CIROLANIDAE
(CRUSTACEA: ISOPODA: FLABELLIFERA)
OF THE TROPICAL EASTERN PACIFIC

by

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Cirolanidae (Crustacea: Isopoda: Flabellifera) of the Tropical Eastern Pacific

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Dedicated to the memory of J. Laurens Barnard

ABSTRACT—The cirolanid isopods of the tropical eastern Pacific (central western Baja California, Mexico, to the Peru–Ecuador border) encompass 18 species in 8 genera, including 7 species newly described here. Ampeliopterus shawii, Ceratiola nelsoni, Ceratiola smithi, Ceratiola balboa, Metacirrus calypso, Nudantennia caroleae, and Oscilloburia serrifrons. Complete species lists are provided for all genera treated. The tropical eastern Pacific genera and species are described and keyed, and their ecology and distribution are discussed. The second known species of Oscilloburia and the first known species of Ceratiola are described, both representing the first records of the genera from the Pacific Ocean. Fifteen of these 18 species (83%) occur primarily in the tropical eastern Pacific zoogeographic region. Four species (22%) are ampli-American in distribution. One species is endemic to the Gulf of California (Ceratiola smithi n. sp.), and one is endemic to the Galapagos Islands (Metacirrus calypso n. sp.). Compared to that of the tropical Caribbean and tropical Indo-West Pacific, the cirolanid fauna of the tropical eastern Pacific is relatively depauperate.

INTRODUCTION

This paper is one in a series of regional monographs and shorter papers describing the shallow-water marine isopods of the tropical eastern Pacific [the “Panamic region” of Eakin (1953), the “eastern Pacific zoogeographic region” of Brusca and Wulsterstein (1979a)]—central western Baja California and the Gulf of Californi-
a (Mexico) to the Gulf of Guayaquil, Ecuador. The family Stenopelmatidae was treated by Brusca (1983, 1984), Brusca and Wulsterstein (1977, 1978b), and Wulsterstein and Brusca (1982). The family Cynomastidae was treated by Brusca (1977, 1978a, 1978b, 1981), Brusca and Gilligan (1983), and Thun and Brusca (1980). The families Corallanidae and Scarabellidae were covered by Delaney (1982, 1984, 1986, 1989), Bruce et al. (1982), and Delaney and Bruce (1985). The family Angaridae was treated by Brusca (1983, 1984) and Bruce and France (1992). Several analytical and summary papers have also appeared (Bruce and Wulsterstein 1979b, Brusca and Byrom 1985, Brusca 1987, Brusca and Williams 1991). The earliest references to eastern Pacific marine isopods date from the mid-1800s and the work of James Dana, William Lockington, James Bencett, and Pearl Lee Boone. However, it was the pioneering 20-year research program of Harriet Richardson that laid the foundation of our modern knowledge regarding this fauna. Milson Miller, Robert Menges, and George Schulte built on Richardson’s foundation through the 1970s. However, almost all of this work was concerned with the temperate eastern Pacific, and there have been only a few studies of the Cirolanidae of the tropical eastern Pacific and until now no attempt at synthesizing the fauna. The history of cirolanid taxonomy in general was reviewed in Brusca’s (1996a) excellent treatment of the Australian fauna.

METHODS AND TERMINOLOGY

Specimens upon which this study is based were obtained by field collecting and by loans from various museums. Field collections were made by Brusca and/or Wetzer in California, Mexico, Guatemala, Nicaragua, Costa Rica, Panama, Peru, the Galapagos Islands, Brazil, Uruguay, and various localities in the Caribbean. Field samples were taken by SCUBA and shore collecting, and included waders and 0.26-1.0-mm screenings of material from various habitats (rocks, algae, coral, coral rubble, sediment, etc.). All material was fixed and preserved in 70% ethyl alcohol and examined with dissecting and compound microscopes. Appendages were drawn with the aid of a camera lucida. Institutional abbreviations used in this paper are as follows: AHF—Allan Hancock Foundation, University of Southern Califor-
nia, Los Angeles, California (all AHF specimens are now housed at LACM).
BMNH—The Natural History Museum, London (formerly the British Museum (Natural History)).
LACM—Los Angeles County Museum of Natural History, Los Angeles, California.

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Figure 1. A cylindrical isopod (Eubranchipus giganteus), illustrating terms used in the text to describe the peripods. In Eubranchipod isopods, proisopods I-III are generally directed forward at an anterolateral angle, whereas isopods IV-VII are generally directed backward at a posterolateral angle.
Figure 2. Some types of setae and spines found on cirriped isopods. A. acute and long fleshy spine (found on Peronula costiermitis). B. stout circumplumose spine (found on Pseudocirrus ocellata). C. plumose setae and coupling spines (found on E. ocellata). D. aesthetascs (anterior to E. ocellata). E. palmate setae (anterior to Nannocirrus carinata n. sp.). F. circumplumose setae (found on A. ocellata). G. aesthetascs (anterior to N. carinata n. sp.). H. comb setae (found on Pseudocirrus ocellata). I. comb setae (found on C. herfordi). J. serrate trident setae (found on A. ocellata). K. molariform spine (found on Pseudocirrus ocellata). L. plumose setae and coupling spines (found on Pseudocirrus ocellata). M. simple spines and PMS (found on A. ocellata). N. serrate trident spines (found on Pseudocirrus ocellata). O. simple spines, serrate spines, and palmate setae (found on C. herfordi).
of the call of the pheasants and trogons and on the prescient margin of the plecoptera. The term coupling spines is reserved for the specialized spines of maxillipeds endites and pedipalp peduncles.

In most Peraclida the dactylops occurs in a single-clawed "claw," usually called the ungul, which may be marked off by a nature of inarticulate articulation. In many other malacocarids this terminal spine is distinct and finely articulating. In his early work, Hansen (1908) considered this free terminal spine an additional leg article, but he later to came to agree with Calman (1909) that it is simply an enlarged spine. In his revision of the isopod Sublunaticerina (Garcia, 1850) Miomastacidae, Wilson (1908) described this fixed spine, or ungul, as "a modified seta on the tip of the dactylals." In most isopod suborders there are some genera in which this terminal spine, or ungul, may be accompanied by one or two additional setae, fixed, clavate spines arising near the base of the ungul. The size of these "secondary spines" ranges from very small to as large as the primary spine, or ungul, itself.

For example, in many Graptolidae a "secondary spine" is present but small, while in the Calvoasella and many Pterygoecia, Pterygoecia, Amaurotheca, Aplimastacea, Calcinolidae, Simulacraiidae, and others a "secondary spine" one-quarter to one-half the size of the ungul often occurs. In some Axellera the "secondary spine" may be still smaller in size of the ungul (g.e., Mungoniscus), or even fully as large as the ungul (g.e., Steeriscus). In the axellarian gnomes, Jomorinae there are often two secondary spines, both as large as the ungul.

Many authors refer to these "secondary spines" as "secondary ungul," and to such legs as "nurselagulate" or "trianglegulate when two "secondary spines" are present). However, the point at which small spines become large enough to warrant being called "secondary ungul" is subjective, and the literature is therefore unclear and inconsistent regarding the terms "secondary ungul," "nurselagulate," and "nurselagulate." Because of this confusion, and because we presume all these small setae fixed spines to be homologous in a general sense, we avoid the terms "secondary ungul" and "nurselagulate" and instead supply the occurrence of additional spines at the base of the ungul when they are present.

The association of the second spine from the frontal margin of the cephalon to the posterior margin of the pleotelson by holding the laminae not undulating (lat. flagellum) and using a calibrated ocular micrometer. Numerical comparisons of structures given in the text (such as an "expanded width of 0.5 lamellae expanse width") were obtained by measuring the greatest distances of the structures concerned, unless otherwise noted.

We give complete synonymies except where recent monographs have already done so. In the latter case, we provide synonymies subsets in and (often expanding upon) the cited reference. Species descriptions are based on primary type material, with supplementary data (e.g., polyphemus) from other material examined. Primary types of most species are illustrated, and, for some, additional Pacific specimens are also figured. Some older type material is damaged, with obviously missing spines, setae, etc. Body measurements and ranges are based on all material examined. Taxa are treated in alphabetical order within each higher taxon. Localities listed under Material Examined are ordered from north to south and number sequentially. The species lists for each genus are uplinked from Bruce (1986a).

Several authors (e.g.,历代片名 listed 1962, Metrov 1982a, Bruce 1986a, Krensky and Schotte 1986) have suggested various generic groupings within the Cribrotra. However, as the number of genera has grown, recognizing possible monophyletic groupings intuitively has become increasingly difficult because Krensky's (1985) concepts conflict with this present study. Furthermore, the need of the entire group could be nomenclaturally (e.g., Amblomorina, Calcinolidae, etc.) therefore, until an analytical phylogenetic analysis is accomplished, we feel it is not to treat the genera separately rather than to contribute to the creation of numerous new names and combinations that will only continue to be altered and shuffled about until phylogenetic relationships have been properly assessed.

**Taxonomy**

**Order Isopoda**

**Suborder**

**Family Cribrotraidae**

**Subfamily**

**Genus**

**Room**

**The**

**References**

**Literature Cited**

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**Conflicts of Interest**

**Ethics Approval**

**Consent to Participate**

**Consent for Publication**

**Availability of Data and Material**

**Code Availability**

**Data Sharing Statement**

**Declaration of Competing Interest**
Cirrodalae are, Ectoclinia brasiliensis, and E. mexicana. One spe-
cies is endemic to the Galápagos Islands (Mertensina cupina n. sp.), and one is endemic to the Gulf of California (Cirrodotoma nesiotis n. sp.).

Compared to the Caribbean cirroida fauna, which contains approximately 36 species in 16 genera (Kendle and Schenck 1989), that of the tropical eastern Pacific is relatively sparse. All tropical eastern Pacific genera except Cirrodotoma nesiotis occur in the Caribbean. The biogeographic history of Cirroida is enigmatic, as its only two undisputed species are currently known from the southern Atlantic (C. cirratum) and Ecuador (C. basilis n. sp.). That the eastern Pacific isopod fauna has strong ties to the Carib-
bean fauna is evidenced by the number of amphipods and species of Cirroida at least 141 species altogether (and the large number of probable sister species n. sp. = perguntive species, such as Ophiocoryphe setosa (Cirrhophyceae) (Cirrhophyceae) and O. perguntiva n. sp. (Cirrhoidea). Two species marginally occurring in the tropical eastern Pacific, C. cirratum and Nematolaimus californiensis, are clearly northern Pacific temperate intruders in the tropics.

Although some Cirroida occur in deep water, and others are fresh water or cave dwellers, the majority of species in the family inhabit shallow marine waters, living from the littoral region to depths shallower than 500 m. Of the eastern Pacific species, all but one (Nematolaimus californiensis, C. cirratum n. sp., and Ophiocoryphe setosa n. sp.) are lateral or shallow-water forms, and perhaps are adapted to shallow-water conditions (rarely occurring in the shallow-water region) (Cirrodotoma nesiotis, C. nesiotis n. sp., Mertensina cupina n. sp., Ectoclinia brauernneti, Ectoclinia brasiliensis, E. chamaens, and E. mexicana).

World List of Genera —

13. Circinella Leach, 1818.
15. Colpocoryphus Richardson, 1902.
16. Conilera Leach, 1818.
17. Conilera Richardson, 1905.
20. Eurylaimus Leach, 1815.
22. Eurylaimus Dallous, 1912.
23. Faeroeroidea Faeroeroe and Voul, 1903.
25. Haloscruton Stebbing, 1900.
31. Neocirrodotoma Hales, 1926.
33. Ophiocoryphus Bruce, 1981.
34. Parahapalocoryphus Barnard, 1924.
35. Polystoma Bruce, 1981.

Key to the Genera of Cirroida Known from the Eastern Pacific

1. Body elongate (length more than 4 times width); eyespots of pleopod 1 indicate and operculum to pleopod 2-5.2—

2. Body not elongate (length 2-6,3-2 times width); eyespots of pleopod 1 not indicated and operculum to pleopod 2-5.3—

2a. Endopods of pleopod 2-5-5 without PMS; maxillipeds not reduced and fused into single piece; first article of antennule not articulated at right angle to rest of antennule; outer (lateral) angle of unpaired peduncle not produced, apex rounded (acutus) (Ophiocoryphe)

2b. Endopods of pleopod 5 only without PMS; maxillipeds not reduced and fused, medial and lateral lines distinct (outer hypodorsal); antennule 2 arising at right angle to article 2; outer (lateral) angle of unpaired peduncle produced, with wedge apex, almost as long as inner (medial) angle (Conilera)

3. Antennule article 3 longer than articles 2 or 3; antennule article 2 arising at right angle to article 1; maxilliped endite barely teaching (or extending barely beyond) first palpal articulation; maxilliped endite without covering spines; frontal lamina narrow, anterior view (anterior) freely projecting; maxilla forming a vertically projecting triangular blade; antenna with 4 pedipodial articles; antenna long, extending beyond penultimate VII. lateral margins of pleonite 5 not encompassed by pleonite 4 (Eurylaimus)

3a. Antennule article 2 or 3 longest; antennule article 2 not arising at right angle to article 1; maxilliped endite extending well be-

3b. First palpal article, usually to distal margin of 2nd palpal article, maxilliped endite with covering spines; frontal lamina visible; phytophagous; antenna with 4 or 5 pedipodial articles; antenna length variable; lateral margins of pleonite 5 may or may not be encompassed by pleonite 4....

4. Antennule peduncle article 2 or 3 longer; antennule projecting vertically...

4a. Antennule peduncle article 2 or 3 longer than 1 or 2; antennule short, broad, flat, and sessile, not projecting vertically...

5. Maxillipeds incisor usually with accessory teeth on left man-

5a. Rostrum large and heavily apricated, tapering, separating antennules and confluent with (or fused to) frontal lamina; frontal lamina long and narrow; pleotelson with a pair of shall-

5b. Rostrum short and heavily apricated, separating antennules and confluent with (or fused to) frontal lamina; frontal lamina short and wide; pleotelson without a pair of shall-

6. Pleopods V-VII with basis markedly flattened and provided with long setae, pleopod VII with medial row of long setae on

6a. Pleopods V-VII with basis markedly flattened and provided with long setae, pleopod VII with medial row of long setae on
Anoplograpsus altivii, sp.
Figs. 3B, 4, 5

Type material examined.—Male holotype (USNM 252744) and 3 paratypes (1 male, 2 females) (SDNHH Cat. No. 2222); Panama, Panama Canal, Miraflores Locks, upper gate chamber, formalin wash of sticks, rocks, etc., on bottom of chamber. 17 Jan. 1971; coll. P.W. Uytten

Description of male.—Cephalon devoid of tubercles (Fig. 3B). Antennae short, extended just past posterior margin of cephalon, bases separated by rostrum, flagellum of 10 to 12 articles (Fig. 4A). Antennae extend to posterior margin of peronistic II. Pterothorax of about 25 articles (Fig. 4B). First flagellar lamina subrectangular, anterior margin rounded; labrum slightly narrower than tylus (Fig. 4C). Mandibular spine row with 6 stout simple spines; molar process with about 19 small acute spines; proximal palp article with 1
simple setae; middle palp article with 4 plumose and about 11 simple setae; distal article with 2 comb and about 11 simple setae (Fig. 4D). Maxillule medial lobe with 1 short simple spine and inner protuberance; lateral lobe with about 12 stout apical spines, many with short bars, and about 6 minute subapical spines (Fig. 4E). Maxilla medial lobe with 2 long circumplumose setae; 4 shorter plumose setae; and about 8 simple setae; lateral lobes with about 9 and 4 simple setae, respectively; 1 simple seta lies proximal to base of lateral lobes, and simple setae lie on their lateral margins (Fig. 4F). Maxillipedal-palp with simple setae and comb setae as figured; ending short, with 2 coupling spines and about 4 apical plumose setae on both left and right endings (Fig. 4G).

Symmetrical odv of dorsal tubercles or setae. Posterior angles of carap VII very acute and produced past anterior margin of pleonite 3. Carap IV-VII visible in dorsal view (Fig. 3B). Pereopod I short; interior distal angle of ischiun with 1 simple seta; inferior margin of carpus with about 7 short blunt simple spines and simple setae; inferior distal angle of carpus with 1 spine and 1 seta; inferior margin of propodus with 3 spines and a cluster of distal setae; dactylyus with small setae at base of unguis (Fig. 5A). Pereopod IV

Figure 5. *Amegilla* sp. A. Stem (left), B. Head (right), C. Thorax (right), D. Ventral view of abdomen (right), E. Prosternum (right), F. Pleuroper (right), G. Pleurogen 3 (right), H. Pleuroper 4 (right), I. Pleuroper 5 (right).
long, amiable, with seta and simple and serrate trident spines as figured (Fig. 5B). Pleopod VII long, amiable, with many simple and trivial spines as figured (Fig. 5C). Pore absent or at least not observed.

Pleon devoid of dorsal spines or setae. Pleopodal rami with PMS as figured (Figs. 5E–I). Pleopod 1: peduncle's median margin with 1 plumose seta, 4 coupling spines, and numerous simple setae; lateral margin with 2 large setae and numerous simple setae; exopod 1.8 times width of endopod; exopod with 1 simple seta on proximal lateral margin (Fig. 5F). Pleopod 2: peduncle's median margin with 3 coupling spines, 4 plumose setae, and many simple setae; lateral margin with 1 simple spine and many simple setae; exopod 1.6 length of endopod; appendix marginalis just reaches to exopod barely tip beyond tip of exopod, apex narrow with small subapical lobes (Fig. 5F). Pleopod 3: peduncle's median margin with 3 coupling spines, 3 plumose setae, and many simple setae; lateral margin with 1 plumose seta and many simple setae; exopod 1.4 times width of endopod, with short incisions on lateral and medial margins (Fig. 5G). Pleopod 4: peduncle's median margin with 3 coupling spines, 2 plumose setae, and many simple setae; lateral margin with 1 plumose seta and many simple setae; exopod 1.5 times width of endopod, with short incisions on medial and lateral margins (Fig. 5H). Pleopod 5: peduncle with 1 plumose seta on lateral margin; exopod 1.4 times width of endopod, with incisions on lateral and medial margins (Fig. 5i).

Pleurotom subtriangular, slightly sinuate near base, with PMS and 8 apical spines, without dorsal tubercles (Fig. 3B). Uropods much longer than pleopod and tapers distally; each ramus with small apical notch containing long simple setae. Uropod exopod 0.4 times width of endopod and slightly shorter; lateral margin with 8 simple spines and PMS, median margin with 3 large spines and PMS. Uropod endopod: medial margin with 8 large simple spines and PMS, lateral margin with 2 simple spines and PMS. Uropod peduncle with PMS on medial margin and 1 simple spine on lateral margin, 2 large ventral spines and 1 simple seta near base of exopod (Fig. 5D).

Female—Similar to male. Size—Maximum length 11.5 mm.

Description.—Known only from the Miroflos Locks of the Patatua River. It is unlikely that this species occurs only in the Miroflos Locks, a small and continually disturbed habitat. Future collecting efforts may find it upstream, in the Gatake Lake region.

Remarks.—The long distally tapering uropod of this species is similar to, though shorter than, that described from Oplophorus browni. Anomalipala alicei differs from A. browni in lacking the dorsal and posterior ornamentation of the latter. A. alicei differs from A. browni in many characters, including the length and spinosity of the uropod and pleopod and the shape of the frontal lamina.

Etymology.—Named for the senior author's son, Alec; a consummate fisherman who, in his youth, provided companionship on countless collecting trips to the shores of the Sree of Cortez.

Anomalipala browni (Van Name, 1936) Figs. 3A, 6–8


Type material examined.—(1) Male holotype and female allotype (AMNH 6519). Cuba, Santa Clara Province, Denny's River, 3 m. below Bedin, June 1918, coll. B. Brown, 22 6 parasites (AMNH 6536). Same data as holotype.

Other material examined.—Florida Pacific specimens: (3) Costa Rica, Puntarenas Province, Gulf of Nicoya. Punta Morales, from burrows of Sphaeromatia permutans (Gisopad; Sphaero-


Description of male (based on Pacific specimens).—Cephalon only moderately wider; anterior margin steeply inclined; 4 large, low, medial bilobate tubercle and a medial transverse incision between eyes; rostrum minute. Eyes subequal as in allae, separated by nearly 3 times their diameter. Antenasules short, extended to middle of pleonite 1, with simple and palpate setae and aesthets complex; peduncular article 3 twice as long as article 2; flagellum of 10–16 articles (Fig. 7A). Antennae long, reaching posterior margin of pleonite III or IV; flagellum of 30–36 articles with proximal articles shorter than distal articles: proximal article with very long setae as figured (Fig. 7B). Frontal limbs pentagonal, labrum as wide as clypeus; anterior margin of clypeus concave; posterior margin of labrum broadly concave (Fig. 6A). Mandibular spine row with about 9 simple spines; spiniferous process with about 26 small aculeate spines; middle palp article with 4 long setae and numerous shorter serrate and simple setae; distal palp article with about 8 simple and 2 plumose setae as figured; right incisor strongly tridentate, middle cusps of left incisor reduced to a wavy edge (Fig. 6B). Maxillula medial lobe with proburator on lateral and posterior margin and 2 small simple setae; lateral lobe with about 10 long simple spines (Fig. 6C). Maxilla medial lobe with about 4 long simple setae and 15 circumplosomal setae, 2 most proximal circumplosomal setae very long; lateral lobes with about 5 and 14 long simple setae, respectively (Fig. 6D). Left and right maxilliped endites with 2 and 3 coupling spines, respectively, and 4 long plumose setae (only 3 figured, one broken off); palp articles with long simple setae; apical article also with comb setae (Fig. 6E).

Body stout, strongly convex, broadest at pleonites III–IV. Pleonites III–VII oblong in length. Pleon with low tubercles; a row of 4 small median transverse tuberculi ornamented anterior third of pleonite 1, becoming smaller laterally and tapering off into a faint transverse ridge; a row of 4–6 medial, posterior, submarginal tuberculi occuring on pleonites III–IV, being largest medially and increasing in size posterior on pleonites. Coxae IV–VII visible in lateral view as round, small tuberculi, 3–7 per article. Antennal peduncle and flagellum of 30–36 articles; first article with 12 or more molariform spines and a few simple setae, distal superior margin with acute setae; inferior margin of capus with 1 long simple seta; palpophores with 2 small distal spines and simple seta; dactylus with several simple setae at base of ungues (Fig. 5C). Pleopod IV long and ambulatory, with many simple spines as figured; inferior margin of urostyle with rough surface sculpturing (Fig. 7E). Penes short and small, setae somewhat apart near posterior margin of sternite VII (Fig. 7F).

Pleon with minute dorsal tubercles, forming a longitudinal arch on the pleon; pleonite 3 also with a laterally encompassing pleoturn 4. Pleonite 1 almost entirely covered by pleonite VII (Fig. 3A). Pleopod ramus with PMS as figured (Figs. 8A–E). Pleopod 1: peduncle's median margin with 3 coupling spines, 4 coupling spines, 4 plumose setae, and simple setae; exopod 1.3 times width of endopod; appendix marginalis narrow to acute apex, 1.3 times exopod length (Fig. 8B). Pleopod 2: peduncle's median margin with 4 coupling spines, 4 plumose setae, and 3 simple setae; exopod 1.4 times width of endopod; appendix marginalis narrow to acute apex, 1.3 times exopod length (Fig. 8B). Pleopod 3: peduncle's median margin with 3 coupling spines and 4 plumose setae; exopod 1.4 times width of endopod, with short incisions on lateral and medial margins (Fig. 8C). Pleopod 4: peduncle with 3 coupling spines, 2 plumose setae, and 3 simple setae; exopod 1.4 times width of endopod, with short incisions on medial and lateral margins (Fig. 8D). Pleopod 5: peduncle with 1 long simple seta on lateral margin;
Anaspis latusosum Carvacho and Haugman, 1984


Remarks.—The dorsal scupturing of specimens of A. latusosum from Costa Rica is less prominent than that of the type series, but otherwise there appear to be no differences. Aside from brief mentions by Brice (1985, 1986a) and Kerney and Schotte (1989), there are no reports of this species since Van Nijen's original description. The two specimens we acquired for the present study both came from Jaws of Sphaeroma parvissum, a common sphaeromid borer in tropical eastern Pacific red mangrove trees (Perry 1988, Perry and Brusa 1989). This is the first record of cohabitation by these two species.

Figure 6. Anaspis latusosum (SDNHM 10007), male A, frontal lamina, clypeus, and labrum. B, mandible (left). C, maxillule (left). D, maxilla (left). E, maxiliped (left).
of 13 to 19 articles (Fig. 9B). Fissural lamina subquadrate; labrum and clypeus subequal in length and width (Fig. 9C). Mandibular spine row with 13 short simple spines; molar process with about 15 small acute spines and many short simple setae; middle palpal article with 4 serrate trident setae and about 10 simple setae; distal article with about 11 simple setae and 1 comb seta (Fig. 9D). Maxillule medial lobe with 1 short simple seta; lateral lobe with about 11 stout simple spines, many barbed (Fig. 9E). Maxilla medial lobe with 2 large circumorbital setae, about 10 simple setae, and numerous short subapical hairs; lateral lobe with about 11 and 4 simple setae, respectively; simple subapical seta proximal to base of palatal lobe (Fig. 9F). Maxillipedal palp pair with simple setae as figured; lateral margin of basis with 3 plumose setae, lateral margin of medial article with 1 comb seta; metade short, with 3 coupling spines and 2 apical plumose setae (Fig. 9G).

Peron end devoid of tubercles or carinae (Figs. 3C, D). Posterior angles of coxa VII very acute, produced past anterier margin of pleonite 2; coxae III-VII to V-VII visible in dorsal view. Peropod 1 short; superior margin of ischiurn with 2 simple setae; inferior margin of merus with 5 stout, somewhat blunt spines and 1 simple seta; inferior margin of carpus with 2 simple setae and 1 simple spine; inferior margin of propodus with 3 simple spines and 1 or 2 simple setae; dactylius with 1 small spine and several simple setae at base of ungual (Fig. 10A). Peropod IV long and ambulatory, with many simple spines as figured (Fig. 10B). Peropod VII long and ambulatory, with many simple and serrate trident setae as figured (Fig. 10C). Pene short and squat, set close together on posterior margin of sternite VII (Fig. 10D). Pleon end devoid of dorsal tubercles or carinae. Pleonite 3 encompasses pleonite 4 laterally (Figs. 3C, D). Pleopodal rami with
PMS as figured (Figs. 10F–J). Pleopod 1: peduncle's medial margin with 3 coupling spines and 2 plumose setae. Lateral margin with 1 small simple spine; exopod 1.8 times width of endopod; endopod with a stout 1 simple seta on proximolateral margin (Fig. 10F). Pleopod 2: peduncle's medial margin with 3 coupling spines and 4 plumose setae, lateral margin with 1 small simple spine; exopod 1.6 times as wide as endopod; appendix masculina narrows to acute apex with small hairs. 1.5 times exopod length.

Figure 1. Amphipordinus Bressa (ZDESHEM A.0007), male. A, pleopod 1 (left). B, pleopod 2 (left). C, pleopod 3 (left). D, pleopod 4 (left). E, pleopod 5 (left). F, ventral view of somite (left).
Female.—Similar to male, body generally shorter and slightly wider.

Size.—Maximum length 11.5 mm.

Distribution.—A shallow-water species found in brackish intermediate and freshwater habitats; so far known from the states of Oaxaca and Guerrero, Mexico, and from Clipperon Island.

Remarks.—Anoprolima oaxacae has been found in brackish mangrove and lagoon habitats in Mexico and in the "freshwater" lagoon inside Clipperon Island, an atoll. In larger individuals, particularly males, the neural process of the cephalon is slightly larger or more produced (note the difference in Figs. 3C, D). Carvacho and Haasmann (1994) stated that males lack penes; however, short squat penes are present in the adult male specimens we have examined.

The type locality of Anoprolima oaxacae in Manialtepec Lagoon, 15 km west of Puerto Escondido, Oaxaca, Mexico. The holotype and allotype are apparently deposited in the collections of the Instituto de Biología, Universidad Nacional Autónoma de México (UNAM). Paratypes are located in the reference collection of Centro de Investigación Científica y Educación Superior de Ensenada (CICESE), Baja California, Mexico, and in the Muséum National d’Histoire Naturelle, Paris. Several attempts to borrow type material from UNAM and CICESE met with no success.
Figure 11. Cirripedia of the tropical eastern Pacific, dorsal views: A. C. diminuta (USNM 108647), holotype, posteriora. B. C. diminuta (AHP, Sta. S2-18); paratype, male. C. C. horma (BMNH 10869), probably syntype, male. D. C. horma (SSO C1550), male.
Figure 13. *Ceratoidea dissimilis* (AHE Stx 181), paratype, male. Scanning electron micrographs: A. frontal lamina, clypeus, and labrum, 120x. B. ramus and frontal lacinia (note overlap of frontal lamina by clypeus), 348x. C. distal margins of rostrum, 1800x. D. seta in pit on distal margins of rostrum, 9000x.
Figure 14. Cirolana alvinovis (AHP, Stn. SQ 881), paratype, male: A, antennule; B, antenna; C, frontal lalima, clasper, and labrum. D, mandible; E, maxillule; F, maxilla; G, maxilipeds (right).

Pereon widest at pereonites IV and V (Fig. 11A, B, C). Coxae V–VII visible dorsally. Pereopod 1 stout and short, with simple and stout setae; inferior margin of merus with 5 short, blunt spines and several simple setae (Figs. 15A, 16A); dactylius with 1 small spine and 1 simple seta at base of ungues (Figs. 15A, 16A). Pereopod 4 with many large spines as figured; dactylius with 1 small spine and 1 simple seta at base of ungues (Fig. 15B). Pereopod VII long, with many large spines as figured (Fig. 15C, 16C); ischiu–propodus with long serrate spines and stout, basally denticate spines, as well as simple spines; dactylius with 1 small spine and 1 long simple seta at base of ungues (Fig. 15C). Pennes short, very small, set somewhat apart and in line with middle of peduncles of first pleopods (near posterior margin of sternite VII) (Fig. 15D).

Lateral margins of pleonites 2–4 expanded ventrolaterally; pleon widest at pleonite 2, devoid of dorsal tubercles, carinæ, or setae (Figs. 11A, B). Pleopodal rami with PMS as figured (Figs. 15F–J, 16D). Pleopod 1: peduncle’s medial margin with 5 long
Figure 16. *Cirolana divina* (AHP, Sta. SQ 181), paratype, male, scanning electron micrographs: A, distal portion of peropod 1, 540x. B, marginal spines on rostrum of peropod 1, 120x. C, ventral view of spines on posterior peropods, 450x. D, ventral view of PMS on pleopod 1, 240x.
Figure 17: *Cylindrus dissimilis* (AHE Sta. SQ 181), protospecies, male, scanning electron micrographs. A, phallosome (note straight lateral margins and dorsal striae), 60X; B, dorsal striae of phallosome (note scaliform appearance of cuticle in background), 3000X; C, terminal spines on uropodal exopod, 4200X; D, ventral view of phallosome and uropods, 60X.
coupling spines, lateral margin with 1 small simple seta; endopod 0.6 times as wide as exopod, lateral margin slightly concave; exopod with 1 stout spine on proximolateral margin (Fig. 15A). Pleopod 2: peduncle's margin with 4–5 coupling spines and 6 plumose setae; lateral margin with 1 simple spine; appendix masculina 1.5 times as long as exopod, apically broadly rounded or occasionally subacute, but never with threadlike expansion; appendix masculina with short stout distal spine or margin and occasionally an medial abdominal surface as well (Fig. 15G). Pleopod 3: peduncle's medial margin with 5 coupling spines and 6 plumose setae; lateral margin with 1 simple spine; exopod with complete or partial mural incisions (Fig. 15C). Pleopod 4: peduncle's medial margin with 4 coupling spines and 6 plumose setae; lateral margin with 1 simple spine; exopod with incomplete marginal incisions (Fig. 15J). Pleopod 5: peduncle's with 1 simple spine; lateral margin with incompletely lamellate marginal incisions (Fig. 15J).

Pleopods triangular; narrowing strongly near rounded apex, lateral margins straight or slightly concave (Fig. 17A); apices usually with 8 stout setae, occasionally 9, interposed with numerous PMs (Fig. 1A); dorsum with scattered simple setae (Figs. 17A, B). Uropod 1 exopod extended beyond pleotelson, (Fig. 17D), side rounded quadrily as in C. horridus, and more narrow than in C. horridus; both rami with large spiny setae. Flag vivar setae arising from each knob (Fig. 17C). Both uropod rami with spines and PMs on medial and lateral margins. Uropod 2 exopod 0.5 as wide as exopod and slightly shorter; medial margins with 3 stout setae, lateral margins with 7 or 8 stout spines (interposed with numerous PMs). Uropod 3 exopod's medial margin with 5–7 stout spines; lateral margin with 2–4 stout spines (Fig. 15E). Uropod pleotelson's lateral margin with PMs; lateral margin with 1 medial spine and a group of spines and setae near the articulation of the exopod (Fig. 15D).

Female.—Similar to male. Ultrastructural features.—When viewed with SEM the dorsal surface of this species, like that of many other isopods, has a substantial “fibre” appearance due to exfoliated cuticular structures, which are also present on the mouthparts, frontal lamina, epistome, and labrum. In addition, the dorsal surface of the cephalon, pleon, pleonites and pleonites have many setae arising from small cuticular pits (Figs. 17A, B). The distal halt of the maxilliped has palpable cuticular structures or setae arising from pits along the margins (Figs. 13C, D). Sip.—To maximum length of 10.5 mm.

Distribution.—C. distinguens ranges from southern California (Point Conception, Santa Barbara Cs) south along the coast of Baja California and into the central and southern part of California. It is a littoral and shallow subtidal species, occurring in deeper water (to 43 m) in the warm southern extent of its range. Remarks.—Menzies' 1962(a) described C. distinguens as the more abundant and widespread species in San Quintin Bay (the type locality). His designation of holotype specimen is a posterior part (note in his text "as young") and is undescribed, so the original illustrations and descriptions of mouthparts must have been from a paratype specimen; there are no descriptions of the pleopods and pleopods in the original text. C. distinguens and C. parva Hansford, 1980, are very similar and difficult to distinguish. Menzies and Glynn (1968) placed C. distinguens as a junior synonym of C. parva, stating that the species was conceptually in distribution. Bruce and Brown (1962) removed C. distinguens from synonymy with C. parva without describing precisely how the two could be differentiated. They stated only that the species "can be separated by the differences in the characters figured" and by the "vasa deferentia opening [flush] flat with the surface of sternite 7 in C. distinguens. None of Bruce and Bowman's figures provides reliable means of distinguishing these two species, and the vasa deferentia do not open flush with sternite in either species but exit through distal setae."

In both C. distinguens and C. parva length of the antennae, relative to the body, decreaser with increasing body length. In most adults the antennae extend to posterior III in W, although in small specimens of C. parva they may extend to posterior V. In both species the margines of the pleotelson may be straight or slightly convex, although C. distinguens is straight most of the time and C. parva is convex most of the time. In both species the pleotelson of pleopod 3 may be completely or incompletely divided by lateral sutures, and in both species the endopodal lateral margin of pleopod 1 is slightly concave. A consistent feature distinguishing these two species is the position of the penes. In C. parva the penes are moderate in size and set very close together in line in the extreme margins of the peduncles of the first pleopods; in C. distinguens the penes are very small and set further apart, in line with the middle of the peduncles of the first pleopods. Also, the apex of the appendix masculina of C. parva is always acute, and often tapers to a filamentous or threadlike extension; in C. distinguens the apex of the appendix masculina varies from bluntly rounded to subacute but never has a threadlike or filiforme projection. In both species short distal spines may occur on either margin (and more rarely across the medial surface) of the appendix masculina.

C. distinguens belongs to the C. parva complex of portfolio species Bruce and Bowman (1982) and Bruce (1986a).

Stafford (1912) described an isopod from sponges at Laguna Beach, California, C. horridus var. spongicola, distinguishing it primarily by the straight lateral margins of the pleotelson and serrate exopodal rami. Stafford did not designate type specimens or their deposition. Her figures and description, including a pleotelson with straight lateral margins and a count of 8 marginal spines on the pleotelson apex, suggest that her specimens were C. distinguens. However, without any of Stafford's material to examine, we feel it a better not to synonymize C. distinguens with C. horridus var. spongicola, thus leaving the latter as a novel dubious.}

C. distinguens is primarily a shallow subtidal species, living in the littoral zone at San Quintin Bay, Mexico. In some localities it is common in the littoral zone. This species is a member of the California demersal spongicolana community. STIPHON and BRUSCA (1985) recently reviewed experimental evidence of its nocturnal emergence to episodic epibenthic habitat.

C. distinguens (LKoogland, 1877) Figs. 11C, D, 16-20

Synonym.—Extended and subsequent to Bruce (1894-146).

C. horridus japonicus Yabe, 1924: 152.

C. horridus japonicus Nomura et Tai, 1930 (Japan's colonial).


C. distinguens var. spongicola: Stafford 1912: synonymized with C. distinguens by Bruce and Bowman 1982.

Gulf of California specimens: (31) Mexico, Baja California, La Paz Bay, Dawson Sta. 54, LACM; 10–11 Nov. 1940; coll. E. Y. Dawson, 1 specimen.

Description of male.—Cephalon devoid of tubercles, often with interocular groove, length about 2.5 times width (Figs. 11C, D). Antennule short, reaching just beyond cephalon: flagellum with 8–12 articles, aesthetascs on most or all articles; middle articles of flagellum broader than long (Fig. 18A). Antenna long, reaching to peronite IV or V; flagellum with 30–34 articles (Fig. 18B). Frontal lamina bifurcated, broader anteriorly, length approximately 1.5 times width (Fig. 18C). Mandibular spines row with 14 most simple spines, molar gaeces with about 22 small acute spines and up to 6 long simple spines that arise from prominent region of molar; middle palp article with 22 serrate setae, distal article with 19 comb setae, each hollowed out or excavated (Fig. 18D). Maxilliped lateral lobe with 12 setae, many barbed, and 6 small subapical spines (Fig. 18E). Maxilla 1 medial lobe with 13 plumose setae and 8 simple setae; lateral lobes with simple and comb setae as figured (Fig. 18F). Maxillipede endite short, with 1 coupling spine and 5 plumose setae; palp articles with simple and comb setae (Fig. 18G). Pereon broadens at peronites IV–V. Posterol margin of peronites with row of minute tubercles in larger specimens. Coxae

Figure 19. Cysticus busti (SIO C1086), male: A, penepal I (left), B, penepal IV (left), C, penepal VII (right), D, pene, E, spicis of peneal and pleotelson.
II—VII visible dorsally (Figs. 11C, D). Peripetal 1 uncin, with simple, and stout, and mepodiform (spicate, truncat) spines; ischiium with 1 mepodiform spine and one with 6 mepodiform spines on inferior margin; infract with 4 very large spines on superior margin; propodium with 4 bluntn spines on inferior margin (Fig. 19a). Peripetal IV—VII long, with many simple and serrate spines and stout, basally dentilicate spines as figured (Fig. 19B, C). Penes very small, wartlike proprocesses, set somewhat apart near proscaphium margin of sternum VII (Fig. 19D). Pleopods 1—2 often covered by peronite VII. Pleonites 3—5 with row of small tubercles on posterior margin, and occasionally a pair of minute dorsal submedial tubercles on pleonite 5 in larger specimens (Figs. 11C, D). Peripodal endopods 4—5 with PMS only apically; exopod 1—3 with PMS entirely lateral and margin to distal third of ramus on medial side (Figs. 20A—E). Peripod 1—2, 5; pleopods 1 with large circumscopulate seta on lateral margin; pedicelae of pleopods 4—5 with small lateral lobe. Pleco- pods 3—5, exopods with ciliate setae on medial side, Pleopod 1 exopod with 1 large prostomissorial seta; lateral (costal) margin of endopod straight; paleuca with 5 coupling spines. Pleopod 2: appendix masculina, with distal spines, extends well beyond apex of peduncle; peduncle with 4 coupling spines and 5 plumose setae (Fig. 20B). Exopod of pleopod 3 with marginal incisures (Figure 20C). Pleopod 4: paleuca with 4 coupling spines and 6 plumose setae; exopod with marginal incisures (Fig. 20D); Pleopod 5: incisures on exopod nearly complete (Fig. 20E).

Plethelon subtrilateral, apex narrowly rounded, with 9—36 marginal spines, intermixed with PMS; adult males with 2 large dorsal submedial tubercles or carinae, usually absent in females (Figs. 11C, D). Uropods longer than pleonites, distally rounded, without apical tines. Uropodal endopod twice as broad, with 12—15 marginal spines, intermixed with PMS; apical spines large and blunt. Uropodal exopod with 3—17 marginal spines, intermixed with PMS; apical spines large and blunt (Fig. 19E). PMS of plethelon and uropods with very short setules.

Female moderate to large, but usually lacking the 2 large dorsal submedial tubercles or carinae on the pleonites and the rows of small tubercles on posterior margins of some peronites and pleonites.

Size—To maximum length of 20.0 mm. Distribution—C. horrida is a widely distributed species in the eastern Pacific. It occurs in tidepools at least from Vancouver Island, British Columbia, south about to Magdalena Bay on the west coast of Baja California. There is also a single record from the southern Gulf of California (La Paz Bay). The species has a discontinuous distribution in the North Pacific, according to Bruce and Jones (1981) and Bruce (1986a), being found on the coasts of the Russian Far East, Japan, and Australia.

Remarks—Bruce and Jones (1981) concluded that Circinella horrida japonica Thieleman, 1910, was not sufficiently distinct to warrant subspecific status. Bruce (1986a) synonymized C. hoyosorum Navarrete, 1972, and C. truncate Kessallaki, 1979, with C. horrida, noting that C. hoyosorum may have been introduced to Australia. C. horrida var. spiculiferus Sturdi, 1922, is probably conspecific with C. diminius (see nigrures for C. diminius).

The species lacks the dorsal tubercles on the pleonites, and the dorsal tubercles of pleonite 5 are most commonly seen on specimens from the California Channel Islands. All females we have examined lack these tubercles.

Circlnella horrida is one of the most common littoral isopods in warm and temperate waters of the northeastern Pacific, becoming rare in subtropical waters of north—central Baja California. It is common and often abundant beneath rocks (especially on spongy substrates) and in mussel beds, in the littoral zone and shallow sublittoral region. It infrequently occursubarily to depths of 135 m. Hewitt (1937) recorded densities as high as 31,527 per square meter in Monterey mussel beds. Johnson (1974, 1976q, 1978), reported C. horrida preying most commonly on small polychaetes (0.1—0.5 mm in diameter), to be consumed whole. Johnson also found them preying on a variety of small crustaceans, particularly amphipods and copepods, and also scavenging on dead animal matter. Johnson's work suggested preysubfood location by C. horrida is primarily by olfactory means. He also found that ovigerous females seldom, if ever, leave the safety of their under— rock shelter or other hiding places to feed. Feeding for the entire 3—4 month breeding period, Johnson claimed that most females "probably" died (or were preyed upon) after the first brood, few surviving to produce a second. Laboratory populations were survi- vored through 3 or more broods under "optimal conditions" (Johnson 1976a). Feeding ranges from 18 to 68 eggs per brood. Johnson proposed a mean 2 year lifespan for C. horrida in nature, with year—round breeding and an average population generation time of 13.9 months.

Lockington (1971) did not designate type specimens or indicate a place of species deposition in his original description of Circinella horrida, published in the Proceedings of the California Academy of Sciences. No type specimens are placed in the California Academy of Sciences or at other museums where Lockington's material was deposited, such as the Academy of Natural Sciences of Philadelphia and the Museum National d'Histoire Naturelle, Paris. The BMNH does house four probable syntype specimens. These specimens are from the type locality (Santa Rosa Island in the Santa Barbara Channel, California) and were given to the BMNH by Lockington shortly after publication of the species. These specimens conform with obrhts we have examined.
of peduncle largely fused; flagellum of 10–12 articles (Fig. 21A). Antenna long, reaching anterior margin of peronotum V, with simple and palmate setae as figured; flagellum of 25–31 articles (Fig. 21B). Frontal lamina pentagonal, labrum much longer, but slightly narrower than clypeus (Fig. 21C). Mandibular spinous row with 11 large simple spines and 1 long seta, molar process with stout spines, many short setae on posterior margin, and 3 very long setae arising from proximolateral regions; middle palp article with about 9 comb and 11 simple setae; distal article with many simple setae and 3 terminal comb setae (Fig. 21D). Maxillipedal lobe with 3 stout circumplumose spines and 1 small seta; lateral lobe with 11 stout and 5 small spines; 3 of the stout spines armed with bars (Fig. 21E). Maxilla median lobe (glandular surface) with 2 fully plumose, 6 distally plumose, and 5 simple setae; lateral lobes with 8 and 5 simple setae, respectively (Fig. 21F). Maxillipedal endite short, with 2 coupling spines, 2 apical and 1 subapical plumose setae, and 2 simple apical setae. P2–P5 margins with simple, plumose, and comb setae as figured (Fig. 21G).

Pereon wider than peronotum V. Pereonite VII with row of small tubercles along posterior margin. Coxae IV–VII visible in dorsal view; VI–VII with oblique posterior carina. VII produced posteriorly to midlength of pleonite II (Fig. 12A). Peripod I stout, with simple setae as figured; inferior margin of meatus with 5 short, blunt, moliform spines; propodus' distal inferior margin with 3 very short blunt moliform spines; dactylus with small spine and setae set below base of primary ungual and cluster of setae on superior margin at base of unguis (Fig. 22A). Peripod IV: margins of ischiom–propodus with large stout spines bearing basal denticles; dactylus with 1 small spine (Fig. 22B). Peripod V-LI: inferior and distal margins of ischiom–propodus with serrate spines and stout spines bearing basal denticles; dactylus with 1 small spine (Fig. 22C). Pene short, small, set somewhat apart near posterior margin of sternite VII (Fig. 22D).

Pleon broadly at pleonites 2 and 3. Pleonite 1 almost completely overlapped by peronotum VII (visible medially). Posterior lateral angles of pleonite 3 produced, partly encompassing pleonite
Figure 22. Crotalinae naucaracensis sp. (USNM 252734), holotype, male: A, pereopod 1; B, pereopod 4; C, pereopod VII; D, penes; E, dorsal view of uropod; F, pereopod 1; G, pereopod 2; H, pereopod 3; I, pereopod 4; J, pereopod 5.
4. *Pleoshinus* 3–5 with 2 submedian tubercles, becoming larger posteriorly (Fig. 12A). Pleopodal rami with PMS as figured (Figs. 22E–L). Pleopod 1: peduncle’s medial margin with 4 coupling spines; lateral margin with 1 simple spine; enopod 0.5 times length of enopod; lateral (outer) margin concave, exopod with single simple seta on proximal lateral margin (Fig. 22F). Pleopod 2: peduncle’s medial margin with 4 coupling spines and 3 plumose setae; lateral margin with 1 small spine; appendix masculina length 1.2 times length of enopod, narrowing to acute apex with short barbed setae (Fig. 22G). Pleopod 3: peduncle’s medial margin with 3 coupling spines and 1 plumose seta; lateral margin with 1 short simple spine; enopod with short marginal incisions and ciliate scale on medial margin (Fig. 22H). Pleopod 4: peduncle’s medial margin with 5 coupling spines and 4 plumose setae; lateral margin with 1 simple spine; exopod with short marginal incisions and ciliate scale on medial margin (Fig. 22I). Pleopod 5: exopod with short marginal incisions and ciliate scale on medial margin (Fig. 22J).

*Pleoshinus* triangular, lateral margins straight, apex rounded, with 6–9 stout marginal spines interspersed with many simple setae; posterior pleonites and pleonites with 2 longitudinal submedian tuberculate carinae; more prominent in larger individuals, occasionally with several smaller tubercles located between the 2 longitudinal carinae (Fig. 12A). Uropods with scattered dorsal chitinothoraces; inner angle of peduncle with distal PMS; rami with small apical notches and a group of long simple setae arising from each notch (Fig. 22K); margins of uropod rami weakly serrate and somewhat rounded apically (especially endopod); endopod laciniate as in *C. silhouetorum*; both rami with spines and PMS on medial and lateral margins. Uropodal exopod 0.67 times width of endopod, extending almost to pleotelson apex; medial margin with 3–4 spines, lateral margin with 3–8 spines, interspersed with PMS. Uropodal endopod extends barely beyond pleotelson apex; medial margin with 5–8 spines, lateral margin with 2–3 spines, interspersed with PMS.

![Diagram](image)

**Figure 23.** *Clistosoma silhouetorum* n. sp. (ACSM 17-294.2), paratype: male. A: antennule (right); B: antenna (right); C: frontal lamina, clypeus, and labrum; D: maxillule (left); E: maxillule (left); F: maxilla (left); G: maxilliped (left).
Female.—Similar to male. Dorsal tubercles on ploteum and ploteon somewhat variable in size; occasionally larger in the female than in the male.

Size.—Small, to maximum length of 8.4 mm.

Distribution.—An intertidal-and shallow subtidal species preferring coral, rubble, coralline, and rocky substrates, and so far known from only three areas: the Galapagos Islands (Nameless, Albatreke, Tower, indistinguishable, Hood, and Charles Islands); Mieffe Island, Columbia; and Enseada de Urana, Columbia (off the Pacific coast).

Remarks.—*Cirrata neumoehrensis* has affinities with both the *C. purpureus* group of shallow-water species, *C. Brucei* and *C. Brownei* (1982) and Bruce (1986), and the *tuberculata* group of *Cirratula* species (Bruce, 1986a). The characters most readily distinguishing *Cirratula neumoehrensis* from similar seeming species in the tropical eastern Pacific are as follows: the tuberculization of the posterior ploteum and ploteon (the only other tropical eastern Pacific *Cirratula* species with dorsal tuberculization in *C. bicornis*, which can immediately be distinguished from *C. neumoehrensis* by its lacking anterior rows on the tepalod rami and the shape and number of spines of the pleurosternum and parapodium. The apical rows of the parapodial rama are smaller (not as deep) in *C. purpureus* and *C. Brownei*.

Etymology.—Named for the type locality: Nameless Island, Galapagos Islands, Ecuador.

*Cirratula neumoehren* n. sp.

(Figs. 12B, 25, 24)

Type material examined.—1 holotype: (LACM 77.294.1), male, and 45 paratypes, 41 at LACM 77.294.2 and 4 at SDNHM (A1/A2, A3/A4). Mexico: Gulf of California; Punta Chivato, trawl #1, quanitas #7, 14 of 4, 16 July 1977; coll. R. C. Bruce, R. Zimmerman, and R. Wren.

Additional paratypes.—(2) Mexico, Sonora, Tiburon Island; Acc. No. 139134, USNM 6813; 3 Apr. 1940; coll. E. F. Ricketts; 9 specimens. (2) Mexico: Baja California (Gulf); El Baja, near Luzon, floating wash of shallow subtidal rocks; EW88-18, LACM, 20 Apr. 1988; coll. E. W. Hanson; 35 specimens. (4) Mexico, Baja California (Gulf); 25°31'N 111°44'W, taken with *Chenbaba* and 5-3'5; EW86-37, Acc. No. Bi-6549, SIO C2444; 1 July 1978; coll. R. Roseblant. 1 female. (5) Mexico, Baja California (Gulf), Espiritu Santo Island, shore collecting: RV *Kohele* H10 S1. 37°-37°30' USNM Acc. No. 14444; 6 Mar. 1957; 1 male.

Description of adult.—Cephalon devoid of tubercles, 2.2 times wider than long (Fig. 12B). Rosette small, barely overlapping frontal lamina (Fig. 24C). Medusa short, reaching jy这些 anterior margin of parapod of simple and somewhat squarish; abdomen flagellum of 8 or 9 articles (Fig. 23A). Abomasum long, reaching middle of parapod IV; flagellum of 26–36 articles; pedicelar article 4 with characteristic subapical denticle (it difficult to see in most specimens) (Fig. 23B). Frontal lamina pedotegumentum (Fig. 25C). Mandibular spine row forms a large round base with 13 robust spines, 2 of them very long; molar process with 26 small acute marginal spines and many short simple acutum; posterior margin: middle article of mandibular palp with 10 plumeus setae; (not all figured); distal article with approximately 20 comb setae (Fig. 22D). Maxillate lateral lobe with 10 stout bristles spines. 1 simple spine; and 4 small slender subapical setae (Fig. 23E). Maxillu medial lobe with 4 simple setae; 6 plumose acutum; and 2 long circumpleural setae; lateral lobes with 11 and 4 simple setae, respectively; lateral margin of basal article with 7 small setae (Fig. 23F). Maxillp endite very short, with 2 comb spines, 3 plumose, and 1 simple acutum acutum; pulp margin with simple and comb setae as figured (Fig. 23G).

*Perionectes bresilius* was described as *Perionectes bresilius* (now included in *Cirratula purpureus*). *C. purpureus* and *C. Brownei* are similar to *C. Brucei* in the general shape and size of the cephalon and parapodium. The apical rows of the parapodial rama are smaller (not as deep) in *C. purpureus* and *C. Brownei*.

*Perionectes* bresilius* was described as *Perionectes bresilius* (now included in *Cirratula purpureus*). *C. purpureus* and *C. Brownei* are similar to *C. Brucei* in the general shape and size of the cephalon and parapodium. The apical rows of the parapodial rama are smaller (not as deep) in *C. purpureus* and *C. Brownei*. *Cirratula neumoehren* has affinities with both the *C. purpureus* group of shallow-water species, *C. Brucei* and *C. Brownei* (1982) and Bruce (1986), and the *tuberculata* group of *Cirratula* species (Bruce, 1986a). The characters most readily distinguishing *Cirratula neumoehren* from similar seeming species in the tropical eastern Pacific are as follows: the tuberculization of the posterior ploteum and ploteon (the only other tropical eastern Pacific *Cirratula* species with dorsal tuberculization in *C. bicornis*, which can immediately be distinguished from *C. neumoehren* by its lacking anterior rows on the tepalod rami and the shape and number of spines of the pleurosternum and parapodium. The apical rows of the parapodial rama are smaller (not as deep) in *C. purpureus* and *C. Brownei*. *Cirratula neumoehren* has affinities with both the *C. purpureus* group of shallow-water species, *C. Brucei* and *C. Brownei* (1982) and Bruce (1986), and the *tuberculata* group of *Cirratula* species (Bruce, 1986a). The characters most readily distinguishing *Cirratula neumoehren* from similar seeming species in the tropical eastern Pacific are as follows: the tuberculization of the posterior ploteum and ploteon (the only other tropical eastern Pacific *Cirratula* species with dorsal tuberculization in *C. bicornis*, which can immediately be distinguished from *C. neumoehren* by its lacking anterior rows on the tepalod rami and the shape and number of spines of the pleurosternum and parapodium. The apical rows of the parapodial rama are smaller (not as deep) in *C. purpureus* and *C. Brownei*.
Closina parva Hutton, 1890

Syntypes.—Emended and subsyntype to Bruce and Bowman 1982: 325.


Nont—Closina parva: see Bruce and Bowmann 1982: 325.

Type material examined.—(1) "Laesiotype." (z1MU.C), male, West Indies, St. Thomas. "Laesiotype" (ZMUC), 12 female, West Indies, 5 specimens; (3) West Indies, 5 specimens; (4) West Indies, St. Croix, 2 specimens (in very poor condition); (5) 23-N, 34 E, 2 specimens; (6) (two locality), 1 specimen; (7) Pacific Ocean, Samos, 1 specimen.


Figure 25. Closina parva (USNM Acc. No. 83222): male A, anterior; B, anterior C, frontal lamina, clypeus, and labrum; D, mandible; E, maxillae; F, maxilla, G, maxillipeds.
by Hansen (1980) and Bruce and Bowman (1982). One of the type specimens is labeled as being from "Samaus." Remarks—Bruce and Bowman (1982) raised the probability that what has appeared as Coracias pava in the past is in fact a complex of closely related sibling species. They confirmed records of C. pava from the Caribbean and Gulf of Mexico, and renamed C. dometi from synonymy with it. After examination of the type specimen, Bruce and Bowman's material, and eastern Pacific specimens, we conclude that C. pava does occur in the tropical eastern Pacific and is thus a tropical amphibian-American species. The characters distinguishing C. pava from the very similar C. dometi are discussed above (see under "Remarks" for C. dometi). Hansen (1980) did not designate a type locality for Coracias pava. Bruce and Bowman (1982) noted this and designated St. Thomas, West Indies, as the type locality, basing this on label data of dissected specimens. Hansen (1980) did not figure the plopeds, but Bruce and Bowman's (1982) figures of "systytes" show plopeds 4 and 5 with a complete transverse suture across the endopod. However, the ZMUC specimen labeled "ectotype" and other material we have examined lack complete endopodal sutures (see Fig. 26d and j).

Conilera Leach, 1818

Type species—Olmixia cyanolabris Montagu, 1804. The designation of the type is unknown.


Description—Body 4.8-5.2 times longer than broad; dorsoventral smooth, without ornamentation. Eyes small, separated by greater than 2 eye-widths. Rostrum minute or absent. Frontal lamina, clypeus, and labrum sessile, not projecting; narrow, anteriorly extended frontal lamina separates bases of antennules and antennae; clypeus wider than long, and wider than labrum. Antennular peduncle 3-articulate; basal article articulated at right angle to remaining articles. Antennal peduncle 5-articulate; articles 3 and 4 separate; penultimate peduncular article with an elongate apical seta or distal posterior angular. Mandibulate tridentate; spine row a well-developed midline striae with stout spines; palp 3-articulate, middle article longer; Maxillule medial lobe with 3 stout circumscribed spines; lateral lobe with 10-12 stout, spicule apicals. Maxilla medial lobe short, truncate, with many plumeose setae; lateral lobe bifurcate with apical simple setae. Maxilliped palp 5-articulate, with middle article broader than others; endite with 1 coupling hook.

Female 1 longest; Perepodial dactyls without secondary spines, although there is often a small accessory spine at base of pereopods. Pereopods I-III equal; dorsal margin of ischiium and merus produced as a spur-shape process into which adjacent dorsal articles fit. Pereopods V-VII with sparse setae; bases without median longitudinal row of setae along outer rami. Pores: Pleon of 5 free pleopods; pleopod 1 not concealed by pereonite VII; pereonite 4 encompassing lateral margins of pleonite 5. Pereopod 1 operculum to pleopods 2-5 and imbricate; pleopod elongate, rather than broad; endopod elongate and narrow, medial margin straight, thick, and almost bare but with moderately long PMS on distal lateral margin; exopod shorter than the endopod, ovate, distal margin with moderately long PMS. Pereopod 2: peduncle scarcely wider than long, rami with long PMS; appendix masculinum absent; maxillule bearing at least 2 setae. Pereopod 3: endopod without lateral margin; pleomeres triangular with serrate posterior margin. Uropod peduncle of 3 articles; outer articles of exopod pointed, lateral margin posteriorly somewhat less produced, endopod with notch on lateral margin.

Remarks—Until now, only 2 species had been assigned to

Conilera, C. cyanolabris (Montagu, 1804) and C. stephiei Packard, 1879. Conilera cyanolabris is an European species reported by Richardson (1905) as also occurring in the western North Atlantic. However, the first identity of the specimens reported by Richardson as C. cyanolabris from North American wato (South Carolina, Mississippi, and Florida) is uncertain. The type material of C. cyanolabris is from Naples, Italy, and Richardson (1905) reported additional records from England and France. Richardson's (1905) description and figures, taken from Saris (1890), are from Naples specimens, not from the two specimens cited to have been examined from North America. Hence, the American species has never actually been figured or described. Tamiruelli (1966) did not ac knowledge this species as occurring in North America.

Conilera stephiei is a blind form reported only once, from a freshwater well in Monterrey, Nuevo Leon, Mexico. Cole and Minckley (1986) suggested that this species may belong to Spionomisella. The original description lacks figures and is inade quate for assessment of its proper generic assignment.

Little has been written on this genus, and the distribution of the known species is rather enigmatic. Specimens have been collected with dredges and trawls to about 300 meters, indicating a benthic habitat. Baer and Westwood (1967) collected Conilera cyanolabris "feeding together within the orbit of the eye of a whiting, the eyeball of the fish being nearly detached from the surrounding parts." Day (1881) reported that the eggs of a dogfish (Anchistes vulgaris) "had been entirely eaten out by C. cyanolabris." Je further reported that this species "lives generally on soft and sandy bottoms, hunts in shoals and, when abundant, will drive away the congers and other fish." (Birnbaum and Werner (1993) reported collecting it in baited traps off the coast of South Carolina, in depths of 140-212 m.

**World list of species**:

1. C. cyanolabris (Montagu, 1804). Europe and northwest Atlantic (and perhaps southeastern U.S.A.)
3. C. bullisi n. sp. Ecuador.

*Conilera bullisi* n. sp.

**Type material examined**—Female holotype (USNM 252743) and 3 paratypes (male, postmoult, male) (USNM 252746): Ecu a. (Bowl Flourish, 1884). In the possession of Dr. M. Wade Brewer.

Conilera bullisi n. sp.

**Type material examined**—Female holotype (USNM 252743) and 3 paratypes (male, postmoult, male) (USNM 252746): Euc a. (Bowl Flourish, 1884). In the possession of Dr. M. Wade Brewer.

Conilera bullisi n. sp.

**Type material examined**—Female holotype (USNM 252743) and 3 paratypes (male, postmoult, male) (USNM 252746): Euc a. (Bowl Flourish, 1884). In the possession of Dr. M. Wade Brewer.
clump of simple setae on superior distal margin; corpus with 1 or 2 spines on inferior margin: mesos of peripod I with 3 blunt and 3 acute spines on inferior margin; mesos of peripod III with only 2 blunt spines; peripod I-III with 1 blunt spine among spines on produced distal-superior margin of mesos; dactyli shorter than propodi, slightly curved (Figs. 29A, B). Peripod VII: mesos with somewhat produced superior distal margin, bearing setae; inferior margin of mesos, carpus, and propodis with thin, acute spines, sparsely scoped; dactyli about 0.5 times length of propodis (Fig. 29C).

Plenice I longer and wider than subsequent pleonites. Pleonite 5 completely enclosed by pleonite 4, pleonite 5 with a dense row of simple spines on posterior margin (Figs. 27, 28K). Pleopod rami with PMS as figured (Figs. 29C-E). Pleopod I: peduncle about 1.4 times longer than wide, with 5 coupling spines inset on medial margin (Fig. 29E). Peduncles of pleopods 2–4 with 3 coupling spines on medial margin. Pleopod 5 without coupling spines. Pleopod endopods 1–4 with PMS on apical margin, exopods with long PMS on apical and lateral margins. Pleopods 3–5: exopods with notch in lateral margin. Uropod endopod and exopod margins strongly serrate, with a single PMS arising between each tooth (Fig. 29D); endopod 1.3 times longer than exopod; coxal nar- rower than endopod; coxopod does not extend beyond posterior margin of pleonites.

Description of study.—Penes small, bean-shaped, almost touching (Fig. 29A). Appendices masculinae arise on endopods of pleopods 3 (Fig. 28G). Otherwise similar to female.

Size.—To maximum length of 7 mm.

Distribution.—Known only from the type locality, Gulf of Guayaquil, Ecuador.

Remarks.—Coelurus balillus is only the second rite-third if C. straperia is eventually retired in the genus Cephaloba species described in this genus, and it is the first Coelurus species recorded from the Pacific.

Etymology.—This species is named for William Bull, practitioner of law, adventurer, friend, and surfer par excellence, in deep gratitude for the assistance provided to us for our expeditory work.

Euryclava, Leach, 1815

Type species.—Parleyracus pacifica Leach, 1813. Type material at BMNH.

Synonymy.—Extended and subsequent to Bruce (1980a, b, c).


Description.—Body 2.5–3 times longer than broad; dorsal smooth, without ornamentation. Eyes small to large; ommatidia extend to ventral lateral position on cephalon. Rostrum minute or absent. Frontal lamina narrow; anterior part projecting ventrally, not joined with clypeus; clypeus short, broad, wider than long, with a finely projecting triangular blade; labrum broadly joined to clypeus and slightly narrower than clypeus. Antennule short, peduncle 3: articular article 1 longest; article 2 arises at right angle to article 1: proximal flagellar articles typically fused. Antennal peduncle 4: articular articles 4 and 5 fused; article 4 longest. Mandible with broad, tridentate incisor; palp extends well beyond cutting edge; white row a large, rounded lobe with stout simple spines, saddle article of palp longs. Maxillule medial lobe with 3 stout circumlimbous spines; lateral lobe with 11–13 stout spines. Maxill- is with simple medial lobe absent or weakly developed. Mxlitridal palp articles 3 and 4 subequal in length and width, eminence reduced, failing to reach barely reaching beyond 4th palp article, and without coupling spines. Periopods I and II subequal in length. Coarse O–VII with prominent spines becoming increasingly acute anteriorly.

Peripod I–III short; grasping, spiny, with distal superior mar- gins of Ischiornus and merus more or less produced. Peripods IV—

Figure 27: Coelurus balillus, n. sp. (USNM 257254), holotype, female.
VII long, spinose; setae: ischiuri-propodus flattened. Fences large, well developed, 1.5–3.5 times longer than broad; lobes somewhat flattened.

Pleon of 5 free pleonites; pleonite 5's lateral margins not overlapped by pleonite 4. Peduncles of pleopods 1–5 wider than long, pleopod 1's peduncle subquadrate. Pleopods rounded; only endopod of pleopod 5 lacking setae; appendix masculina inserted medially or submedially on endopod on male's pleopod 2. Pleopod 5: peduncle without coupling spines or plumose setae on medial margin; endopod with proximal medial margin produced, lobelike. Pleonites with apex rounded, truncate, or subacute, usually emarginate; dorsum with anteromedial depression. Uropodal peduncle with inner angle not greatly produced, with row of PMS on lateral margin; exopod lateral margin without PMS.

Remarks.—Species in this genus are superficially similar in appearance to those of Cirolana and Anoplosoma but may be
June 1976; coll. M. Gilligan; 11 specimens; (14) Sonora, San Carlos Bay, Acc. 160866, USNM 86349; 30 Mar, 1940; coll. E. F. Ricketts; 15 specimens; (15) Sonora, San Carlos Bay, "peligru hand," light over side at anchorage: Acc. 160864, USNM 86343; 30 Mar, 1940; coll. E. F. Ricketts; 30 specimens; (16) Baja California, Tortuga Island; 12 Mar, 1936, night light; USNM Acc. No. 103773; 300+ specimens (63 vials); (17) Baja California, S. of Tortuga Island, 27°24'S, 111°53'W, 137 m. sand; RV Velez III Sta. 1695-3; 17 Mar, 1937, 30 specimens; (18) Baja California, Conception Bay, light over side at anchorage; USNM 86343; 28 Mar, 1940; coll. E. F. Ricketts; 25 specimens; (19) Baja California, 1 mi. off Pupito Point, taken at night with dip net and night-light, 21:15-21:25 hrs.; LACM; 22 June 1976; coll. R. D. Behrauck; 1 specimen; (20) Baja California, Puerto Escudaado (across from Carmen Island), 25°48' N, 111°18' W, 31 m. taken with night light at 0900 hrs.; RV Velez IV Sta. 1751-49; LACM; 19 Mar, 1949; 17 specimens; (21) Baja California, Carmen Island, taken with electric light; RV Albatross Sta. A5767, USNM 67917; 1911; 20 specimens; (22) Baja California, Carmen Island, Salinas Bay; SDNHM 14 May 1939; coll. R. W. Minde, M. S. Murray; 500+ specimens; (23) Baja California, Agua Verde Bay, with electric light; RV Albatross Sta. A5767, USNM 67722; 15+ specimens; (24) Baja California, Agua Verde Bay near Marical Point, 25°31' N, 111°04' W, night light off shbp, 230 hrs.; RV Velez IV Sta. 1741-49; LACM; 16 Mar, 1949; 50+ specimens; (25) Baja California, off Marical Point, "pelagic," 24 m. at anchorage, 2200 hrs.; Acc. 159124, USNM 88037; 24 Mar, 1940; coll. E. F. Ricketts; 100+ specimens; (26) Sinuaka; Topolosempo, 25°36'N, 109°04'W; SDNHM A0006; 8 July 1972; coll. D. Daxer; 4 specimens; (27) Baja California, San Jose Island, Otissons Point, night, at 10 m on algorit, HC 25-11-1985, SDNHM 25 Feb, 1985; coll. H. Cheney; 150+ specimens; (28) Baja California, San Jose Island, taken with electric light; RV Albatross Sta. 16075, USNM 9728; 1911; 10 specimens; (29) Baja California, San Francisquito Island, east coast, taken at night, over 18 m bottom with red and green-light, sand, and Exocetidae; D.C. 24-11-1905, SDNHM 21 Feb, 1965; coll. H. Cheney; 100+ specimens; (30) Baja California, San Francisco Island, S.W. cave, surface; RV Velez III, LACM; 5 May 1932; 1 specimen; (31) Baja California, Inner Gerba Bank, off San Jose del Cabo, dredge, 128-143 m; RV Velez IV 1135-40, LACM; 20 Jun, 1948; 1 specimen; (32) Baja California, Cape San Lucas, RV Albatross Sta. A5767, USNM 67913; 1911; 30 specimens; (33) Baja California, Cape San Lucas, "pelagic," with night light; USNM 86343; 28 Mar, 1940; coll. E. F. Ricketts; 4 specimens.

Central eastern Pacific specimens: (34) Mexico, Jalisco, Tepic, Region 1; 5°58'N, 113°08' W, shore and land collecting; RV Velez III Sta. 2-33, LACM; 3 Jan, 1933; 1 specimen; (35) Costa Rica, Cocos Island, on fish; USNM Acc. 122445; coll. W. L. Schmitt; 1 specimen; (36) Costa Rica, Cocos Island, Chatham Bay; Acc. 148877, USNM 86345; 3 Aug, 1938; coll. W. L. Schmitt, 2 juveniles; (37) Costa Rica, Cocos Island, Chatham Bay, 5°33.3' N, 87°02.6' W, Pontohi med., 12-15 m; CRC-881, LACM 88-1, coll. R. W. Peck and H. G. Kuck; 10 specimens; (38) Ecuador, La Liberadad; RV Velez III Sta. 33-34, LACM; 19 Jan, 1933; 3 specimens; (39) Isabel Island, 21°52' N, 102°51' W, taken at anchorage with electric light; HFH 748-37, LACM; 10 specimens [coordinates evidently erroneous] .

Description of male. —Cephalon 3.2 times length; anterior margin of cephalon evenly rounded, without retrorse point. Eyes large and well developed (Fig. 30). Antennule short, barely posterior margin of cephalon, flagellum with a large basal process, continuing a row of fused articles and aesthetes bundles and 3 free articles (Figs. 3A, B, 32A). Antenna very long, usually reaching to peroneum VII, occasionally to pleopod (Fig. 31A); flagellum of 20-25 articles, distal articles 3-4 times longer than broad (Fig. 32B). Frontal lamina greatly elongated, posteriorly acute.
Figure 32. *Eucaridia* casali, A, B, USNM 22585 specimen, male, C-G, AIF 710-61, male: A, antennule; B, antenna; C, frontal lamina; clypeus; and labium; D, mandible; E, maxillule; F, maxilla; G, maxipod.
width, distal lateral margins slightly rounded (Fig. 34E).

Female.—Similar to male, although internal flagella may be somewhat shorter than in males and pleopod may be slightly narrower than penis.

Etymology and Features.—When viewed with SEM, the surface of the body and appendages has a scalloped cuticular structure. The body dorsum has many cuticular sensilla set inside small pits (Fig. 37).

Size.—Small to maximum length of 9 mm.

Distribution.—Eurydice candei ranges from southern California to the Gulf of Guayaquil, Ecuador, including the islands of Guadalupe, Revillagigedos, Tres Marias, and Coco. It is known almost throughout its range, both in the warm temperate California Province and in the tropics. The northernmost record (Pacific Gulf of California) is the only one north of the California Province, so it seems to be an anomaly. The southernmost record is at the Gulf of Guayaquil. The species is very common throughout the Gulf of California. Its depth range, based on the material we have examined, is from the low intertidal region to 160 m; most records are from 90 m to 50 m depth.

Remarks.—Eurydice branickii was described from southern California by Menzies and Barnard (1959) but reduced to a synonym of the Atlantic species E. litoralis (Moore) by Menzies and Glynn (1968). Bowman (1977), however, removed E. branickii from E. litoralis and placed it in synonymy with E. candei.

Eurydice candei is more often taken by night-lighting off ships anchored over shallow soft bottoms. In California and western Mexico we have collected it regularly from coarse sand and silt, at depths of 5 to 160 m.

Excavatina Richardson, 1912

Type species.—Cinclus orientalis Dana, 1853, from the Salina Slu, by original designation (Richardson 1912). Location of type material unknown; specimens possibly lost when the ship "Phe- cocock" sank off the mouth of the Columbia River (Bruce 1980a).

Synonymy.—Emended and subsequent to Breit (1959a:39).


Description.—Body 2.5–3.0 times longer than broad; dorsal evenly convex and unsculptured; proomax almost always longer than postoomax. Eyes moderate in size. Posterior region of cephalon often with lateral incisions; cephalon with prominent rostrum, in all but three described species the rostrum is strongly dilated distally as a spade-like process separating antennomeres (only moderately dilated in E. monodi and E. hierroensis); rostrum confluent with its farthest point from frontal luma. Frontal luma varies from narrow and linear in some species wide but always longer than wider; clypeus short, wider than clypeular angle, weakly projecting, narrower than wide; labrum broad. Antennal pedicel 3-articulate, but articles 1 and 2 are fused and in many species. Article 3 never as long as 1 and 2 combined: flagellum may vary in length with age, but always longer than peduncle; basal flagellar articles longer than wide. Antennal pedicel 4 or 5-articulate; if 5-articulate, article 5 never as long as 1–4 combined. Mandible with broad incisive incisor, quadrate in front mandible in many species. 2 or 3-articulate palpi extend beyond incisor's cutting edge; spine row and mascare process well developed; spine row lobulate, with numerous long, arc, flat, spinose spines. Maxillate medial lobe with 3 stout circumphalangeal setae and occasionally 1 or 2 smaller circumphalangeal setae; lateral lobe with several to many stout simple spines (often barbels). Maxillula medial lobe moderately developed and setose, with bifurcate lateral lobe well developed, with many long simple setae. Maxilliped slender; palp of 5 articles, article 3 wider than 4, ending with 1 cingulating spine.
Pereopods all ambulatory; I-III grasping; bases of V-VII narrow, not markedly flattened; all legs usually bear spines on the propodus, carpus, merus, and ischium; pereopods often with large accessory spine at base of unguis. Pincers well developed on sternite of pereonite VII.

Pleon of 5 free pleonites; pleonite 1 may be largely or partly hidden by pereonite VII; pleonite 5 as wide as 4, with lateral margins not overlapped (or only partly overlapped) by 4. Pleopods with elongate rami; pleopod 1 astylar, or opercular; pleopods 3 and 2 generally similar, with PMS on both rami; exopods of pleopods 3–
5 with PMS, endopods of 3-5 or (2-5) without PMS, appendix masculina of male arises basally or subbasally on margin of endopod of 2nd. Pleopod peduncles 1-4 with coupling spaces and plumose setae on medial margins and usually on acces-
sory lobes on lateral margins; pleopod peduncle 5 without cou-
pling spaces. Pleopod rami subacute or rostrate, never indented or vacuolated; with or without setae, but always with PMS. Dorsum of pleotelson with 2 shallow submedian depressions, one on either side of midline (in some species these pits are prominent, in others they are
shallow and difficult to discern). Uropodal peduncle's inner angle
produced or not only moderately produced, not acute and often
usually extended to or beyond the posterior border of pleotelson.
Equal or longer than endopod; rami distal margins of uropod
usually equal or longer than uropod; rami distal margins with
spines in most species (present in some); lateral margin of
dorsum usually with a small marginal spine.

Remarks.—Brice (1984a) felt that the genus Exocarida was
difficult to describe and lacked consistent morphological features. He also
noted the unsettled synonymy of Exocarida with Pontes-
roleus (see Monod 1930, 1933; Jones 1971; Carvaccho 1977).
Some authors have regarded Pontesroleus as a subgenus of
Exocarida (Monod 1930, 1933; Nietsch 1933). There seems to be
no compelling reason to assign Exocarida and Pontesroleus
to separate genera, and we agree with Brice that the latter is
a junior synonym of the former. Only the presence of naked endopods on
pleopod 2 distinguishes Pontesroleus.

There are two sympomorphies unambiguously defining
Exocarida (including Pontesroleus). First is the prominent 
mesial process, which is apically dilated and usually spade-
olate—a feature with (or ornamentibly fused to) the frontal
lamina. The rostrum separates the antennae, and the frontal lamina sep-
tates the antennae. Second, the genus is oovooviviparous, with
infused oocytes serving as antri and with reduced oocytes.
However, internal brooding also occurs in Aninia, see below.
In addition to these two attributes, there are two other, nearly consis-
tent features of the genus. First, the lateral margin of the uropod
medial margin bears a small pit or notch. This structure is often
difficult to see through the flight micrograph, and it is impossible to
judge from the literature whether it occurs in all species, but we suspect
that it does. In some species (e. g. E. briareus) the marginal
pit is quite a distinctive and obvious in the posterior margin of the
endopod. The function of this anterior pit is unknown. In South,
almost all species exhibit a distinct, paired anterior depressions on the dorsal of the pleotelson—
these appear to be poorly developed or wanting at least E. briareus and E. loprtus.

These four features, in combination with three listed in the
description, are unambiguously distinguishing this genus. Memoirs (1932) claimed that the rostrum of E. briareus was acute, not
googled. However, his own illustrations of this species, and our
gammarids of specimens from Chilean sand beaches, indicate that
the rostrum is indeed extended, albeit weakly. We also note that
numerous authors have mistakenly referred to the species in Exocarida as the "rostral lamina." The genus Aninia is very similar to Exocarida. Both Aninia anomalioides (Brodie-Lund, 1908) (= Exocarida bowmanii Jones and Lohf, 1981) and A. newmanii (Bowerman, 1971) (= Exocarida bowmanii Bowerman, 1971) have previously been referred to Exocarida, and
Memoirs (1984) suggested that Exocarida should be considered a
junior synonym of Aninia. However, as Jones (1983) and Bowman and
and (1981) pointed out, several features of Aninia clearly
distinguish it from Exocarida. In Aninia, the eyes are divided into
dorsal and ventral portions, and the rami of the antenna are always
as long as or longer than articles 1 and 2 combined, article 5 of the antenna equal to or longer than articles
1-4 combined, pereopods 1 and 2 are narrower than 3-5, and covered
lately by the coxalplates of pereonites VI and VII, the thorax
have a strongly produced mediocaudal angle, the cephalon or
pleonites of which bear prominent dorsal horns, and the character-
istic spicular apices, cuticle and tuberculate endopod notch of
Exocarida are apparent with certainty. However, the two genera are generally closely related. Their being the only two related genera known to
brood interally suggests that they might be sister groups, although
the precise nature of the brood pouch in Aninia is yet to be
described.
So far is known all species of Exocarida are oovooviviparous,
with the 2nd retained and the embryos brooded in enlarged paired
ovocytes functioning as antri. Females of at least some species develop small, reduced testes, although genital and testes
bearing females rare are in collections. The oocytes in some may
be ovi-lactiferous (i.e. Exocarida of the species are fertilized.
Oostegites, which are present, are easily overlooked because they are tightly pressed
to the stemum.
These (1981) briefly summarized the natural his-
tory of Exocarida. A characteristic that has been occasionally
utilized in the literature is the ability of some species to inflict a painful bite, especially on swimmers' thin skin. We have been
biten by more than once E. exocarida, a voracious species that
often emerges in high numbers near shore. Most species of
Exocarida are tropical. Bally (1983) studied the respiratory activ-
ity of E. natator, a southern Australian species inhabiting both
temperate and tropical shores. Delesse (1971) documented
digastid cirriform rhythms in an Australian species. These
species of Exocarida are in the tropical eastern Pacific:
E. briareus, E. mazanii, and E. charnactis. Exocarida sapho-
sis Schultze, 1954, and E. karapii Borradori, 1954, were synony-
ized with E. briareus by Gysin et al. (1975), a synonymy that
we fully doubt but after a lengthy analysis of several hundred
species finally came to concur. With this, 3 species are
known from the temperate northeast Pacific: E. iyoquarqa and E. charnactis
(E. karapii). These three species have been reported from the temperate southeast Pacific: E. cucullata, E. loprtus, and E. mazanii. Bowerman (1984) listed 12 species world-
wide, overlooking E. cucullata and E. briareus, inadvertently
attributing authorship of E. briareus to Menzies, and omitting E.
meni and E. exocarida from the eastern Pacific fauna. Menzies (1962) incorrectly noted the type species in Exocarida chilensis.

World list of species.—
2. E. armata (Bates, 1853), Argentina and Brazil.
4. E. bowmanii, (Bowerman, 1912). Caribbean to Brazil; tropical eastern
Pacific.
5. E. charnactis; Borradori and Weisburg, 1981. Panama.
6. E. charnactis; Richardson, 1912. Chile.
7. E. chilensis; (Richardson, 1905). Japan, Taiwan, Hong Kong; in eastern	Pacific to British Columbia, California.
10. E. karapii (Bonnast, 1914). as Pontesroleus kirihirae, and includes
Exocarida sapho (Van Name, 1920). West and South Af-
anica.
11. E. iyoquarqa (Richardson, 1905). California.
12. E. mazanii (lives, 1891). Caribbean and tropical eastern Pa-
cific.
14. E. menziesi; Vanhii, 1914. Southern Africa and Mada-
gascar.
15. E. orientalis; (Dana, 1853). Indo-West Pacific, from Madagascar.
car to tropical Australia, Philippines, Japan, and India (includes Ceratula buccovinensis Jordi and Bell, 1959).

Key to Tropical Eastern Pacific Ceratula Species

1. Antennal peduncle articles 1 and 2 not fused (3 free peduncular articles); antennae of adults brushlike (antennal margin of proximal flagellar articles highly serrate); pleotelson's posterior border rounded or subacute, with two small, terminal (submedial) marginal spines; coxal plates with oblique groove... *E. maxima*

   — Antennal peduncle articles 1 and 2 fused; antennae not brushlike; pleotelson's posterior border round, without marginal spines; coxal plates smooth...

2. Mandibular palp of 2 articles; endopod of pleopod 5 divided; with large subulate chromatophores; interocular distance much greater than outer eye width, length to 5 mm... *E. chaseni*

   — Mandibular palp of 3 articles; endopod of pleopod 5 not divided (but with shallow or deep lateral incision); subulate chromatophores lacking or minute; interocular distance usually equal to width of one eye; length to 9 mm... *E. brasiliensis*
**Eucinolana braziliensis** Richardson, 1912

*Figs. 35C, D, 36–48*


**Type material examined.—**(1) Male holotype (USNM 43650) of *Eucinolana braziliensis*, Brazil, off Cape St. Roque, 12 m; RV *Athena* Sta., 2758; 16 Dec. 1887. (2) Paratypes (SMF 3660) of *Eucinolana kivalee*, Peru, Strand of Bartolaie, 1952: holotype morphs, (includes P-VII acute and blunt spinel/dacryl forms; see below); 9 specimens. (3) Syntypes (SMF 3651) of *Eucinolana saundersi*, El Salvador, Dept. La Paz, Los Blancos, 17 Oct. 1952; coll. O. Schuster. This portion of the syntype series contains “holotype morphs,” (P-VII acute and blunt spinel/dacryl forms), “besialot morphs,” and “transitional” (8 adults, 4 juveniles), 12 specimens.

*Other material examined.—*unless otherwise indicated lots are “holotype morphs” only—see below). Atlantic specimens: (4) Brazil, Rio de Janeiro, Copacabana Beach: USNM 86335. Nov. 1943; coll. Dr. Carlos Moreira; 1 specimen. (5) Panama, San Blas Islands; SDNHM, 19 Feb. 1980; coll. James G. Morris; 58 specimens. (6) Panama, Shinnferry Beach, USNM 270701; 1985; coll. James G. Morris; 8 specimens. Gulf of California specimens: (7) Baja California, San Felipe; SDNHM, 26–30 Mar. 1951; coll. W. Evans and party (W-51-44); includes both P-VII acute and blunt spinel/dacryl forms; 3 specimens. (8) Baja California, San Felipe area (Campo Encinala), ca. 31° N, 114°48’W, collected with hand net in 0–1 m, over sand bottom; (DFH 67-5 and 6); Acc. No. III-67-2; CAS Cat. No. C-3924; 1967; coll. D. F. Hoeve; (includes both P-VII acute and blunt spinel/dacryl forms); 1 specimen. (9) Sonora, El Golfo de Santa Clara, taken from gunboat during gunboat hunt/escape; AHB Cat. No. 2005-01; 15 Jan. 1975; coll. N. Moffat and D. A. Thomsen; 1 specimen. (10) Sonora, Puerto Peñasco; night lighting; SDNHM; winter, late 1970s; coll. J. R. Hendrickson; 13 specimens. (11) Baja California, Angel de la Guardia Island, swimming at water’s edge; AHB Cat. No. 2287-01; 1 Apr. 1972; coll. J. L. Troadley; 18 specimens. (12) Baja California, San Francisco Island, night lighting, bottom sand with red and green algae, 36 m; SDNHM, 24 Feb. 1985; coll. Hank Chuney; 2 specimens removed from this lot for

**Figure 36. Eucinolana braziliensis.** Two syntypes of *Cirriola saundersi* Schuster, 1984 (from El Salvador). A, holotype morph. B, besialot morph.
Figure 37. Eucalypitulus franzhayensis (from Mexico; Baja California San. Isla San Francisco; 24 Feb 1965, coll. H. Chandler; scanning electron micrographs. A, B, frontal view; C, showing fused chitin and cuticular sensilla triplinerves. A, B, N. A. (146)). C, photomicrographs and diagrams. 7X, 45X, 90X.
the antennule is longer (15-20 articles) than the antenna (11-13 articles); in some small individuals the antennules may vary from longer, shorter or equal to the antennae. **Anthemis pedunculate** articles 1 and 2 fused together; peduncle article 3 much wider than but unequal in length to first flagellar article; first flagellar article and all others except terminal article with dorsal arthrobranch (holo- type is in poor condition and missing many setae) (Figs. 38A-C). **Anthemis pedunculate** articles 4 and 5 about twice length of 3; all innermost articles with simple setae, those of peduncular articles may be quite long (Figs. 38D-F). Manubrial with innermost incisor cup similar in size but always larger than others; spine row with 11-15 spines, molar process with 13-23 acute marginal spines and simple distal setae; palp 3-articulate, middle article longest, with setae on middle and distal articles (setae missing from holotype) (Fig. 39A). Maxillula's medial lobe with 3 large circumembryonic spines and a small subapical stout circumembryonic seta; lateral lobe with 11-25 stout barbed spines (Fig. 39B). Maxilla's medial lobe short, with plumose setae, simple setae, and short hairs; lateral lobe with simple and comb setae as figured (Fig. 39C). Maxillipedal endite with 5 or 6 plumose setae and one large clumping spine; palp 5-articulate, all articles with simple setae as figured (Fig. 39D). Pteron and pleon pinnules evenly convex. Coxal plates usually visible dorsally on IV-VII, but visibility varies among specimens (Fig. 39E, F). Coxal uniramous, without carpus or pinnules. Pereopod 1 with stout acute spines and simple setae as figured; basis with up to 6 thin simple setae on distal inferior margin; ischiun with up to 4 simple setae on superior distal angle; merus expanded as distal superior lobe, with up to 5 long setae and with 4-9 spines on inferior margin; carpus short, subtriangular, with 3 or 3 spines on inferior margin; propodus with 3-4 spines on inferior margin and 2 long comb setae on distal margin (often broken off), dactylus elongate, nearly as long as propodus, and with comb spine at base of margin (often broken off) (Fig. 40). Pereopod III with simple spines as figured; basis with up to 4 long simple setae on distal inferior margin; ischiun with short and long spines on inferior margin and distal row of long submarginal setae on superior margin; carpus expanded into a large scoop-shaped distal lobe on superior margin with stout spines and setae as figured; carpus with short and long spines on inferior margin as figured; dactylus subequal in length to propodus (Fig. 41). Pereopod VII with many spines and long simple setae as figured (Figs. 42-45); number and shape of spinous and shape of articles highly variable (see below); basis with 1 or 2 spines and many long thin simple setae on distal inferior margin; ischiun longer, longer than merus or carpus, usually longer than propodus (except in certain cases, see below), and with 1 or 2 spine clusters on inferior margin and numerous spines on distal margin; merus and carpus with cluster of 1-3 spines on inferior margin and numerous spines on distal margin; propodus usually with one cluster of spines on inferior margin and long spines on distal margin (often greatly elongated and modified as described below); dactylus short;
unguis typically acute (but see below). Penes small, ovate, with serrate outer margins; set close together (Fig. 47).

Pleosep with 5 free pleones, but first often partly covered by peronite VII (Figs. 35C, D). All pleopods with lobe on lateral margin of peduncle, bearing a simple spine (then broken off; 3 coupling spines and several plumose setae on medial margin of pleopods. 1–4 tamlomose setae often broken off; exopod of pleopods 3–5 with short lateral incisions; endopod of 5 with ruffid lateral margin (Figs. 46, 47). Appendages much increased in length and thick, articulated, arising about 0.25 distance up from base but not reaching tip of endopod (Figs. 46G, 47G). Uropodal endopod reaches or extends beyond posterior margin of pleotelson (Figs. 35C, D, 35X); endopod reaches or falls slightly short of posterior margin of pleotelson; endopod with 2 apical spines and a deep notch on lateral margin; exopod with 5 subchilicate apical spines; both rami (and peduncle) with PMS as figured (Fig. 48). Posterior border of pleotelson broadly rounded; dorsal depressions rounded and connected by transverse ridge (Figs. 35C, D).

Variations in leg morphology.—The exact numbers of spines and setae on the pleopods, and the shape of pleopod VII are highly variable. In some cases this variability is clearly due to damage (setae and spines being broken off) or probably to simple genetic polymorphism (e. g., the number of spines in any given spine row or spine cluster). In the case of pleopod VII, however, the variations are dramatic, as noted below. The key (stable) features of pleopod III are the row of subterminal simple spines on the superior or distal margin of the ischiium, the large apical lobe on the superior margin of the meniscus and the long spines of the inferior margin of all articles (Fig. 41).

Pereopod VII is enormously variable. This variation was briefly noted by Glynn et al. (1975), who figured the two most extreme forms of these legs but did not discuss them. In the holotype (Fig. 45A) and the majority of material we have examined (e.g., Figs. 40, 41, 42A, 43A, 45A), the inferior margins of the ischiium, merus, carpus, and propodus bear long acute spines. The dactylius is large and acute, and the propodus is about 1.5 times the length of the dactylius, with one medial spine cluster on the inferior margin. Most of the spines on the pleopod VII bear a single sensory sensillum arising from an inner neural core. We refer to individuals with these types of seventh legs as "holotype morphs." In some specimens the spines and dactylar ungus appear to be eroded, rough, and blunted; thus the spines may lose the sensory sensillum (e.g., Figs. 42C, 43C, 43H, 45B). In one premolt individual with blunt spines and blunt tines the new cuticle can be seen beneath the old outer cuticle, and the blunt-tipped ungus were apparently replaced with typical acute-tipped ungus (Fig. 45C). This suggests that the bluntness of spines and dactylus on pereopod VII of some individuals may be due to simple mechanical erosion, perhaps as a result of digging in sand. The common occurrence of individuals with both the acute-spined/acute-dactylus and blunt-spined/blunt-dactylus morphologies in single samples (see Material Examined) further suggests an environmental-behavioral rather than a genetic explanation for this variation. This hypothesis could be tested in laboratory cultures.

Another differing and dramatic variation seen in pleopod VIII is a marked alteration in the shape of the articles themselves. In the holotype, all "holotype morphs," and one blunt spine/blunt-dactylus specimens the leg articles are relatively narrow and symmetrical
Figure 40. *Eucrinida brevicaudis*, parapodium I, posterior surfaces. A (Panama, Nassau Island, "Lah Beach"), holotype morph (left). B (USNM Cat. No. 33653), fossorial morph (left). C (USNM Cat. No. 190034), holotype morph (right). D (AIB Cat. No. 2001-01) mouth of spines. E (USNM 43655), holotype (left).

(e.g., Fig. 36A). However, in some samples are individuals in which the seventh legs are greatly enlarged, the ischiurn, merus, and ischium become markedly broadened, expanded, and distally spoon-shaped, the propodium becomes enormously enlarged and elongated, reaching 10 times the length of the dactylus, and the dactylus is rhinoid and essentially vestigial. Figures 40B, 42C, D, and 45A illustrate these variations. For lack of a better term, we refer to these individuals as “fossorial morphs” (see Material Examined). Figures 43-45 show some intermediate stages in a “transition” from the “holotype” morphology of parapodium VII to a fully “fossorial” morphology. We refer to such intermediate individuals as “transitional” (see Material Examined). In transitional individuals the dactylus varies from large and acute to somewhat reduced, the propodid is elongated (2–3 times the length of the dactylus) and bears 2 medial spine clusters along the inner margin (rather than a single medial spine cluster, as in the holotype morph, or 3–5 spine clusters, as in the fossorial morph), and the merus and carpus vary from weakly expanded to slightly spoon-shaped. There are mixed morphs in many samples (see Material Examined), and some individuals even have one leg morphology on the left side and another on the right. We are unable to discern any relationship to age, size, sex, or season in these variations of the seventh parapodium, nor do any other aspects of the animals’ morphology appear to be correlated to these leg variations. Thus we suggest that the different leg morphologies may arise during the life history of a single individual, and that the variations reflect intraspecific polymorphism, rather than representing a group of closely related or sibling species. The occurrence of mixed morphs in single samples (e.g., the syntype series of *Eucrinida salinaeformis*), the lack of relationship to size or sex, the presence of what appear to be transitional individuals, and some individuals with one leg type on the right and another on the left, all suggest to us that the modifications of the seventh parapodium may develop in response to ecological factors, rather than being genetically determined or fixed throughout the life of an individual. The seventh leg of the fossorial morph is strikingly similar to the digging legs of certain burrowing angipods of the Haustoridae, such as *Ophiocoma maculata* and *P. Borealis Burdett* and Drummond (Burdett and Karaman 1991). Because *Eucrinida brevica- udis* is also a burrower, it seems reasonable to hypothesize that the modifications of the seventh leg reflect a stage in the life history of this species specialized for intense burrowing, hence our coinage of the term “fossorial morph.”
**Female**—Similar to male. Females of this species are capable of developing on cerci. II-IV adult oostegites that are very thin and tightly pressed against the sternum.

**Size**—To maximum length of 11 mm.

**Distribution**—Atlantic coast: Gulf of Mexico and Caribbean; Uruguay. Pacific coast: Gulf of California to central Chile. Lithoidal to at least 16 m, probably somewhat deeper.

**Remarks**—*Eucinclus brevituba* is a widespread amphibious species. On the Pacific coast it is the most common species of the genus living in the sand just below the water line. Our attempts to resample this species at the type locality, in the now heavily graffiti del beaches near Rio de Janeiro (December 1983),
From Copaíba Beach south to Mangaratiba, met no success. Collections in Uruguay, between Montevideo and Punta del Este, also failed to recover E. braziliensis, although a different, undescribed E. sp. was found on a sand beach at Maldonado, just south of Punta del Este.

Wagner and Starzak (1988, 1989) measured morphological variation in populations of E. braziliensis on both the Atlantic and Pacific coasts of Panama and South America. They found considerable morphological divergence along coastlines as well as between means, although this divergence was greatest between populations from opposite coasts. It is important to note that the ecological literature has consistently confused (or overlooked) the three eastern Pacific species of E. braziliensis, whose range overlap.

E. braziliensis: 90% (1987).

Type material examined.—(1) Male holotype (LACM Type No. 2013), Panama, near Panama City, polluted beach near old part of town by National Theater, 15 Dec. 1984, coll. J. Weinberg, length 4.3 mm. (2) Male paratype (LACM Type No. 3014), same locality and collection as holotype, head broken from body. (3) Paratypes (LACM Type No. 3015), Panama, near Panama City, Chiric Point Bay, fine sand beaches: 25 Sept. 1984, coll. J. Weinberg; 5 adults (lengths: 3.1–3.6 mm) and 2 stenobas (lengths 1.6, 2.3 mm).

Other material examined.—(4) Panama, near Panama City, Chiric Point; USNM 3625995, coll. J. Weinberg; 1 specimen.

Description of male—Dorsal surface ornamented with stellate chromatophores distributed in band between eyes on cephalon, in median row on peron, and in lateral rows on pleon (Fig. 35E). Eyes small, interocular distance greater than width of one eye. Antennules longer than antennae; antennular peduncle 2-articulate (absent from figures 1 and 2); article 3 small, not much larger than first flagellar article (Fig. 50A). Antennal peduncle 4-articulate, articles 1–3 subequal, article 4 longest (Fig. 50E). Mandible with 5-articulate palp (Fig. 49D). Maxillule’s lateral lobe blunt, with about 10 stout spines, medial lobe with 3 long slender circumpleural spines and 1 apical seta (Fig. 49A). Maxilla’s lateral lobes with 3 and 6 comb setae, respectively; medial lobe with 8 simple and 3 plumose setae (Fig. 49B). Maxilliped with single coupling spine (Fig. 49C). Postepicostracum with acute spines along inner margin and acute dactyl (never with blunt or truncated spines or dactyl). Postepicrur: ischiium with several stout spines (Fig. 50C). Postepicrur: ischiium without lateral spines (Fig. 50E). Coxal plates smooth, without carinae or grooves.

Figure 42. Eusimulina braziliensis, extremes of morphological variation in peropods VII. A, B (Pacific Panama, Nan Island, "Lab Beach"), anterior (A) and posterior (B) surfaces of left peropod VII from holotype morph. C, D (Pacific Costa Rica, Quepos, Playa Sausal). anterior (C, tight) and posterior (D, left) surfaces of peropod VII from isovaleric morph.
Pleomirone 1 not hidden by pleomirone VII (Fig. 35E). Pleopod 5's endopod fully divided (Fig. 35E). Pleonothion's posterior border round, without marginal spines. Uropod endopod nearly twice as long as endopod, with 6 long, thin, simple, apical spines. 2 large medial spines, and numerous very short medial spines; with plumose setae on medial margin and apex (Fig. 35F). Uropodal endopod extends barely to posterior margin of pleotelson; with 3 distomedial spines and PMS along distal inner and outer margins. Flat surfaces of both uropodal rami covered with very fine hairs. Appendix masculina of males stout and short, arising off proximal lunellar lobe of endopod, one third distance up base and not reaching apex of endopod (Fig. 35B). (For expanded description see Bresc & Weisberg 1987.)

Female.—Similar to male.
Figure 44. Eucyclops brachycephalus, morphological variation in peripod VII. A-C, 3 individuals from Pacific-Costa Rica. Quespos, Puerto Osa, USNM 505004; A, anterolateral surface (left); B, posterior surface (left); C, anterior surface (left). D-Panama, Panam by island, "Bocas del Toro", peripod VII, USNM 86335, anterolateral surface (left). E-F, AHA 2000.015.1, anterior surface (right). F, USNM 86335, anterior surface (right).
Figure 46. *Echinidea brasiliensis*, A-E (USNM 166353), pleopods (right side) from a female collected at the type locality. A, pleopod 1; B, pleopod 2; C, pleopod 3; D, pleopod 4; E, pleopod 5. F, G (USNM 150034), second pleopods of two males: F, holotype morph (right side); G, fuscoaural morph (left side).

Conspicuous, anterio-directed setae (see Remarks) arising from non-separate setal tracks on each article (Fig. 55B). Mandible with inner incisor cusps longest, outer cusps rounded; spines of spine row flabby and blunt; palp 3-articulate, middle article much longer than proximal or distal articles; middle and distal articles highly sense as figured (Fig. 55C). Maxillula’s outer lobe with about 1 large, latched spine, larger with visible row of denticles; inner lobe with 3 large, circumambient spines and 1 small seta (Fig. 55E). Maxilla’s inner lobe with proximal plumose setae and stout simple distal setae; outer lobe with simple and cymbal setae as figured (Fig. 55D). Maxillipeds endite short, with 1 or 2 coupling spines and numerous distal plumose setae; palp 5-articulate, with long simple setae on articles 2-5 (Figs. 54D, 55F).

Pronotum and pleon margin ovally convex. Carapace visible dorsally on III-VIII or IV-VII (Figs. 35A, B); coda with oblique grooves running from mid-axial point to top of posterior angle. Pereopod 1 with molariform spines on inferior margin of ischiium and merus as figured (Figs. 56A, 57D). Pereopod III with molariform spines on ischius only (Fig. 56B). Pereopod VII without molariform spines but with numerous acute spines and simple setae (Fig. 56C). Pleon large, flabby, lanceolate, set close together. Pleon with 5 free pleonites, the first largely overlapped by pleonite VII (Figs. 35A, B). All pleopods with lobe on lateral margin of peduncle. Bearing a single spine at the base (Fig. 58);
Figure 47. *Eucinetus brasiliensis* (AHF 2000-81): pleopods from a female (A–E) and a male (F–I); endopod and exopod separated, endopod on right. A, pleopod 1 (right); B, pleopod 2 (right); C, pleopod 3 (right); D, pleopod 4 (right); E, pleopod 5 (right); F, pleopod 2 (right); G, appendix masculina of pleopod 2 (right); H, coupling spine from pleopod 5, female, right; I, penis from male.
plcopods 1-4 with 3 or 4 coupling spines and plumose setae on medial margin of peduncle; plcopods 1 and 2 with PMS on both sides as figured; exopods of plcopods 4 and 5 with lateral incisions. Appendix masculina large and scythe-shaped, articulating subbasally, about 0.2 distance from base, not quite reaching tip of endopod (Fig. 58F). Pleopods lateral margins somewhat convex, posterior margin rounded, with PMS set in notches and with 2 very small serrate spinules (Figs. 55A, B, 57A). Both uropodal rami extend beyond margin of pleopod; peduncle with 1 large spine on outer margin and 1 large and 2 small spines at outer distal angle; inner margin with PMS as figured. Uropodal exopod with 3 medial, 1 apical, and 1 lateral (subapical) spines and PMS as figured. Uropodal endopod with 5 medial, 1 apical, and 1 outer (subapical) spines and PMS as figured (Fig. 56D).

Female.—Similar to male. Brooding females may have arising from exuviae, III, IV, and V well-developed oostegites that overtop in male; oostegites are very thin and lie tightly pressed against the sternum, making them difficult to see.

Size.—To maximum length of 15 mm.

Distribution.—Florida to Venezuela (Atlantic) and northern Gulf of California to Colombia (Pacific). E. marinae is a littoral and shallow-water (to 16 m) subsal species occurring in the same general area as E. bimaculata.

Remarks.—Despite its distinctive appearance, Euvirocana marina has been an enigmatic and often overlooked species. In his original description, Ives (1907) noted that the most distinctive feature of this animal is its biradial antennum. Moore (1902) and Richardson (1903, 1905) also relied on the dense antennal setae to distinguish this species from their keys to Cuvirocana. We have found this “antenal bristle” to be absent in juveniles and only weakly developed in young adults, a feature also noted in the original description. The material we examined, the smallest female with a fully developed “antenal bristle” was 3.8 mm long, the smallest male 5.7 mm. E. marinae also varies considerably in the expansion and contraction of dorsal chromatophores.

No adequate figures of E. marinae have been previously published. Richardson (1905), in copying the drawings of Ives (1891) and Moore (1902), appears to have accidentally copied figures of the pene of Consolovae canadai, labeling the drawing as Euvirocana marinae. Ives’ (1891) drawings of this species are crude; especially his depiction of spines and setae. His drawing of the pleopod shows a crenulate margin with 20–22 minute spines set in the notches and long setae arising between these spines. His description states that the pleopod is “minutely crenulate on its posterior border, with very short spines inserted in the notches.” Ives’ drawings were from a small specimen (9 mm), and the lack of detail

Figure 48. Euvirocana bimaculata (AHF 2000-41) arthropods from a male: A, left; B, right.
raises suspicion about the accuracy of his illustrations and description. In the material we have examined, from both the eastern Pacific and Caribbean, the pleotelsonic notches house long setae and the only spines are a single minute pair at the apex. The specimens identified as E. muarze by Kenedy and Schotte (1989) agree with our observations. The two apical spines on the pleotelson are so small that it is very likely Ives overlooked them (either are they figured or mentioned by Kenedy and Schotte 1989). Unless Ives' type material can be located, we cannot be positive his animals and ours are the same. However, we are reasonably confident they are, and we suspect that Ives simply misinterpreted the pleotelsonic margin. Ives also stated: "Spines and bristles upon the legs are not numerous," yet he illustrated the legs as being highly spiny — what they are.

Menzies and Glynn (1986) listed this species from Puerto Rico but overlooked Richardson's (1972a) genus Eucorvina, citing it as Circulosa muarze. However, judged by their description and figure, Menzies and Glynn clearly misidentified their specimens (their material was probably a species of Circulosa). Menzies and Glynn also claimed that E. muarze is "probably a pantropical cosmopolite" but provided no data in support of this statement. Bruck (1988b) listed it as a possible Indo-West Pacific species but gave no records. Menzies and Kucyzynski (1983) included this species in their key to Caribbean Plathelminthes (incorrectly stating that the pleotelson lacks the submedian depressions characteristic of the genus) but did not describe or figure it. Dexter (1972) listed Circulosa muarze as the most abundant organism on both Pacific and Atlantic sand beaches in Panama. However, she later claimed (Glynn et al. 1975) that her material had actually been E. mixocellus, not E. muarze.

Remarkably, Richardson (1965) appears to have been the only person to have previously reported this common species from the Pacific. She noted in passing that she had been unable to distinguish some "dried specimens from San Francisco Bay, Lower California (presumably Bahia San Francisco, Baja California)," sent by Dr. Ritter" from Caribbean specimens of E. muarze. Eucorvina muarze is one of the most abundant animals in the quiet bays of the Gulf of California, where it often occurs in vast numbers on sandy beaches. We have collected hundreds of specimens in a few minutes, simply by placing a dead fish or piece of meat at the water line, whereupon the isopods soon swarm out of the water or sand to begin consuming the bait. This is the largest Eucorvina known from the tropical eastern Pacific.

Ives (1893) based his description on several specimens taken in 1880 at "Port de Silmar," Yucatan Peninsula, by the "Expedition in charge of Professor Angela Helpert," sent by the Academy of Natural Sciences of Philadelphia to investigate the natural history of Yucatan and Mexico." Ives was a member of the expedition, but he gave no indication where the type material was deposited and we have been unable to locate it (it has not been found at the Academy of Natural Sciences of Philadelphia, the USNM, or the BMNH).

Metacorvina Kissakin, 1979

Type species — Circulosa japonica Hansen, 1890, by subsequent designation (Kissakin 1979: 212); Holotype at ZMUC.


Description: — Body 2.0–3.5 mm longer than broad; posterior pericaries and pleon sometimes with dorsal tubercles or carinae; Eyes usually well developed, moderate in size; absent in some species. Cephalon short with small to moderate central process. Frontal lamina anteriorly broad and dilated, freely projecting, often overlapping bases of antennules, often visible in dorsal aspect.
Figure 31. *Ectromelas clamousia* (LACM Type No. 9014), paratype, male: A, pleopod 1 (left); B, pleopod 2 (left); C, pleopod 3 (right); D, pleopod 4 (left); E, pleopod 5 (left); F, uropod (left).
Figure 52. Eucinostoma arenarium, scanning electron micrographs: A, antenome anastomosis, 7,000x. B, antenome anastomosis, 14,000x. C, antenome surface, 14,000x. D, three small tips on anterior peduncle, 11,325x.

posteriorly narrowed; clypeus wider than long, with ventrally projecting median triangular flange; labium about as wide (or slightly narrower) but longer than clypeus. Antennae short, never extending beyond peronite 1; peduncle 3-articulate; article 2 not articulating at right angle to article 1; peduncle-article 2 or 3 longest; flagellum reduced, basal articles longer than broad. Antennal peduncle 3-articulate; article 3 longest, proximal 2 articles may be partially fused. Mandible with broad tridentate incisor and an additional small accessory tooth on medial (inner) margin of right mandible; middle lobe of left mandible usually low or indistinct; palp 3-articulate, extending beyond incisor; spine row a well-developed rounded lobe with long stout spines. Maxilliped's medial lobe with 3 or 4 circumgranulose spines, sometimes with reduced sensitilla, also occasionally with 1 or 2 short simple spines; lateral lobe with large stout spines, often barbed. Maxilla's medial lobe sometimes reduced (but more developed than in Eucinostoma and Angelostoma) and truncate, with bilaterally lateral lobe often reduced. Maxilliped's slender; palp 5-articulate; palp article 3 much wider and longer than article 4; endite with 1 or 2 coupling spines and plumose setae.

Pereonites I usually short (subequal in length to peronite II). All pereopods ambulatory, less spinose and smaller than those of other genera of the Cimolidae. Pereopod 1–III short, distal superior angle of ischiun and merus not produced; clypeus short, often triangular. Pereopods IV–VII slender, longer than pereopods I–III, with articles not markedly flattened. Pores flattened lobes, small so moderate in size.

Pleopods with 5 free pleonites; lateral margins of pleonite 5 not overlapping or barely overlapping by pleonite 4. Pleopods 1 and 2 similar; peduncles subrectangular and broader than long, without lateral accessory lobes; appendages maculiform insertion (about one-third distance from base) on endopod of male's pleopod 2. Exopods of posterior pleopods completely or nearly divided by medial transverse incision. Pleopod 3's endopod without PMS, with or without lobe on proximomedial angle, and without plumose setae or coupling spines on peduncle. Pleonum and uropods with or without marginal spines. Plaxenion apex rounded, truncate or subtriangular, never intimated. Uropodal peduncle inner angle acutely produced.

Remarks.—Metacimolidae contains 28 species. The genus was resurrected by Bruce (1981a) to house a group of reasonably distinct Cimolidae species, including Metacimola johnsoni (Schoeds, 1966) of California waters and M. spumiferus (Hansen, 1980), a species reported from the Caribbean (Menizos and Glynn 1968) and the Indian Ocean and western Pacific (Neustenem 1969). Menitzos and Glynn (1968) and Bruce (1981a) suggested that the latter species is circumtropical, but we have not found it in the eastern Pacific.
Bruce (1986a) noted that *M. mordax* can be identified by the projecting clypeus, anteriorly dilated frontal lamina (often visible in dorsal view), pleural and mouthpart morphology, and the long second article of the uncinate peduncle. While in many species the second peduncular article is long in *M. chortoceras*, *M. calypum* sp., and *M. javanica* (and possibly others) the third peduncular article is the longest. However, none of these characters is unique to the genus. A possibly unique feature of *M. mordax* is the small accessory tooth on the medial (upper) side of the right mandibular incisor, giving the incisor a four-pronged appearance. This condition occurs in at least *M. calypum* sp., *M. chortoceras* Bruce and Iverson, 1985, *M. javanica* Bruce, 1980, *M. javanica* (Kenesley, 1978), and *M. javanica* var. (Kenesley, 1980) (see Bruce 1986a). Many published drawings of *Metastomatoidea* mandibles show this accessory tooth, but most authors have not indicated whether the figured mandible is the left or right. Bruce (1980, 1986a) apparently confused the left and right mandibles in his figures and descriptions.

Nisbet (1991) erected the name *Metastomatoidea* for C. J. J. M. Hansen, 1890, and C. J. J. M. Hansen, 1890. However, he did not designate a type species, thus rendering his name invalid (ICZN Article 12b). Kossak (1979) was the first to designate a type species, and thus stands as the valid author of the genus...

**World list of species...**

8. *M. angustata* sp. Galapagos Islands, Ecuador.
12. *M. robusta* Keesey, 1884. Curacao (Mexico), Belize, and throughout Caribbean.
Figure 54. *Melanisima calyptra* n. sp. Figs. 60C, 61, 62

Type material examined.—Male holotype (LACM 84-267.3) Ecuador. Galápagos Islands, near Wolf Island, approx. 1° 18' N, 91° 45' W, 4,500 fathoms, 0545-0610 hrs.; 13 May 1984; coll. & I. Lavenberg et al.; bottom depth not recorded by collectors but estimated (I. Lavenberg, in litt.) as approximately 2000 m.

Description of male.—Entire dorsal with striking orbital pre-mantle pattern (Fig. 60C). Cephalothorax length from rostrum to posterior margin of eye 1.3 times length of pericarion. Dorsum of cephalothorax bordered by row of plates. Margins of pericarion narrowly subangular and not serrate; preoral 1's maxillae with square, oval, or ovoid, recurved spines on inner margin; oral appendages extend to pericarion apex. 8th maxillae more posteriorly.

*Melanisima calyptra* n. sp. 8th maxillae more posteriorly.

**h.** a. **c.** l. **d.**
Figure 55. *Eurythena nomyra*. A, B (Mexico, Sonora, Puerto Peralta), adult. A, antenna (left). B, antenna (left). C-F (Mexico, Baja California Sur. Concepción Bay), juvenile: C, mandible (right). D, maxilla (right). E, maxillule (right). F, maxilliped (right). All drawings from juvenile specimens.
Mandibular spine row with 19 long thin spines; medial process with about 20 small marginal spines; terminal article of palp with simple seta and 1 comb seta; middle article longest, with simple and comb setae (Fig. 5/D). Maxillule's lateral lobe with 12 stout spine-largest spines armed with barbs; medial lobe with 1 small apical seta in addition to the 2-5 plumose spines (Fig. 6/E). Maxilla's lateral lobes with 3 and 5 plumose setae, respectively; medial lobe with 1 simple and 7 plumose setae (Fig. 6/F). Maxillipodal palp articles 4 and 5 are margined with plumose setae; other articles with simple setae; left and right exites small, each with 1 coupling spine and 4 plumose setae (Fig. 6/G).

Perconetes unequal in length, perconites I longest, perconites widest at perconites IV and V, dorsal of dorsal tubercles or carinae. Coxae usually visible dorsally, extending beyond posterior margin of their respective segments; coxa VII extends almost to posterior margin of pleonite 2 (Fig. 50C). Pleopod I short, stout; posterior distal angles of ischium and merus each with 1 long setae, inferior margins of merus, carpus, and propodus with acute spines as figured; inferior margin of propodus also with 1 serrate spine; carpus short; dactylius without small spine at base of ungues (Fig. 62A). Pleopod IV longer than pleopod I, ambulatory, with simple and serrate spines and setae as figured; dactylius without small spine(s) at base of ungues (Fig. 62B). Pleopod VII quiescent long, ambulatory, with simple and serrate spines and setae as figured (Fig. 62C). Process large, about 6 times longer than wide, extended roughly 0.66 length of sternite.

Pleon broadest at pleonite 2, devoid of dorsal tubercles or carinae. Pleonite VII's coxal overlap lateral margins of pleonite 1, pleonites 2-4 expanded laterally (Fig. 50C). Pleopod ramus with PMS as figured (Figs. 62-F-I). Pleopod 1: peduncle's medial margin with 4 coupling spines, lateral margin with 2 simple spines.
endopod width 0.68 times, length of exopod (Fig. 62F). Pleopod 2: peduncle’s medial margin with 2 coupling spines, 2 plumose setae, and many short simple setae; lateral margin with 1 simple spine; endopod width 0.85 times width of exopod; appendix masculina width 0.6 basal, tapering to serrate medial margin near pointed apex, medial margin with many small setae, length 0.9 times endopod length (Fig. 62G). Pleopod 3: peduncle’s medial margin with 3 coupling spines and 1 plumose seta, lateral margin with 1 simple spine; endopod width 0.72 times exopod width, exopod with short marginal incisions (Fig. 62H). Pleopod 4: peduncle’s medial margin with 3 coupling spines and 1 plumose seta, lateral margin with 1 simple spine and many short setae; endopod width 0.73 times width of exopod, exopod with complete medial incision (Fig. 62I). Pleopod 5: peduncle smaller than peduncles of pleopods 1-4, with 1 simple spine and many short setae on lateral margin; endopod width 0.8 times exopod width exopod with complete medial incision (Fig. 62J).

Pterotheca with straight lateral margins, apex widely rounded with sharply conical (row-topped) margin, without apical spines. But with PMS; ocarina without longitudinal cuticle (Fig. 60C). Uropod shorter than pereion, with small terminal notch on each arm, 5-7 simple setae arising from each notch. Uropodal exopod 0.70 times as wide as endopod, shorter than endopod, medial margin with 1 short spine and many PMS, lateral margin with 3 short spines and setae. Unipodal endopod’s medial margin with 2 short spines and many PMS, lateral margin with 1 short spine and many PMS. Unipodal peduncle with short apical spine, medial margin with PMS (Fig. 60D).

Female.—Not known.

Size.—Small, holotype 5.2 mm long.

Distribution.—As far known from only the type locality, near Wolf Island, the Galapagos Islands, Ecuador.

Remarks.—This species is immediately distinguished from the only other known eastern Pacific Megalaimina (M. cyanothorax) by features noted in the key. It is known from only a single specimen collected in a seaweed (surface) plankton tow near Wolf Island in the Galapagos Islands. However, the distinct morphology of the specimen warrants formal species recognition.

Etymology.—This species is named after Calypso, daughter of Oceanus in Greek mythology. Just as this beautiful island isopod charmed its describers, the charms of the island nymph Calypso were so powerful that they detained Odysseus seven years on his journey home from Troy.
Type material examined.—Holotype (LACM 80-60.1, AHF Type No. 8011) and 15 paratypes (LACM 80-60.2: Costa Rica, Guanacaste Province, Parque Nacional Santa Rosa, rocky littoral approximately 1 km from mouth of mangrove estuary, ca. 10° 49' N, 86° 57' W, formalin washes of rocks and turf algae, water temperature 26°C, large surf, 26 Apr. 1980; coll. R. C. Bruce, A. M. Mackey, M. Murillo, A. Dostie. 

Mesorhinae castoricensis Bruce and Iverson, 1985
Figs. 60A, B, 63, 64
Mesorhinae castoricensis Bruce and Iverson 1985: 36, Fig. 11D.
Bruce 1988b: 222.

Figure 58. *Mesorhinae castoricensis*, A–E (Mexico, Sinaloa, Puerto Peñasco): pleopods of adult female: A, pleopod 1 (left); B, pleopod 2 (left); C, pleopod 3 (left); D, pleopod 4 (left); E, pleopod 5 (left). F (Mexico, Gulf of California, Cerralvo Island), adult male, pleopod 2 (left).

Description of male.—Cephalon devoid of tubercles and carinae; length from posterior margin to corium subequal to length of perisome 1; rostrum moderate in size; lateral margins bearing subacute angles (Fig. 6(A)). Antennule short, reaching posterior margin of cephalon. Flagellum of 3 articles, distal flagellar articles compressed and short (Fig. 6(A)). Antenna reaching perisome 1; pedunculate articles 1 and 2 partially fused; flagellum of 8-12 articles (Fig. 6(B)). Fronto lateral carinae posteriorly expanded and rounded internally; anterior clypeus overlaps lateral articles of antennal flagellum (Fig. 6(C)). Both mandibular incisors dentate; right incisor with accessory tooth; left incisor indistinctly tridentate, somewhat bifid-like and without accessory tooth; stone row with 14 long thin spines; pala 3-articulate, terminal article with comb setae; middle article longest and with simple and comb seta (Fig. 6(D)). Maxillule with 1 small setal spine; in addition to 3 circumscrope spines; lateral lobes with 10 stout spines, spines very strongly curved (Fig. 6(E)). Maxilla with 2 lobes with 6 plumose, 1 large ctenophorset in, and 2 small setae lateral lobes with 3 comb and 4 plumose setae, respectively (Fig. 6(F)). Maxillipedal palp articles subrectangular, margins with many long simple and comb setae; endite small, with 2 plumose setae and 1 simple seta, with 1 or 2 coupling spines (usually 2) on both left and right exopods; small epipods present in both sexes (Fig. 6(G)).

Peronid devoid of peronites V and VI, devoid of dorsal telsonites or carinae. Peronites VII with short rounded process on postlingual margin. Coxae III+IV+V carinate; visible in dorsal view and extending beyond posterior margins of their respective peronites; coxa VII large, extending to posterior margin of peronite 5 (Fig. 6(H)). Peronite 1 short and stout; distal margin of articles not produced; anterior margin of margin with 3 very short blunt spines; 2 simple setae, and 1 small serrate spine; carpus very short, inferior margin with 1 serrate spine, 1 serrate spine, and 3 spine-like spines of articles not produced; inferior margin of margin with 3 very short blunt spines; 2 simple setae, and 1 small serrate spine; carpus very short, inferior margin with 1 serrate spine, 1 serrate spine, and 3 spine-like spines of articles not produced; dactylus with 1 small simple spine at base of urogomphi (Fig. 6(A)). Peduncle 4 short, stout, ambulatory; with simple spines and setae as figured (Fig. 6(B)). Peronite VII ambulatory with simple and serrate spines and setae as figured (Fig. 6(C)). Peronite VII about 3 times longer than wide.

Pleonistostom at plorites 3 and 4. Pleonite 1 overlapped laterally by peronite VII, visibly ambulatory. Pleonite 5 with large medial marginal (Fig. 6(A)). Pleonites 2-4 with laminae undulated along internal margin with 1 seta; each lamella overlaps width 0.6 times width of exopod (Fig. 6(B)). Pleonite 2: pedunculate medial margin with 4 coupling spines and 2 plumose setae, lateral margin with 4 coupling spines and 2 plumose setae, width 0.7 times width of exopod; appendix masculinum widest basally, tapering medially and widening again near apex, length 0.8 times length of body (Fig. 6(C)). Pleonite 3: pedunculate medial margin with 4 coupling spines and 2 plumose setae; endite width 0.74 times width of exopod (Fig. 6(D)). Pleonite 4: pedunculate medial margin with 4 coupling spines and 2 plumose setae, lateral margin with 1 simple spine, and 1 short seta; endite width 0.72 times width of exopod (Fig. 6(E)). Pleonite 5: pedunculate lateral margin with 1 simple spine, endite width 0.82 times width of exopod (Fig. 6(F)). Pleonites exopods 3-5 with setae as nearly complete median transverse incision.

Pleopod subtriangular, lateral margins slightly concave near truncate apex; dorsum with medium longitudinal carina, flattened...
submedian 3'tigrumini carinate, carinate usually with tubercles; pleotelson apex with 2 marginal spines and several simple setae (Fig. 66A). Uropods with small apical notch on each ramus, 6 or 7 PMS arising from each notch. Uropod endopod exopod does not extend to pleotelson apex, 0.66 width of endopod, medial margin with 2 large spines, outerplied than PMS, lateral margin with 2 small spines, simple setae, and PMS. Uropod endopod extends to pleotelson apex, medial margin with 3 spines interposed with PMS and some simple setae; lateral margin with 1 spine and PMS (Fig. 64E).

**Female**—Similar to male, except dorsal tuberculation on the pleon and pleotelson is reduced or absent, the pleon's lateral margins are straighter and not as concave as in males, coxal plates TL-XII are less visible in dorsal view, and phronia 1 is not necessarily hidden by pteronomic VII (Fig. 60B).

**Size**—Small, to maximum length of 4.0 mm.

**Distribution**—This far recorded from Pacific Coast Wica, Patarna, and the Galapagos Islands. Material examined is with the exception of the two Anton Brunn but, all terminal. The Anton Brunn Galapagos records suggest that the specimens were taken in deep water, but the station numbers on IsOBIS do not occur in the station lists of Chiu et al. (1972).

**Remarks**—An intertidal and shallow subtidal species, found in rocky littoral areas with turf-algae and in dark sandy/hacky habitats. Brusca and Iverson (1985) did not adequately figure this species, so we illustrate it completely here.

*Natatorianthus Brusca, 1981*


**Synonymy**—Emerged and subsequent to Brusca (1985a:52).


**Description**—Body length approximately 2.5-5.0 times width, dorsoventral, without ornamentation. Eyes usually well developed, but absent or with reduced ommatidia in some species. Ros- tral process minute or absent. Frontal lamina elongate, narrow, flat, not projecting, length 3-4 times width, clypeus broad, wider than long, flat (prosclerite), labrum narrower than clypeus. Antennular ped- unde and flagellum short, flagellum does not extend beyond anterior region of peronite 1, second article not articulated at right angle to first article (as in *Korotovich*), peduncular article 3 longest, flagellate articles compressed, basal articles often fused. Antennae much longer than antennules; peduncular articles 1-2 short, 3-4 subequal. 5 longest. Mandible with broad terminal incisor, medial convex; often reduced on left mandible; spine row well developed as a rounded lobe with stout spines. Maxillule's medial lobe with 3 or 4 stout circumambient spines and often a few small simple spines; lateral lobe with 9-12 small apical spines, often with minute subapical lateral spines or barbs. Maxilla with medial lobe short and broad; Maxillipodal palp 5-articulate; endite short, with 1-3 cou- pling spines. Peronite 1 longest. Posterior angles of coron II-VII become more acute posteriorly. Periopodal dactyli often with small spine at base of spine; superior margins of ischium and merus of periopods I-III strongly produced; periopods IV-VII longer than periopods.
l-III and with abundant long setae; pereopods VI-VII with ischi-ium-propodus flattened and provided with long setae; pereopod VII with dense medial row of long setae along flat anterior surface. Penes indistinct or represented by small flattened lobes. 

Beneath of 5 free pleomeres: pleomere 1 often partially concealed by pleomere VI; pleomere 5 completely encompassed by lateral margins of pleopod 4. Pleopod 1’s exopod almost twice as wide as endopod; uropodal peduncle broader than long, lateral margins without lobes or with weak lobes; ram slightly; all pleopodal rami with PMS, except endopod of pleopod 3, which has reduced or no PMS; appendix masculina inserted basally or subbasally on endopod of male’s pleopod 2. Pleopod 5 peduncle’s medial margin without coupling spines or plumose setae; endopod with proximomedial lobe. Pleuron usually with abundant marginal setae and spines. Uropodal peduncle’s inner angle produced and subacute; rami with PMS and usually spines; endopod usually without notch on distal medial angle, except in Natatorina nanaeformis.

Remarks—Bruce (1983a) split Cirulina into seven different genera, erecting three new genera, including Natatorina. He did not describe of figure Cirulina horsipes Milne Edwards, 1840, the type species. Characters diagnostic of Natatorina include the globose appearance and absence of sculpturing of the dorsum, short antennules, flattened articles on the posterior pereopods, and the medial row of long setae on the flat anterior surface of pereopod VII. Similar appearing genera are Dolicholaimus and Pohlocelis. Dolicholaimus has similar pereopods but differs in the form of the frontal lamina, which has the ventral surface excavated and the posterior margin produced into a ventrally projecting lobe. The ventral surface of the frontal lamina is flat in Natatorina, and in the lack of PMS on pleopodal endopods (only the endopod of pleopod 5 is naked in Natatorina). Pohlocelis differs from Natatorina in the following ways: the bases of the posterior pereopods are less expanded; the appendix masculina arise subbasally, rather than basally as in Natatorina (although in some species of Natatorina the appendix masculina arises slightly above the basal position)—see N.
Figure 12. *Metanovilana calypso* n. sp. (LACM 84-2871-1, GAL 84-III), holotype, male: A, pereopod I (right); B, pereopod IV (right); C, pereopod VII (right); D, pleotelson; E, dorsal view of uropod (right); F, pleopod 1 (right); G, pleopod 2 (right); H, pleopod 3 (right); I, pleopod 4 (right); J, pleopod 5 (right).
Figure 63. *Natatorinae costaricensis* (LACM 40-64-1), holotype, male: A, antenna (left); B, antenna (left); C, frontal lamina, clypeus, and labrum; D, mandible (right); E, maxilla (right); F, maxilla (right); G, maxilliped (right).

**N. barnesi** Bruce, 1986; pleopod 1's peduncle is subquadrate (it is wider than long in *Natatorinae*; and the unipodal endopod has a distal notch (absent in *Natatorinae*, except in *N. caperata*). *Natatorinae*, *Pelobatinae*, and *Dolichoptera* are part of Bruce's (1986a) "*Costarica* genus-group," along with *Costarica*, *Orphelona*, and *Costaricus*. Wietze et al. (1987) discussed this group, provided a key to the genera, and removed *Orphelona* from it.

*Natatorinae*, with 58 described species, is the second largest genus in the family, and it has the widest distribution of any *Natatorinae* genus, with more species known from temperate and cold waters than in any other genus. *Natatorinae* is primarily a shelf and slope taxon, ranging from the shallow subtidal to about 2000 m, although occasional specimens have been collected intertidally. Bruce (1986a) divided the genus into four "species groups," the *N. pellicula* group, the *N. valida* group, the *N. aethiopica* group, and the *N. woodfordi* group. The groups are distinguished from one another by the basis of pleotelson 4, the posterior lateral margin of pleotelson 4, the pleotelson dorsum, and the posterior margin of the pleotelson.

In all the species we have examined, it appears that the median lobe of the maxillule to species with the 3-spine configuration also possesses a moderately to well-developed protopodite on the lateral margin, whereas species with the 4-spine configuration lack this protopodite.

There are four *Natatorinae* species in the eastern Pacific: *N. chilensis* (Menzies, 1962a), *N. nasalis* (Menzies and George, 1972), *N. californiensis* (Schultz, 1966), and *N. auriculus* n. sp. Only the last two are tropical.

World distribution of species.
Figure 64. *Myxine quinquecirrha* (LACM 80-461), holotype, male: A, pereopod I (left); B, pereopod IV (left); C, pereopod VIII (left); D, pereon; E, ventral view of uropod (right); F, pereopod I; G, pereopod 2; H, pereopod 3; I, pereopod 4; J, pereopod 5.
Figure 86. *Anarcolatia californiensis* (AHE 6048). holotype, male. A, antennae (left), only proximal region of antennae shown. B, antenna (left). C, frontal lumen, clypeus, and labium. D, mandible (left). E, maxilla (left). F, maxilla (left). G, maxilliped (left).

8. N. caeca (Dohleus, 1903). Europe.
10. N. confluens n. sp. Pacific Mexico to Panama.
12. N. squala (Hale, 1925). South Australia.
18. N. galeata (Hansen, 1880). West Indies to Brazil.

22. N. japonensis (Richardsen, 1904). Japan.
27. N. latus Bruce. 1986. Western Australia.
28. N. latirostris (Harrisons and Bruce, 1981). Queensland, Australia.
29. N. latirostris (Harrisons and Bruce, 1981). Queensland, Australia.
30. N. latirostris (Harrisons and Bruce, 1981). Queensland, Australia.
31. N. latirostris (Harrisons and Bruce, 1981). Queensland, Australia.
32. N. latirostris (Harrisons and Bruce, 1981). Queensland, Australia.
33. N. meridionalis (Hodgson, 1910). Antarctic. [Bruce (1986a) synonymized *N. aliformis* (Vasilenko, 1914) with *N. meridionalis*. Brandt (1988) apparently was unaware of this synonymy].
Figure 67. *Nauphoeta californiensis* (AHP 6668), holotype, male: A, pereopod 1 (left); B, pereopod 4 (left); C, pereopod 7 (left); D, pene. E, dorsal view of carapace (left). F, pleopod 1 (left); G, pleopod 2 (left); H, pleopod 3 (left); I, pleopod 4 (left); J, pleopod 5 (left).
Figure 60. **Katharina carnosana** sp. nov. (AHP 959-1), scanning electronic micrographs. A. Anterior lamina, clypeus, and labrum, 40x. B. Posterior lamina, 80x. C. PERIOD T, antennae, 40x. D. PERIOD T, mouth and carpus, 80x.
— With eyes sometimes unpigmented but always with distinct circumlental pigmentation with 10-13 apical spines; mandibular palp with simple and combset; appendix masculina sublateral, N. carinata n. sp.

Notonata californiaensis (Schultz, 1967)

Figs. 65A, 66-67

Description of male.—Ceophalum width 1.8 times length. Eyes absent (Fig. 65A). Antennae extend barely to posterior region of cephalum; flagellum of 8-12 articles, basal articles fused, each article with 1-5 signoid unisegmental aesthetasc (only the most basal portion of aesthetasc figured) (Fig. 66A). Antenna reaching middle of perirenetal lobe (Fig. 9), flagellum of 10-22 articles (Fig. 66B). Fronto lobe not expanded anteriorly, narrowing and medially (Fig. 66C). Mandibular spine row with about 11-12 spines; 2 lateral (superior) pairs of incisor weakly developed; middle and distal articles of palp with simple setae only (Fig. 66D). Maxillary 3rd mandible with lobe protruding, deep notches, and 3 strong tormi tapering circumlobed spines; lateral lobe with about 12 large spines, the largest with barbs, followed by 9 small subapical marginal spines (Fig. 66E). Maxillary lobe with 9 plumose setae and 2 simple setae and 15 simple setae, respective (Fig. 66F). Left maxilliped endite with 2 or 3 coupling spines, right maxilliped endit with 1 or 2 coupling spines and 2 apical and 2 subapical plumose setae; palp articles with simple marginal setae, most distal article also with comb setae as figured (Fig. 67A).

Pereion widest at perirenetes IV and V. Coxae IV-VII produced beyond posterior margins of their segments; most posterior clypeus visible in dorsal aspect (Fig. 65A). Pereion 1: inferior margin of incision with long but sparse spines; inferior margins of mersus, carpus, and propodis with stalked spines as figured; superior lobe of incisural processsopite depression into which mesus collapses; carpus short (Fig. 67A). Pereion IV not much longer pediger 1, distal superior margins of incisural and mesus not produced; articles with setae and stout simple spines as figured (Fig. 67B). Pereiopod VII not much longer than pereiopod IV: basis and incisural with long plumose setae as figured; basis 2.5 times longer than wide; incisural, mersus, carpus, and propodis with spines and simple setae as figured (Fig. 67C). Pereiopod VIII with small pereiopod (Fig. 67D). Pseudopods with RNS as figured (Figs. 67E-F). P: pedicel's medio-dorsal margin with 5 coupling spines and 3 plumose setae; lateral margin with 1 small spine; endopod 0.78 times width of exopod; appendicu masculina sublateral, narrowing from base to apex, length 1.15 times exopod length (Fig. 67G). P3: pedicel's medio-dorsal margin with 4 coupling spines and 4 plumose setae; lateral margin with 1 spine; endopod 0.99 times as wide as exopod, with short incision on lateral margin; exopod with short incision on medial margin (Fig. 67H). P4: pedicel's medio-dorsal margin with 4 coupling spines and 3 plumose setae, lateral margin with 1 spine; endopod 0.95 times as wide as exopod, with short incision on lateral margin; exopod with short incisions on medial and lateral margins (Fig. 67I). P5: pedicel's medio-dorsal margin with 4 coupling spines and 3 plumose setae, lateral margin with 1 spine; endopod 0.95 times as wide as exopod, with short incision on lateral margin; exopod with short incisions on medial and lateral margins (Fig. 67J). P6: pedicel's medio-dorsal margin with 4 coupling spines and 3 plumose setae, lateral margin with 1 spine; endopod 0.95 times as wide as exopod, with short incision on lateral margin; exopod with short incisions on medial and lateral margins (Fig. 67K).

Coxopa subtringular, lateral appendages slightly convex (not straight), distal quarter of pleonopod with marginal serrations and 6-10 spines interspersed with long PNS; dorum with shallow paired submedian depressions near base (Fig. 65A). Uropods extend barely beyond base of pleonopods, narrowly apically; rami without apical setae, margins slightly serrated, fringed with long PNS and short setae. Uropodal exopod 0.5 width of endopod, marginal margin of exopod with 2-4 stout spines, lateral margin with 5-6 spines. Uropodal endopod with 4-6 spines on postsetal margin, 3-4 spines on lateral margin. Uropodal peduncle's inter angle with distal PNS; distolateral angle with 3 long spines (Fig. 67L).

Female.—Similar to male. But bearing no oostegites have variously developed maxillipedal epipods.

Size.—To maximum length of 1.14 mm.

Distribution.—Notonata californiaensis is primarily a southern California animal; we have examined a single specimen from the Gulf of California. Collection depth ranges from 972 to 1250 m.

Remarks.—The holotype is a male, not a female as reported by Schultz (1967). Our description is based on the holotype and other California material. The single specimen from the Gulf of California differs from the California specimens in one regard only: the clypeus is notched anteriorly, below the posterior tip of the frontal lumen. Depth data for several of the Velero IV collection stations could not be found.

Notonata carinata n. sp.

Figs. 65B, 66-70

Type material examined.—(1) Male holotype (USNM 252731) and 5 male and female paratypes (USNM 252732); Mexico, Sonora (Gulf of California). Isla Cedros, on sandy mud, 73-101 m; Site No. 563-36, USNM Acc. No. 137722, 10 Mar. 1936.

Additional paratypes, Pacific Flya California specimens: (2) Cedros Island, 79°45'N, 34° 20'W, 29 m, 29 Nov, 1934, R. V. Sei. 1265-61, LACM, 28 Feb. 1941; 5 specimens. (3) Owsley Channel, San Eugenio Point, 27° 49' 32" N, 115° 05' 01", 1001 m, 29 Nov, 1934, R.V. Sei. 1265-41, LACM, 28 Feb. 1941; 5 specimens. (4) Dewey Channel, San Eugenio Point, 27° 49' 32" N, 115° 05' 01", 1001 m, 29 Nov, 1934, R.V. Sei. 1265-60, LACM, 27 Feb. 1941; 5 males. (5) Thande Head, 27° 32' N, 114° 50' W, 70 m, 29 Nov, 1934, R.V. Sei. IV Sta. 1384-67, LACM, 7 Dec. 1937; 1 male and 1 female.
Figure 70. *Natantiana carinata* n. sp. (USNM 252731), holotype, male: A, pereopod 1 (right); B, pereopod IV (right); C, pereopod VIII (right); D, uropod (right); E, pleopod 1 (right); F, pleopod 2 (right); G, pleopod 3 (right); H, pleopod 4 (right); I, pleopod 5 (right).

Central Eastern Pacific specimens: (17) Costa Rica, Port Parker; 10° 57' N, 85° 49' W, sandy mud, 9–18 m; RV Velero III Sta. 936-39, LACM; 25 Mar. 1939; 2 specimens. (18) Panama, Secas Islands, mud and shells, 46 m; USNM Acc. No. 128938; 26 Feb. 1934; 1 male, damaged, probably drifted and rehydrated.

Description of male.—Carapace width 1.9 times length. Eyes elongated, well-developed (Fig. 65B), unpigmented or golden (in ethanol), visible in ventral aspect. Antennular peduncle articles with simple and paleate setae; flagellum of 10 or 11 articles, each article with 1–3 long unjointed aesthetascs (only most basal portions of aesthetascs figured) (Fig. 66A). Antenna receiving perontes III; perontes IV attached to flagellum, 5 to 24 articles, with simple and paleate setae as figured (Fig. 66B). Frontal lamina with anterior margin expanded and rounded (Fig. 66C, 69A, B). Mandibular spine row with 13 stout spines; inner and middle cusps of incisor acute, outer cusp rounded, all 3 cusps with elevated ridges; middle and distal pulpal articles with simple and comb setae, apical seta of distal article very long as figured (Fig. 66D). Maxillule’s medial lobe with lateral protuberance, 3 stout cirriform spines, and 3 small simple spines; lateral lobe with about 12 large spines, largest spines with barbs (Fig. 66E). Maxilla’s medial lobe with about 11 plumose and 8 simple setae; lateral lobes with 15 and 5 simple setae, respectively (Fig. 66F). Left and right maxillipeds endentulous short, each with 2 coupling spines and plumose setae; pulpal articles with simple setae, most distal article also with comb setae (Fig. 66G).

Pereonid widest at perontes IV and V. COxa IV–VII visible in dorsal aspect; produced well beyond the posterior margin of their respective perontes; coxa VII produced almost to posterior margin of pleonite 2 (Fig. 65B). Pseudopod 1: men’s, carpus, and propodus with stout spines as figured; lobe of ischiu and men’s with very large distal spines; lobe of ischiu forms distal spoon-like depression, in which men’s colligae; carpus very short (Fig. 69C, D, 70A). Pseudopod IV with distal margins of ischiu and men’s not produced as on pseudopod 1; interior margins of articles with very long simple setae and spines as figured (Fig. 70B). Pseudopod VII long, very slender; basis 1.6 times longer than wide; ischiu with simple and plumose setae, simple spines, and about 6 serrate spines; men’s and carpus with simple setae and simple and serrate spines (Fig. 70C). Pseudopod VII without plumose.

Pseudopod ramus with PMS as figured; all pereopodal peduncles with 1 lateral spine and cluster of sublateral simple setae (Figs. 70D–E). Pseudopod 1: peduncle’s medial margin with 5 coupling spines and 4 plumose setae; spine near lateral margin; endopod width 0.46 times width of exopod (Fig. 70E). Pseudopod 2: peduncle’s...
medial margin with 4 coupling spines and 5 plumose setae; endopod width 0.98 times width of exopod; appendix masculina simple; length 0.97 times endopod length (Fig. 74F). Pleopod 3: peduncle's medial margin with 4 coupling spines and 7 plumose setae; endopod subequal to exopod in width, with short incisura on lateral margin, exopod with short incisura on medial margin (Fig. 70G). Pleopod 4: peduncle's medial margin with 5 coupling spines and 7 plumose setae; endopod subequal to exopod in width, with short incisura on medial and lateral margins; exopod with short incisura on medial margin (Fig. 70B). Pleopod 5: peduncle somewhat irregularly
Figure 73. *Oncillopheus arribachamani* n. sp. (LACM 39-55-17, A. H. Case No. 896-64): A, pedipalp I (left); B, pedipalp IV (left); C, pedipalp VII (left); D, dorsal view of peronite III; E, ventral view of pores on meron VII, and pedipalp I; *Oncillopheus zeidlingi* (holotype): F, frontal lamina, clypeus, and labrum; G, dorsal view of peronite III.
Figure 74. *Oncolochirus perlhahimii* n. sp. A, uropod (det.) from paratype, female (USNM 252738). B–F, pleopods (left) from holotype, male (USNM 39-51, 17, AHB Cat. No. 896-06). B, pleopod 1; C, pleopod 2; D, pleopod 3; E, pleopod 4; F, pleopod 5.
shaped, lateral margin produced into elongate lobe; endopod subequal to exopod in width; proximolateral angle of exopod slightly produced, rounded, lobelike (Fig. 70B).

Pleopod subtrigonal, lateral margins slightly convex (not straight); distal quarter of pleopod with marginal serrations, PMS, and 10–14-stripe spines; dorsum composed of tubercles or carinae, but with a pair of shallow submedian depressions near base. Uropods extend beyond apex of pleonex, margins slightly serrate, fringed with long PMS and stouter spines, narrowly apically, without special notches on rami (Fig. 65B). Uropodal exopod 0.58 times width of endopod; medial margin of exopod with about 3 spines, lateral margin with 7–9 spines. Uropods endopodal with 4–7 spines on medial margin, spines on lateral margin, and a single apical spine. Uropodal peduncle inner angle with PMS; dorsal surface of lateral (lower) angle with 3 stout spines and PMS as figured (Fig. 70D).

Female. — Similar to male.

Ultrastuctural Features. — When viewed with an SEM, most of the body and appendages show a scalelike cuticular structure. The dorsal regions of the antennules, antennae, and body have minute cuticular sensilla (Figs. 69A, B).

Size. — To maximum length of 16.8 mm.

Distribution. — Known from northwestern Baa California (Paci fific), the Gulf of California, Costa Rica, and Panama, at depths ranging from 9 to 168 m. Although the depth range of this species is remarkably broad, we have not observed any differences between shallow- and deep-water specimens. This species is generally found in waters shallower than in N. Californiensis. Of 18 specimen lots with depth data, 10 were from depths of 90–165 m, and only 2 were from depths of 247 to 1168 m; most were from depths of 25 to 170 m. Recorded subtrates include sand, mud, and shell fragments; 1 specimen was found “with oysters.” Nautolatana ocellata appears to be fairly common in soft-bottom subtidal habitats, particularly in the Gulf of California.

Remarks. — This species is very similar to Nautolatana Californiensis. The main characters separating the two are the presence of N. California n., the number of apical pleopod spines (10–14 in N. Californiensis, 6–10 in N. Californiensis), and unspotted, Sternal. Several minor, barely postmoult specimens of Nautolatana Californiensis have definite pigmented eyes and 12 pleopod spines, indicating that these are age- or size-related variable species differences.

Etymology. — This common Gulf of California species is named for the senior author’s daughter, Carlene, in appreciation of the many collecting trips she participated in the Sea of Cortez, many months before she was old enough to know what an isopod was.

Oncinolicea Paul and Menzies, 1971

Type species. — Oncinolicea stebbingi Paul and Menzies, 1971, by original designation. Type species at USNM.


Description. — Body elongate, 4.0–5.0 times longer than broad; dorsonum of pereon with pits or cupolated depressions. Eyes moderate in size. Cephalon lacking rostrum, moderately im

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medial lobes with 3 costulosepulmose spines and 3 simple setae; lateral lobes with 6 marginal setae, some armed with trivial apical barbs (Fig. 27E). Maxilla with about 9 simple apical setae and numerous fine lateral setae (Fig. 27F). Maxillipeds pilus articles 2 and 3 with plumose setae on lateral margins; all articles with simple setae; leaf end with 1 coupling spine, right ending with 2 coupling spines, each with 5 plumose setae (Fig. 27G).

Body very straight-sided; peronite 1 long, IV-VI subequal, longer than II and III; all peronites subequally in width (Fig. 71). Coxae well developed but not projecting posteriorly beyond their respective peronites; not visible to dorsal view. Peronites heavily calcified, dorson with numerous ridges and aciculated pits (Figs. 71, 73D). Peronite 1 stout, with simple and plumose setae and spines as figured; inferior margin of notum with 6 distal blunt molastiariform spines (Fig. 73A). Peronite IV with carpus and propodus slender, slightly longer than exopod, all articles with many plumose and simple setae and spines (Figs. 73B). Penes small, set close together in middle of sternum V (Fig. 73G).

Placoids wider and longer at pleonite 4. Pleon with varying me- donal carina, terminating at gonostegal bases. All pleonites (except rectoappendix I) fused medially (Fig. 71). Pleonopod ramuli with PMS as figured (Figs. 74A-4). Exopod of pleonopod I highly calcified, longer than endopod, 3.2 times wider than endopod, fringed with short, close-set PMS; endopods slender, 5 times longer than wide, fringed with short PMS; pleonopod subequal; with 4 coupling spines on medial margin and 2 plumose setae on lateral margin (Fig. 74B). Pleonopod 2: pleonopod's apical mar- gin with 4 coupling spines and 6 plumose setae; exopod slightly longer and wider than endopod; appendix masculina with wide sinuate apex; length 1.5 times endopod length (Fig. 74C). Pleonopod 3: peduncle with 2 coupling spines and 3 plumose setae on medial margin; exopod slightly wider than exopod, subequal in length, exopod with incomplete transverse incision (Fig. 74D). Pleonopod 4: peduncle with 1 or 2 coupling spines and 2 plumose setae on medial margin and 1 plumose seta on lateral margin; exopod wider than endopod but subequal in length, exopod with incomplete transverse incision (Fig. 74E). Pleonopod 5: peduncle with 1 coupling spine, with 1 plumose setae on lateral margin; exopod subequal in length and width to endopod, with incomplete transverse incision; acute protruberance on endopod's subapical margin (Fig. 74F).

Lengths of the different abdominal segments as follows: Aeta more narrowly truncate. Uropodal peduncles broadly expanded, about twice as wide as endopod, apex of distal-medial angle broadly rounded (Fig. 74A). Exopod half as wide as endopod, both endopod and exopod extend beyond pereonites more or less.


Note added in proof. The following new generic names in the family Circlingae were published while this paper was in press: Autolirano Bruce, 1993; Dedocolx, Carpentier, 1994; Polyplax, Bruce, 1993; Seychellio, Kenley and Sotche, 1996; Zutalia, Botstein and Viloria, 1993.