set back from margin, outstanding, buttressed by carina extending posteriorly to about hepatic groove, another lateral carina extending posteriorly from near hepatic groove nearly to posterior margin of carapace; abdomen without median dorsal carina on 2 anterior somites, feebly carinate on 3rd somite, strongly so on 3 posterior somites with posteromesial tooth, 3rd somite with posterior margin nearly straight and unarmed, 6th somite more than twice as long as posterior height; telson with broad, sharply margined sulcus in dorsal midline; eyestalk with blunt papilla arising from mesial margin at junction with cornea and directed anteromesially, not nearly reaching level of distal surface of cornea; maximum carapace length 26 mm.

RANGE.—Known previously only from the type-locality off southern Celebes. There are specimens in the Smithsonian collections from the Banda Sea, Indonesia, and from the eastern South Pacific east of the Marquesas Islands. Open net collections suggest that the species usually occurs in midwater depths of nearly 1000 m or deeper.

14. *Acanthephyra smithi* Kemp, 1939

FIGURES 3*k*, 4*w*, 5*w*, 7*j*, 10*f*

Acanthephyra smithi Kemp, 1939:573, 577 [type-locality: Indo-Pacific from eastern Africa to 131°W, latitudinally to 14°S in the west and to 20°N to 24°S in the east; mesopelagic].

DIAGNOSIS.—Integument firm; rostrum in adults shorter than carapace, not overreaching antennal scale, ventral margin convex, armed with several teeth; carapace with semblance of low, blunt ridge anteriorly, broadly rounded posteriorly, nearly level, branchiostegal spine obscurely buttressed, with obscure longitudinal suture terminating on anterior margin just dorsal to spine, suprabranchial ridge indistinct; abdomen strongly carinate dorsally on all but anterior somite, 4 posterior somites with posteromesial tooth, 3rd somite with posterior margin somewhat excavate either side of median tooth, 6th somite no more than 1½ times posterior height; telson distinctly sulcate in dorsal midline, with 3 pairs of dorsolateral spines; eyestalks with triangular projection directed mesially from mesial margin; maximum carapace length 27 mm.

RANGE.—Of the three species of the *A. purpurea* group recorded from the central Indian Ocean, the Philippines, and Indonesia, *A. smithi* has been found farthest east in the Pacific. It seems to have a broader latitudinal range than *A. sanguinea* but it does not appear to wander far enough south to be represented in the South African or South Atlantic faunas, like *A. quadrispinosa*.

**Ephyrina* Smith, 1885

FIGURES 15–19

Ephyrina Smith, 1885:506. [Type-species, by monotypy: *Ephyrina Benedicti* Smith, 1885:506; gender: feminine.]

DIAGNOSIS.—Integument soft but not membranous; rostrum compressed into subtriangular or subrectangular vertical lamina, unarmed except for often acute anterodorsal angle; carapace not denticulate dorsally, with blunt, somewhat sinuous ridge or carina extending posteriorly from behind orbit nearly to posterior margin, without hepatic spine, hepatic furrow abruptly delimited posteriorly by oblique carina; abdomen without dorsal carina in midline of any somites, 6th somite longer than 5th; telson superficially blunt or subtruncate, not tapering regularly to sharply acute posterior end, without spinose endpiece; eye with cornea at least as wide as eyestalk in lateral aspect; antennal scale without lateral teeth proximal to distolateral spine; mandibles slightly dissimilar, incisor process unarmed over about ½ of opposable margin nearest palp; 2nd maxilla with proximal endite bearing papilla and submarginal lamina; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment ovoid, attached diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with ischium and merus unusually broad and compressed, 4th pair with epipod vestigial; appendix masculina

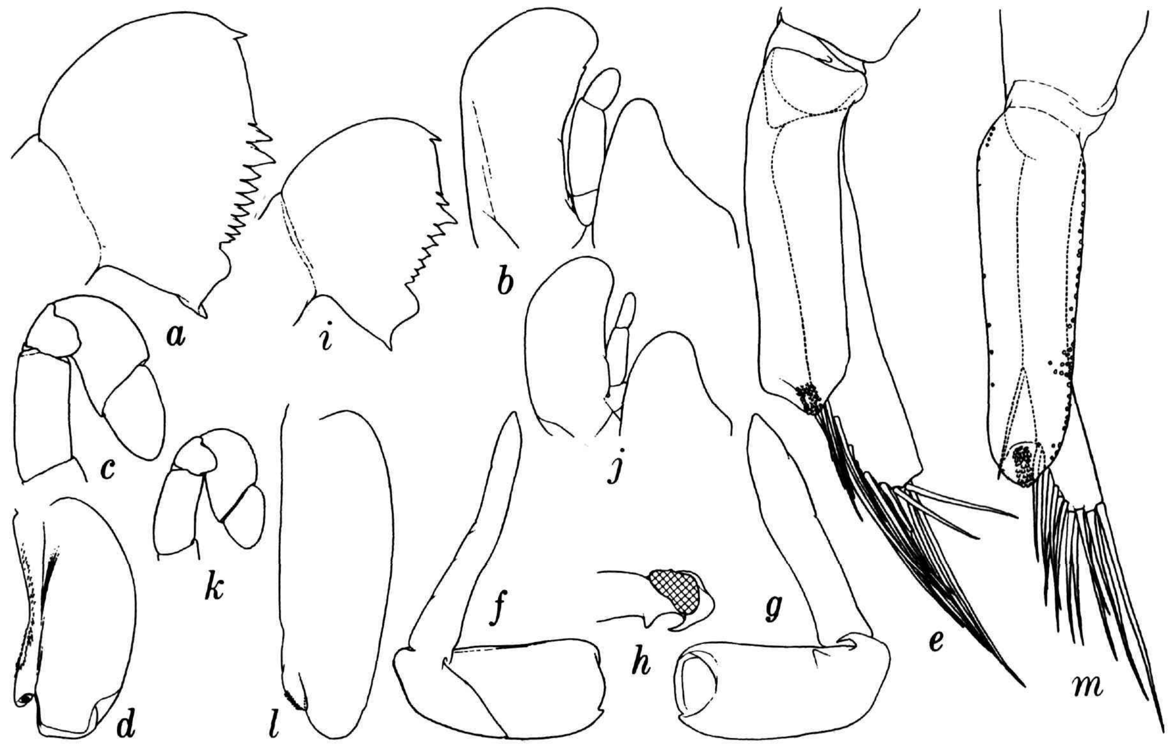

FIGURE 15.—*Ephyrina* (*a–h*, *E. bifida*, male [35.5 mm], *Albatross* sta 2653, Tongue of the Ocean, Bahamas; *i–m*, *E. figueirai*, male [23.0 mm], *Albatross II* sta 20323, Gulf Stream off Chesapeake Bay): *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, distal part of right 1st maxilliped; *c*, terminal segments of right 2nd maxilliped; *d*, endopod of right 1st pleopod; *e*, right appendices interna and masculina; *f*, epipod from right 2nd pereopod (lateral aspect); *g*, same (mesial aspect); *h*, same, mesial teeth (dorsal aspect); *i*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *j*, distal part of right 1st maxilliped; *k*, terminal segments of right 2nd maxilliped; *l*, endopod of right 1st pleopod; *m*, right appendices interna and masculina.

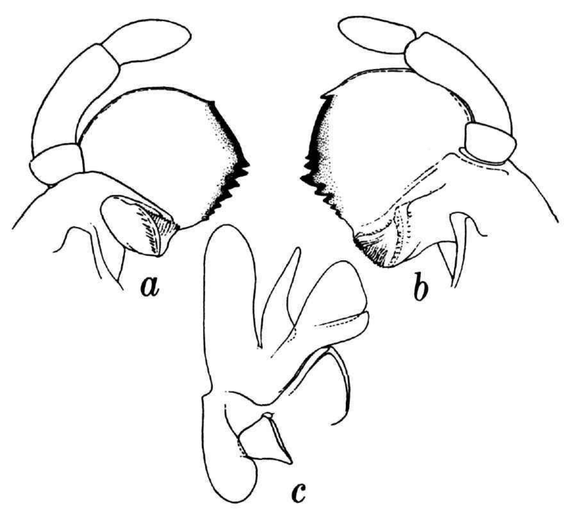

FIGURE 16.—*Ephyrina benedicti*, female or juvenile, [11.0 mm], *Atlantis II* sta RHB3055, north of Venezuela: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla.

present on 2nd pleopod of males; eggs large and few (less than 50).

RANGE.—Indian Ocean, Philippines, Indonesia, Japan, eastern Pacific, western North Atlantic, and eastern North and South Atlantic; mesopelagic and bathypelagic.

CLASSIFICATION.—Crosnier and Forest (1973) are to be commended for their skillful analysis of this genus, resulting in the confirmation of five valid species. In extension of that important syllogism, a sixth species is described below.

Key to the Species of *Ephyrina*

1. Third abdominal somite armed with flattened posteromesial tooth 2
   Third abdominal somite without tooth on posterior margin 3
2. Rostrum, in adults, with anteroventral margin oblique; 3rd abdominal somite with posteromesial tooth simple, triangular; telson overreaching mesial branch of uropod, row of dorsolateral spines submarginal, numbering 22–27 pairs . . . . ***E. benedicti*** Smith, 1885:506
   (Japan and northeastern Philippine Sea west of Bonin Islands; western North Atlantic and eastern North and Equatorial Atlantic; mesopelagic and bathypelagic)
   Rostrum, in adults, with anteroventral margin nearly vertical; 3rd abdominal somite with posteromesial tooth bifid, margins subparallel; telson not reaching distal end of mesial branch of uropod, row of dorsolateral spines not submarginal, nearer dorsal surface, numbering 4–7 pairs . . . . ***E. bifida*** Stephensen, 1923:58
   (Western North Atlantic and eastern North and Equatorial Atlantic; mesopelagic)
3. Pleuron of 5th abdominal somite rather sharply acute posteroventrally; telson armed with 14–34 dorsolateral spines disposed in 2 rows on each side . . . . *16. ***E. figueirai***
   Pleuron of 5th abdominal somite bluntly rounded posteroventrally; telson with 4–12 dorsolateral spines in single row on each side 4
4. Adults with 6th abdominal somite distinctly sulcate in dorsal midline; telson with row of dorsolateral spines submarginal . . . 17. ***E. ombango***
   Adults with 6th abdominal somite transversely convex or very feebly depressed in dorsal midline; telson with row of dorsolateral spines not submarginal, situated nearer dorsal surface 5
5. Rostrum, in adults, with anteroventral margin convexly oblique anteriorad, apex distinctly advanced beyond margin; telson with 6–8 pairs of dorsolateral spines; 3rd pereopod with dactyl longer than propodus . . . . 15. ***E. childressi***
   Rostrum, in adults, with anterior margin convexly subvertical or curved posteriorad dorsally, apex not advanced beyond margin; telson with 4–6 pairs of dorsolateral spines; 3rd pereopod with dactyl about as long as propodus . . . . ***E. hoskynii*** Wood-Mason, in Wood-Mason and Alcock, 1891:194
   (Arabian Sea and Bay of Bengal; presumably mesopelagic)

15. *Ephyrina childressi*, new species

FIGURE 17

DIAGNOSIS.—Rostrum directed rather steeply anterodorsad, anteroventral margin oblique, curving with uncommon regularity from orbit to apex; abdomen with 3rd somite unarmed posteromesially, pleuron of 5th somite subrectangularly rounded posteroventrally, 6th somite transversely convex dorsally, without median sulcus; telson about as long as 6th somite, not overreaching mesial branch of uropod, bearing 6–8 pairs of dorsolateral spines aligned in single row somewhat removed from margin; 3rd pereopod with dactyl longer than propodus and merus about 2½ times as long as wide; maximum carapace length more than 22 mm.

SIZE.—Carapace length of ovigerous female holotype, 21.9 mm, of remaining juvenile and female specimens, 8.1–19.2 mm.

MATERIAL.—Eleven juveniles and females (1 ovigerous) collected in the Halmahera Sea by R/V *Alpha Helix*, 17–21 May 1975, during the Southeast Asian Expedition of the University of California, Santa Barbara, under the leadership of James J. Childress. The holotype is the ovigerous female from station 148 (USNM 211378).

TYPE-LOCALITY.—*Halmahera Sea, Indonesia:*

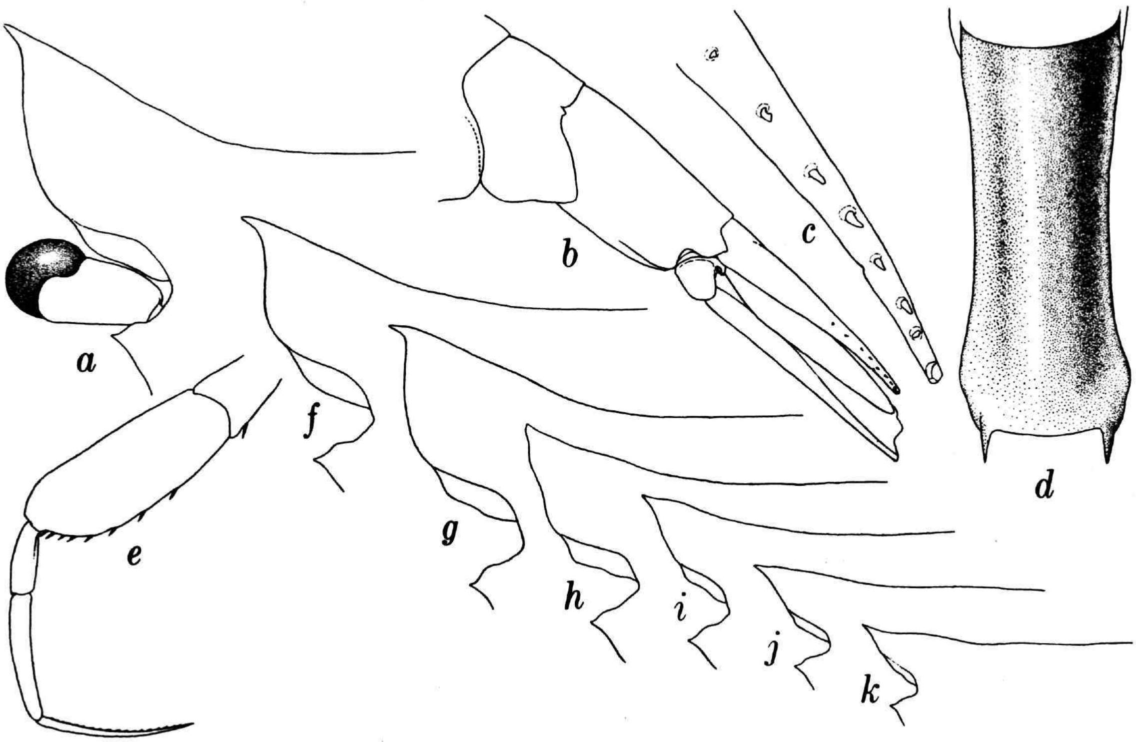

FIGURE 17.—*Ephyrina childressi*, new species: *a*, rostrum and eye of ovigerous female holotype [21.9 mm], *Alpha Helix* sta 148, Halmahera Sea; *b*, posterior end of abdomen of holotype; *c*, posterior part of telson (lateral aspect) of holotype; *d*, 6th abdominal somite (dorsal aspect) of holotype; *e*, left 3rd pereopod of holotype; *f*, rostrum of female paratype [19.2 mm], *Alpha Helix* sta 142; *g*, rostrum of female paratype [18.2 mm], *Alpha Helix* sta 123; *h*, rostrum of male paratype [16.0 mm], *Alpha Helix* sta 130; *i*, rostrum of juvenile paratype [11.8 mm], *Alpha Helix* sta 142; *j*, rostrum of juvenile paratype [10.3 mm], *Alpha Helix* sta 148; *k*, rostrum of juvenile paratype [8.1 mm], *Alpha Helix* sta 148.

0°33'42"S, 128°52'06"E; 950–1200 m; 21 May 1975; midwater trawl RMT-8.

RANGE.—Known only from the Halmahera Sea, Indonesia, in midwater depths of 600–1500 m.

REMARKS.—The inclusion of a species not represented in the *Albatross* collections is inconsistent with the intent expressed in the first part of this series to avoid the time-consuming study of collateral collections from the Philippine-Indonesian region. The temptation to examine some of the fine *Alpha Helix* material recently acquired by the Smithsonian was virtually irresistible because it seemed to offer an opportunity to determine whether *E. ombango* occurs in the Philippines and Indonesia. The discovery of this undescribed species resulted from that departure from my "game plan," and it seemed a rather minor accessory transgression to call attention to a taxon that was otherwise unknown from the area explored by the *Albatross* Philippine Expedition.

Ephyrina childressi seems to be quite distinct from its previously known congeners. The configuration of the rostrum approaches that in *E. benedicti*, but the unarmed third abdominal somite, the far fewer dorsolateral teeth on the telson, and the proportionately longer dactyl of the third pereopod serve to refute any close relationship between those species. The total absence of a dorsal longitudinal sulcus on the sixth abdominal somite seems to be duplicated only in *E. hoskynii* (except for *E. benedicti* and *E. bifida*, which are distinguished by the dentate third abdominal somite), and *E. hoskynii* differs markedly from *E. childressi* in the shape of the rostrum. Although juveniles of the latter species and of *E. ombango* in which the dorsal sulcus has not yet developed on the sixth abdominal somite might be confused, the form of the rostrum, the position of the row of telson spines, and the length of the dactyl of the third pereopod should reveal differences sufficient to separate the species.

ETYMOLOGY.—It is fit and proper that this species should bear the name of James J. Childress, whose generosity in making the caridean shrimps of the *Alpha Helix* Southeast Asian Expedition available to me exclusively provoked the chain of events that led to the dissemination of the above description.

*16. *Ephyrina figueirai* Crosnier and Forest, 1973

FIGURE 15*i–m*

Ephyrina figueirai Crosnier and Forest, 1973:73, figs. 20*b*, 21*g,h*, 22*c,d*, 23 [type-locality: Bay of Biscay; 0–2350 m].

DIAGNOSIS.—Rostrum directed moderately anterodorsad, anteroventral margin steeply oblique, not curving regularly from orbit to apex; abdomen with 3rd somite unarmed posteromesially, pleuron of 5th somite rather sharply acute posteroventrally, 6th somite with longitudinal sulcus in dorsal midline in adults, sometimes distinct only posteriorly; telson longer than 6th somite, reaching nearly as far as distal end of mesial branch of uropod, bearing 14–34 pairs of dorsolateral spines disposed in 2 rows; 3rd pereopod with dactyl longer than propodus and merus 2–3 times as long as wide; maximum carapace length 26 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde Island Passage, north of Mindoro:* sta 5285; 13°39'36"N, 120°32'55"E; 497 m; soft mud; 8.1°C; 20 Jul 1908 (1005–1033); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [18.5]. *Sibuyan Sea south of Bondoc Peninsula, Luzon:* sta 5379; 12°59'15"N, 122°30'40"E; 1682 m; 10.3°C; 4 Mar 1909 (1446–1602); 12' Agassiz beam trawl, mud bag: 1 juv [11.0].

RANGE.—Indian Ocean, Philippines, Indonesia (*Alpha Helix* record from Halmahera Sea), and western and eastern North Atlantic; mesopelagic.

REMARKS.—Crosnier and Forest (1973:75, 81) noted that the ovigerous female from *Albatross* station 5285, examined by them, differed from available Atlantic specimens in the more extensive dorsal sulcus on the sixth abdominal somite, broader pereopodal meri, and slightly longer pereopodal dactyli. Fourteen specimens that I have been able to examine—one male and seven immature specimens from the western North Atlantic and the ovigerous female and five immature specimens from the Philippines and Indonesia—are insufficient to confirm that the Indo-Pacific and Atlantic populations are taxonomically distinct. The sulcus on the sixth abdominal somite is not developed in juvenile specimens; to be sure, it is much deeper and more extensive in the ovigerous female from the Philippines than it is in the male from the North Atlantic, but more evidence is needed to determine the reliability of a character, such as this one, that may be subject to alteration by preservation. The merus of the third pereopod of the Philippine ovigerous female is barely 2.4 times as long as wide, but it is only 2.6 times as long as wide in the Atlantic male; it varies from 2.4 to 3.1 times as long as wide in Philippine and Indonesian juveniles and from 2.0 to 3.1 in those from the Atlantic. The greater relative length of the dactyl of the third pereopod may prove to be significant when more material becomes available for study; as indicated by Crosnier and Forest (1973:81), the propodus of the third pereopod in the Philippine ovigerous female is only two-thirds as long as the dactyl, whereas it is noticeably longer, proportionately, in juveniles from both regions. It is evident, however, that a clear distinction between the two populations is not yet apparent.

17. *Ephyrina ombango* Crosnier and Forest, 1973

FIGURES 18, 19

Ephyrina ombango Crosnier and Forest, 1973:68, figs. 20*a*, 21*a–f*, 22*a,b* [type-locality: off São Tomé, Gulf of Guinea; 0°30'N, 6°30'E, 0–1000 m in total depth of 2900m].

Ephyrina sp. A.—Crosnier and Forest, 1973:78–82, fig. 24*c–e*.

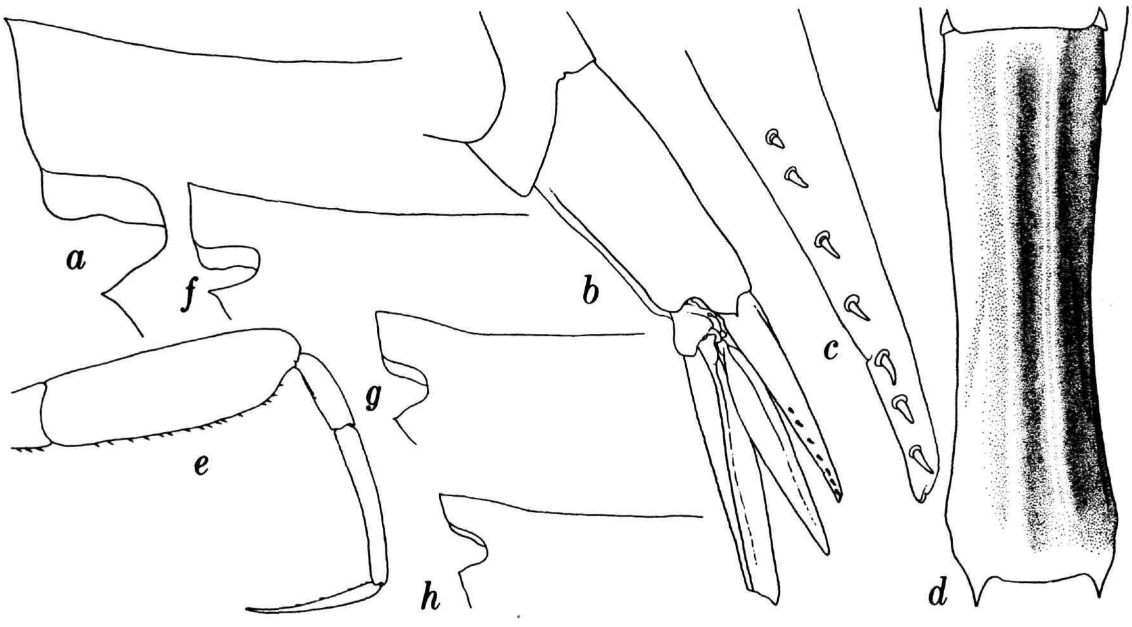

FIGURE 18.—*Ephyrina ombango*: *a*, rostrum of ovigerous female, [23.0 mm], *Alpha Helix* sta 97, Banda Sea; *b*, posterior end of abdomen of same specimen; *c*, posterior part of telson (lateral aspect) of same specimen; *d*, 6th abdominal somite (dorsal aspect) of same specimen; *e*, right 3rd pereopod of same specimen; *f*, rostrum of juvenile [13.3 mm], *Alpha Helix* sta 112, Banda Sea; *g*, rostrum of juvenile [9.7 mm], *Alpha Helix* sta 97, Banda Sea; *h*, rostrum of juvenile [7.5 mm], *Alpha Helix* sta 97, Banda Sea.

DIAGNOSIS.—Rostrum directed moderately anterodorsad, anteroventral margin steeply oblique to nearly vertical, not curving regularly from orbit to apex; abdomen with 3rd somite unarmed posteromesially, pleuron of 5th somite bluntly acute, rounded posteroventrally, 6th somite with pronounced longitudinal sulcus in dorsal midline in adults; telson shorter than 6th somite, not reaching distal end of mesial branch of uropod, bearing 5–12 pairs of dorsolateral spines aligned in single submarginal row; 3rd pereopod with dactyl shorter than propodus and merus 2½–3¼ times as long as wide; maximum carapace length 27 mm.

RANGE.—*Ephyrina ombango* has probably been found off the Cocos-Keeling Islands, Indian Ocean; in the Sulu Sea, Philippines; the Banda Sea, Indonesia; the eastern Pacific off Panama; the western North Atlantic; and the eastern North and South Atlantic. It is a mesopelagic species.

REMARKS.—Crosnier and Forest (1973:82) believed that specimens collected by the *Dana* Expedition off Cocos-Keeling Islands and in the eastern Pacific off Panama were conspecific with *E. ombango* but that the specimen taken by the same vessel in the Sulu Sea (page 78) represented a distinct species that they called "*Ephyrina* sp. A." As no species of *Ephyrina* other than *E. figueirai* was found in the *Albatross* Philippine

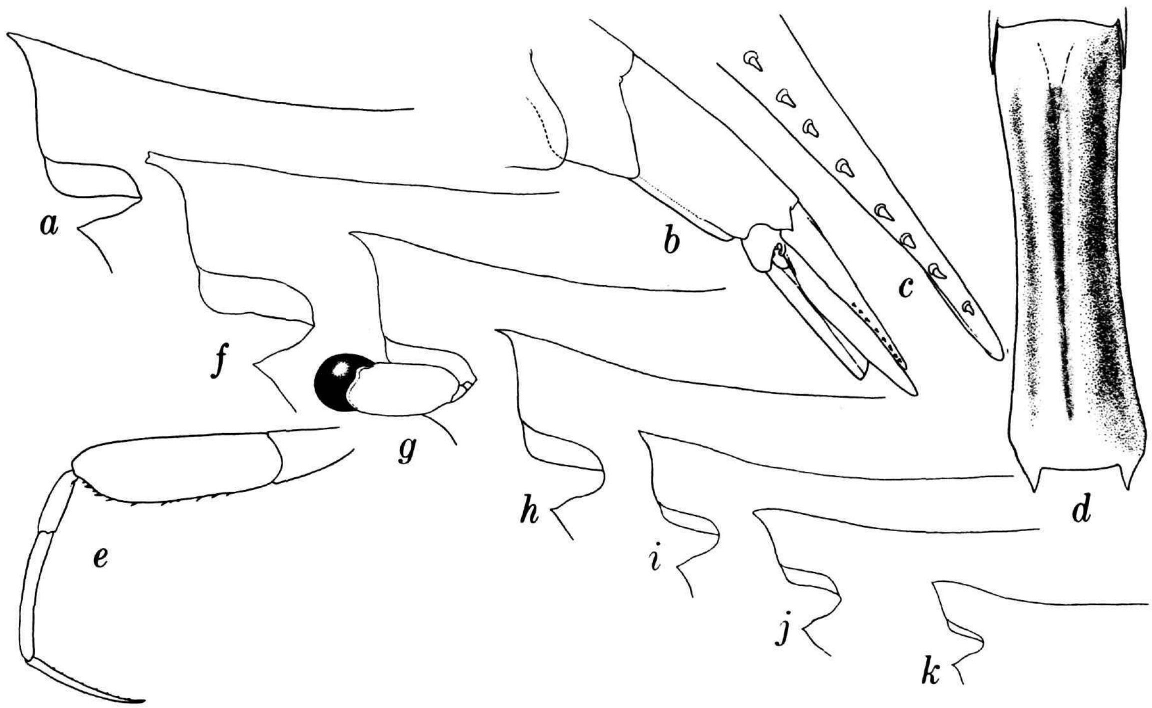

FIGURE 19.—*Ephyrina ombango*, variety ("sp. A" Crosnier and Forest, 1973): *a*, rostrum of female [18.2 mm], *Alpha Helix* sta 180, Sulu Sea; *b*, posterior end of abdomen of same specimen; *c*, posterior part of telson (lateral aspect) of same specimen; *d*, 6th abdominal somite (dorsal aspect) of same specimen; *e*, left 3rd pereopod of same specimen; *f*, rostrum of ovigerous female [21.3 mm], *Alpha Helix* sta 167, Sulu Sea; *g*, rostrum and eye of female [16.3 mm], *Alpha Helix* sta 180, Sulu Sea; *h*, rostrum of female [15.7 mm], *Alpha Helix* sta 193, Sulu Sea; *i*, rostrum of female, [12.5 mm], *Alpha Helix* sta 193; *j*, rostrum of juvenile [10.0 mm], *Alpha Helix* sta 187, Sulu Sea; *k*, rostrum of juvenile [8.3 mm], *Alpha Helix* sta 173, Sulu Sea.

material, I have examined the collections of the *Alpha Helix* Southeast Asian Expedition in an attempt to determine the probable status of *E.* sp. A. This effort revealed the presence of three different forms that might be referable to that taxon in the Sulu Sea, the Halmahera Sea, and the Banda Sea, respectively. The population in the Halmahera Sea has been desribed above as a distinct species. Those in the Sulu and Banda seas seem to differ only in the form of the rostrum (Figures 18, 19), specimens from the Banda Sea resembling the typical *E. ombango* and those from the Sulu Sea having the rostrum like that depicted for *E.* sp. A. This study has led to the conjecture that *E. ombango* is a variable species that has spawned varietal populations in parts of its range.

Heterogenys, new genus

TYPE-SPECIES.—*Acanthephyra microphthalma* Smith, 1885:502.

DIAGNOSIS.—Integument firm; rostrum with fewer dorsal than ventral teeth; carapace not carinate or denticulate dorsally, without lateral carinae, without hepatic spine, hepatic furrow not abruptly delimited posteriorly; abdomen dorsally carinate on 3rd through 6th somites, 6th somite longer than 5th; telson superficially blunt, not tapering regularly to sharply acute posterior end, without spinose endpiece; eye with cornea much narrower than eyestalk; antennal scale without lateral teeth proximal to distolateral spine; mandibles distinctly dissimilar, molar process with transverse distal surface triangular on right member of pair, compressed, sub-bilinear on left, incisor process armed with blunt teeth along entire opposable margin, sharply tapered to narrow opposable margin on left member of pair; 2nd maxilla with proximal endite bearing papilla and acute submarginal lamina; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment subtriangular, attached diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod vestigial; appendix masculina present on 2nd pleopod of male; eggs small and numerous (more than 80).

RANGE.—Bay of Bengal, Celebes Sea, off Japan, south of Tuamotu Archipelago, west of Oregon, and western and eastern North Atlantic; 2000–4792 m; probably benthic.

CLASSIFICATION.—This genus differs from *Acanthephyra*, with which it seems to be most closely allied, in having fewer dorsal than ventral teeth on the rostrum, unusual dentition on the abdominal somites, and, especially, the most dissimilar mandibles in the family, with relatively few, blunt teeth on the incisor process, and the other mouthparts uncommonly elongate. Only one species is currently recognized.

ETYMOLOGY.—From the Greek *heteros*, different, plus *genys*, jaw. The gender is feminine.

18. *Heterogenys microphthalma* (Smith, 1885), new combination

FIGURE 20

Acanthephyra microphthalma Smith, 1885:502 [type-locality: northwestern Sargasso Sea, east of North Carolina: 36°16'30"N, 68°21'00"W, 4707 m]; 1886b:668, pl. 13: fig. 3.

Acanthephyra longidens Bate, 1888:735, pl. 124: fig. 4 [type-locality: the two *Challenger* specimens were taken at two widely distant stations: eastern Celebes Sea: 2°55'N, 124°53'E, 3932 m, and South Pacific south of Tuamotu Archipelago: 32°36'S, 137°43'W, 4344 m].

DIAGNOSIS.—Rostrum directed anterodorsad, about as long as carapace, overreaching antennal scale, armed with 3 small dorsal teeth above orbit and 8 or 9 ventral teeth on anterior ⅔ of length; carapace rounded in dorsal midline, postcervical groove distinct laterally, not mesially, branchiostegal spine without buttress; abdomen with 3rd somite bearing long, slender posterodorsal spine overreaching 4th somite and preventing full extension of abdomen, 4th and 5th somites posteriorly unarmed, 6th with inconspicuous posterodorsal tooth; telson overreaching both branches

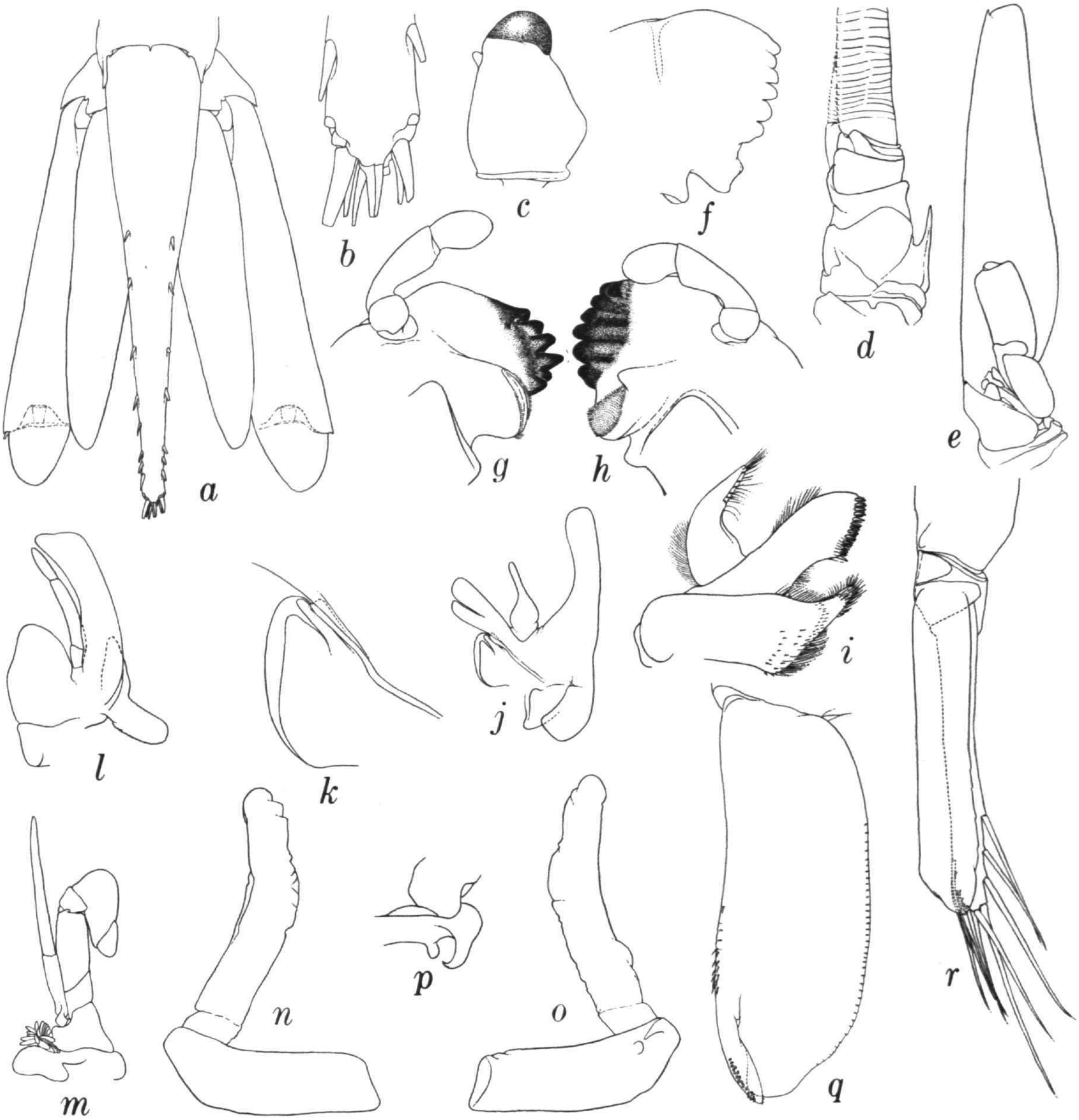

FIGURE 20.—*Heterogenys microphthalma*, male [20.8 mm], *Columbus Iselin* sta 3, Bahamas: *a*, telson and uropods; *b*, posterior end of telson; *c*, right eye (dorsal aspect); *d*, right antennular peduncle (dorsal aspect); *e*, right antenna (ventral aspect); *f*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *g*, left mandible (flexor or dorsal surface); *h*, right mandible (same aspect); *i*, right 1st maxilla; *j*, left 2nd maxilla; *k*, same, proximal endite; *l*, left 1st maxilliped; *m*, right 2nd maxilliped; *n*, epipod (lateral aspect) from right 2nd pereopod; *o*, same (mesial aspect); *p*, same, mesial teeth (dorsal aspect); *q*, endopod of right 1st pleopod; *r*, right appendices interna and masculina.

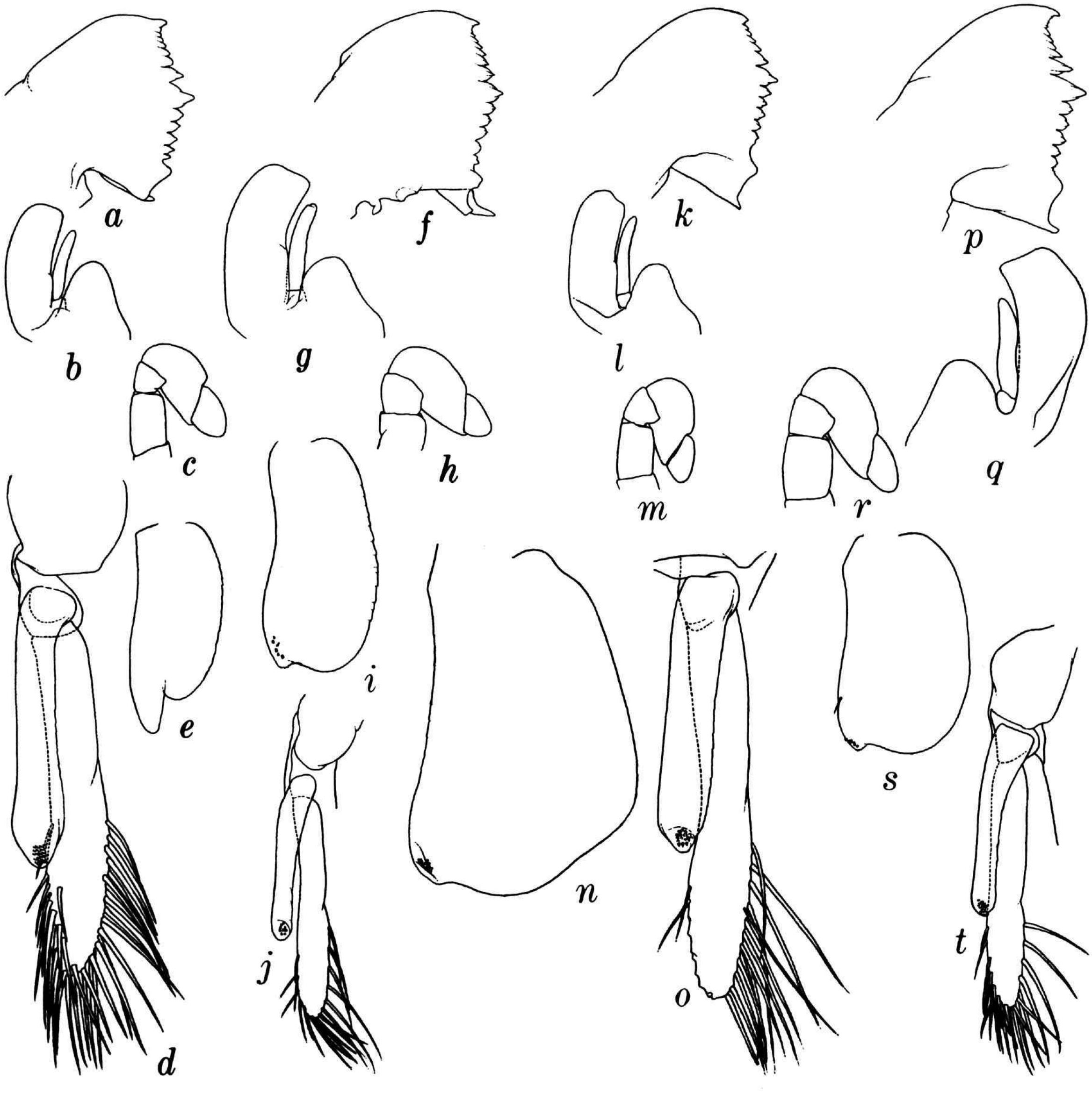

FIGURE 21.—*Hymenodora* (*a–e, H. acanthitelsonis; f–j, H. frontalis*, male [12.0 mm], *Albatross* sta 4764, Aleutian Islands; *k–o, H. glacialis*, male [~20 mm], *Triton*, off England; *p–t, H. gracilis*, male [~12 mm], *Columbus Iselin* sta 10, Bahamas): *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible of male [18.8 mm], *Yaquina* sta 6907C, BMT-94, off Oregon; *b*, distal part of right 1st maxilliped of same specimen; *c*, terminal segments of right 2nd maxilliped of same specimen; *d*, right appendices interna and masculina of same specimen; *e*, endopod of right 1st pleopod of male holotype 13.2 mm], *Yaquina* sta 7003b, BMT-189; *f*, right mandible; *g*, right 1st maxilliped; *h*, right 2nd maxilliped; *i*, endopod of right 1st pleopod; *j*, right appendices interna and masculina; *k*, right mandible; *l*, right 1st maxilliped; *m*, right 2nd maxilliped; *n*, endopod of right 1st pleopod; *o*, right appendices interna and masculina; *p*, right mandible, *q*, left 1st maxilliped; *r*, right 2nd maxilliped; *s*, endopod of right 1st pleopod; *t*, right appendices interna and masculina.

of uropod, sulcate in anterior part of dorsal midline and armed with 7 or 8 dorsolateral spines; maximum carapace length 23 mm.

RANGE.—Although the number of published records of *H. microphthalma* is relatively low, they represent such remote localities (see generic "Range") as to suggest a nearly worldwide distribution in tropical and temperate seas. Most of the records are based on specimens taken in bottom trawls between 2000 and 4792 m, but two (Coutière, 1911, and Aizawa, 1974) refer to open midwater nets, and Wasmer (1972b:261) concluded, from an analysis of the foregut contents of a specimen taken in a beam trawl that the species "is probably not confined to the immediate neighborhood of the bottom." It seems to me, however, that a nektonic species would be seriously hampered by the unusual posteromesial spine on the third abdominal somite, which effectively prevents extension of the abdomen.

Hymenodora G.O. Sars, 1877

FIGURES 21, 22

Hymenodora G.O. Sars, 1877:340. [Type-species, by monotypy: *Pasiphaë glacialis* Buchholz, 1874:279; gender: feminine.]

DIAGNOSIS.—Integument thin, sometimes membranous; rostrum dentate on dorsal margin only; carapace not denticulate dorsally, without uninterrupted lateral carina extending from near orbit to near posterior margin, without hepatic spine, posterior slope of hepatic furrow not abruptly delimited by oblique carina; abdomen without carina or posteromesial teeth in dorsal midline on any somites, 6th somite longer than 5th; telson superficially blunt, not tapering regularly to sharply acute posterior end, rarely with spinose endpiece; eye with cornea narrower than eyestalk; antennal scale without lateral teeth proximal to distolateral spine; mandibles dissimilar, molar process with transverse distal surface triangular on right member of pair, compressed, sub-bilinear on left, incisor process toothed along entire opposable margin; 2nd maxilla with proximal endite lacking papilla and submarginal lamina; 1st maxilliped with slender central lobe subdivided by only 1 transverse suture; 2nd maxilliped with distal segment somewhat ovoid, attached diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod vestigial or absent; appendix masculina present on 2nd pleopod of males; eggs large and few (less than 50).

RANGE.—South Africa, Indian Ocean, Australian Basin, Philippine Sea, northern and eastern

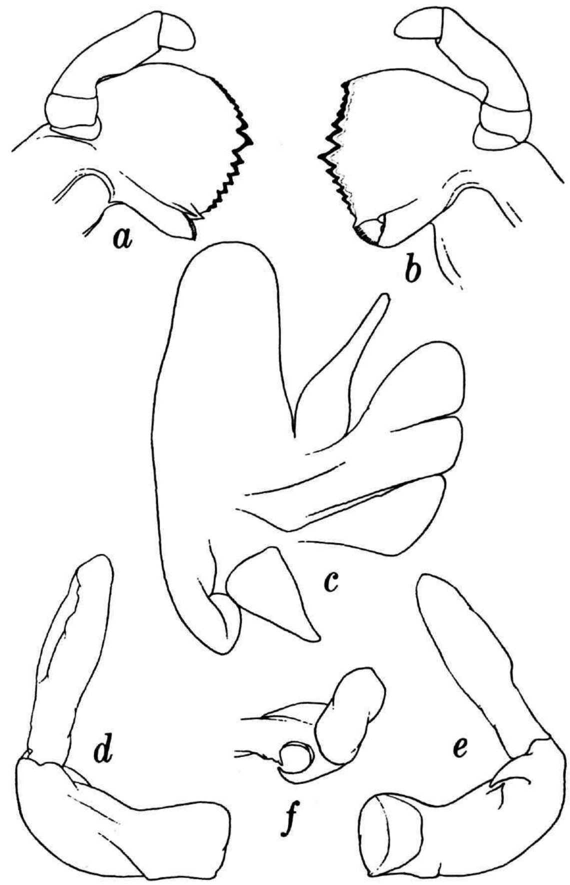

FIGURE 22.—*Hymenodora glacialis*, male [~20 mm], *Triton*, off England: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pereopod; *e*, same (mesial aspect); *f*, same mesial teeth (dorsal aspect).

Pacific and western and eastern North and South Atlantic; mesopelagic and bathypelagic. I am unaware of any records of *Hymenodora* from either the Philippines or Indonesia, proper.

CLASSIFICATION.—In some respects, *Hymenodora* seems to bridge the gap between some of the species of the possibly polyphyletic genus *Acanthephyra* and other oplophorid genera, even sharing some characters with the very different appearing large-eyed genera *Janicella* and *Oplophorus*. The only other genus without a semblance of a dorsal carina on any of the abdominal somites is *Ephyrina*, which has very different mouthparts, especially mandibles. The sharply sulcate telson is similar to that found in *Meningodora* and *Notostomus*, but a similar form is noticed in *Systellaspis cristata*, and the surprising occurrence of an endpiece in *Hymenodora acanthitelsonis* is certainly reminiscent of the similar structure in *Janicella* and *Systellaspis*. The rather unusual molar process on the left mandible may be intermediate between the form characteristic of *Acanthephyra* and the very different one found in *Systellaspis*. The second maxilla seems to lack both a papilla and a submarginal lamina on the proximal endite, an extreme condition that seems to be approached only in *Janicella*, and, of course, *Hymenodora* and *Janicella* are the only oplophorid genera in which there is only a single transverse suture subdividing the slender central lobe of the first maxilliped. The terminal segment of the second maxilliped is similar in shape to the one in *Ephyrina*, and both of them are intermediate between the triangular outline in *Acanthephyra* and *Notostomus* and the almost regularly ovoid segment in *Janicella*, *Oplophorus*, and *Systellaspis*. Finally, the large eggs produced by the species of *Hymenodora* are like those found otherwise in *Ephyrina*, *Janicella*, *Oplophorus*, and *Systellaspis*, whereas small eggs are characteristic of *Acanthephyra*, *Notostomus*, and the other genera.

Key to the Species of *Hymenodora*

1. Rostrum reaching at least as far as distal end of antennular peduncle; antennal scale with anteromesial angle of blade produced distally, reaching nearly to level of tip of distolateral spine .... ***H. frontalis*** Rathbun, 1902:904 (Sea of Okhotsk, off Aleutian Islands and Pacific coast of North America to southern California; mesopelagic)

   Rostrum rarely overreaching eyes; antennal scale with distal end of blade subtruncate, not produced 2

2. Integument thin but not membranous; telson provided posteriorly with posteriorly rounded endpiece flanked by pair of long lateral spines and fringed on entire margin with about 30 long, contiguous spines .... ***H. acanthitelsonis*** Wasmer, 1972a:87 (Off Pacific coast of Oregon; bathypelagic, 2400–3000 m

   Integument membranous; telson not terminating in spinose endpiece .. 3

3. Carapace with hepatic region delimited posterodorsally by anteriorly convex groove extending from epibranchial groove nearly to groove extending posterodorsally from near middle of hepatic furrow; antennal peduncle with dorsal lobe of 2nd segment (dorsal to base of antennal scale) regularly convex; 2nd maxilliped without podobranch .... ***H. glacialis*** (Buchholz, 1874:279)

(Known with certainty from Arabian Sea, southern Indian Ocean, eastern Pacific off Oregon and Bay of Panama, Arctic region southward in North Atlantic, both west and east, to at least 30° N latitude, and South Atlantic off Argentina and Tristan da Cunha; mesopelagic and bathypelagic)

Carapace with hepatic region between suprabranchial groove and groove extending posterodorsally from near middle of hepatic furrow not delimited by transverse groove posterodorsally; antennal peduncle with dorsal lobe of 2nd segment produced laterally into blunt tooth; 2nd maxilliped with podobranch .... ***H. gracilis*** Smith, 1886b:76[680]

(South Africa, Arabian Sea, southern Indian Ocean, eastern Pacific off Oregon and seamounts west of Mexico, North Atlantic from Greenland to Gulf of Mexico and Bahamas in west and to off Congo in east; mesopelagic and bathypelagic)

****Janicella*, new genus**

TYPE-SPECIES.—*Oplophorus spinicauda* A. Milne-Edwards, 1883.

DIAGNOSIS.—Integument firm; rostrum with more teeth in dorsal series than in ventral; carapace not denticulate dorsally, without lateral carina extending from near orbit to near posterior margin, without hepatic spine, hepatic furrow not abruptly delimited posteriorly by oblique carina; abdomen dorsally carinate on 2nd and 4th somites, with strong posteromesial tooth on 2nd, 3rd, and 4th, 6th somite longer than 5th; telson terminating posteriorly in sharply pointed, laterally spinose endpiece flanked by pair of long lateral spines; eye large, cornea wider than eyestalk; antennal scale with lateral teeth proximal to distolateral spine; mandibles similar, molar processes reduced, subtriangular, not directly opposable, incisor process toothed along entire opposable margin; 2nd maxilla with papilla and submarginal lamina on proximal endite reduced, not prominent; 1st maxilliped with slender central lobe subdivided by only 1 transverse suture; 2nd maxilliped with distal segment symmetrically oval, attached only slightly diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods broad but not rigid; pereopods with neither ischium nor merus broadly compressed, 3rd pair with dactyl longer than propodus, 4th pair with epipod well-developed except for vertical component; no appendix masculina on 2nd pleopod of male; eggs large, 9 or 10 in number.

RANGE.—Perhaps pantropical, except for extreme eastern Pacific Ocean off American continents; mesopelagic.

CLASSIFICATION.—*Janicella* seems to be intermediate between *Oplophorus* and *Systellaspis*. It agrees with most species of *Oplophorus* and differs from most of those of *Systellaspis* in having the carapace carinate throughout the length of the dorsal midline; in lacking lateral spines on the posterior margins of the fourth and fifth abdominal terga; in having the antennal scale laterally dentate; and in having the exopods on the third maxilliped and first pereopod broadly compressed. It agrees with *Systellaspis* and differs from *Oplophorus* in having the sixth abdominal somite nearly twice as long as, rather than shorter than, the fifth; the telson terminating in a spinose endpiece; and the exopods on the third maxilliped and first pereopod flexible, rather than rigid. It differs from both *Oplophorus* and *Systellaspis* in lacking a posteromesial tooth on the fifth abdominal somite; in having the molar process of the mandible reduced and differently formed; in having only one transverse suture in the slender central lobe of the first maxilliped; and in having the dactyl of the third pereopod longer than the propodus. Finally, *Janicella* disagrees with all other members of the Oplophoridae and most other natantian shrimps in having a strong posteromesial spine on the second abdominal somite and in lacking any trace of an appendix masculina on the male second pleopod. Only one species is currently recognized.

ETYMOLOGY.—My wife, Janice, is fully aware of my opposition to the practice of naming biological taxa for relatives and personal friends who have not participated directly in activities associated with the description of those organisms. Credit for this first and last ostensible exception to that creed must go to some of my colleagues who have convinced me, after repeated appeals, that someone who has clearly modified her life style for more than 50 years in deference to the foibles of a spouse addicted to the rapture of descriptive zoology has surely contributed importantly to his professional research. The die having thus been cast, it is appropriate that *Janicella* be proposed as a component of the only crustacean family that is familiar to the honoree, as the result of editorial assistance rendered on my oplophorid doctoral dissertation during our courtship more than half a century ago. The gender of the name is feminine.

*19. *Janicella spinicauda* (A. Milne-Edwards, 1883), new combination

FIGURES 23, 24

Oplophorus spinicauda A. Milne-Edwards, 1883 [type-locality: off Casablanca, Morocco: *Travailleur* sta 65; 34°13′30″N, 7°43′W, 636 m; muddy sand; 30 Jul 1882].—Chace, 1940:184, fig. 54.

Oplophorus foliaceus Rathbun, 1906:922, pl. 20: fig. 8 [type-locality: western end of Kaiwi Channel, Hawaii: *Albatross* sta 3471; 21°10′30″N, 157°48′30″W, 616 m; fine white sand; 4 Dec 1891; large beam trawl].

Acanthephyra anomala Boone, 1927:104, fig. 21 [type-locality: north of Glover Reef, Gulf of Honduras: *Pawnee I*, 885 m; 20 Apr 1925].

DIAGNOSIS.—Integument firm but softer than in species of *Oplophorus*; rostrum up to twice as long as carapace, armed dorsally with 10–13 prominent teeth, including 2 or 3 situated on carapace posterior to orbital margin, ventrally with 6–8; carapace without discrete antennal spine separate from ventral angle of orbit, with submarginal ventral carina becoming marginal posterior to branchiostegal spine; abdomen with ventral margins of pleura of 1st and 2nd somites convexly incised in males, less distinctly so in females; telson faintly grooved in dorsal midline, overreaching both branches of uropod; antennal scale armed with 3 or 4 lateral teeth, distal margin of blade separated from distolateral spine by deep notch; mandible with large incisor process, much reduced molar process; 2nd maxilliped with penultimate segment transverse distally, terminal segment longer than broad; maximum carapace length 11 mm.

MATERIAL.—PHILIPPINES. *Verde Island Passage, north of Mindoro:* sta 5270; 13°35′45″N, 120°58′30″E; 430 m; 8 June 1908 (1507–1527); 3-meter open net towed horizontally at 256 m; 1 juv [4.4]. *Albay Gulf, east of southern Luzon:* sta 5458; 13°10′54″N, 123°59′38″E; [366 m]; 8 Jun 1909 (1404–1427); 12′ Agassiz beam trawl: 2♀ [6.1, 8.0] 30 juv [2.1–3.9]. *North of Tawitawi Island, Sulu Archipelago:* sta 5574; 5°30′45″N, 129°07′57″E; 622 m; 23 Sep 1909 (0720–0744); 9′ Tanner beam trawl, mud bag: 1 ovig ♀ [8.9].

RANGE.—As indicated above, *J. spinicauda* seems to be widespread mesopelagically in the tropical seas of the world, except in the eastern Pacific off the Americas. It is represented in considerable numbers in the midwater collections of the *Alpha Helix* from the Sulu, Halmahera, and Banda seas.

REMARKS.—*Janicella spinicauda* is the only oplophorid shrimp, of which adults cannot be sexed by reference to the appendix masculina. With experience, however, one can identify most mature males by the depth of the sinuses in the

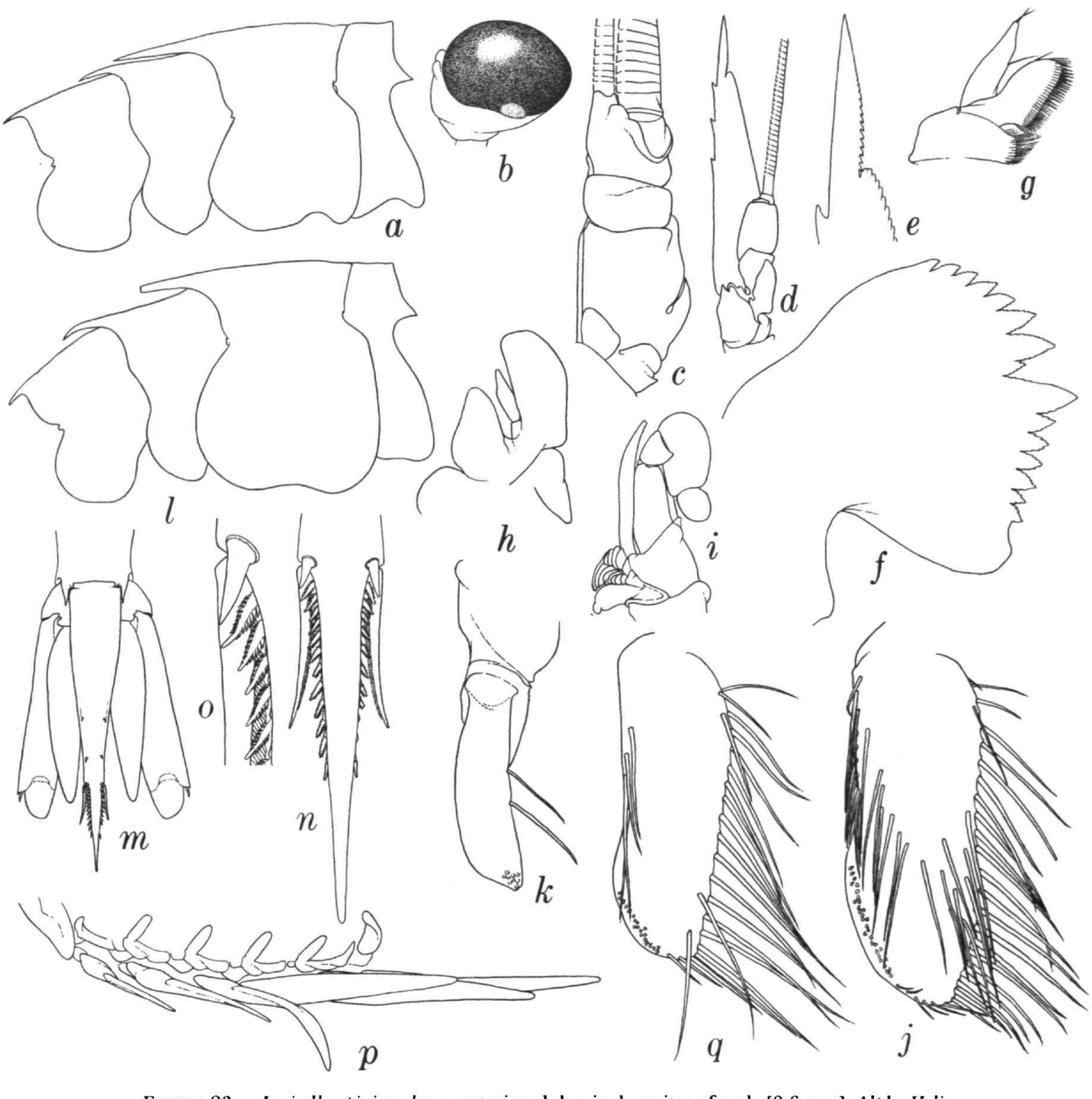

FIGURE 23.—*Janicella spinicauda: a,* anterior abdominal somites of male [8.6 mm], *Alpha Helix* sta 188, Sulu Sea; *b,* eye of same specimen; *c,* right antennular peduncle (dorsal aspect) of same specimen; *d,* right antenna (ventral aspect) of same specimen; *e,* apex of antennal scale of same specimen; *f,* extensor (ventral) surfaces of incisor and molar processes of right mandible of same specimen; *g,* right 1st maxilla of same specimen; *h,* left 1st maxilliped of same specimen; *i,* right 2nd maxilliped of same specimen; *j,* endopod of right 1st pleopod of same specimen; *k,* appendix interna on right 2nd pleopod of same specimen; *l,* anterior abdominal somites of ovigerous female [8.5 mm], *Alpha Helix* sta 182, Sulu Sea; *m,* telson and uropods of same specimen; *n,* posterior end of telson; *o,* same, detail of spination; *p,* right series of epipods and exopods of same specimen; *q,* endopod of right 1st pleopod of same specimen.

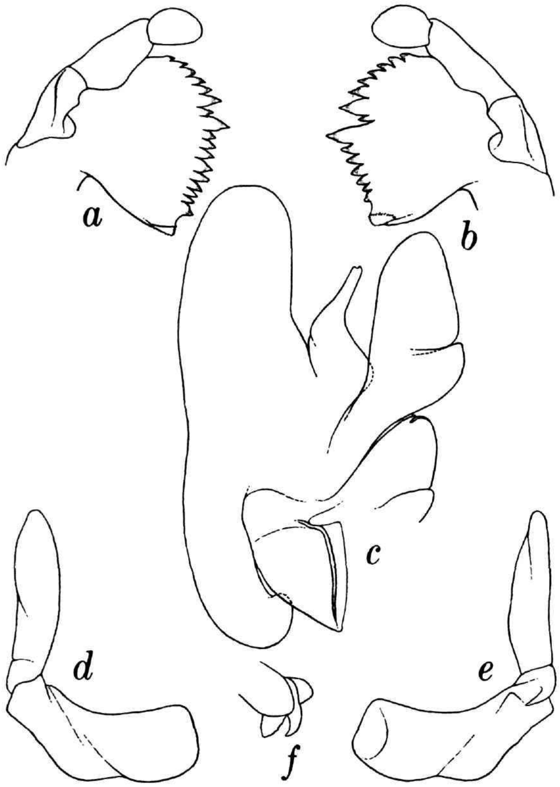

FIGURE 24.—*Janicella spinicauda*, male [8.6 mm], *Alpha Helix* sta 188, Sulu Sea: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pleopod; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

ventral margins of the pleura of the first and second abdominal somites.

Kemphyra, new genus

FIGURE 25

TYPE-SPECIES.—*Notostomus corallinus* A. Milne-Edwards, 1883.

DIAGNOSIS.—Integument thin but not membranous; rostrum with more teeth in dorsal series than in ventral; carapace with median dorsal carina not denticulate, without uninterrupted longitudinal carina extending from near orbit to near posterior margin, with hepatic spine, hepatic furrow not sharply delimited posteriorly; abdomen dorsally carinate on all somites, with posteromesial tooth on 3rd through 6th, 6th somite longer than 5th; telson superficially blunt posteriorly, not tapering regularly to sharply acute posterior end, without spinose endpiece; antennal scale without lateral teeth proximal to distolateral spine; mandibles dissimilar, molar process with transverse distal surface triangular on right member, compressed, sub-bilinear on left, incisor process toothed along entire, rather short opposable margin; 2nd maxilla with proximal endite bearing papilla and submarginal lamina; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment subtriangular, attached diagonally to preceding joint; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod vestigial; appendix masculina present on 2nd pleopod of male; eggs small and numerous (more than 80).

RANGE.—Off South Africa, the Horse Latitudes of the Indian and South Atlantic oceans, and the eastern North Atlantic off northern Portugal; about 1000 to more than 2700 m. There are two juvenile specimens in the Smithsonian collections that are certainly congeneric with *K. corallina* from Hawaii (1760–1937 m) and from the North Atlantic southwest of the Azores (3200 m).

CLASSIFICATION.—There is little doubt that this genus, like *Heterogenys*, is closely related to *Acanthephyra*. I must confess that the decision to remove *K. corallinus* from the enigmatic genus *Acanthephyra* was prompted chiefly by the unusual presence of an hepatic spine in that species. A spine in this position is unique in the family and it is uncommon in most caridean families, except the Palaemonidae, where it is often assumed to be of generic importance. In the latter family, however, an hepatic spine usually represents a displaced branchiostegal spine, whereas both hepatic and branchiostegal spines are present in *Kemphyra*. The two monotypic genera

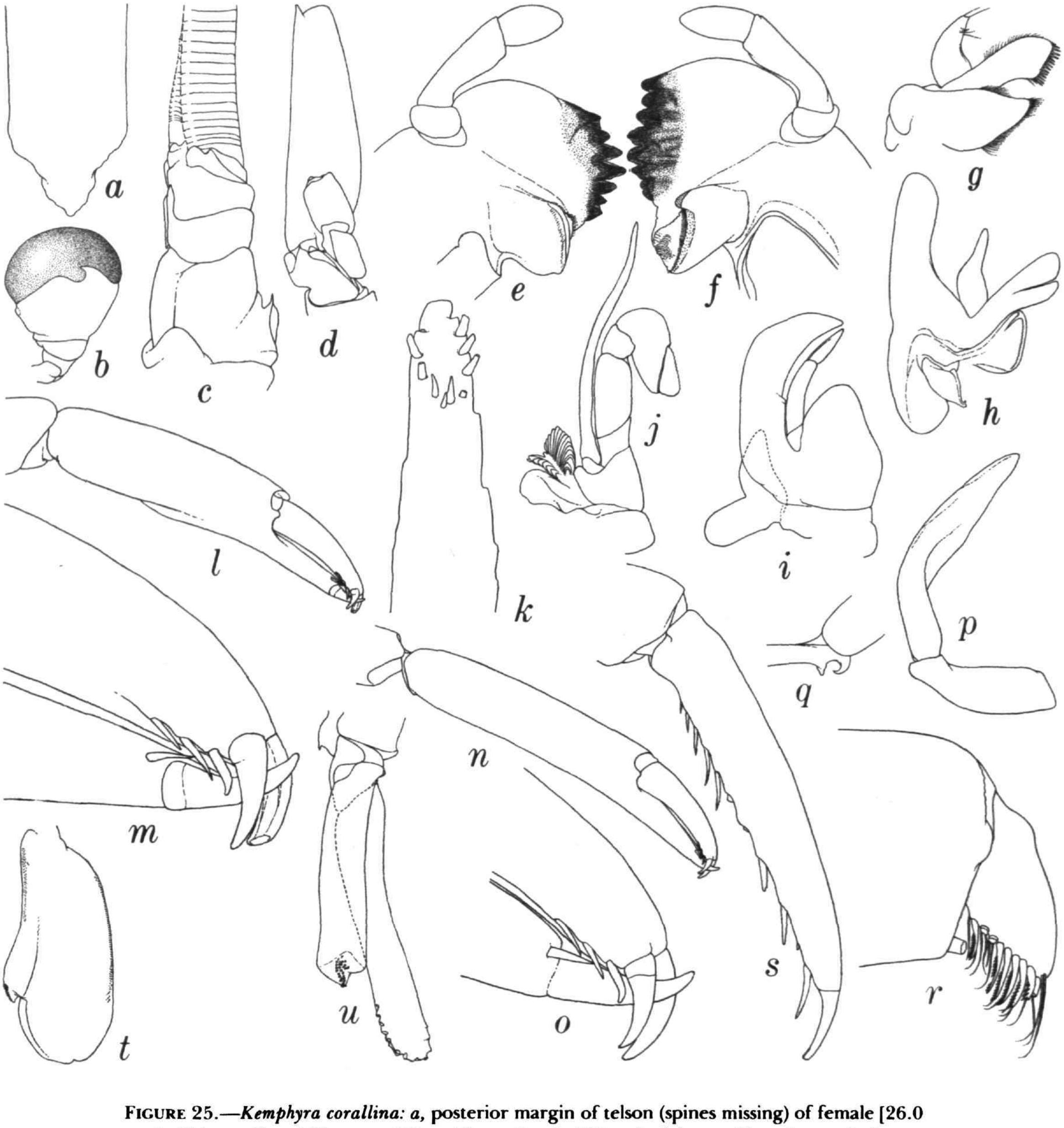

FIGURE 25.—*Kemphyra corallina: a,* posterior margin of telson (spines missing) of female [26.0 mm], *Africana II* sta 190, west of Cape Town, South Africa; *b,* right eye (dorsal aspect) of same specimen; *c,* right antennular peduncle (dorsal aspect) of same specimen; *d,* right antenna (ventral aspect) of same specimen; *e,* left mandible (flexor or dorsal surface) of same specimen; *f,* right mandible of same specimen; *g,* right 1st maxilla of same specimen; *h,* right 2nd maxilla of same specimen; *i,* right 1st maxilliped of same specimen; *j,* right 2nd maxilliped of same specimen; *k,* distal end of right 3rd maxilliped of same specimen; *l,* right 1st chela of same specimen; *m,* distal ends of fingers of same; *n,* right 2nd chela of same specimen; *o,* distal ends of fingers of same; *p,* epipod (dorsal aspect) from right 2nd pereopod of same specimen; *q,* mesial tooth of same (dorsal aspect); *r,*right 5th pereopod of same specimen; *s,* dactyl of right 4th pereopod of male [38.0 mm], *Africana II* sta 319, west of Cape Town, South Africa; *t,* endopod of right 1st pleopod of same specimen; *u,* right appendices interna and masculina of same specimen.

removed herein from the genus *Acanthephyra*—*Heterogenys* and *Kemphyra*— differ greatly in general appearance, but they do seem to have something in common: both are probably confined to the deep-sea floor and both display similar mouthparts (mandibles with relatively narrow incisor process and second maxilla and first and second maxillipeds more elongate than usual in the genus *Acanthephyra*).

ETYMOLOGY.—This genus is dedicated to Stanley W. Kemp (1882–1945), who added so much to our knowledge of the Oplophoridae, from 1906 when he first recorded *Acanthephyra* from off the coast of Ireland to 1939 when he completed his masterful analysis of the *A. purpurea* group, and who devoted an extraordinary amount of time more than 50 years ago to cordial and much appreciated correspondence with an apprehensive young carcinologist who was trying to understand oplophorid systematics without other pertinent assistance. The name is formed by combining the surname Kemp with *Ephyra*, the oldest generic name in the family Oplophoridae, albeit a twice preoccupied junior homonym; I am indebted to L.B. Holthuis for suggesting the name. The gender is feminine.

REMARKS.—*Notostomus corallinus*, the type-species of the genus, was originally illustrated by A. Milne-Edwards (1883) from a specimen collected by the *Travailleur* off northern Portugal in 1882. A second specimen was taken by the *Valdivia* in the south central Indian Ocean and was described by Balss (1914:595) as *Acanthephyra valdiviae* and beautifully illustrated by the same author (1925:260, pl. 23). No less than seven specimens were found by the *Africana II* in 1959 off the Cape of Good Hope (Kensley, 1968:314, figs. 15–17). Finally, Burukovsky and Romensky (1982:1800) recorded a single specimen from the southeastern Atlantic west of the Cape of Good Hope.

*Meningodora Smith, 1882

Meningodora Smith, 1882:73. [Type-species, by monotypy: *Meningodora mollis* Smith, 1882:74; gender: feminine.]

DIAGNOSIS.—Integument thin, typically membranous; rostrum with more dorsal than ventral

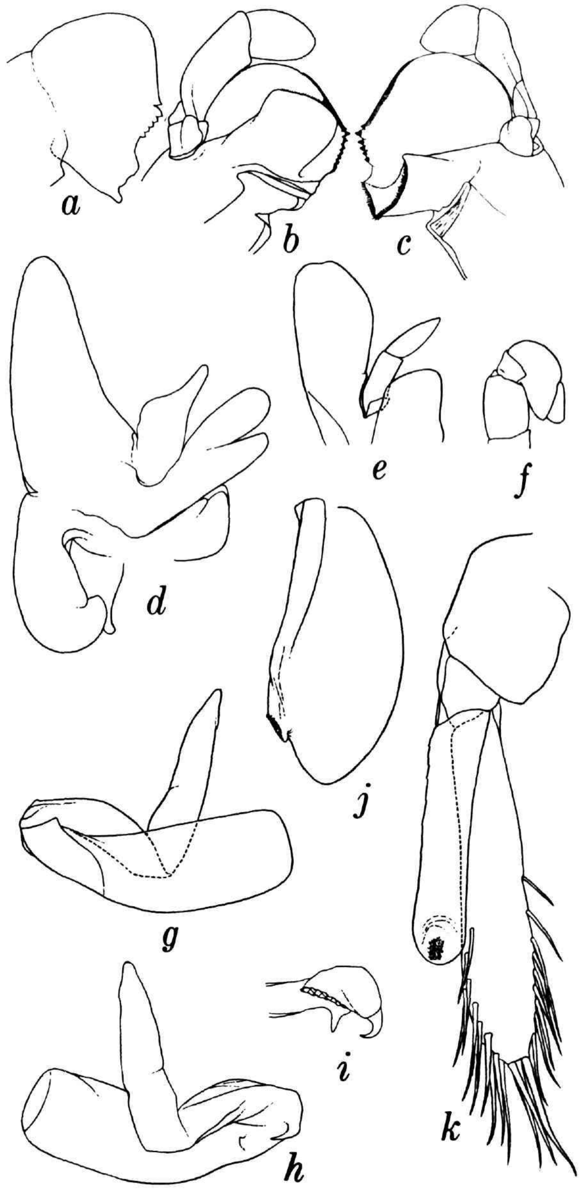

FIGURE 26.—*Meningodoro mollis*, male [22+ mm], *Oregon* sta 1028, Gulf of Mexico: *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, left mandible (flexor or dorsal surface); *c*, right mandible (same aspect); *d*, right 2nd maxilla; *e*, distal part of right 1st maxilliped; *f*, terminal segments of right 2nd maxilliped; *g*, epipod (lateral aspect) from right 2nd pereopod; *h*, same (mesial aspect); *i*, same, mesial teeth (dorsal aspect); *j*, endopod of right 1st pleopod; *k*, right appendices interna and masculina.

teeth; carapace not denticulate dorsally, with single uninterrupted carina extending posteriorly from near orbit to near posterior margin, without hepatic spine, hepatic furrow abruptly delimited posteriorly by oblique carina; abdomen dorsally carinate on at least 3rd through 6th somites and posteromesially dentate on at least 4th, 5th, and 6th, 6th somite at least as long as 5th; telson not terminating posteriorly in spinose endpiece; eye with cornea usually about as wide as eyestalk but typically much narrower; mandibles dissimilar, molar process with transverse distal surface triangular on right member of pair, compressed, sub-bilinear on left, incisor process unarmed over about ½ of opposable margin nearest palp; 2nd maxilla with papilla and submargial lamina on proximal endite; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment subtriangularly ovoid, attached diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod vestigial; appendix masculina present on 2nd pleopod of male; eggs small and numerous (more than 80).

RANGE.—Off South and eastern Africa, Indian Ocean, Indonesia, Philippines, South China Sea, eastern Pacific off Galapagos Islands, Panama, and Oregon, and western and eastern North and South Atlantic; mesopelagic.

CLASSIFICATION.—The restoration of *Meningodora* by Holthuis (1955:13, 17) was certainly proper, but my current study has engendered some doubt about the congeneric status, with *M. mollis*, of the four species now assigned to the genus that were originally described in the genus *Notostomus*. *Meningodora mollis* seems to differ from the other four species in the membranous, fragile integument; the eye with the cornea distinctly narrower than the eyestalk; the right mandible with the dentate part of the opposable margin of the incisor process less extensive and the anterior limit of the unarmed part not marked by a small tooth; the distal lobe of the scaphognathite of the second maxilla more nearly triangular than usual in the family; the lateral lobe of the first maxilliped not projecting mesiad at the distal end; and the appendix masculina overreaching the appendix interna by less than half the length of the latter, rather than being more than twice as long. The reason that I hesitate to propose a separate genus for *M. compsa*, *M. marptocheles*, *M. miccyla*, and *M. vesca* at this time is the fact that the mouthparts of *M. miccyla* are not as different from those of *M. mollis* as are those of the other three species.

Key to the Species of *Meningodora*

1. Third abdominal somite without posteromesial tooth 2
   Third abdominal somite bearing posteromesial tooth 4
2. Integument membranous; eye with cornea much narrower than eyestalk . . . . *21. ***M. mollis***
   Integument soft but firm; cornea at least as wide as eyestalk in lateral aspect 3
3. Abdomen with 2nd somite dorsally carinate, 6th somite little longer than 5th . . . . ***M. compsa*** (Chace, 1940:156)
   (Western and eastern North Atlantic; mesopelagic)
   Abdomen with 2nd somite not carinate dorsally, 6th somite about twice as long as 5th . . . . *22. ***M. vesca***
4. Abdomen with posteromesial tooth on 3rd somite acutely triangular like those on following somites; chelipeds with movable finger terminating in 2 long slender spines; maximum carapace length 23 mm . . . . 20. ***M. marptocheles***

Abdomen with posteromesial tooth on 3rd somite broadly truncate or concave distally; chelipeds with movable finger terminating in 2 small blunt spines; maximum carapace length 10 mm .... *M. miccyla* (Chace, 1940:161)
(Off South Africa and western and eastern North Atlantic; mesopelagic)

20. *Meningodora marptocheles* (Chace, 1940)

Notostomus marptocheles Chace, 1940:158, figs. 33, 34 [type-locality: Northeast Providence Channel, Bahamas; 25°-29'N, 77°18'W; mesopelagic].

DIAGNOSIS.—Integument rather firm, not membranous; abdomen with 2nd somite dorsally carinate, 3rd somite armed with acutely triangular posteromesial tooth, 6th somite fully twice as long as 5th; eye with cornea about as wide as eyestalk in lateral aspect, narrower than eyestalk in dorsal aspect; chelipeds with movable finger terminating in 2 long curved spines; maximum carapace length 23 mm.

RANGE.—Banda Sea, Indonesia (one specimen apparently of this species collected by the *Alpha Helix*) and western North Atlantic; mesopelagic and bathypelagic.

*21. *Meningodora mollis* Smith, 1882

FIGURE 26

Meningodora mollis Smith, 1882:74, pl. 11: figs. 8, 8a, 9, pl. 12: figs. 5,5a, 6–9 [type-locality: east of Cape Lookout, North Carolina; 34°28'25"N, 75°22'50"W, 2985 m].
Hymenodoro mollis.—Bate, 1888:841, pl. 136: fig. 5.
Notostomus fragilis Faxon, 1893:207 [type-locality: southeast of Isla del Cooco, Costa Rica; 5°26'20"N, 86°55'00"W; 1408 m].
Acanthephyra mollis.—De Man, 1920:41, 45.
Notostomus mollis.—Balss, 1925:266, fig. 37.—Chace, 1940:164, fig. 38.

DIAGNOSIS.—Integument fragile; abdomen without dorsal carina on 2nd somite, without posteromesial tooth on 3rd somite, 6th somite about 1⅔ times as long as 5th; eye with cornea distinctly narrower than eyestalk; chelipeds with movable finger terminating in 2 small, blunt, unequal teeth; maximum carapace length 26 mm.

MATERIAL.—SOUTH CHINA SEA. *Luzon Strait west of Batan Islands, Philippines:* sta 5320; 20°58'N, 120°03'E; 3300 m; gray mud; 2.3°C; 6 Nov 1908 (1518–1551); 3-meter open net or ⅓-meter plankton net towed horizontally at 914 m: 1♀ [19.0].

RANGE.—Off South and eastern Africa, Indian Ocean, South China Sea, eastern Pacific between the Galapagos Islands and Panama and off Oregon, and western and eastern North and South Atlantic; mesopelagic and bathypelagic.

*22. *Meningodora vesca* (Smith, 1886)

FIGURE 27

Notostomus viscus Smith, 1886a:189, 192 [nomen nudum].
Notostomus vescus Smith, 1886b:676 [72] [type-locality: Gulf Stream east of Chesapeake Bay; 37°12'20"N, 69°39'00"W, 5393 m; globigerina ooze; beam trawl].—Chace, 1940:153, fig. 29.
Acanthephyra brevirostris Bate, 1888:751, pl. 126: figs. 5, 6 [type-locality: equatorial Atlantic ENE of St. Peter and St. Paul Rocks; 1°22'N, 26°36'W, 2743 m; globigerina ooze; trawled; not *A. brevirostris* Smith, 1885].
Acanthephyra batei Faxon, 1895:167 [replacement name for *A. brevirostris* Bate, not Smith].
Acanthephyra parvirostris Coutière, 1911:157 [erroneous spelling of *A. brevirostris*].
Meningodora vesca.—Crosnier and Forest, 1973:46, fig. 10*d*.

DIAGNOSIS.—Integument rather firm, not membranous; abdomen without dorsal carina on 2nd somite, 3rd somite unarmed, 6th somite fully twice as long as 5th; eye with cornea fully as wide as eyestalk in lateral aspect, narrower than eyestalk in dorsal aspect; chelipeds with movable finger terminating in 2 short spines; maximum carapace length 18 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5120; 13°45'30"N, 120°30'15"E; 719 m; green mud, sand; 6.5°C; 21 Jan 1908 (1441–1510); 3-meter open net towed horizontally at 640 m; 1♀ [8.7].

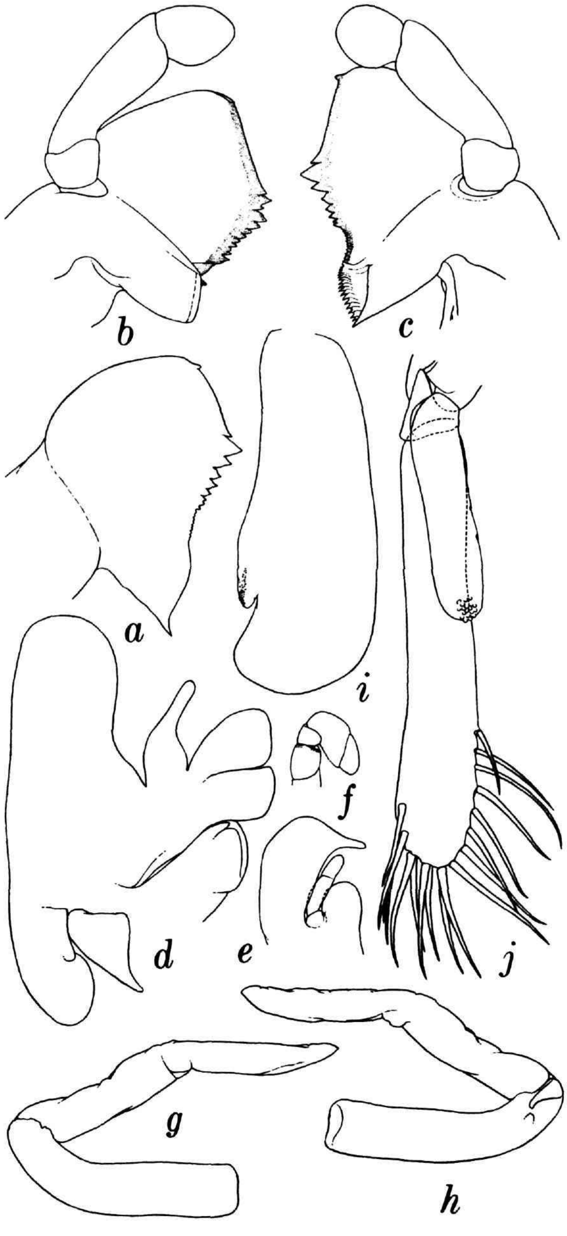

FIGURE 27.—*Meningodora vesca*, male [9.5 mm], *Albatross* sta 5544, Sulu Sea: *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, left mandible (flexor or dorsal surface); *c*, right mandible (same aspect); *d*, right 2nd maxilla; *e*, distal part of right 1st maxilliped; *f*, terminal segments of right 2nd maxilliped; *g*, epipod (lateral aspect) from right 2nd pereopod; *h*, same (mesial aspect); *i*, endopod of right 1st pleopod; *j*, right appendices interna and masculina.

Eastern end of Mindanao Sea: sta 5497; 9°07′15″N, 124°59′30″E; 1756 m; green mud, fine sand; 11.3°C; 3 Aug 1909 (0955–1059); 3-meter open net towed horizontally at 1463 m: 1♂ [9.5]. *Sulu Sea northwest of Mindanao:* sta 5544; 8°16′30″N, 122°26′30″E; 1389 m; green mud, fine sand; 9.9°C; 6 Sep 1909 (1034–1117); 3-meter open net towed horizontally at 1097 m: 3♂ [7.5–9.3] 2♀ [9.0, 10.0].

RANGE.—Bay of Bengal, Philippines, Indonesia, western North Atlantic, and eastern North and South Atlantic; mesopelagic.

REMARKS.—Comparison of 28 specimens collected by the *Alpha Helix* in Indonesia and the Philippines, received from James J. Childress, with 47 specimens from the western North Atlantic collected by vessels from the Woods Hole Oceanographic Institution, provided by David C. Judkins, has revealed differences in the rostral dentition of the two populations that may eventually prove to be taxonomically significant. The presumably typical form from the western Atlantic bears from 8 to 12 (average 9.8) teeth in the dorsal rostral series as opposed to 5–11 (average 8.9) in those from Indonesia and the Philippines. In the western Atlantic population, 40%–80% (average about 55%) of the teeth in the dorsal rostral series arise from the carapace posterior to the level of the posterior orbital margin; in the Philippine-Indonesian specimens, 50–90% (average about 65%) arise from the carapace posterior to the orbital margin. In the Atlantic series, 20–65% (average 45%) of the rostrum, proper, is dorsally unarmed anteriorly; in the Philippine-Indonesian sample, 30–95% (average nearly 60%) of the rostrum is dorsally unarmed. Most strikingly, 33 of 46 western Atlantic specimens have the rostrum armed with one tooth on the ventral margin, seven specimens have two ventral teeth, and six specimens have the rostrum unarmed ventrally, whereas only three of 27 Philippine Indonesian specimens have a single ventral rostral tooth, the other 24 specimens having no ventral teeth on the rostrum. These quantitative differences seem to suggest a clear distinction between these two populations; in the absence of other differences—except for a slightly shorter appendix masculina—it seems best to postpone even a subspecific designation for the Philippine-Indonesian form until representatives from other parts of the world can be similarly compared with the typical facies.

Notostomus* A. Milne-Edwards, 1881

FIGURES 28–31

Notostomus A. Milne-Edwards, 1881b:7. [Type-species, by original designation: *Notostomus gibbosus* A. Milne-Edwards, 1881b:7; gender: masculine.]

DIAGNOSIS.—Integument thin but not membranous; rostrum with more dorsal than ventral teeth; carapace with denticulate median carina throughout length, with 2 or more longitudinal carinae extending onto posterior ½ of lateral surface, without hepatic spine, hepatic furrow abruptly delimited posteriorly by oblique carina; abdomen carinate in dorsal midline of all somites and posteromesially dentate on 3rd through 6th, 6th somite longer than 5th; telson not terminating posteriorly in spinose endpiece; eye with cornea at least as wide as eyestalk; mandibles dissimilar, molar process with transverse distal surface triangular on right member of pair, compressed, sub-bilinear on left, incisor process unarmed over about ½ of opposable margin nearest palp; 2nd maxilla with papilla and submarginal lamina on proximal endite; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures; 2nd maxilliped with distal segment subtriangular, attached diagonally to preceding segment; 3rd maxilliped and 1st pereopod with exopods not unusually broad or rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod vestigial; appendix masculina present on 2nd pleopod of male; eggs small and numerous (more than 80).

RANGE.—Probably all tropical and temperate seas; mesopelagic.

REMARKS.—The following provisional key to the species of *Notostomus* that seem to me to be valid at the present time is offered with considerable reluctance because it may inhibit some of the intensive study that must be pursued before a complete understanding of the genus can be achieved. The species concepts on which the key is based stem in large part from the conclusions convincingly proposed, or merely suggested, by Crosnier and Forest (1973:49–64). The chief deterrent to definitive knowledge of the species of the genus has been the continuing paucity of available study material, especially of clearly adult specimens. Even the series of 32 specimens of *N. japonicus* which prompted the redescription of that species by Stevens and Chace (1965) contained no ovigerous females, and the largest males are considerably smaller than the male holotype of the species. It is regrettable that Stanley Kemp did not live to complete his promising study of the numerous specimens of *Notostomus*—incuding at least one undescribed species (see Crosnier and Forest, 1973:63, footnote)—collected by the *Dana* Expedition, and it is to be hoped that someone else will have the opportunity to conclude that study in the near future.

Key to the Species of *Notostomus*

1. Two lateral carinae on base of rostrum 2
   One lateral carina, coincident with dorsal margin of orbit, on base of rostrum 6
2. Two lateral carinae ventral to carina supporting branchiostegal spine . . 3
   One longitudinal carina ventral to carina supporting branchiostegal spine 5
3. Upper lateral rostral carina not extending posteriorly beyond level of posterior margin of orbit nor reaching anteriorly as far as extremity of

lower lateral rostral carina; anterior abdominal somite with median dorsal carina more than 1/2 as long as tergite, measured laterally; stylocerite not reaching 3rd segment of antennular peduncle .... *23. ***N. elegans***

Upper lateral rostral carina extending posteriorly beyond level of posterior margin of orbit and anteriorly overreaching lower lateral rostral carina; anterior abdominal somite with median dorsal carina less than 1/2 as long as tergite, measured laterally; stylocerite overreaching 2nd segment of antennular peduncle 4

4. Lateral rostral carinae extending anteriorly nearly to anterior extremity of rostrum; gastro-orbital carina sinuous at posterior extremity; anterior abdominal somite with median dorsal carina not dentate anteriorly; telson with 5 pairs of dorsolateral spinules .... ***N. auriculatus*** Barnard, 1950:670
(Off Cape of Good Hope and South Atlantic Ocean south of 25°S latitude; mesopelagic)

Lateral rostral carinae extending anteriorly little beyond level of distal extremity of antennular peduncle; gastro-orbital carina curving slightly dorsad at posterior extremity, not sinuous; anterior abdominal somite with median dorsal carina dentate anteriorly; telson with 2 or 3 pairs of dorsolateral spinules .... ***N. crosnieri*** Macpherson, 1984:54
(Eastern Atlantic Ocean between 25°N latitude and 19°S latitude; mesopelagic)

5. Short carina extending posterodorsad from midlength of dorsal longitudinal lateral (gastro-orbital) carina on carapace .... ***N. japonicus*** Bate, 1888:830
(South of Honshu, Japan, and eastern North Pacific off northwestern United States; mesopelagic)

No carina extending posterodorsad from midlength of dorsal longitudinal lateral (gastro-orbital) carina on carapace .... ***N. murrayi*** Bate, 1888:829
(South central Atlantic west of Tristan da Cunha)

6. Dorsal margin of carapace rather regularly convex in adults; lower lateral rostral carina continuous with gastro-orbital carina on carapace .... 24. ***N. gibbosus***

Dorsal margin of carapace nearly straight in central part in adults; lower lateral rostral carina not continuous with gastro-orbital carina on carapace 7

7. Dorsal teeth at base of rostrum smaller than those on slender anterior part; subhepatic carina not extending nearly to posterior margin of carapace .... ***N. distirus*** Chace, 1940:166
(Western North Atlantic off Bermuda; 1829 m)

Dorsal teeth at base of rostrum enlarged; subhepatic carina extending posteriorly nearly to posterior margin of carapace .... ***N. robustus*** Smith, 1884:377
(Western temperate North Atlantic; mesopelagic)

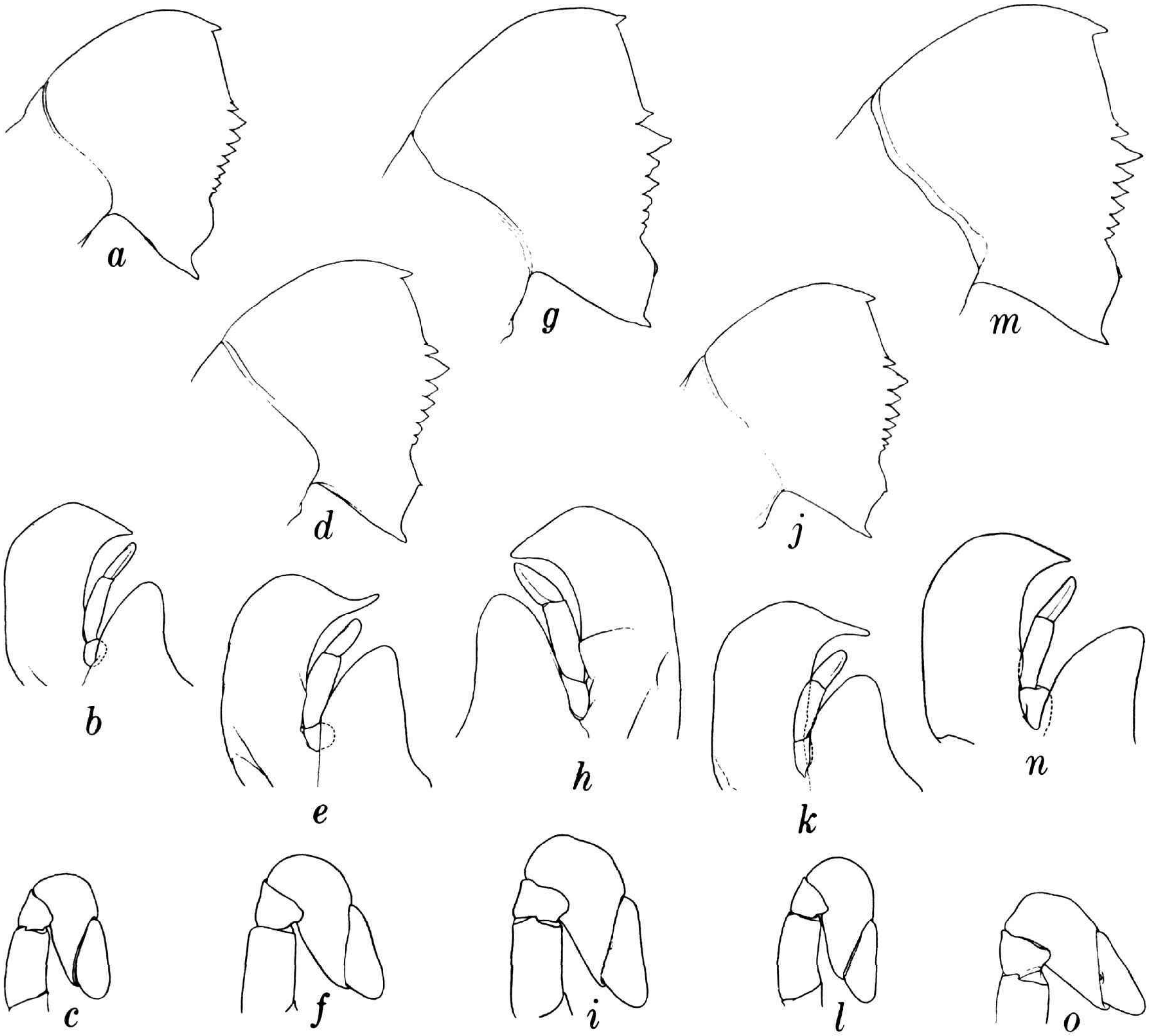

FIGURE 28.—*Notostomus* (*a–c*, *N. crosnieri*, male [30.0 mm], *Atlantis II* sta RHB2075, south of Cape Verde Islands; *d–f*, *N. elegans*, male [35.8 mm], *Oregon* sta 1303, Gulf of Mexico; *g–i*, *N. gibbosus*, male [50.0 mm], *Albatross* sta 2381, Gulf of Mexico; *j–l*, *N. japonicus*, male [31.9 mm], *Brown Bear* sta 199-74, northeastern Pacific west of Vancouver; *m–o*, *N. robustus*, male syntype [46.0 mm], *Albatross* sta 2042, western North Atlantic east of New Jersey): *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, distal part of right 1st maxilliped; *c*, terminal segments of right 2nd maxilliped; *d*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *e*, distal part of right 1st maxilliped; *f*, terminal segments of right 2nd maxilliped; *g*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *h*, distal part of left 1st maxilliped; *i*, terminal segments of right 2nd maxilliped; *j*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *k*, distal part of right 1st maxilliped; *l*, terminal segments of right 2nd maxilliped; *m*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *n*, distal part of 1st maxilliped; *o*, terminal segments of right 2nd maxilliped.

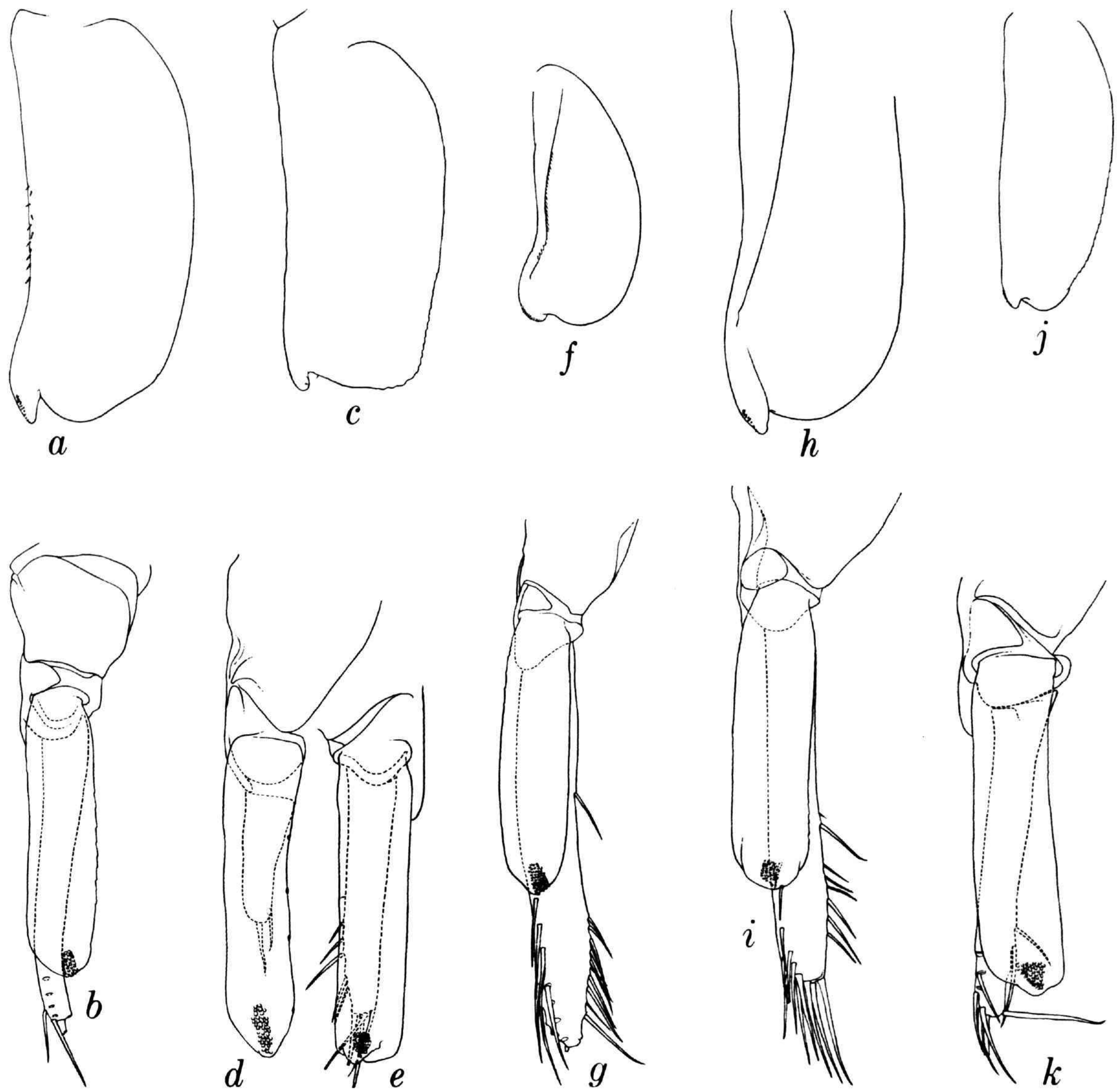

FIGURE 29.—*Notostomus* (*a,b, N. crosnieri*, male [30.0 mm], *Atlantis II* sta RHB2075, south of Cape Verde Islands; *c–e, N. elegans*, male [35.8 mm], *Oregon* sta 1303, Gulf of Mexico; *f,g, N. gibbosus*, male [50.0 mm], *Albatross* sta 2381, Gulf of Mexico; *h,i, N. japonicus*, male [31.9 mm], *Brown Bear* sta 199-74, northeastern Pacific West of Vancouver; *j,k, N. robustus*, male syntype [46.0 mm], *Albatross* sta 2042, western North Atlantic east of New Jersey): ***a***, endopod of right 1st pleopod; ***b***, right appendices interna and masculina; ***c***, endopod of right 1st pleopod; ***d***, right appendices inderna and masculina; ***e***, left appendices interna and masculina; ***f***, endopod of right 1st pleopod; ***g***, right appendices interna and masculina; ***h***, endopod of right 1st pleopod; ***i***, right appendices interna and masculina; ***j***, endopod of right 1st pleopod; ***k***, right appendices interna and masculina.

*23. *Notostomus elegans* A. Milne-Edwards, 1881

FIGURES 28*d–f*, 29*c–e*, 30

Notostomus elegans A. Milne-Edwards, 1881b:8 [type-locality: southeastern Gulf of Mexico; 24°36′N, 84°05′W, 1746 m].—Crosnier and Forest, 1973:56, figs. 15, 16*a,b*.
Notostomus patentissimus Bate, 1888:826, pl. 133: figs. 1, 1*a–c*, 2 [type-locality: eastern Celebes Sea west of Kepulauan Sangi, Indonesia; 2°55′N, 124°53′E, 3931 m; trawled].
Notostomus longirostris Bate, 1888:833, pl. 135: fig. 4 [type-locality: Banda Sea south of Ceram, Indonesia; 4°21′S, 129°07′E, 3006 m; trawled].
Notostomus westergreni Faxon, 1893:208 [type-locality; off northern Ecuador; 1°07′N, 81°04′W, 3182 m].
Notostomus atlanticus Lenz and Strunck, 1914:330 [type-locality: North Atlantic northwest of Cape Verde Islands; 20°41′N, 31°53′W, 3000 m].

DIAGNOSIS.—Rostrum with 2 lateral carinae at base, upper one not extending posteriorly beyond orbital margin, lower one not continuous with dorsal longitudinal lateral (gastro-orbital) carina, dorsal basal teeth not noticeably enlarged; carapace with dorsal margin nearly straight on central part in adults, no carina extending posterodorsad from midlength of dorsal longitudinal lateral (gastro-orbital) carina, 2 longitudinal carinae ventral to subhepatic carina supporting branchiostegal spine, latter extending posteriorly nearly to posterior margin of carapace; abdomen with median dorsal carina on anterior somite more than ½ as long as tergite, measured laterally; stylocerite not reaching 3rd segment of antennular peduncle; basal antennal segment armed with spine of moderate size, not very long; maximum carapace length 45 mm.

MATERIAL.—PHILIPPINES. *Off Panaon Island, south of Leyte:* sta 5203; 9°58′N, 125°07′40″E; 1417 m; green mud; 11.6°C; 10 Apr 1908 (1421–1547); 12′ Agassiz beam trawl, 3 mud bags: 2 juv [17.0, 20.0].

RANGE.—If the synonymy suggested above is valid, *N. elegans* has an extensive distribution in the Philippines and Indonesia, the eastern tropical Pacific off Ecuador, and the western and eastern North Atlantic; mesopelagic.

REMARKS.—The important examination by Crosnier and Forest (1973:59–64) of type-specimens of the nominal species of *Notostomus* having five longitudinal carinae on the posterior half of the carapace, coupled with the description of *N. crosnieri* by Macpherson (1984:54), fixes the number of species of this group at three: *N. auriculatus* from off the Cape of Good Hope and

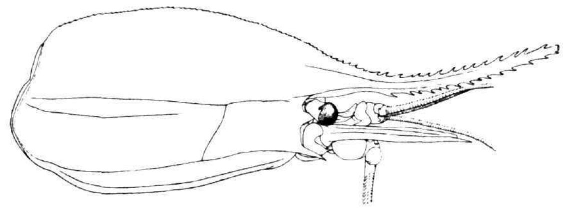

FIGURE 30.—*Notostomus elegans*, juvenile [20.0 mm], *Albatross* sta 5203, off Panaon Island.

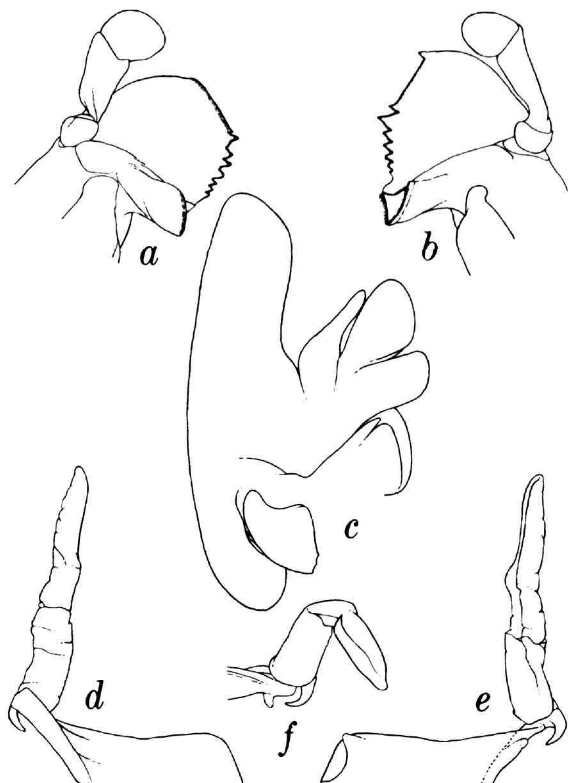

FIGURE 31.—*Notostomus gibbosus*, male [50.0 mm], *Albatross* sta 2381, Gulf of Mexico: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pereopod; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

the Atlantic south of 25°S latitude; *N. crosnieri* from the eastern Atlantic between 25°N and 19°S latitude; and *N. elegans*, with the distribution indicated above.

24. *Notostomus gibbosus* A. Milne-Edwards, 1881

FIGURES 28*g–i*, 29*f,g*, 31

Notostomus gibbosus A. Milne-Edwards, 1881b:7 [type-locality: off Grenada, Lesser Antilles; 12°04′50″N, 61°51′25″W, 1147 m].—Crosnier and Forest, 1973:49, fig. 13.

Notostomus perlatus Bate, 1888:831, pl. 135: fig. 2 [type-locality: eastern Celebes Sea west of Kepulauan Sangi, Indonesia; 2°55′N, 124°53′E, 3931 m; trawled].

Notostomus brevirostris Bate, 1888:832, pl. 135: fig. 3 [type-locality: off Recife, Brazil; 8°37′S, 34°28′W, 1234 m; trawled].

DIAGNOSIS.—Rostrum without 2nd lateral carina at midheight of base, remaining one continuous with dorsal longitudinal lateral (gastro-orbital) carina, dorsal basal teeth not noticeably enlarged; carapace with dorsal margin rather regularly convex in adults, no carina extending posterodorsad from midlength of dorsal longitudinal lateral (gastro-orbital) carina, only 1 longitudinal carina ventral to subhepatic carina supporting branchiostegal spine, latter extending nearly to posterior margin of carapace; abdomen with median dorsal carina on 1st somite more than ½ as long as tergite, measured laterally; stylocerite not reaching 3rd segment of antennular peduncle; basal antennal segment armed with spine of moderate size, not very long; maximum carapace length 60 mm.

RANGE.—Off east coast of Africa, Indonesia, Marquesas Islands, and western and eastern North and equatorial Atlantic; mesopelagic.

**Oplophorus* H. Milne Edwards, 1837

FIGURES 32, 33

Oplophorus H. Milne Edwards, 1837:423. [Type-species, by monotypy: *Oplophorus typus* H. Milne Edwards, 1837:424; gender: masculine.]

DIAGNOSIS.—Integument unusually firm and polished; rostrum with as many or more teeth in dorsal series as in ventral; carapace not denticulate dorsally, without lateral carina extending from near orbit to near posterior margin, without hepatic spine, hepatic furrow not abruptly delimited posteriorly by oblique carina; abdomen with strong posteromesial tooth on 3rd, 4th, and 5th somites, 6th somite shorter than 5th; telson acute posteriorly but not terminating in spinose endpiece; eye large, cornea at least as wide as eyestalk; antennal scale with lateral teeth proximal to distolateral spine, except in *O. novaezeelandiae;* mandibles not very dissimilar, molar process consisting of rather deep channel flanked by thin walls opposing similar structure on other member of pair, incisor process toothed along entire opposable margin, 2nd maxilla with short papilla but without distinct submarginal lamina on proximal endite; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures, distal segment small; 3rd maxilliped and 1st pereopod with exopods broadly compressed and rigid; pereopods with neither ischium nor merus broadly compressed, 3rd pair with dactyl shorter than propodus, 4th pair with epipod well-developed, except for vertical component; appendix masculina present on 2nd pleopod of male; eggs large and few (less than 50).

RANGE.—Most tropical and temperate seas except extreme eastern North Pacific off America; mesopelagic.

Key to the Species of *Oplophorus*

1. Carapace with sharp tooth near posterior end of ventral margin in adults 2
   Carapace with ventral margin unarmed 3
2. Rostrum distinctly overreaching antennal scale; posterior extensions of upper lateral rostral carinae on carapace subparallel in dorsal aspect;

FIGURE 32.—*Oplophorus* (*a–e*, *O. gracilirostris*, male [17.8 mm], *Albatross* sta 5120, west end of Verde Island Passage, Philippines; *f–j*, *O. novaezeelandiae*, male [14.5 mm], *Discovery* sta 250, South Atlantic northeast of Tristan da Cunha; *k–o*, *O. spinosus*, male [16.0 mm], *Atlantis II* sta RHB2037, off Western Sahara; *p–t*, *O. typus*, male [16.0 mm], *Albatross* sta 5630, southern end of Selat Patinti, Halmahera): *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, distal part of right 1st maxilliped; *c*, terminal segments of right 2nd maxilliped; *d*, endopod of right 1st pleopod; *e*, right appendices interna and masculina; *f*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *g*, distal part of right 1st maxilliped; *h*, terminal segments of right 2nd maxilliped; *i*, endopod of right 1st pleopod; *j*, right appendices interna and masculina; *k*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *l*, distal part of right 1st maxilliped; *m*, terminal segments of right 2nd maxilliped; *n*, endopod of right 1st pleopod; *o*, right appendices interna and masculina; *p*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *q*, distal part of right 1st maxilliped; *r*, terminal segments of right 2nd maxilliped; *s*, endopod of right 1st pleopod; *t*, right appendices interna and masculina.

pleuron of 1st abdominal somite armed with small tooth on ventral margin; antennal scale unarmed on only distal 1/6 of lateral margin . . . . *25. ***O. gracilirostris***

Rostrum rarely overreaching antennal scale; posterior extensions of upper lateral rostral carinae on carapace converging posteriorly in dorsal aspect; pleuron of 1st abdominal somite unarmed; antennal scale with distal 1/4 of lateral margin unarmed . . . . *26. ***O. typus***

3. Antennal scale with distinct barb on mesial margin near apex, lateral margin dentate . . . . ***O. spinosus*** (Brullé, 1839:18)
(Indian Ocean, southern Japan, off Hawaii, seamounts west of North America, and northeast of Easter Island, western and eastern subtropical North Atlantic, central South Atlantic, mesopelagic)

Antennal scale unarmed on both mesial and lateral margins . . . . ***O. novaezeelandiae*** De Man, 1931:369
(Off southwestern Australia, New Zealand, and central and eastern South Atlantic as far north as 12°37′S latitude off Angola; mesopelagic)

*25. *Oplophorus gracilirostris* A. Milne-Edwards, 1881

FIGURE 32*a–e*

Oplophorus gracilirostris A. Milne-Edwards, 1881b:6 [type-locality: off Dominica, Lesser Antilles, 216 m].—Chace, 1947:44, figs. 4–7.
Oplophorus longirostris Bate, 1888:765, pl. 127: fig. 2 [type-locality: Fiji Islands; 19°07′50″S, 178°19′35″E, 1116 m; trawled].
Hoplophorus Smithii Wood-Mason, in Wood-Mason and Alcock, 1891:194 [type-locality: Bay of Bengal; 16°44′30″N, 88°19–32′E, 2631 m; trawled, and 15°14′N, 81°09′E, 2305 m; trawled].

DIAGNOSIS.—Rostrum distinctly overreaching antennal scale; carapace with sharp tooth near posterior end of ventral margin in adults, with posterior extensions of upper lateral rostral carinae subparallel in dorsal aspect; abdomen with pleuron of 1st somite armed with small tooth on ventral margin in adults; antennal scale dentate on proximal 5/6 of lateral margin, without barb

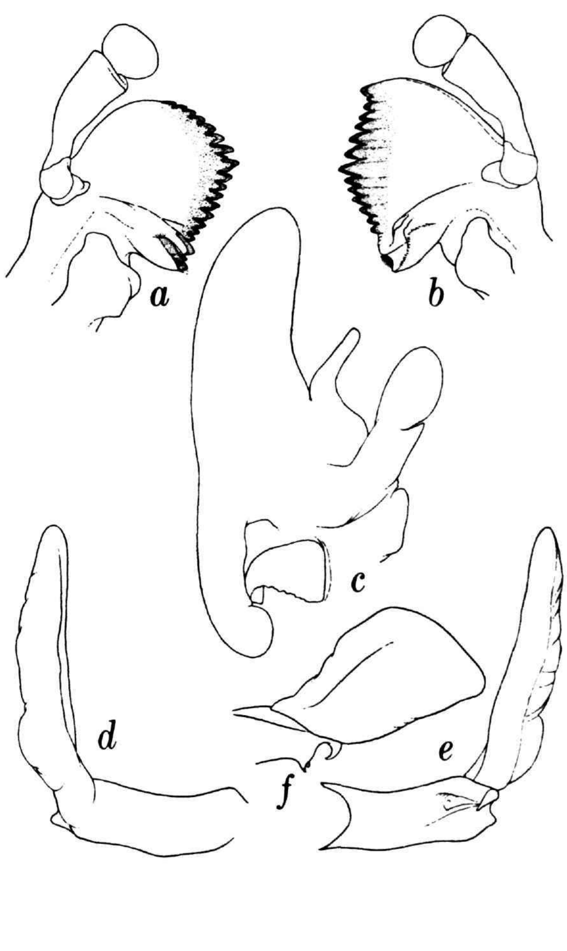

FIGURE 33.—*Oplophorus typus*, male [16.0 mm], *Albatross* sta 5630, southern end of Selat Patinti, Halmahera: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pereopod; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

near apex of mesial margin; maximum carapace length 21 mm.

MATERIAL.—PHILIPPINES. *Babuyan Channel, north of Luzon:* sta 5328; 18°29'45"N, 121°39'E; 274 m; blue mud; 12.2°C; 19 Nov 1908 (0923–0944); 12' Tanner beam trawl, mud bag: 1♂ [16.7]; sta 5329; 18°33'N, 121°37'30"E; 388 m; blue mud; 10.8°C; 19 Nov 1908 (1125–1135); 12'Tanner beam trawl, mud bag: 4♀ [14.0–16.0], 3 ovig [14.0–14.9]. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5120; 13°45'30"N, 120°30'15"E; 719 m; green mud, sand; 6.5°C; 21 Jan 1908 (1441–1510); 3-meter open net towed horizontally at 640 meters: 1♂ [17.8] 2 juv [9.0, 10.0]. *Verde Island Passage:* sta 5270; 13°35'45"N, 120°-58'30"E; 430 m; 8 Jun 1908 (1507–1527); 3-meter open net towed horizontally at 256 m: 1 juv [6.3]; sta 5296; 13°40'09"N, 120°57'45"E; [384 m]; [mud, sand]; 24 Jul 1908 (1247–1307); 12'Agassiz beam trawl, mud bag: 1♂ [17.0]. *Batangas Bay, southern Luzon:* sta 5267; 13°42'20"N, 120°58'25"E; 311 m; pebbles, shells; 8 Jun 1908 (1025–1045): 12' Agassiz beam trawl, mud bag: 2♂ [16.1, 16.3].

Northwest of Panay: sta 5259; 11°57'30"N, 121°42'15"E; 571 m; globigerina; 9.6°C; 3 Jun 1908 (1031–1051); 12' Agassiz beam trawl, mud bag: 1♂ [14.2]. *West of Jolo Island, Sulu Archipelago:* sta 5548; 6°00'20"N, 120°45'35"E; 424 m; sand, broken shells; 11.9°C; 17 Sep 1909 (0755–0820); 9' Tanner beam trawl, mud bag: 1♀ [12.5]; sta 5551; 5°54'48"N, 120°44'24"E; 353 m; fine sand; 11.8°C; 17 Sep 1909 (1407–1427); 9' Tanner beam trawl: 2♂ [10.2, 12.1] 1♀ [12.5] 3 juv [9.1–10.1]; sta 5566; 5°52'12"N, 120°31'00"E; 446 m; fine sand, shells; 11.4°C; 21 Sep 1909 (1407–1434); 9' Tanner beam trawl: 1 ovig ♀ [14.8].

INDONESIA. *West of Halmahera:* sta 5618; 0°37'00"N, 127°15'00"E; 763 m; gray mud; 27 Nov 1909 (1444–1504); 12' Agassiz beam trawl: 1 juv [9.0]. *Ceram Sea south of Pulau Obi:* sta 5634; 1°54'00"S, 127°36'00"E; 602 m; 3 Dec 1909 (0627–0702); 12' Agassiz beam trawl: 1 juv [8.3].

RANGE.—Off southeastern Africa, Indian Ocean, Indonesia, Philippines, southern Japan, Fiji Islands, Hawaii, Gulf of Mexico, Bahamas, Caribbean Sea; mesopelagic.

*26. *Oplophorus typus* H. Milne Edwards, 1837

FIGURES 32*p–t*, 33

Oplophorus typus H. Milne Edwards, 1837:424, pl. 25bis: fig. 6 [type-locality: New Guinea].—Bate, 1888:762, pl.127, fig. 1.—Chace, 1947:45, figs. 8–11.

Oplophorus brevirostris Bate, 1888:766, pl. 127: fig. 3 [type-locality: Sibuyan Sea off Tablas Island, Philippines; 12°21'N, 122°15'E, 1280 m; trawled].

DIAGNOSIS.—Rostrum rarely overreaching antennal scale; carapace with sharp tooth near posterior end of ventral margin in adults, with posterior extensions of upper lateral rostral carinae converging posteriorly in dorsal aspect; abdomen with pleuron of 1st somite unarmed; antennal scale dentate on proximal ¾ of lateral margin, without barb near apex of mesial margin; maximum carapace length 17 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde Island Passage, north of Mindoro:* sta 5286; 13°38'15"N, 120°34'20"E; 823 m; gray sand, mud; 5.8°C; 20 Jul 1908 (1231–1309); 12' Agassiz beam trawl, mud bag: 1♂ [13.3]. *Verde Island Passage, north of Mindoro:* sta 5287; 13°37'40"N, 120°39'E; 694 m; gray sand; 6.3°C; 20 Jul 1908 (1458–1542); 3-meter open net towed horizontally at 567 m for 20 minutes, then raised vertically to surface in 24 minutes: 1♂ [15.4] 3♀ [10.2–11.1]. *Northeast of Mindoro:* sta 5123; 13°12'45"N, 121°38'45"E; 518 m; green mud; 2 Feb 1908 [1344–1404); 12' Tanner beam trawl, mud bag: 1♂ [13.0]. *Tablas Strait, east of Mindoro:* sta 5227; 12°53'45"N, 121°52'30"E; 589 m; green mud; 5 May 1908 (1304–1330); 3-meter open net towed horizontally at 530 m: 1 ovig ♀ [11.7]. *Mindoro Strait, west of Mindoro:* sta 5333; 12°26'30"N, 120°37'45"E; 567 m; sand; 23.2°C [?]; 14 Dec 1908 (0740–0826); 12' Agassiz beam trawl, mud bag: 2♀ [11.0, 12.2], 1 ovig [12.2]. *Mompog Pass, east of Marinduque:* sta

5219; 13°21'N, 122°18'45"E; 969 m; green mud; 10.4°C; 23 Apr 1908 (1357–1437); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [12.9]. *Burias Pass, south of southeastern Luzon:* sta 5216; 12°52'N, 123°23'30"E; 393 m; green mud; 11.1°C; 22 Apr 1908 (0836–0856); 12' Agassiz beam trawl, mud bag: 4♂ [12.9–13.9]; sta 5387; 12°54'40"N, 123°20'30"E; 382 m; soft green mud; 11.3°C; 11 Mar 1909 (1342–1402); 12' Agassiz beam trawl, mud bag: 1♂ [14.7]. *Lagonoy Gulf, east of southern Luzon:* sta 5467; 13°35'27"N, 123°37'18"E; [878 m]; gray mud; 18 Jul 1909 (0752–0834); 12' Agassiz beam trawl, mud bag: 1♂ [16.2]. *Panay Gulf, south of Panay:* sta 5184; 10°18'30"N, 122°23'30"E; 1033 m; green mud; 9.9°C; 30 Mar 1908 (1355–1413); 12' Agassiz beam trawl, 3 mud bags: 1♂ [12.0]; sta 5421; 10°33'30"N, 122°26'E; 251 m; green mud; 14.7°C; 30 Mar 1909 (1738–1810); 12' Agassiz beam trawl, mud bag: 1♂ [13.7].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5586; 4°06'50"N, 118°47'20"E; 635 m; gray mud; 6.7°C: 28 Sep 1909 (1144–1217); 9' Tanner beam trawl, mud bag: 1♂ [14.3]. *Makassar Strait west of Celebes:* sta 5667; 2°56'00"S, 118°47'30"E; 671 m; gray sand, mud; 5.4°C; 29 Dec 1909 (0955–1025); 12' Agassiz beam trawl: 1 ovig ♀ [12.2]. *Southwest of Makassar, Celebes:* sta 5662; 5°43'00"S; 119°18'00"E; 386 m; 9.3°C; 21 Dec 1909 (0612–0632); 12' Agassiz beam trawl: 2♂ [15.3, 15.9]. *West of Halmahera:* sta 5621; 0°15'00"N, 127°24'35"E; 545 m; gray and black sand; 28 Nov 1909 (0950–1010); 12' Agassiz beam trawl, mud bag: 1 ovig ♀ [12.1]. *Selat Patinti, Halmahera:* sta 5628; 0°28'30"S, 127°45'00"E; 2361 m; gray mud; 30 Nov 1909 (1122–1245); 12' Agassiz beam trawl: 1♂ [12.5]. *Southern end of Selat Patinti, southern Halmahera:* sta 5630; 0°56'30"S, 128°05'00"E; 1041 m; coral sand, mud; 2 Dec 1909 (0936–1000); 12' Agassiz beam trawl: 1♂ [16.0].

RANGE.—*Oplophorus typus* seems, from present records, to be confined to the Indo-West Pacific from southeastern Africa, through the Indian Ocean to the Philippines and Indonesia, where it appears to be especially common; it has not yet been reported from any seas east of New Guinea; mesopelagic.

**Systellaspis* Bate, 1888

FIGURES 34–36

Systellaspis Bate, 1888:757. [Type-species, by original designation: *Systellaspis lanceocaudata* Bate, 1888:758; gender: feminine.]

Hoplopasiphaea Yokoya and Shibata, 1965:4. [Type-species, by monotypy: *Hoplopasiphaea philippinensis* Yokoya and Shibata, 1965:4; gender: feminine.]

DIAGNOSIS.—Integument firm; rostrum with more teeth in dorsal series than in ventral; carapace not denticulate dorsally, without hepatic spine, hepatic furrow not abruptly delimited posteriorly; abdomen with 6th somite longer than 5th; telson terminating posteriorly in sharply pointed, laterally spinose endpiece flanked by pair of long lateral spines; eye with cornea at least as wide as eyestalk; antennal scale without lateral teeth proximal to distolateral spine; mandibles not very dissimilar, molar process consisting of rather deep channel flanked by thin walls opposing similar structure on other member of pair, incisor process toothed along entire opposable margin; 2nd maxilla with short papilla and submarginal lamina on proximal endite; 1st maxilliped with slender central lobe subdivided by 2 transverse sutures, distal segment small; 3rd maxilliped and 1st pereopod with exopods neither unusually broad nor rigid; pereopods with neither ischium nor merus broadly compressed, 4th pair with epipod well-developed, except for vertical component; appendix masculina present on 2nd pleopod of male; eggs large and few (less than 50).

RANGE.—Most tropical and temperate seas; mesopelagic and benthic in 291–3292 m.

REMARKS.—There is little doubt that *Hoplopasiphaea* Yokoya and Shibata, 1965, is a junior synonym of *Systellaspis*. The unique holotype of *H. philippinensis* may have a regenerating fourth pereopod, at least on the illustrated left side. The

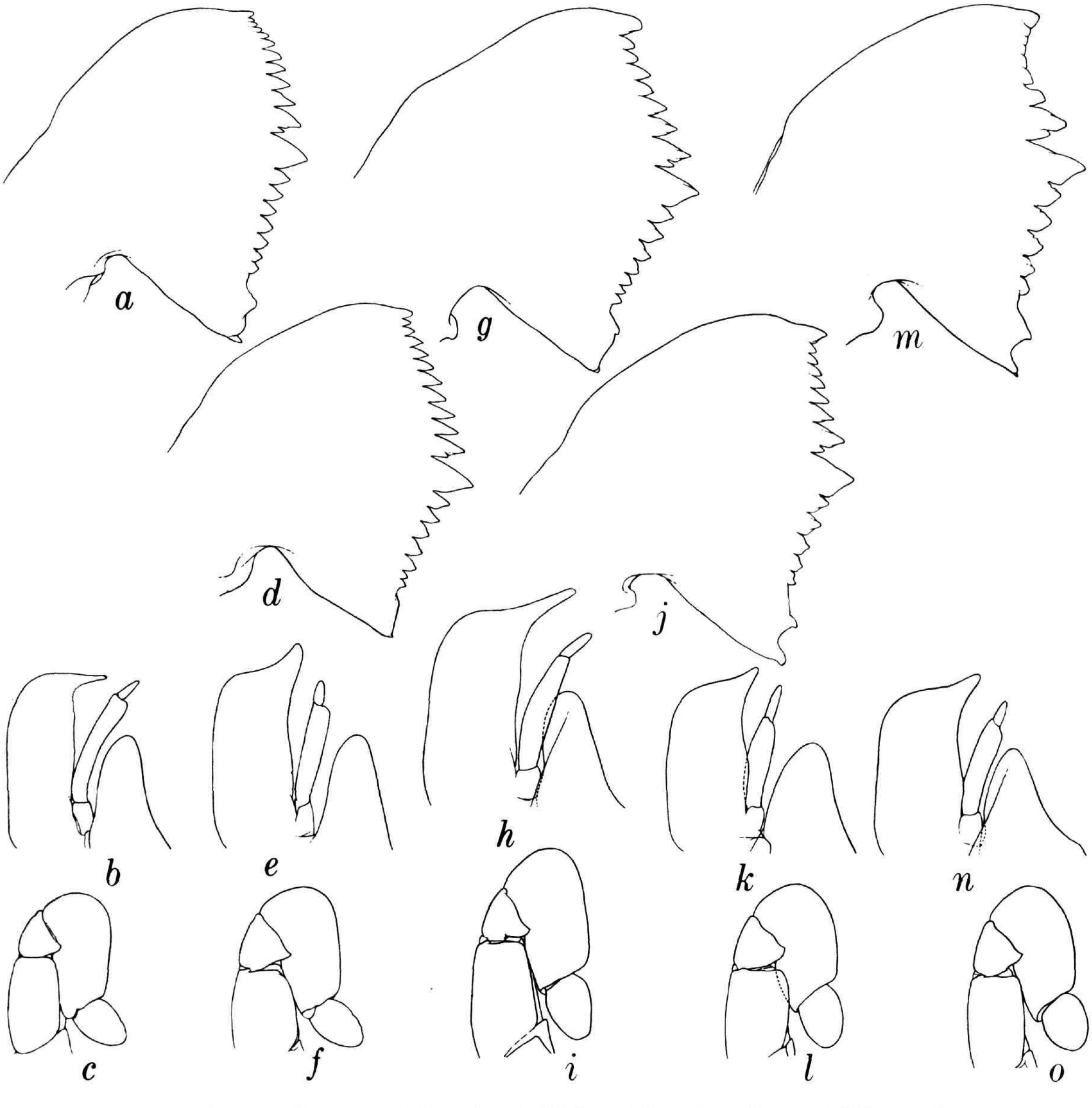

FIGURE 34.—*Systellaspis* (*a–c*, *S. braueri*, male [25.0 mm], *Columbus Iselin* sta 10, Bahamas; *d–f*, *S. cristata*, male [15.8 mm], *Albatross* sta 4655, off Peru; *g–i*, *S. debilis*, male [14.2 mm], *Albatross* sta 5447, Lagonoy Gulf, Philippines; *j–l*, *S. lanceocaudata*, female [13.1 mm], *Albatross* sta 5065, Suruga Wan, Japan; *m–o*, *S. pellucida*, male [13.5 mm], *Albatross* sta 5111, Balayan Bay, Philippines): *a*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *b*, distal part of right 1st maxilliped; *c*, terminal segments of right 2nd maxilliped; *d*, extensor (ventral) surface of right mandible; *e*, distal part of right 1st maxilliped; *f*, terminal segments of right 2nd maxilliped; *g*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *h*, distal part of right 1st maxilliped; *i*, terminal segments of right 2nd maxilliped; *j*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *k*, distal part of right 1st maxilliped; *l*, terminal segments of right 2nd maxilliped; *m*, extensor (ventral) surfaces of incisor and molar processes of right mandible; *n*, distal part of right 1st maxilliped; *o*, terminal segments of right 2nd maxilliped.

type-locality—a 6-foot Isaacs-Kidd midwater trawl sample from 100 meters, over a total depth of more than 7000 meters at the extreme northern end of the Philippine Trench—suggests that the species may be referable to *Systellaspis debilis*, although figure 5 accompanying the description by Yokoya and Shibata, not surprisingly, fails to show the sharp spine characteristically situated on the posterior margin of the pleuron of the fifth abdominal somite of that species. Ken-Ichi Hayashi has informed me that he learned from Keishi Shibata at Nagasaki University in 1969 (Yu Yokoya died in 1967) that the type-specimens of the species described in the 1965 paper were missing and that he (Shibata) was no longer involved with the taxonomy of marine animals.

All five currently recognized species of *Systellaspis* are known from the Philippine-Indonesian region, and four of them are represented in the *Albatross* collections.

Key to the Species of *Systellaspis*

1. Carapace with sinuous lateral ridge extending posteriorly from orbital region nearly to posterior margin; telson armed laterally with 2 or more rows of small spines totalling at least 20 on each side 2
   Carapace without lateral ridge extending posteriorly from orbital region nearly to posterior margin; telson armed dorsolaterally with single row of no more than 10 small spines on each side 3
2. Rostrum triangular in lateral aspect, overreaching antennular peduncle little if at all; carapace not carinate on posterior ½ of dorsal midline, without prominent carina near ventral margin; abdomen without distinct carina in dorsal midline of any somite . . . . 27. ***S. braueri***
   Rostrum elongate anteriorly, extending at least to level of distal ¼ of antennal scale; carapace carinate on dorsal midline as far as tubercle near posterior margin, with sharp carina near ventral margin extending posteriorly from near branchiostegal spine to posterior margin; abdomen with high sharp carina on dorsal midline of 3rd somite . . . . *28. ***S. cristata***
3. Abdomen with posterior margins of tergum of 4th and 5th somites spinulose lateral to posteromesial tooth, 5th somite with sharp spine on posterior margin of pleuron, 6th somite dorsally rounded, about 1⅔ times as long as 5th . . . . *29. ***S. debilis***
   Abdomen with posterior margins of tergum of 4th and 5th somites not spinulose lateral to posteromesial tooth, at most with single spine near juncture with pleuron, 5th somite with rounded prominence but no spine on posterior margin of pleuron, 6th somite dorsally flattened or longitudinally sulcate, about twice as long as 5th 4
4. Abdomen with 6th somite distinctly sulcate in dorsal midline; telson deeply sulcate dorsally throughout length . . . . *30. ***S. lanceocaudata***
   Abdomen with 6th somite dorsally flattened, not distinctly sulcate; telson shallowly sulcate dorsally in posterior ½. . . . . *31. ***S. pellucida***

27. *Systellaspis braueri* (Balss, 1914)

FIGURES 34*a–c*, 35*a,b*

Acanthephyra Braueri Balss, 1914:594 [type-locality: the three original *Valdivia* specimens were taken at two stations in the Gulf of Guinea: 0°26′N, 6°32′W, 0–4000 m; and 0°56′N, 4°34′W, 0–4000 m].

Systellaspis densispina Stephensen, 1923:57, fig. 17 [type-locality: Bay of Biscay: 46°30′N, 7°00′W, more than 4000 m].

Systellaspis Braueri.—Balss, 1925:245, figs. 16–20, pl. 21.

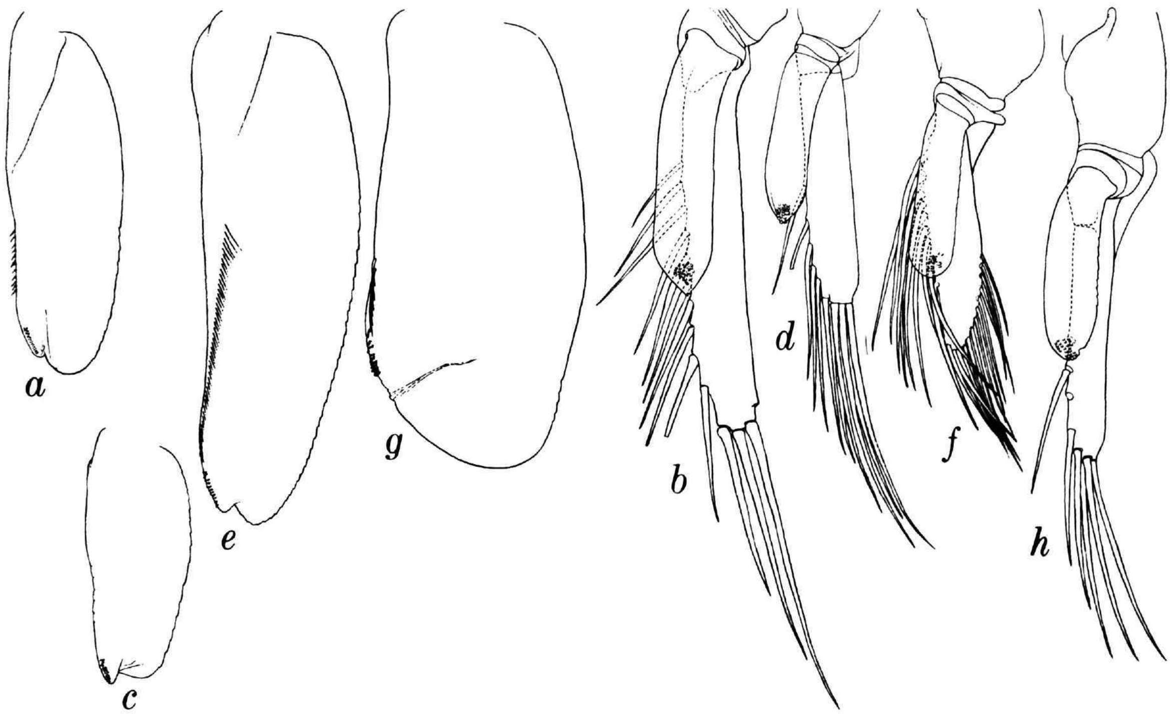

FIGURE 35.—*Systellaspis* (*a, b, S. braueri,* male [25.0 mm], *Columbus Iselin* sta 10, Bahamas; *c, S. cristata,* male [12.7 mm], *Albatross* sta 5619, west of Halmahera; *d, S. cristata,* male [15.8 mm], *Albatross* sta 4655, off Peru; *e, f, S. debilis,* male [14.2 mm], *Albatross* sta 5447, Lagonoy Gulf, Philippines; *g, h, S. pellucida,* male [13.5 mm], *Albatross* sta 5111, Balayan Bay, Philippines): *a,* endopod of right 1st pleopod; *b,* right appendices interna and masculina; *c,* endopod of right 1st pleopod; *d,* right appendices interna and masculina; *e,* endopod of right 1st pleopod; *f,* right appendices interna and masculina; *g,* endopod of right 1st pleopod; *h,* right appendices interna and masculina.

DIAGNOSIS.—Rostrum triangular in lateral aspects, overreaching antennular peduncle little if at all; carapace not carinate on dorsal midline posterior to series of dorsal rostral teeth, with low, blunt, sinuous ridge extending posteriorly from orbital region nearly to posterior margin, without carina near ventral margin extending posteriorly from near branchiostegal spine to posterior margin; abdomen without distinct carina on dorsal midline of any somite, 4th and 5th somites not spinulose on posterior margin of tergum lateral to posteromesial tooth, 5th somite with sharp tooth on posterior margin of pleuron, 6th somite flattened dorsally, about twice as long as 5th; telson shallowly sulcate dorsally, with numerous small spines arranged in more than 2 irregular rows laterally; maximum carapace length 36 mm.

RANGE.—Bay of Bengal, eastern Pacific off Oregon, California, and Mexico, western North Atlantic from southeast of Newfoundland to the Bahamas, and eastern Atlantic from southwest of Ireland to off Congo; mesopelagic. The species was taken by the *Alpha Helix* in the Banda Sea.

*28. *Systellaspis cristata* (Faxon, 1893)

FIGURES 34*d–f*, 35*c*

Acanthephyra cristata Faxon, 1893:206 [type-locality: the two specimens on which the species is based came from two *Albatross* stations in the eastern Pacific south of Panama:

6°10'00"N, 83°06'00"W and 4°56'00"N, 80°52'-30"W]; 1895: 162, pl. 43: fig. 1.

DIAGNOSIS.—Rostrum elongate, extending anteriorly to level of distal ¼ of antennal scale or beyond; carapace carinate on nearly entire length of dorsal midline, with rather prominent and posteriorly sharp sinuous ridge or carina extending posteriorly from orbital region nearly to posterior margin, with sharp carina near ventral margin extending posteriorly from near branchiostegal spine to posterior margin; abdomen with sharp high carina on dorsal midline of 3rd somite, 4th and 5th somites not spinulose on posterior margin of tergum lateral to posteromesial tooth, 5th somite with sharp tooth on posterior margin of pleuron, 6th somite rounded dorsally, less than twice as long as 5th; telson shallowly sulcate dorsally, with 4–8 small spines on each lateral margin of sulcus and 20 or more similar spines in irregular 2nd row near ventral margin of telson; maximum carapace length 19 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5120; 13°45'30"N, 120°30'15"E; 719 m; green mud, sand; 6.5°C; 21 Jan 1908 (1441–1510); 3-meter open net towed horizontally at 640 m: 1 juv [4.3]. Batangas Bay, southern Luzon: sta 5288; 13°43'30"N, 121°E; [256 m]; sand, mud; 22 Jul 1908 (0814–0841); 3-meter open net towed horizontally at 192 m: 1 juv [6.1]. Lagonoy Gulf, east of southern Luzon: sta 5449; 13°21'36"N, 124°00"30"E; 549 m; 4 Jun 1909 (1438–1459); 12' Agassiz beam trawl, mud bag: 1♀ [11.3].

INDONESIA. *West of Halmahera:* sta 5618; 0°37'00"N, 127°15'00"E; 763 m; gray mud; 27 Nov 1909 (1449–1504); 12' Agassiz beam trawl: 1 ovig ♀ [15.2]; sta 5619; 0°35'00"N, 127°14'40"E; 795 m; fine gray sand, mud; 27 Nov 1909 (1612–1641); 12' Agassiz beam trawl: 1♂ [12.7]. *Southern end of Selat Patinti:* sta 5631; 0°57'00"S, 127°56'00"E; 1480 m; green mud; 2 Dec 1909 (1311–1416); 12' Agassiz beam trawl: 1 ovig ♀ [14.8].

RANGE.—Indian Ocean, Philippines, and Indonesia, eastern Pacific off Vancouver Island, British Columbia, to northern South America, Gulf of Mexico, and eastern Atlantic from the Bay of Biscay to Angola; mesopelagic.

REMARKS.—The Philippine and Indonesian specimens seem to have a longer rostrum and higher dorsal crest on the third abdominal somite than do those from the eastern Pacific, but the evidence is not yet sufficient to justify recognizing the two forms as distinct taxa.

*29. *Systellaspis debilis* (A. Milne-Edwards, 1881)

FIGURES 34*g–i*, 35*e,f*

Acanthephyra debilis A. Milne-Edwards, 1881b:13 [type-locality: "trouvee a une profoundeur de 500 brasses dans le canal de Bahama"].
Miersia gracilis Smith, 1882:70, pl. 11: fig. 4 [type-locality: east of Cape Lookout, North Carolina; 34°28'25"N, 75°22'50"W].
Acanthephyra debilis Var. *Europoea* A. Milne-Edwards, 1883, pl. 33: fig. 2 [type-locality unknown].
Systellaspis Bouvieri Coutière, 1905:8, fig. 3 [type-locality: Azores Plateau; 36°46'N, 26°41'W, 0–3250 m].
Systellaspis debilis, var. *indica* De Man, 1916:151 [type-locality: eastern Halmahera Sea east of Kofiau; 1°10.5'S, 130°09'E; 798 m].
Systellaspis debilis.—Chace, 1940:181, fig. 51.

DIAGNOSIS.—Rostrum elongate, overreaching antennal scale; carapace not carinate on posterior ½ of dorsal midline, without lateral ridge extending posteriorly from orbital region nearly to posterior margin, without carina near ventral margin extending posteriorly from near branchiostegal spine; abdomen bluntly carinate on dorsal midline of 3rd somite, 4th and 5th somites spinulose on posterior margin of tergum lateral to posteromesial tooth, 5th somite with sharp tooth on posterior margin of pleuron, 6th somite dorsally rounded, about 1⅔ times as long as 5th; telson narrowly sulcate dorsally, with 4–8 dorsolateral spinules in single row; maximum carapace length about 17 mm.

MATERIAL.—PHILIPPINES. *Western end of Verde Island Passage, east of Lubang Islands:* sta 5120; 13°45'30"N, 120°30'15"E; 719 m; green mud, sand; 6.5°C; 21 Jan 1908 (1441–1510); 3-meter open net towed horizontally at 640 m: 1♀ [13.1]. Verde Island Passage north of Mindoro: sta

5287; gray sand; 6.3°C; 20 Jul 1908 (1458–1548); 3-meter open net towed horizontally at 567 m for 20 minutes, then raised vertically to surface in 24 minutes: 1♂ [9.0] 3 juv [5.9–7.3]. *Lagonoy Gulf, east of southern Luzon:* sta 5447; 13°28′N, 123°46′18″E; 567 m; green mud; 7.4°C; 4 Jun 1909 (0614–0635); 12′ Agassiz beam trawl: 1♂ [14.2]; sta 5466; 13°38′36″N, 123°41′45″E; 988 m; gray mud; 17 Jun 1909 (1040–1102); 12′ Agassiz beam trawl, mud bag: 1♂ [12.9].

INDONESIA. *Selat Patinti, Halmahera:* sta 5628; 0°28′30″S, 127°45′00″E; 2361 m; gray mud; 30 Nov 1909 (1122–1245); 12′Agassiz beam trawl: 1 ovig ♀ [14.3].

RANGE.—South Africa, Indian Ocean, Philippines, Indonesia, Hawaii, western Atlantic from south of Greenland to Gulf of Mexico and Bahamas, and eastern Atlantic from the Faeroe Islands to Angola; mesopelagic, commonly between 650 and 800 m during the day time and about 150 m at night.

*30. *Systellaspis lanceocaudata* Bate, 1888

FIGURES 34*j–l*, 36

Systellaspis lanceocaudata Bate, 1888:758, pl. 124: fig. 7 [type-locality: Sagami Nada, Japan; 35°11′N, 139°28′E; 631 m].

DIAGNOSIS.—Rostrum elongate, overreaching antennal scale; carapace not carinate on posterior ½ of dorsal midline, without lateral ridge extending posteriorly from orbital region nearly to posterior margin, without carina near ventral margin extending to posteriorly from near branchiostegal spine; abdomen sharply carinate on dorsal midline of 3rd somite, 4th and 5th somites with posterior margin of tergum entire, not spinulose, between posteromesial tooth and single tooth near juncture with pleuron, 5th somite with rounded prominence but no spine on posterior margin of pleuron, 6th somite distinctly sulcate in dorsal midline, about twice as long as 5th; telson deeply sulcate dorsally, margins of sulcus armed with 3 pairs of small spines; maximum carapace length 17 mm.

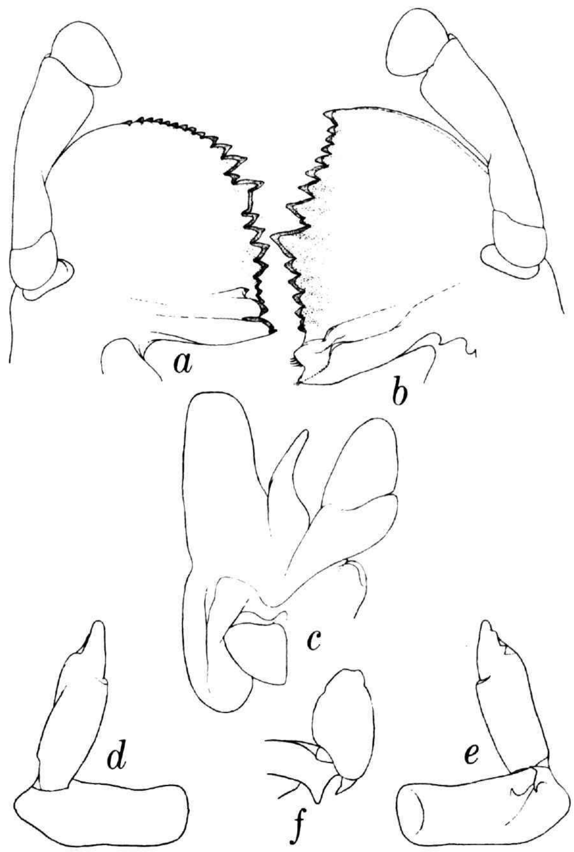

FIGURE 36.—*Systellaspis lanceocaudata*, female [13.0 mm], *Albatross* sta 5065, Suruga Wan, Japan: *a*, left mandible (flexor or dorsal surface); *b*, right mandible; *c*, right 2nd maxilla; *d*, epipod (lateral aspect) from right 2nd pereopod; *e*, same (mesial aspect); *f*, same, mesial teeth (dorsal aspect).

MATERIAL.—PHILIPPINES. *Babuyan Channel, north of Luzon:* sta 5329; 18°33′N, 121° 37′30″E; 388 m; blue mud; 10.8°C; 19 Nov 1908 (1125–1135); 12′ Tanner beam trawl, mud bag: 1♀ [10.7].

RANGE.—This species seems to have been positively recorded previously only from the female holotype taken by the *Challenger* in Sagami Nada, Honshu, Japan, in 631 m. The single female from off Zanzibar identified at this species by Balss (1925:243) may belong to *S. pellucida*, of which a fine series from the Zanzibar area was compared with the holotype of *S. lanceocaudata* by

Calman (1939:190). In addition to the Philippine female reported above, there is in the Smithsonian collections (USNM) a slightly larger female (carapace length 13.1 mm) collected at station 5065 in Suruga Wan in 430–386 m (less than 100 km from the type-locality of *S. lanceocaudata*) during the Northwestern Pacific Cruise of the *Albatross* in 1906. It would seem, therefore, that *S. lanceocaudata* is certainly known only from three female specimens from southeastern Honshu, Japan, and off northern Luzon, Philippines in depths of about 380–630 m. The indication that all three specimens were taken in bottom trawls or a dredge and that all were found in relative proximity to land might suggest that this species, like *S. pellucida*, lives on or near the bottom, at least during daylight hours.

*31. *Systellaspis pellucida* (Filhol, 1885)

FIGURES 34*m–o*, 35*g,h*

Acanthephyra pellucida Filhol, 1885:144, 162 [type-locality (based on lectotype selection by Crosnier and Forest, 1973:93): off Cabo Bojador, Spanish Sahara; 26°20′N, 14°53′W, 782 m].

Acanthephyra affinis Faxon, 1896:162, pl. 2: figs. 1–3 [type-locality: off Grenada; 12°03′15″N, 61°46′25″W, 291 m].

Systellaspis pellucida.—Crosnier and Forest, 1973:92, figs. 26*c*, 27*c*.

DIAGNOSIS.—Rostrum elongate, overreaching antennal scale; carapace not carinate on posterior ½ of dorsal midline, without lateral ridge extending posteriorly from orbital region nearly to posterior margin, without carina near ventral margin extending posteriorly from near branchiostegal spine; abdomen strongly carinate in dorsal midline of 3rd somite, 4th and 5th somites with posterior margin of tergum entire, not spinulose, between posteromesial tooth and single tooth near junction with pleuron, 5th somite with rounded or rectangular prominence but no sharp spine on posterior margin of pleuron, 6th somite dorsally flattened but not distinctly sulcate in dorsal midline, about twice as long as 5th; telson shallowly sulcate dorsally in posterior ½, margins of sulcus armed with 3 pairs of small spines; maximum carapace length 19 mm.

MATERIAL.—PHILIPPINES. *Balayan Bay, southern Luzon:* sta 5111; 13°45′15″N, 120°46′30″E; 432 m; green mud; 16 Jan 1908 (1508–1538); 12′ Tanner beam trawl, mud bag: 1♂ [13.5]. *Mindoro Strait, west of Mindoro:* sta 5333; 12°26′30″N, 120°37′45″E; 567 m; sand; 23.2°[?]; 14 Dec 1908 (0740–0826); 12′ Agassiz beam trawl, mud bag: 1♂ [9.5]. *Southeast of Cebu:* sta 5534; 9°26′00″N, 123°26′37″E; 609 m; gray globigerina ooze; 11.8°C; 19 Aug 1909 (0823–0853); 12′ Tanner beam trawl: 1♂ [9.7]. *Macajalar Bay, Mindanao:* sta 5506; 8°40′N, 124°31′45″E; 479 m; green mud; 11.8°C; 5 Aug 1909 (0912–0926); 12′ Tanner beam trawl: 1♂ [13.5]. *West of Jolo Island, Sulu Archipelago:* sta 5548; 6°00′20″N, 120°45′35″E; 424 m; sand, broken shells; 11.9°C; 17 Sep 1909 (0755–0820); 9′ Tanner beam trawl, mud bag: 1♀ [11.3]. *Southwest of Jolo Island, Sulu Archipelago:* sta 5566; 5°52′12″N, 120°31′00″E; 446 m; fine sand, shells; 11.4°C; 21 Sep 1909 (1407–1434); 9′ Tanner beam trawl: 8 ovig ♀ [13.2–15.7]. *Between Jolo and Tawitawi islands, Sulu Archipelago:* sta 5567; 5°48′00″N, 120°33′45″E; 490 m; fine sand; 11.1°C; 21 Sep 1909 (1536–1557); 9′ Tanner beam trawl, mud bag: 1♂ [12.0] 5♀ [12.6–14.2], 4 ovig [12.6–13.7]. *Tawitawi Island, Sulu Archipelago:* sta 5569; 5°33′15″N, 120°15′30″E; 555 m; coral sand; 11.3°C; 22 Sep 1909 (0849–0859); 9′ Tanner beam trawl, mud bag: 1 ovig ♀ [14.3].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5583; 4°19′00″N, 118°56′20″E; 818 m; fine sand; 4.6°C; 27 Sep 1909 (1348–1433); 9′ Tanner beam trawl, mud bag: 1♂ [12.7]. *Makassar Strait west of Celebes:* sta 5666, 2°54′30″S, 118°47′00″E; 497 m; green mud; 8.6°C; 29 Dec 1909 (0839–0918); 12′ Agassiz beam trawl: 1♂ [12.5].

RANGE.—Western Indian Ocean, South China Sea, Philippines, Indonesia, Gulf of Mexico, Bahamas, West Indies, and off northwest Africa from Morocco to Gabon; usually found on or near bottom in 291–3292 m, commonly between 300 and 600 m.

*NEMATOCARCINIDAE Smith, 1884

NEMATOCARCININAE Smith, 1884:368.

DIAGNOSIS.—Rostrum immovably attached to remainder of carapace, laterally compressed, narrow in lateral aspect; carapace relatively smooth, not strongly sculptured; antennular flagella simple, without accessory branches; mandible with palp, molar and incisor processes deeply separated; 1st maxilliped with flagellum on exopod; 2nd maxilliped with terminal segment applied as narrow strip to penultimate segment; 3rd maxilliped elongate, not unusually expanded, 5-segmented, bearing well-developed exopod and straplike epipod; 4 anterior pairs of pereopods with exopods and straplike epipods lacking endpiece extending vertically into branchial chamber, 2 anterior pairs with well-developed chela and undivided carpus, 3 posterior pairs unusually long, with carpus several times as long as propodus; pleopods with appendix interna.

RANGE.—Probably all tropical and temperate seas and as far south as 71°S in the Weddell Sea off Antarctica; usually benthic in 51–3931 m.

Only one genus is recognized.

Nematocarcinus* A. Milne-Edwards, 1881

Nematocarcinus A. Milne-Edwards, 1881b:14. [Type-species, by monotypy: *Nematocarcinus cursor* A. Milne-Edwards, 1881b:14; gender: masculine.]

DIAGNOSIS.—See "Diagnosis" for the family, above.

RANGE.—See "Range" for the family, above.

CLASSIFICATION.—The shrimps of this genus apparently represent a dominant and often very common element of the deeper benthic communities, especially in depths greater than 500 meters, but identification of the species is often difficult. Thnaks to the intensive work of Crosnier and Forest (1973), the Atlantic species are now reasonably well known, but the systematic arrangement of the Indo-Pacific populations has progressed little since the majority of the nominal species were described by Bate (1888) in the *Challenger* report. Attempts to use the *Albatross* Philippine collections to alleviate this situation have not been as successful as had been hoped for. The form of the pleuron of the fifth abdominal somite and of the pre-anal tooth on the sixth, the shape and proportions of the antennal scale, and the relative lengths of the two distal segments of the third and fourth pereopods proved to be so variable that they had to be abandoned as specific characters of the Philippine-Indonesian representatives of the genus. The usefulness of even those characters that were adopted—the length, curvature, and dentition of the rostrum; the presence of absence of a protuberance near the posterior end of the ventral surface of the sixth abdominal somite; and the proportions of the appendix masculina—was minimized by inconsistencies in aberrant specimens. It has been impossible, therefore, to construct a key that would be reliable for all specimens found in the region; the one offered below should be used with caution.

The eight species previously recognized from the area were described by Bate (1888). On the basis of evidence available, I have been unable to distinguish two of those species (*N. intermedius* and *N. tenuipes*) from *N. productus*, and they have been tentatively synonymized with the latter pending subsequent investigation. Although *N. productus* and *N. undulatipes* have been synonymized with *N. ensifer* (Smith, 1882:77) and *N. cursor* A. Milne-Edwards, 1881b:14, respectively, by most authors since Bate, the discovery by Crosnier and Forest (1973) of minor but apparently consistent differences in Atlantic populations of these two species has led me to retain Bate's names until the genus is carefully reviewed on a worldwide basis. The proposed new species described below seems to be consistently different from all of those known previously, but it is represented by only four females from two widely separated stations, and confirmation of its validity must await the eventual collection of additional material, particularly of males.

Key to the Philippine-Indonesian Species of *Nematocarcinus*

1. Rostrum typically not overreaching antennular peduncle 2
   Rostrum of adults typically overreaching antennular peduncle 4
2. Sixth abdominal somite with double tubercle near posterior end of ventral midline . . . . *33. ***N. bituberculatus,*** new species
   Sixth abdominal somite about tubercles on ventral surface 3
3. Dorsal teeth of rostrum closely and subequally spaced throughout; 3rd and 4th pereopods with dactyl shorter than propodus . . . . *34. ***N. gracilis***
   Dorsal teeth of rostrum more widely spaced anteriorly than posteriorly; 3rd and 4th pereopods with dactyl longer than propodus . . . . *38. ***N. undulatipes***
4. Rostrum armed with 7–11 dorsal teeth, including 3–5 on caparace posterior to orbital margin; 6th abdominal somite typically with protuberance near posterior end of ventral midline. . . . . . *37. ***N. tenuirostris***
   Rostrum armed with 14–34 dorsal teeth, including 6–9 on carapace posterior to orbital margin; 6th abdominal somite without protuberance on ventral surface 5
5. Rostrum armed with more than 30 dorsal teeth . . . . . 36. ***N. proximatus***
   Rostrum armed with less than 30 dorsal teeth 6
6. Rostrum with posterior teeth of dorsal series grouped in narrowly spaced series above and posterior to orbit, remainder much more widely spaced on rostrum proper . . . . 32. ***N. altus***
   Rostrum with dorsal teeth forming continuous series, anterior teeth spaced only slightly more widely than those above orbit . . . . *35. ***N. productus***

32. *Nematocarcinus altus* Bate, 1888

Nematocarcinus altus Bate, 1888:809, pl. 132: fig. 4 [type-locality: eastern Celebes Sea; 2°55′N, 124°53′E; 3931 m].

DIAGNOSIS.—Rostrum slightly overreaching antennal scale, armed dorsally with 10 close-set teeth above and posterior to orbit and about 8 much more widely spaced teeth on rostrum proper, armed ventrally with 5 inconspicuous teeth; abdomen with 3rd somite noticeably produced posteromesially; telson short, not overreaching mesial branch of uropod; carapace length 35 mm.

RANGE.—Known only from the unique type-specimen from the Celebes Sea.

*33. *Nematocarcinus bituberculatus*, new species

FIGURE 37

DIAGNOSIS.—Rostrum curving slightly dorsad, reaching about to level of distal end of antennular peduncle, armed dorsally with 2–4 teeth posterior to orbit and 6 teeth becoming more widely spaced anteriorly on rostrum proper, ventral margin unarmed or with single subapical tooth; abdomen with 3rd somite rounded posteriorly, only moderately produced, pleuron of 5th somite armed with sharp posteroventral tooth, 6th somite with paired tubercles near posterior end of ventral midline; telson reaching about as far as distal end of lateral branch of uropod; maximum carapace length about 25 mm.

FIGURE 37.—*Nematocarcinus bituberculatus*, new species: *a*, anterior carapace and appendages of female holotype [24.8 mm], *Albatross* sta 5624, west of Halmahera; *b*, 3rd abdominal somite of holotype; *c*, 5th abdominal somite of holotype; *d*, posterior end of 6th abdominal somite of holotype (right aspect); *e*, pre-anal tooth of holotype (right aspect); *f*, telson and uropods of holotype; *g*, posterior end of telson of holotype; *h*, right antennal scale of holotype; *i*, right mandible of holotype; *j*, right 1st maxilla of holotype; *k*, right 2nd maxilla of holotype; *l*, right 1st maxilliped of holotype; *m*, right 2nd maxilliped of holotype; *n*, right 3rd maxilliped of holotype; *o*, rostrum of ovigerous female paratype [25.4 mm], type-lot; *p*, rostrum of ovigerous female paratype [24.3 mm], type-lot.

DESCRIPTION.—Rostrum (Figure 37*a*) curving slightly dorsad, reaching about to level of distal end of antennular peduncle; dorsal margin armed with 8–10 basally articulated, somewhat appressed teeth becoming more widely spaced anteriorly, 2–4 teeth of dorsal series situated on carapace posterior to level of orbital margin; ventral margin unarmed or with single small fixed tooth near apex. Carapace without prominent grooves or ridges except for rather broad groove on anterior ¼ extending posteriorly and slightly ventrad from orbital region. Antennal and pterygostomial spines well developed, sharp. Abdomen with pleura rounded on 4 anterior somites; 3rd somite (Figure 37*b*) rounded posteriorly, not much produced posteromesially; 5th somite (Figure 37*c*) with pleuron armed with sharp posteroventral tooth; 6th somite with paired tubercles near posterior end of ventral midline (Figure 37*d*); pre-anal tooth (Figure 37*e*) sharp, curved spine extending posteriorly from rather deep flange between bases of uropods. Telson (Figure 37*f*) reaching about as far as distal end of lateral branch of uropod, armed with 9 or 10 pairs of dorsolateral spinules and 2 pairs of posterior spines (Figure 37*g*), lateral pair more than twice as long as mesial pair.

Eyes about as broad as long.

Antennular peduncle with stylocerite reaching about as far as dorsodistal margin of first segment, deeply and rather sharply notched dorsally in lateral view.

Antennal scale (Figure 37*h*) nearly 3¼ times as long as wide, distomesial angle of scale reaching fully as far as distolateral spine.

Mouthparts as illustrated (Figures 37*i–n*). Incisor process of mandible armed with 7 teeth. Third maxilliped reaching almost as far as end of antennal scale, exopod nearly reaching distal ⅕ of antepenultimate segment.

First pereopod overreaching antennal scale by chela and about ⅙ of carpus. Remaining pereopods detached or missing in all specimens.

Eggs small and numerous, measuring about 0.5 mm in major diameter.

SIZE.—Carapace length of nonovigerous female holotype, 24.8 mm; of nonovigerous female paratype, 24.2 mm; of ovigerous female paratypes, 24.3 and 25.4 mm.

MATERIAL.—PHILIPPINES. *Lagonoy Gulf, east of southern Luzon:* sta 5447; 13°28′N, 123°46′18″E; 567 m; green mud; 7.4°C; 4 Jun 1909 (0614–0935); 12′ Agassiz beam trawl: 1♀ [24.2].

INDONESIA. *West of Halmahera:* sta 5624; 0°12′15″N, 127°29′30″E; 527 m; fine sand, mud; 29 Nov 1909 (1058–1118); 12′ Agassiz beam trawl: 3♀ [24.3–25.4], 2 ovig [24.3, 25.4], nonovigerous ♀ is holotype (USNM 211375).

TYPE-LOCALITY.—West of Halmahera, Indonesia; 0°12′15″N, 127°29′30″E; 527 m.

RANGE.—Known only from the type-series from Lagonoy Gulf, Philippines, and west of Halmahera, Indonesia, in depths of 527 and 567 m.

REMARKS.—Because of the variability of many Indo-Pacific species of *Nematocarcinus* and because this form is represented by only four females, final validation of the species must await the availability of additional material, especially males. The short rostrum and its dentition are similar to those characters in *N. undulatipes*, but the rather prominent tubercles on the ventral surface of the sixth abdominal somite may indicate a relationship with *N. tenuirostris*.

ETYMOLOGY.—The Latin *bi-* (two, double) plus the New Latin *tuberculatus* (tuberculate) refers to the paired tubercles on the ventral surface of the sixth abdominal somite.

*34. *Nematocarcinus gracilis* Bate, 1888

FIGURE 38

Nematocarcinus gracilis Bate, 1888:815, pl. 132: fig. 8 [type-locality: the *Challenger* specimens came from two stations: Fiji Islands; 19°07′50″S, 178°19′35′E, 1116 m; and near the Kermadec Islands; 28°33′S, 177°50′W, 1097 m]. —De Man, 1920:90, pl. 8, fig. 21*a–h*, pl. 9: fig. 21.

DIAGNOSIS.—Rostrum nearly horizontal, reaching to or slightly beyond level of distal end of second segment of antennular peduncle, armed dorsally with 13–22 upstanding, basally articulated, subequally spaced teeth, including 4–7 on carapace posterior to orbit; ventral margin typically armed with single strong fixed subapical tooth; abdomen with 3rd somite rounded posteriorly, only moderately produced, pleuron of 5th somite armed with sharp posteroventral tooth, 6th somite without tubercles on ventral surface; telson reaching about as far as distal end of lateral branch of uropod; pereopods with 3rd

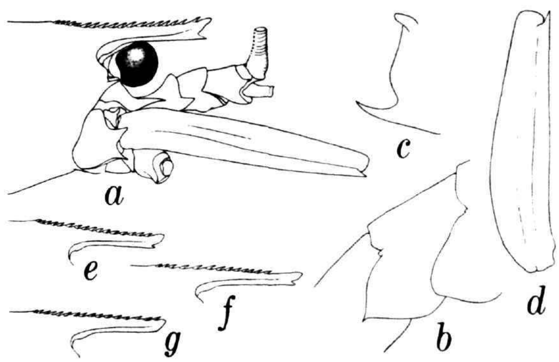

FIGURE 38.—*Nematocarcinus gracilis: a,* anterior carapace and appendages of ovigerous female [20.8 mm], *Albatross* sta 5634, Ceram Sea south of Pulau Obi; *b,* 5th abdominal somite of same specimen; *c,* pre-anal tooth of same specimenl; *d,* right antennal scale of same specimen; *e,* rostrum of ovigerous female [17.9 mm], same station in Ceram Sea; *f,* rostrum of ovigerous female [18.9 mm], same station; *g,* rostrum of ovigerous female [18.1 mm], same station.

and 4th pairs having dactyl shorter than propodus; maximum carapace length 24 mm.

MATERIAL.—PHILIPPINES. *Off Arangasa Islands, eastern Mindanao:* sta 5236; 8°50'45"N, 126°26'52"E; 203 m; fine gray sand; 5.1°C; 11 May 1908 (1027–1102); 12' Agassiz beam trawl, 3 mud bags: 1♂ [19.0].

INDONESIA. *Ceram Sea south of Pulau Obi:* sta 5634; 1°54'00"S, 127°36'00"E; 602 m; 3 Dec 1909 (0625–0702); 12' Agassiz beam trawl: 5 ovig ♀ [17.9–20.8]; sta 5635; 1°53'30"S, 127°39'00"E; 732 m; coral, rock, soapstone; 3 Dec 1909 (0956–1001); 12' Agassiz beam trawl: 1y♂ [10.5] 1? [?].

RANGE.—Arabian Sea to Hawaii; 165–1170 meters.

REMARKS.—The single male taken at station 5236 has the rostrum broken, and the identification is therefore tentative. In all of the other *Albatross* specimens, the tip of the rostrum is blunt, except in the larger, damaged specimen from station 5635, in which the rostrum is distally acute.

*35. *Nematocarcinus productus* Bate, 1888

FIGURE 39

Nematocarcinus productus Bate, 1888:810, pl. 132: fig. 5 [type-locality: the *Challenger* series came from four rather widely separated stations: China Sea off Lingayen Gulf, Luzon, Philippines; 16°42'N, 119°22'E; 1920 m; Banda Sea south of Ceram, Indonesia; 4°21'S, 129°07'E; 2606 m; southeast of Sagami Nada, Honshu, Japan; 34°37'N, 140°32'E; 3429 m; North Fiji Basin; 18°30'S, 173°52'E; 2651 m].

Nematocarcinus tenuipes Bate, 1888:812, pl. 132: fig. 6 [type-locality: the type-series was taken at three stations by the *Challenger*: south of Honshu, Japan; 34°07'N, 138°00'E; 1033 m; north of New Guinea; 2°33'S, 144°04'E; 1701 m; Sagami Nada, Honshu, Japan; 35°11'N, 139°28'E; 631 m].

Nematocarcinus intermedius Bate, 1888:821, pl. 132: fig. 13 [type-locality: north of New Guinea; 2°33'S, 144°04'E; 1701 m].

Nematocarcinus ensifer var. *producta*.—De Man, 1920:76, pl. 8: figs. 18, 18*a*.

DIAGNOSIS.—Rostrum curving somewhat dorsad, rarely horizontal, overreaching antennular peduncle in adults, armed dorsally with 14–27

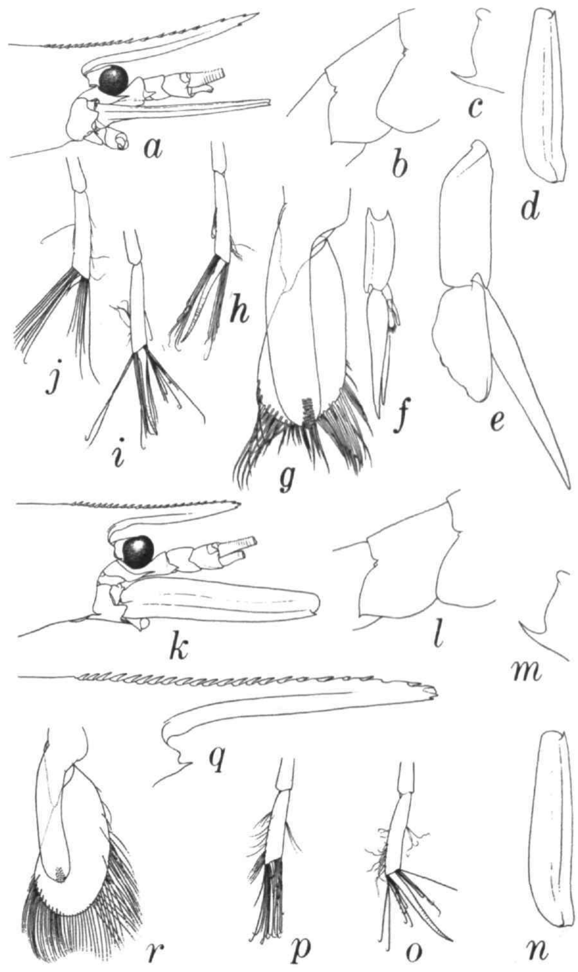

FIGURE 39.—*Nematocarcinus productus*: *a*, anterior carapace and appendages of male [15.0 mm], *Albatross* sta 5492, eastern Mindanao Sea; *b*, 5th abdominal somite of same specimen; *c*, pre-anal tooth of same specimen; *d*, right antennal scale of same specimen; *e*, right 1st pleopod of same specimen; *f*, right 2nd pleopod of same specimen; *g*, same, appendices interna and masculina; *h*, dactyl and propodus of right 3rd pereopod of female [17.7 mm], *Albatross* sta 5494, eastern Mindanao Sea; *i*, dactyl and propodus of left 4th pereopod of same specimen; *j*, dactyl and propodus of right 5th pereopod of same specimen; *k*, anterior carapace and appendages of female [16.9 mm], *Albatross* sta 5636, Ceram Sea; *l*, 5th abdominal somite of same specimen; *m*, pre-anal tooth of same specimen; *n*, right antennal scale of same specimen; *o*, dactyl and propodus of left 3rd pereopod of same specimen; *p*, dactyl and propodus of left 5th pereopod of same specimen; *q*, rostrum of male [18.0 mm], *Albatross* sta 5636, Ceram Sea; *r*, right appendices interna and masculine of same specimen.

basally articulated teeth in continuous series, including 6–9 on carapace posterior to orbit, ventral margin typically armed with single subapical tooth, occasionally with 2 or none; abdomen with 3rd somite not strongly produced in dorsal midline, pleuron of 5th somite armed with sharp posteroventral tooth, 6th somite without tubercles on ventral surface; telson reaching nearly as far as distal end of lateral branch of uropod; appendix masculina on endopod of male second pleopod no more than twice as long as broad; maximum carapace length 26 mm.

MATERIAL.—PHILIPPINES. *Lagonoy Gulf, east of southern Luzon:* sta 5468; 13°35'39"N, 123°40'28"E; [1041 m]; green mud; 18 Jun 1909 (0958–1031); 12' Agassiz beam trawl, mud bag: 1♂ [19.9]; sta 5470; 13°37'30"N, 123°41'09"E; [1024 m]; [mud]; 18 Jun 1909 (1526–1600); 12' Agassiz beam trawl: 1♂ [15.8]. *Eastern Mindanao Sea:* sta 5491; 9°24'N, 125°12'E; 1346 m; green mud, coral; 11.3°C; 1 Aug 1909 (1012–1043); 12' Agassiz beam trawl: 6♂ [14.8–18.6] 9♀ [15.5–20.7]; sta 5492; 9°12'45"N, 125°20'E; 1344 m; gray mud; 11.3°C; 1 Aug 1909 (1331–1359); 12' Agassiz beam trawl: 4♂ [14.8–17.3] 6♀ [16.7–17.9]; sta 5494; 9°06'30"N, 125°18'40"E; 1240 m; green mud, sand; 11.8°C; 2 Aug 1909 (0917–0952); 12' Agassiz beam trawl: 6♀ [16.1–18.9]; sta 5495; 9°06'30"N, 125°00'20"E; 1785 m; gray mud; 11.3°C; 2 Aug 1909 (1244–1354); 12' Agassiz beam trawl: 3♂ [16.9–19.5] 8♀ [17.7–22.1]. *Sulu Sea east of Palawan:* sta 5428; 9°13'N, 118°51'15"E; 2021 m; gray mud; 9.8°C; 3 Apr 1909 (1014–1123); 12' Agassiz beam trawl, mud bag: 1♂ [17.7].

INDONESIA. *Makassar Strait west of Celebes:* sta 5668; 2°28'15"S, 118°49'00"E; 1648 m; gray mud; 3.4°C; 29 Dec 1909 (1645–1704); 12' Agassiz beam trawl: 1♂ [19.7]; sta 5670; 1°19'00"S, 118°43'00"E; 2160 m; gray mud; 3.4°C; 30 Dec 1909 (0818–0838); 12' Agassiz beam trawl: 1y♂ [13.9] 2♂ [20.1, 20.3] 7♀ [21.9–24.0], 4 ovig [22.2–22.8]. *Makassar Strait off northwestern Celebes:* sta 5671; 1°05'00"S, 118°56'00"E; 1756 m; gray mud; 3.4°C; 30 Dec 1909 (1241–1345); 12' Agassiz beam trawl: 2♀ [23.0, 24.2], 1 ovig [23.0]. *Teluk Tomini, Celebes:* sta 5606; 0°16'28"N, 121°33'30"E; 1525 m; 17 Nov 1909 (1007–1027); 12' Agassiz beam trawl: 1 ovig ♀ [22.0]; sta 5608; 0°08'00"S, 121°19'00"E; 1992 m; gray mud; 2.4°C; 18 Nov 1909 (1248–1402); 12' Agassiz beam trawl: 1♀ [25.2]; sta 5609; 0°11'00"S, 121°16'00"E; 1997 m; green mud; 2.4°C; 18 Nov 1909 (1537–1651); 12' Agassiz beam trawl: 3♂ [15.1–17.3] 2♀ [21.3, 24.8]. *Molucca Sea:* sta 5614; 0°31'00"N, 125°58'45"E; 2012 m; gray mud, sand, globigerina; 22 Nov 1909 (0644–0758); 12' Agassiz beam trawl: 1♂ [18.6]. *Selat Patinti, Halmahera:* sta 5628; 0°28'30"S, 127°45'00"E; 2361 m; gray mud; 30 Nov 1909 (1122–1245); 12' Agassiz beam trawl: 2♀ [15.0, 21.8], 1 ovig [21.8]. *Ceram Sea south of Pulau Obi:* sta 5636; 1°55'00"S, 127°42'30"E; 2308 m; gray mud, fine sand; 3 Dec 1909 (1151–1318); 12' Agassiz beam trawl: 1♂ [18.0] 1♀ [16.9].

RANGE.—See "Remarks."

REMARKS.—On the basis of Bate's descriptions, I have been unable to recognize *N. tenuipes* or *N. intermedius* as species distinct from *N. productus;* the latter has been selected as the senior synonym because of page priority. On the other hand, the Philippine-Indonesian material of that species seems to be sufficiently different from the typical form of *N. ensifer* (Smith, 1882:77) from the Atlantic, especially in regard to the less produced posterior margin of the third abdominal somite, to justify the belief that the two populations are specifically distinct. Until, however, populations from different parts of the world, particularly the eastern Pacific, are carefully compared, the distributional limits of *N. productus* must remain indeterminate.

36. *Nematocarcinus proximatus* Bate, 1888

Nematocarcinus proximatus Bate, 1888:808, pl. 132: fig. 3 [type-locality: the *Challenger* series came from five rather widely separated Indo-Pacific stations: southern Indian Ocean between Prince Edward and Crozet islands; 46°46'S, 45°31'E, 2514 m; Aarafura Sea south of New Guinea; 9°59'S, 139°42'E, 51 m; southeast of Sagami Nada, Honshu, Japan; 34°37'N, 140°32'E, 3429 m; eastern Pacific off Islas Juan Fernandez, Chile; 33°42'S, 78°18'W, 2514 m; and eastern Pacific west of southern Chile; 42°43'S, 82°11'W, 2651 m].

DIAGNOSIS.—Rostrum overreaching antennal scale in adults, armed dorsally with continuous series of more than 30 teeth gradually becoming more widely spaced anteriorly, about 9 teeth of series placed on carapace posterior to orbit, ventral margin armed with 1 or 2 teeth considerably removed from apex; telson reaching about as far as distal end of lateral branch of uropod; carapace length 30 mm.

RANGE.—Known only from the type-series recorded from the southern Indian Ocean, south of Japan, the Arafura Sea, and the eastern Pacific west of Chile. The indication that the 15 specimens taken by the *Challenger* in the Arafura Sea were living at a depth of only 51 m, whereas all of the other specimens of the species taken by that vessel occurred in depths greater than 2500 m, suggests that the specimens from that station may belong to a different species and that the true *N. proximatus* may not be represented even in areas adjacent to the Philippine-Indonesian region.

*37. *Nematocarcinus tenuirostris* Bate, 1888

FIGURE 40

Nematocarcinus tenuirostris Bate, 1888:817, pl. 132: fig. 10 [type-locality: this species was recorded from two *Challenger* stations: southern Philippine Sea off Kepulauan Talaud; 4°33'N, 127°06'E, 914 meters; and Fiji Islands; 19°07'50"S, 178°19'35"E, 1116 m].

Neomatocarcinus tenuirostris var. *sibogae* De Man, 1917:279 [type-locality: off the south coast of Roti, Lesser Sunda Islands; 10°48'36"S, 123°23'06"E, 918 m].

Nematocarcinus tenuirostris var. *Sibogae*.—De Man, 1920:79, pl. 8: fig. 19–19*d*.

DIAGNOSIS.—Rostrum horizontal or slightly concave dorsally, overreaching antennular peduncle and even antennal scale in large specimens, armed dorsally with 3–5 teeth posterior to level of orbital margin and 3–6 teeth becoming more widely spaced anteriorly on rostrum proper, ventral margin typically armed with single tooth anterior to anteriormost tooth of dorsal series but some distance from apex, rarely unarmed ventrally; abdomen with posterior margin of 3rd somite not produced posteriorly in dorsal midline, pleuron of 5th somite armed with short posteroventral tooth, 6th somite usually bearing broad protuberance near posterior end of ventral midline; telson reaching fully as far as distal end of lateral branch of uropod; maximum carapace length more than 30 mm.

MATERIAL.—PHILIPPINES. *Off western Lubang Islands:* sta 5274; 13°57'30"N, 120°03'25"E; 960 m; gray mud, sand; 5.2°C; 16 Jul 1908 (0959–1029); 12' Agassiz beam trawl: 1 ovig ♀ [25.8]. *Lagonoy Gulf, east of southern Luzon:* sta 5469; 13°36'48"N, 123°38'24"E; [914 m]; green mud; 18 Jun 1909 (1329–1411); 12' Agassiz beam trawl: 1♀ [28.7]. *North of Samar:* sta 5445; 12°44'42"N, 124°59'50"E; 700 m; green mud, sand; 6.8°C; 3 Jun 1909 (1201–1238); 12' Agassiz beam trawl: 2♀ [27.2, 28.9], 1 ovig [27.2]. *Off Arangasa Islands, eastern Mindanao:* sta 5236; 8°50'45"N, 126°26'52"E; 903 m; fine gray sand; 5.1°C; 11 May 1908 (1027–1102); 12' Agassiz beam trawl, 3 mud bags: 2♀ [26.2, 26.9]. *Northern Palawan Passage:* sta 5349; 10°54'N, 118°26'20"E; 1335 m; coral, sand; 4.8°C; 27 Dec 1908 (1340–1400); 12' Tanner beam trawl, mud bag: 1♂ [20.2].

INDONESIA. *Celebes Sea off Sabah* (North Borneo): sta 5585; 4°07'00"N, 118°49'54"E; 871 m; gray mud; 5.1°C; 28 Sep 1909 (0931–0951); 9' Tanner beam trawl, mud bag: 1 ovig ♀ [28.1]. *Teluk Tomini, Celebes:* sta 5607; 0°04'00"S, 121°36'00"E; 1392 m; fine sand; 18 Nov 1909 (0920–0940); 12' Agassiz beam trawl: 3♂ [19.1–23.2] 2♀ [18.8, 23.9]. *Molucca Sea:* sta 5601; 1°13'10"N, 125°17'05"E; 1399 m; sand, globigerina, pteropods; 13 Nov 1909 (1418–1439); 12' Agassiz beam trawl, mud bag: 2♂ [25.8, 26.8] 1♀ [22.8]. *West of Halmahera:* sta 5618; 0°37'00"N, 127°15'00"E; 763 m; gray mud; 27 Nov 1909 (1444–1504); 12' Agassiz beam trawl: 2♀ [22.3, 25.0], 1 ovig [25.0]; sta 5623; 0°16'30"N, 127°30'00"E; 497 m; fine sand, mud; 29 Nov 1909 (0922–0942); 12' Agassiz beam trawl: 1 ovig ♀ [24.3]. *Southern end of Selat*

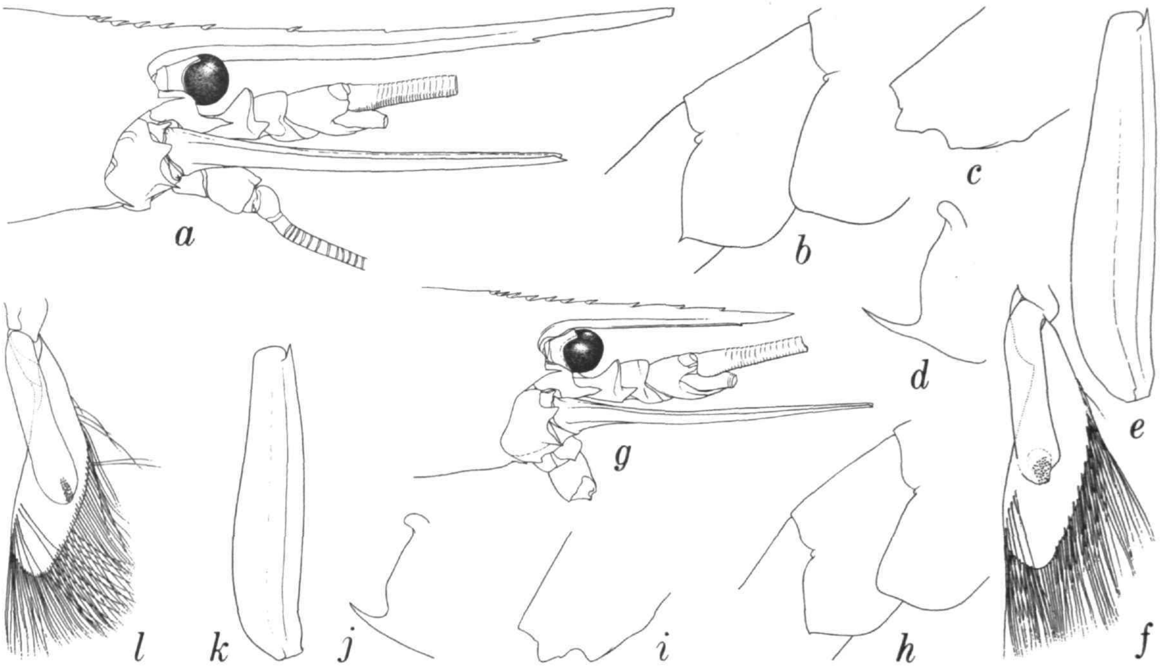

FIGURE 40.—*Nematocarcinus tenuirostris*: *a*, anterior carapace and appendages of male [28.3 mm], *Albatross* sta 5630, southern Halmahera; *b*, 5th abdominal somite of same specimen; *c*, posterior end of 6th abdominal somite (right aspect) of same specimen; *d*, pre-anal tooth of same specimen; *e*, right antennal scale of same specimen; *f*, right appendices interna and masculina of same specimen; *g*, anterior carapace and appendages of male [23.0 mm], *Albatross* sta 5651, Teluk Bone, Celebes; *h*, 5th abdominal somite of same specimen; *i*, posterior end of 6th abdominal somite of same specimen; *j*, pre-anal tooth of same specimen; *k*, right antennal scale of same specimen; *l*, appendices interna and masculina of same specimen.

Patinti, southern Halmahera: sta 5630; 0°56′30″S, 129°05′00″E; 1041 m; coral sand, mud; 2 Dec 1909 (0936–1000); 12′ Agassiz beam trawl: 1♂ [28.3] 1♀ [21.1]. *Off southern Buru:* sta 5638; 3°47′15″S, 126°23′40″E; 946 m; fine gray sand; 10 Dec 1909 (1400–1436); 12′ Agassiz beam trawl: 1♀ [22.4]. *Teluk Bone, Celebes:* sta 5650; 4°53′45″S, 121°29′00″E; 988 m; green mud; 4.5°C; 17 Dec 1909 (0922–0932); 12′ Agassiz beam trawl: 1 ovig ♀ [30.8]; sta 5651; 4°43′50″S, 121°23′24″E; 1280 m; green mud; 3.7°C; 17 Dec 1909 (1432–1452); 12′ Agassiz beam trawl: 1♂ [23.0] 1♀ [18.7]; sta 5652; 4°35′00″S, 121°23′06″E; 960 m; green mud; 5.1°C; 17 Dec 1909 (1639–1724); 12′ Agassiz beam trawl: 1♂ [22.1]; sta 5658; 3°32′40″S, 120°31′30″E; 933 m; gray mud; 5.1°C; 19 Dec 1909 (1423–1443); 12′ Agassiz beam trawl: 1 ovig ♀ [29.0].

RANGE.—Off southeastern India to Hawaii; 301–1611 m.

Remarks.—Of the 27 *Albatross* specimens assigned to this species, four females lack the protuberance near the posterior end of the ventral surface of the sixth abdominal somite; there is a slight possibility that the absence of this swelling is correlated with the lack of a ventral tooth on the rostrum.

*38. *Nematocarcinus undulatipes* Bate, 1888

FIGURES 41, 42

Nematocarcinus undulatipes Bate, 1888:801, pl. 130 [type-locality: the type-series consists of specimens from four different *Challenger* stations: western Moro Gulf, Mindanao, Philippines; 6°47′N, 122°28′E, 457 m; southern Philippine Sea off Kepulauan Talaud; 4°33′N, 127°06′E, 914 m; Banda Sea off Kepulauan Banda; 4°34′S, 129°57′30″E, 366 m; and off Kermadec Islands; 28°33′S, 177°50′W, 1097 m].—De Man, 1920:83, pl. 8: fig. 20–20*h*.

DIAGNOSIS.—Rostrum nearly horizontal, usually reaching to level of about midlength of 3rd segment of antennular peduncle, armed dorsally with 7–14 basally articulated teeth becoming more widely spaced anteriorly, including 3–6 teeth on carapace posterior to orbital margin, ventral margin typically armed with single tooth short distance from apex, occasionally unarmed ventrally; abdomen with 3rd somite rounded posteriorly, only slightly produced, pleuron of 5th somite armed with variably distinct posteroventral tooth, 6th somite without tubercles on ventral surface; telson variable in length, reaching about as far as distal end of mesial branch of uropod to slightly beyond lateral branch; maximum carapace length 26 mm or more.

MATERIAL.—PHILIPPINES. *Western Verde Island Passage, north of Mindoro:* sta 5282; 13°53′N,

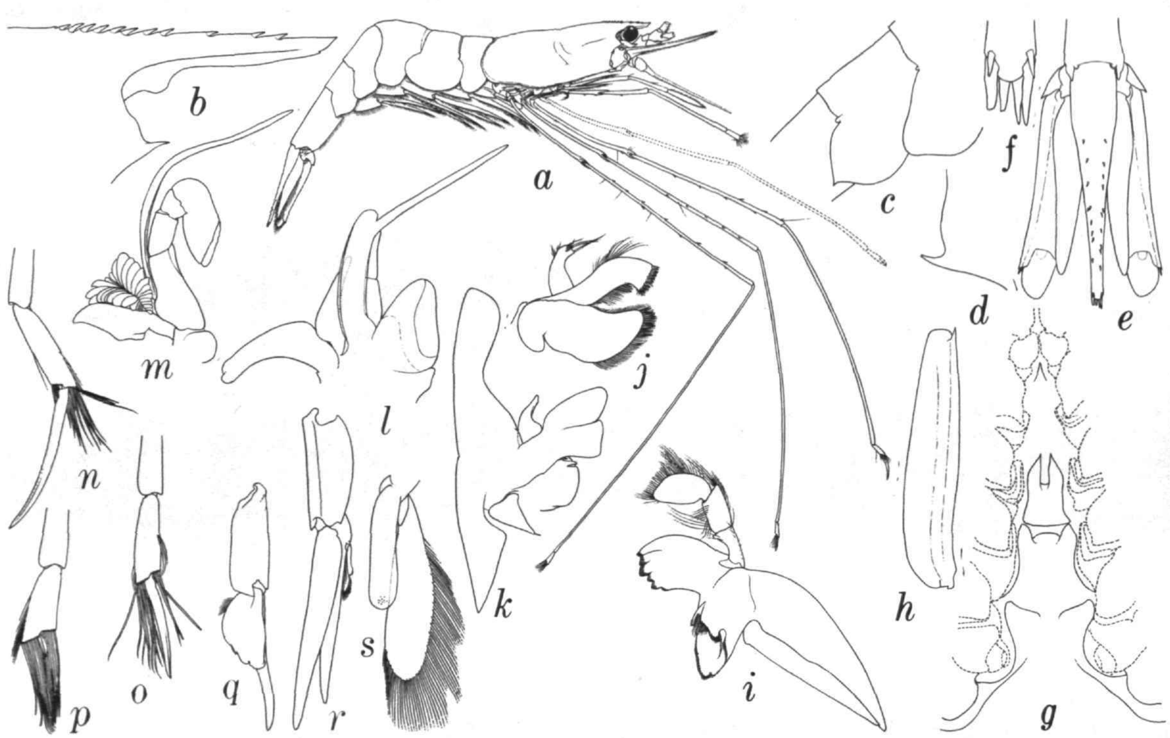

FIGURE 41.—*Nematocarcinus undulatipes*, male [19.3 mm], *Albatross* sta 5620, west of Halmahera: *a*, entire shrimp in lateral aspect; *b*, rostrum; *c*, 5th abdominal somite; *d*, pre-anal tooth; *e*, telson and uropods; *f*, posterior end of telson; *g*, thoracic sternum; *h*, right antennal scale; *i*, right mandible; *j*, right 1st maxilla; *k*, right 2nd maxilla; *l*, right 1st maxilliped; *m*, right 2nd maxilliped; *n*, dactyl and propodus of right 3rd pereopod (lateral setae removed); *o*, dactyl and propodus of left 4th pereopod; *p*, dactyl and propodus of left 5th pereopod; *q*, right 1st pleopod; *r*, right 2nd pleopod; *s*, appendices interns and masculina.

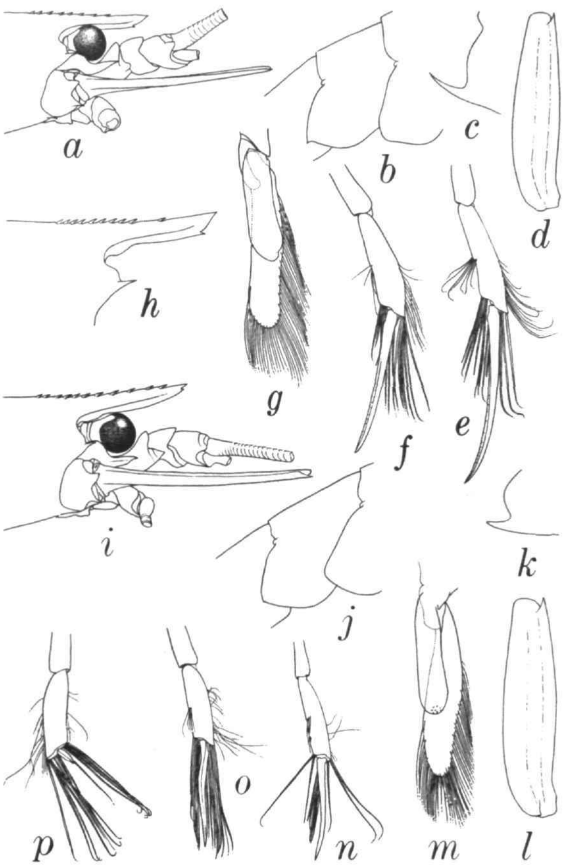

FIGURE 42.—*Nematocarcinus undulatipes*: *a*, anterior carapace and appendages of male [15.9 mm], *Albatross* sta 5259, northwest of Panay; *b*, 5th abdominal somite of same specimen; *c*, pre-anal tooth of same specimen; *d*, right antennal scale of same specimen; *e*, dactyl and propodus of right 3rd pereopod of same specimen (proximal setae removed); *f*, dactyl and propodus of right 4th pereopod of same specimen; *g*, right appendices interna and masculina of same specimen; *h*, rostrum of female [21.7 mm], same station northwest of Panay; *i*, anterior carapace and appendages of male [18.3 mm], *Albatross* sta 5467, Lagonoy Gulf, Philippines; *j*, 5th abdominal somite of same specimen; *k*, pre-anal tooth of same specimen; *l*, right antennal scale of same specimen; *m*, right appendices interna and masculina of same specimen; *n*, dactyl and propodus of right 3rd pereopod (proximal setae removed) of female [17.2 mm], *Albatross* sta 5468, Lagonoy Gulf; *o*, dactyl and propodus of right 4th pereopod of same specimen; *p*, dactyl and propodus of right 5th pereopod of same specimen.

120°26′45″E; 454 m; dark gray sand; 8.5°C; 18 Jul 1908 (1144–1204); 12′ Agassiz beam trawl, mud bag: 1♂ [18.6] 1 ovig ♀ [22.3]. *Balayan Bay, southern Luzon:* sta 5111; 13°45′15″N, 120°46′30″E; 432 m; green mud; 16 Jan 1908 (1508–1538); 12′ Tanner beam trawl, mud bag: 1 ovig ♀ [22.7]; sta 5365; 13°44′24″N, 120°45′30″E; [391 m]; 22 Feb 1909 (0904–0940); 25′ Agassiz beam trawl: 3♂ [16.2–17.3] 8♀ [15.6–21.2], 1 ovig [20.1]. *Lagonoy Gulf, east of southern Luzon:* sta 5449; 13°21′36″N, 124°00′30″E; 549 m; 4 Jun 1909 (1438–1459); 12′ Agassiz beam trawl, mud bag: ly♂ [15.9]; sta 5463; 13°40′57″N, 123°57′45″E; [549 m]; [sand]; 16 Jun 1909 (1028–1044); 12′ Agassiz beam trawl, mud bag: 4♂ [17.8–19.2] 2♀ [16.2, 30.7], 1 ovig [30.7]; sta 5465; 13°39′42″N, 123°40′39″E; [914 m]; gray mud; 17 Jun 1909 (0839–0859); 12′ Agassiz beam trawl, mud bag: 1♀ [22.5]; sta 5467; 13°35′27″N, 123°37′18″E; [878 m]; gray mud; 18 Jun 1909 (0752–0834); 12′ Agassiz beam trawl, mud bag: 10♂ [15.2–21.9] 32♀ [16.9–25.3], 2 ovig [21.3, 23.8]; sta 5468; 13°35′39″N, 123°40′28″E; [1041 m]; green mud; 18 Jun 1909 (0958–1031); 12′ Agassiz beam trawl, mud bag: ly♂ [12.0] 10♂ [15.6–21.5] 11♀ [12.1–23.2]; sta 5469; 13°36′48″N, 123°38′24″E; [914 m]; green mud; 18 Jun 1909 (1329–1411); 12′ Agassiz beam trawl: 4♂ [18.2–21.9] 4♀ [17.8–24.2]; sta 5470; 13°37′30″N, 123°41′09″E; [1024 m]; [mud]; 18 Jun 1909 (1526–1600); 12′ Agassiz beam trawl: 2♂ [16.1, 20.1] 10♀ [17.2–24.1]. *North of Samar:* sta 5444; 12°43′51″N, 124°58′50″E; 564 m; green mud; 7.4°C; 3 Jun 1909 (1032–1049); 12′ Agassiz beam trawl: 3♂ [19.0–20.6] 5♀ [19.8–25.4], 2 ovig [22.2, 25.4]; sta 5445; 12°44′42″N, 124°59′50″E; 700 m; green mud, sand; 6.8°C; 3 Jun 1909 (1202–1238); 12′ Agassiz beam trawl; 1♂ [19.3] 3♀ [20.6–26.0], 1 ovig [26.0]. *Northwest of Panay:* sta 5259; 11°57′30″N, 121°42′15″E; 571 m; gray mud, globigerina: 9.6°C; 3 Jun 1908 (1031–1051); 12′ Agassiz beam trawl, mud bag: 2♂ [10.6, 15.9] 6♀ [17.9—21.7], 2 ovig [19.2, 21.0].

INDONESIA. *West of Halmahera:* sta 5619;

0°35′00″N, 127°14′40″E; 795 m; fine gray sand, mud; 27 Nov 1909 (1612–1646); 12′ Agassiz beam trawl: 3♂ [15.1–21.2] 3♀ [15.8–24.7], 1 ovig [24.4]; sta 5620; 0°21′30″N, 127°16′45″E; 655 m; gray mud; 28 Nov 1909 (0624–0645); 12′ Agassiz beam trawl: 18♂ [15.0—21.0] 12♀ [10.3–23.0], 3 ovig [20.8–21.3]; sta 5622; 0°19′20″N, 127°28′30″E; 503 m; gray mud; 29 Nov 1909 (0803–0824); 12′ Agassiz beam trawl, mud bag: 4♂ [17.3–21.0]; sta 5623; 0°16′30″N, 127°30′00″E; 497 m; fine sand, mud; 29 Nov 1909 (0922–0944); 12′ Agassiz beam trawl: 1♀ [15.1]. *Teluk Bone, Celebes:* sta 5655; 3°34′10″S, 120°50′30″E; 1112 m; gray mud, fine sand; 4.0°C; 18 Dec 1909 (1100–1120); 12′ Agassiz beam trawl: 1♂ [21.2]; sta 5657; 3°19′40″S, 120°36′30″E; 900 m; gray mud; 5.2°C; 19 Dec 1909 (1108–1128); 12′ Agassiz beam trawl: 1♂ [16.9] 1 ovig ♀ [22.2].

RANGE.—Eastern Africa to the Kermadec Islands, north of New Zealand; 366–1269 m.

REMARKS.—This is an exasperatingly variable species as regards the form and inclination of the rostrum, the distinctness of the tooth on the pleuron of the fifth abdominal somite, the length of the telson, the shape of the antennal scale, the proportionate lengths of the distal segment of the third and fourth pereopods, and even the form of the appendix masculina. Individual lots are likely to be composed of specimens so similar in appearance that the presence of several specific populations is suggested, but the examination of additional material dispels the thought that *N. undulatipes* can be subdivided as Crosnier and Forest (1973) were able to do with the corresponding Atlantic species, *N. cursor*.

In spite of the variability of *N. undulatipes*, I have decided that it is best for the time being to consider it as distinct from the related Atlantic species. In nearly all of the Philippine-Indonesian specimens examined, the dorsal margin of the rostrum is horizontal or slightly concave anteriorly, not slightly convex near the tip as in typical specimens of *N. cursor*. In this respect, *N. undulatipes* resembles *N. africanus* Crosnier and Forest (1973:101), but the dorsal teeth of the rostrum seem to be more widely spaced anteriorly in the Philippine populations. Finally, although the tooth on the pleuron of the fifth abdominal somite may be almost vestigial in a few of the *Albatross* specimens, in none of them is it entirely lacking as in *N. rotundus* Crosnier and Forest (1973:103).

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Text-reference system (author, year:page used within the text, with full citation in "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all Contributions Series and is strongly recommended in the Studies Series: "(Jones, 1910:122)" or ". . . Jones (1910:122)." If bibliographic footnotes are required, use the short form (author, brief title, page) with the full citation in the bibliography.

Footnotes, when few in number, whether annotative or bibliographic, should be typed on separate sheets and inserted immediately after the text pages on which the references occur. Extensive notes must be gathered together and placed at the end of the text in a notes section.

Bibliography, depending upon use, is termed "Literature Cited," "References," or "Bibliography." Spell out titles of books, articles, journals, and monographic series. For book and article titles use sentence-style capitalization according to the rules of the language employed (exception: capitalize all major words in English). For journal and series titles, capitalize the initial word and all subsequent words except articles, conjunctions, and prepositions. Transliterate languages that use a non-Roman alphabet according to the Library of Congress system. Underline (for italics) titles of journals and series and titles of books that are not part of a series. Use the parentheses/colon system for volume (number): pagination: "10(2):5–9." For alignment and arrangement of elements, follow the format of recent publications in the series for which the manuscript is intended. Guidelines for preparing bibliography may be secured from Series Section, SI Press.

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Some points of style: Do not use periods after such abbreviations as "mm, ft, USNM, NNE." Spell out numbers "one" through "nine" in expository text, but use digits in all other cases if possible. Use of the metric system of measurement is preferable; where use of the English system is unavoidable, supply metric equivalents in parentheses. Use the decimal system for precise measurements and relationships, common fractions for approximations. Use day/month/year sequence for dates: "9 April 1976." For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc. Omit space between initials of a personal name: "J.B. Jones."

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