The Nannoniscidae (Isopoda, Asellota): *Hebefustis* n. gen. and *Nannoniscoides* Hansen

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ABSTRACT.—The morphologically diverse asellote isopod family Nannoniscidae Hansen 1916 is redefined and contrasted with the other major families of the superfamily Janiroidea. The bulbous fifth article of antenna I and the medial fusion of pereonites 6 and 7 are generally useful in distinguishing a nannoniscid. Where these features are absent, other characters must be employed: the single major dactylar claw on pereopods II-VII, the flat triangular molar process of the mandible, uropodal shape, and the presence of major setae on the tergites of pereonites 2-4.

The desmosomatid genus *Thaumastoma* Hessler is referred to the Nannoniscidae. *Sugoniscus* Menzies and George is placed in family *incertae sedis* pending further study. Features of *Desmosoma coalescum* Menzies and George are redrawn and the species is referred to *Nannoniscus*.

The definition of the genus *Nannoniscoides* Hansen is clarified and four new species are described. *Nannoniscus excavatifrons* Birstein is transferred to *Nannoniscoides*. A morphologically similar new genus, *Hebefustis*, is described with seven new species. *Nannoniscus primitivus* Menzies, *N. robustus* Birstein and *Nannoniscoides hirsutus* Menzies are referred to *Hebefustis*.

These new descriptions are based on materials taken from benthic samples encompassing a depth range of 587-5223 m in the North and South Atlantic Ocean. The bathymetric range of *Nannoniscoides* is 180-4833 m; the range of *Hebefustis* is 587-5223 m. A list of the described species of the family is given.

The isopod superfamily Janiroidea (= Paraselloidea Wolff, 1962) is found throughout the benthic marine environment (Kussakin, 1973). Although its representatives are reasonably abundant in many shallow-water habitats, it achieves its greatest diversity in the deep sea (Wolff, 1962; Menzies et al., 1973; Hessler and Thistle, 1975). Here the superfamily has undergone a major radiation, both in terms of species richness and variety of supraspecific taxa, such that it is one of the most diverse elements in any deep-sea community (Hessler and Sanders, 1967).

The Janiroidea contains approximately 20 family in current usage. About 12 of these are to be regarded as significant. For the most part these families are easily recognized and distinctly well defined. However, the Nannoniscidae is unusual in that while there is seldom any question about which species should be included within it, there are no key features which are universally possessed by all of its members. Thus, the Nannoniscidae displays a range of morphologies (e.g., *Nannoniscoides angulatus* Hansen, 1916; *Nannoniscus hanseni* Just, 1970; and *Nannonisconus latipleonus* Schultz, 1966) that causes considerable difficulty in constructing an adequate familial diagnosis.

This paper treats two genera [*Hebefustis* n. gen. with seven new species and *Nannoniscoides* Hansen (1916) with four new species] which highlight this problem in that both lack the distinctive bulbosity of the distal article of the first antenna and some lack the medial fusion of the sixth and seventh pereonites. These have generally been used as the hallmarks of the family. In order to clarify why we, and others in the past, feel these genera belong in the family, the paper redefines the Nannoniscidae and compares it to the other families.

The present study is based primarily on the extensive collections accumulated by the deep-sea sampling program of the Woods Hole Oceanographic Institution (Sanders et al., 1965; Hessler and Sanders, 1967; Sanders and Hessler, 1969). This program has made a series of sampling transects throughout the Atlantic Ocean, running out from shallow coastal waters into the abyss. Such transects are located off the northeastern United States (Gay Head–Bermuda transect), Surinam,

northern Brazil, Argentina, Southwest Africa, Angola, Senegal, and Ireland. Additional samples have come from the Bay of Biscay (J. Allen, University of Newcastle upon Tyne), the Canary Islands (J. Allen), and the Weddell Sea (J. Rankin, University of Connecticut). A list of stations is given in Table 1.

Institutional abbreviations used in this study follow: WHOI, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, USA; SIO, Scripps Institution of Oceanography, La Jolla, California, USA; ZMUC, Zoological Musem, University of Copenhagen, Copenhagen, Denmark; USNM, United States National Museum, Washington, D.C., USA.

SYSTEMATICS

Nannoniscidae Hansen, 1916 (Nannoniscini *auctoris*)

Diagnosis.—Body usually slender, less commonly broad and flat. Cephalon not fused with thorax; pereonites 5-7 not enlarged; 1-5 free, 6 and 7 frequently fused medially *(Nannonisconus* has pereonite 7 fused to pleon instead); often a recurved ventral medial spine present on pereonite 7 or female operculum. Eyes absent. Antenna I often 5-segmented with bulbous distal article, or unmodified and with 6 or rarely 7 segments. Antennae well separated; frons with interantennal ridges, varying from slightly to massively developed, or with rostral crest. Antenna II of male generally more robust and setose than that of female. Mandibular molar process flattened, triangular lobe with setiferous apex; palp generally present and well developed. Maxilliped with second and third segments of palp broad, approximately width of endite, segments 4 and 5 much more slender. Pereopods of normal length, with one major terminal claw; epimeres of I-IV rarely project markedly anteriorly; major anterolateral seta of pereonites 2-4 stems from tergite, not coxa of limb; pereopods V-VII not exceptionally flattened for swimming, but may have plumose natatory setae. Uropods insert ventrally, almost universally biramous, with well-developed protopod.

Type species.—*Nannoniscus oblongus* G. O. Sars, 1870.

References.—Nannoniscini Hansen, 1916:83; Gurjanova, 1932:50; 1933:413; Nordenstam, 1933:251; Menzies, 1962a:29; 1962b:133; Wolff, 1962:31; Menzies and George 1972:95.

Remarks.—This definition is lengthy in contrast to some of those in the past (Hansen, 1916; Gurjanova, 1932, 1933; Nordenstam, 1933; Menzies, 1962a, 1962b; Wolff, 1962; Menzies and George, 1972), but such detail is necessary in view of the fact that no single feature uniformly diagnoses the family. The definition retains the essential features of Hansen's definition of the group Nannoniscini (1916), while accommodating the new morphologies that have been discovered since his work.

Two features are commonly useful in distinguishing a nannoniscid—the bulbous distal article on the first antenna and the medial fusion of pereonites 6 and 7. However, not uncommonly one and rarely both of these features are absent *(Austroniscus, Nannoniscoides biscutatus, N. coronarius).* In such cases other characters must be utilized.

Nannoniscid pereopods II-VII have only one major dactylar claw, which separates them from the Janiridae,[1], Jaeropsidae, Acanthaspididae, Microparaselidae, and Antiasidae.

A yet more useful feature is the flat, triangular molar process, which is found in only three other families: Macrostylidae, Pseudomesidae, and Desmosomatidae. Even the Thambematidae, which are similar to nannoniscids in so many ways, can be differentiated in this respect.

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[1]*Janthura abyssicola* Wolff, 1962 is a janirid that blurs the distinction between the two families in two ways. The pereopodal dactyli have only one major claw, and the mandibular molar process is triangular. As Wolff pointed out, these features are quite aberrant within the Janiridae, but the species shows other features that document its inclusion. Important in the present context are the bifid lateral margins of pereonites 1-3, relatively slender maxillipedal palp articles (segments) 2 and 3, large biramous uropod, and typical janirid body shape.

TABLE 1. Station data.

Station	Depth (m)	Latitude	Longitude
WHOI 95	3753	38°33′ N	68°32′ W
122	4833	35°51′ N	65°32′ W
126	3806	39°37′ N	66°47′ W
142	1624-1796	10°30′ N	17°52′ W
155	3730-3783	00°03.5′ S	27°48′ W
156	3459	00°45′ S	29°26′ W
159	834-939	07°58′ S	34°22′ W
162	1493	07°59′ S	34°06′ W
167	943-1007	07°54′ S	34°17′ W
169	587	08°03′ S	34°24′ W
202	1427-1643	09°05′ S	12°17′ E
		08°56′ S	12°15′ E
245	2707	36°55.7′ S	53°01.4′ W
247	5208-5223	43°33′ S	48°58.1′ W
256	3906-3917	37°40.9′ S	52°19.3′ W
328	4426-4435	50°04.7′ N	15°44.8′ W
Chain 35, Dredge 12	769-805	07°09′ S	34°25′ W
ALLEN S33	1784	43°40.8′ N	03°36′ W

Macrostylids are easily distinguished by several special features, including distinctive body form, extensive elaboration of sensory setae on the first antenna of mature males, close packing of pereonites 1-3, unique adaptation of pereopods I-III for living beneath the sediment surface, and styliform uropods.

The Pseudomesidae can be differentiated on the basis of their compact, uniramous uropod and lack of both squama on the second antenna and palp on the mandible. *Micromesus,* which Birstein (1963a) placed in the Pseudomesidae, does have a bulbous first antenna, but is similar in no other way.

Differentiation from the Desmosomatidae is a difficult problem. There is nothing in the diagnosis of this family (Hessler, 1970) to exclude *Austroniscus* or the two above-mentioned species of *Nannoniscoides.* Unquestionably, the two families are very closely related, yet viewing all the species as a whole, they do fall into two subgroups. It is not surprising that it is the species which should be regarded as relatively primitive within the Nannoniscidae that blur the distinctions (the secondary amplification of swimming morphology in *Austroniscus* notwithstanding).

Our diagnosis of the Nannoniscidae does include one feature that objectively discriminates the two families. The major seta on the anterolateral corner of pereonites 2-4 stems from the tergite as opposed to the coxa. Two exceptions to this are *Nannoniscus muscarius* and *N. perunis* Menzies and George, 1972. Here the seta arises from the coxa of pereopod II. In both species the coxa of this limb projects well forward, whereas in nannoniscids in general the coxae do not extend much beyond the tergite. In desmosomatids the coxae of pereopods II-IV always project in front of the tergite. Thus, the positioning of this seta may reflect the general development of the coxal epimere.

Generic composition.—Nannoniscus Sars, 1870; *Austroniscus* Vanhöffen, 1914 (partim); *Nannoniscoides* Hansen, 1916; *Nannonisconus* Schultz, 1966; *Thaumastosoma* Hessler, 1970; *Hebefustis* n. gen.

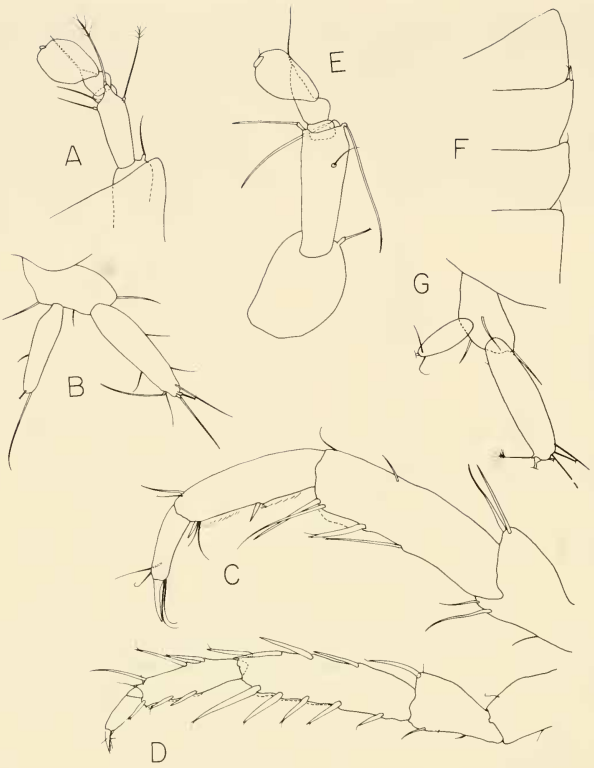

Figure 1. *Nannoniscus* sp., Anton Bruun 11 Sta. 108, brooding female (USNM 120965, identified as *Desmosoma coalescum* Menzies and George, 1972). A. right antenna I, lateral view; B. left uropod, *in situ;* C. right pereopod I, *in situ;* D. right pereopod II, *in situ. Nannoniscus coalescus,* Anton Bruun 11 Sta. 179 (holotype, *Desmosoma coalescum* Menzies and George, 1972, USNM 120964). E. right antenna I, dorsal view; F. pereonites 1-4; G. right uropod, *in situ,* exopod somewhat foreshortened in this perspective.

Synonomy.—Nannoniscella Hansen, 1916, with *N. groenlandica* Hansen, 1916, and *N. vinogradovi* Gurjanova, 1950 is a synonym of *Austroniscus* Vanhöffen, 1914 (by Birstein, 1962:33-34). The monotypic *Austroniscoides* Birstein, 1963b *(A. bougainvillei* Birstein, 1963b) is a synonym of *Janthura* (by Menzies and George, 1972:95). *Austrofilius* Hodgson, 1910, is a synonym of *Neojaera* Nordenstam, 1933 (by Menzies, 1962a:74-75).

We concur with Menzies and George (1972) in the transfer of *Austroniscoides* Birstein, 1963b from the Nannoniscidae to the Janiridae, and the synonomy of *Austroniscoides* with *Janthura* Wolff, 1962. Birstein (1962, 1963a) included *Austrofilius* Hodgson, 1910 in the Nannoniscidae. However, we follow Menzies (1962a:74-75) and Wolff (1962:206) in the removal of *Austrofilius* from the family, and its synonomy with *Neojaera* Nordenstam, 1933.

The monotypic genus *Sugoniscus* Menzies and George, 1972 was placed by them in the Nannoniscidae, requiring them to broaden the familial diagnosis in order to accommodate it. However, *Sugoniscus* does not show even superficial resemblance to any nannoniscid; it bears no features that ally it to this family in

particular. In *Sugoniscus* the cephalon and mouthpart appendages are highly modified to accommodate a possibly parasitic mode of existence. The genus lacks interantennal ridges, and the antennae are much more laterally placed than is typical of the Nannoniscidae. The first antenna is unmodified. Pereonites 6 and 7 are unfused, and there are no ventral spines. The high degree of fringing ornamentation is unknown in the Nannoniscidae. Its inclusion renders the concept of the family useless. Therefore, we relegate *Sugoniscus* to family *incertae sedis* pending further study.

By the criterion of the seta on the anterolateral corner of pereonites 2-4, the genus *Thaumastosoma*, which Hessler (1970) placed in the Desmosomatidae, should be removed to the Nannoniscidae. This genus also possesses midventral spines on pereonite 7 and the female operculum. Such a feature is common in the Nannoniscidae, but is otherwise unknown among the Desmosomatidae.

Species realignment.—*Nannoniscus primitivus* Menzies, 1962b, *Nannoniscus robustus* Birstein, 1963a, and *Nannoniscoides hirsutus* Menzies, 1962b are referred to *Hebefustis* (see below). *Nannoniscus excavatifrons* Birstein, 1970 is referred to *Nannoniscoides* (see below).

Previously, two species have been removed from the family: *Nannoniscus bicuspis* Sars, 1885 to *Haploniscus* by Richardson (1908:75); and *Austroniscus ectiformis* Vanhöffen, 1914 to *Caecianiropsis* by Menzies and Pettit (1956:442).

Desmosoma coalescum Menzies and George, 1972 should also be placed in the Nannoniscidae, because it has pereonites 6 and 7 fused, and a 5-segmented first antenna having a bulbous fifth article. Menzies and George's original illustration (Menzies and George, 1972, fig. 31B) is incorrect regarding antenna I, based on our examination of the holotype. The fifth article in their drawing is in reality a lateral projection of the fourth, and the bulbous fifth was omitted (Fig. 1E). In addition, their fig. 31A erroneously shows epimeres on the anterior four pereonites. Other aspects of this species morphology are consistent with the diagnosis of the Nannoniscidae as given here, and should be considered as *Nannoniscus coalescus*. The additional two specimens designated *D. coalescum* (USNM 120965) by Menzies and George are also nannoniscids, but they differ from the holotype *inter alia* in the structure of the first pereopod and in having a large recurved ventral medial spine anterior to the operculum, and therefore are not this species, but are an undescribed species of *Nannoniscus*. Table 2 gives the names of species referable to Nannoniscidae.

Nannoniscoides Hansen, 1916

Type species.—*Nannoniscoides angulatus* Hansen, 1916.

Diagnosis.—Antenna I unspecialized, 6- (or rarely 7-) segmented; segments 3-5 well developed; penultimate segment lacking lateral projection; distal segment with simple, unmodified terminal aesthetasc. Pleon with posterolateral spines. Operculum (female pleopod II) elongate, with concavity and calcareous fringe at midline of distal edge; operculum approximately 0.85 or more dorsal length of pleon. Pereopods I-III lack epimeres. Pereopod I of medium robustness; ventral surface of carpus and propodus with thin setae, except for distal robust seta on carpus. Cephalon with pointed lateral lappets. Pereonites 6 and 7 may be free or fused. Pereonite 2 with robust seta on anterolateral corners. Medial lobes of male pleopods I taper distally. Uropod length averages 0.3 length of pleon. Body depressed; length roughly three times tergal width of pereonite 2.

Remarks.—The only other nannoniscid genera with a 6-segmented, unmodified antenna I are *Austroniscus* and *Thaumastosoma*. *Nannoniscoides* differs in having pleonal posterolateral spines, and in lacking an epimere on the coxa of pereopod I. *Thaumastosoma* displays a sexual dimorphism of pleonar shape not seen in *Nannoniscoides*. In addition the female operculum of *Austroniscus* is much smaller in

TABLE 2. A compilation of the nannoniscid species (* indicates generic type species).

Genus	Species
Nannoniscus	*acanthurus* Birstein, 1963a; *aequiremis* Hansen, 1916; *affinis* Hansen, 1916; *analis* Hansen, 1916; *arcticus* Hansen, 1916; *armatus* Hansen, 1916; *australis* Vanhöffen, 1914; *bidens* Vanhöffen, 1914; *camayae* Menzies, 1962b; *caspius* Sars, 1897; *coalescus* (Menzies and George, 1972); *crassipes* Hansen, 1916; *detrimentus* Menzies and George, 1972; *hanseni* Just, 1970; *inermis* Hansen, 1916; *laevis* Menzies, 1962b; *laticeps* Hansen, 1916; *minutus* Hansen, 1916; *muscarius* Menzies and George, 1972; *oblongus** Sars, 1870 (figured 1899); *ovatus* Menzies and George, 1972; *perunis* Menzies and George, 1972; *plebejus* Hansen, 1916; *reticulatus* Hansen, 1916; *simplex* Hansen, 1916; *spinicornis* Hansen, 1916; *tenellus* Birstein, 1963a
Nannonisconus	*latipleonus** Schultz, 1966
Austroniscus	*acutus* Birstein, 1970; *groenlandicus* (Hansen, 1916); *karamani* Birstein, 1962; *ovalis** Vanhöffen, 1914; *rotundatus* Vanhöffen, 1914; *vinogradovi* (Gurjanova, 1950)
Nannoniscoides	*angulatus** Hansen, 1916; *biscutatus* n. sp.; *coronarius* n. sp.; *excavatifrons* (Birstein, 1970); *gigas* n. sp.; *latediffusus* n. sp.
Hebefustis	*alleni* n. sp.; *cornutus* n. sp.; *dispar* n. sp.; *hexadentium* n. sp.; *hirsutus* (Menzies, 1962b); *mollicellus* n. sp.; *par* n. sp.; *primitivus* (Menzies, 1962b); *robustus* (Birstein, 1963a); *vafer** n. sp.
Thaumastosoma	*distinctum* (Birstein, 1963a); *platycarpus** Hessler, 1970; *tenue* Hessler, 1970

relation to the size of the pleon, a reflection of the broadened swimming morphology of this genus. The insertions of the posterior pereopods in *Austroniscus* become more medial as one moves posteriorly, whereas in *Nannoniscoides* the posterior insertions are all equally far from the midline.

Nannoniscoides females closely resemble *Hebefustis* n. gen. in general body shape, particularly in the shape of the pleon. They may be easily distinguished by the number of segments in the first antenna, the robustness of the setae on the propodus and carpus of pereopod I, the form of the cephalic lappets, and the shape of the operculum.

This genus contains the following species: *Nannoniscoides latediffusus,* n. sp.; *N. biscutatus,* n. sp.; *N. coronarius,* n. sp.; *N. gigas,* n. sp.; *N. angulatus* Hansen, 1916, type species; *N. excavatifrons (= Nannoniscus excavatifrons* Birstein, 1970). *Nannoniscoides hirsutus* Menzies, 1962b is transferred to *Hebefustis* (see discussion in that section). The reassignment of *Nannoniscus excavatifrons* Birstein, 1970 to *Nannoniscoides* is based on its obvious similarity to the type species. Its inclusion provides a continuum of morphological features from the extreme of the type species, described from only male specimens (Hansen, 1916; Just, 1970; Gurbunov, 1946 mentions the occurrence of *N. angulatus* in the Kara Sea, but provides only biogeographic information) to the species described here from females and immature males.

The type species, *Nannoniscoides angulatus,* is distinct in several respects, including length-width ratios, the ventral medial projection of pereonite 7 and the shape of the pleon. *Nannoniscoides excavatifrons* and a male of *N. latediffusus* n. sp. closely resemble *N. angulatus* in head structure and the lengthening of the lateral lobes of pereonite 2. *Nannoniscoides excavatifrons* has a 6-segmented unmodified antenna I; *N. latediffusus* has an unmodified antenna I which is unique in being 7-segmented in the male. The shape of the pleon, the length-width ratios, and the type of setation on the propodus and carpus of pereopod I of *N. excavatifrons* clearly link the new species described here with *N. angulatus.* These features strengthen the case for the assignment of these species to *Nannoniscoides,* a decision based principally on the 6-segmented structure of antenna I (Just, 1970),

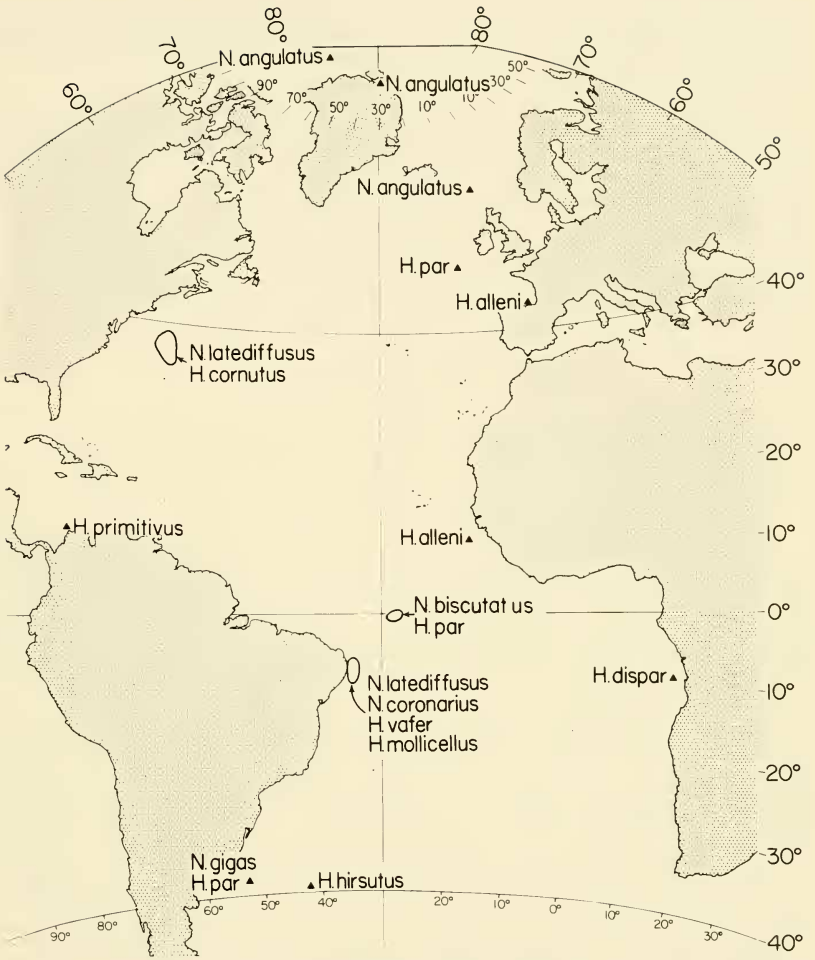

Figure 2. *Nannoniscoides* and *Hebefustis:* geographical distribution of species in the Atlantic Ocean.

the shape of the pleon, and the pointed cephalic lappets.

Sexual dimorphism.—The sexual dimorphism exhibited in this genus is the most extreme seen in the Nannoniscidae. Mature, or nearly mature males may have a more massively developed cephalon than females (cf. male and female of *N. latediffusus),* and more strongly produced lateral lobes of pereonite 2. Typically, the primary sexual differences in nannoniscids (aside from the pleopod differences) are merely the more robust male second antenna and differences in overall body and pleonar dimensions and ratios.

In *Nannoniscoides* there is also an indication of sexual differences in the first antenna, unique in the Nannoniscidae. These differences may be manifest in the number of aesthetascs and relative lengths of segments 5 and 6 (cf. *N. biscutatus).* (The number of segments varies between the male and female of *N. latediffusus.)*

However, the occurrence of extreme sexual dimorphism within the genus appears to be variable; one finds species in which sexual dimorphism is expressed mainly in the robustness of the second antennae, as is commonly the case in other genera (see drawing of undescribed male, *Nannoniscoides* No. 5, Fig. 6).

Distribution.—Nannoniscoides angulatus: North Atlantic, north of the Faroes, 1284 m (Hansen, 1916); northernmost part of the Kara Sea, 698 m (Gurbunov, 1946); Jørgen Brønlund Fjord, Greenland, 160-180 m (Just, 1970). *Nannoniscoides excavatifrons:* northwest Pacific, in the Kurile-Kamchatka area, 1440-1540 m (Birstein, 1970). *Nannoniscoides latediffusus:* northwest Atlantic, equatorial southwest Atlantic, 587-4833 m. *Nannoniscoides biscutatus:* equatorial southwest Atlantic, 3459-3783 m. *Nannoniscoides coronarius:* equatorial southwest Atlantic, 1493 m. *Nannoniscoides gigas:* South Atlantic, Argentine Basin, 3909-3917 m. *Nannoniscoides* No. 5: South Atlantic, Argentine Basin, 2707 m. The map in Fig. 2 shows the distribution of species of *Nannoniscoides* in the Atlantic Ocean.

Nannoniscoides biscutatus n. sp.

Figure 3

Holotype.—WHOI 156, brooding female, 1.7 mm long, USNM 169386.

Paratype.—WHOI 155, male, 2.0 mm long, USNM 169387; WHOI 156, 1 preparatory female, 1 juvenile female, WHOI 155, 2 brooding females, SIO.

Distribution.—Equatorial Atlantic Ocean, 3459-3783 m.

Etymology.—bis, Latin, in two ways, twice; *scutatus,* Latin, armed with a shield.

Diagnosis.—Antenna I terminal segment elongate, not inflated, length to width ratio (l/w) 5.0 (holotype), 3.6 (allotype). Segment 6, 0.5 (holotype), 0.4 (allotype) times length of segment 2. Combined length of segments 3-6, 1.4 (holotype), 1.89 (allotype) times length of segment 2. Segment 5 of male much longer than segment 6; segment 5 with two distal aesthetascs, segment 6 with one. (Differs from female which has single aesthetasc on segment 6 and segment 6 longer than segment 5.)

Pereonites 6 and 7 free.

Pleon with posterolateral processes (teeth), 0.67 (holotype and allotype) removed from anterior edge. Width of pleon between midpoints of concavities formed by teeth 0.79 (holotype), 0.84 (allotype) width of pleon; pleon l/w 1.06 (holotype), 1.10 (allotype). Pleon 0.67 (holotype), 0.69 (allotype) times width of pereonite 2.

Female operculum l/w 1.6; 1.0 times length of pleon (excluding pleonal somite 1).

Male pleopod I sides from proximal end to lateral lobes relatively straight. Lateral lobes forming posteriorly projecting spines. Outer margins of medial lobes convex, tapering to broad points distally. Pleopod I l/w 5.6; 0.8 length of pleon.

Uropod length 0.4 (holotype and allotype) length of pleon. Endopod l/w 4.0 (holotype and allotype). Exopod l/w 4.0 (holotype and allotype). Endopod length 1.8 (holotype and allotype) times length of protopod.

Cephalic keels (on inner margins bordering antennae) not strongly developed. Cephalic width 0.8 times that of pereonite 2.

Body length 3.3 (holotype), 3.7 (allotype) times tergal width of pereonite 2.

Remarks.—Nannoniscoides biscutatus n. sp. may be distinguished from *N. coronarius* n. sp., the other member of the genus which lacks medial fusion of pereonites 6 and 7, by the less developed and more widely separated cephalic keels of *N. biscutatus,* as well as by its more elongate uropodal rami, the narrower, more elongate form of the articles of antenna I and the somewhat more elongate body form.

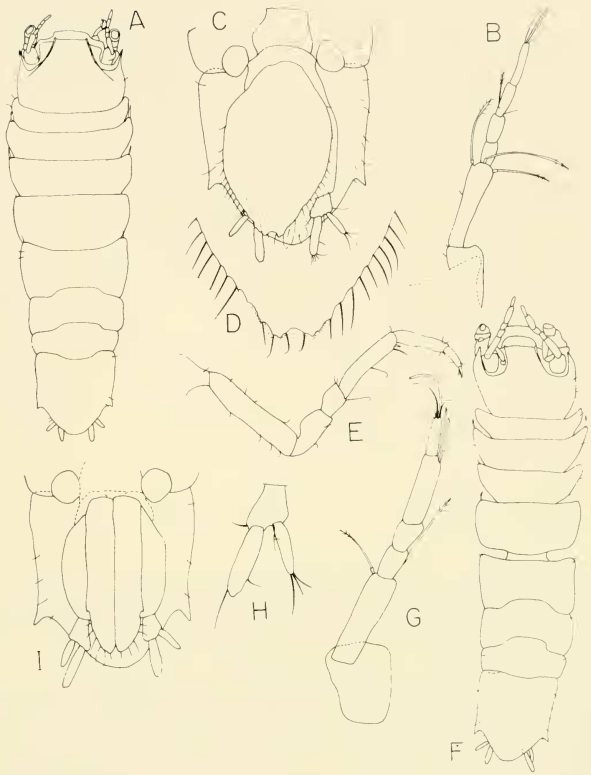

Figure 3. *Nannoniscoides biscutatus* n. sp., WHOI 156. A. brooding female (holotype), dorsal view; B. brooding female (holotype) right antenna I, lateral view; C. brooding female (holotype) operculum; D. posterior margin of operculum; E. juvenile female right pereopod I. WHOI 155. F. male (paratype) dorsal view; G. male (paratype) left antenna I, dorsal view; H. male (paratype) left uropod, *in situ;* I. male (paratype) pleon, ventral view.

Nannoniscoides gigas n. sp.

Figure 4

Holotype.—WHOI 256, preparatory female, 2.8 mm long, USNM 169388.

Paratype.—WHOI 256, 1 additional preparatory female, SIO.

Distribution.—Argentine Basin, South Atlantic Ocean, 3909-3917 m.

Etymology.—Latin, giant.

Diagnosis.—Antenna I terminal segment inflated, length to width ratio (l/w) 2.0; length of segment 6, 0.5 times length of segment 2; combined length of segments 3-6, 0.3 times length of segment 2.

Pereonites 6 and 7 fused.

Pleon with posterolateral processes (teeth) 0.71 removed from anterior edge. Width of pleon between midpoints of concavities formed by teeth 0.76 width of pleon; pleon l/w 0.93; pleon width 0.74 times width of pereonite 2.

Female operculum l/w 1.3; 0.8 times length of pleon.

Figure 4. *Nannoniscoides gigas* n. sp., WHOI 256, preparatory female (holotype). A. dorsal view; B. right pereopod I; C. right antenna I, lateral view; D. posterior margin of operculum; E. pleon, ventral view.

Uropod 0.2 times length of pleon. Endopod 1/w 2.6; exopod 1/w 3.5; endopod length 1.6 protopod length.

Cephalic keels not well developed. Cephalic width 0.7 times that of pereonite 2.

Body length 3.0 times tergal width of pereonite 2.

Remarks.—Of the species with fused pereonites 6 and 7, *N. gigas* is only similar to *N. latediffusus. Nannoniscoides gigas* differs in having the pleonal posterolateral teeth positioned much more posteriorly, less elongate distal segments on antenna I and a somewhat shorter and broader female operculum.

Nannoniscoides coronarius n. sp.

Figure 5

Holotype.—WHOI 162, brooding female, 1.4 mm long, USNM 169389.

Other material.—Holotype female only.

Distribution.—Equatorial southwest Atlantic Ocean, 1493 m.

Etymology.—Latin, relating to a crown or garland.

Diagnosis.—Antenna I terminal segment relatively narrow, not inflated, length to width ratio (1/w) 2.6; segment 6, 0.3 times length of segment 2. Combined length of segments 3-6, 1.3 times length of segment 2.

Pereonites 6 and 7 free.

Pleon with posterolateral processes (teeth) 0.73 removed from anterior edge. Width of pleon between midpoints of concavities formed by teeth 0.68 width of pleon. Pleon 1/w 0.81; width 0.79 times width of pereonite 2.

Female operculum 1/w 1.6; approximately as long as pleon.

Uropod length 0.3 length of pleon; endopod 1/w 2.8; exopod 1/w 2.1. Endopod length 1.6 times protopod length.

Distinct cephalic keels, located on surface of frons rather than on its lateral margins. Cephalic width 0.9 times that of pereonite 2.

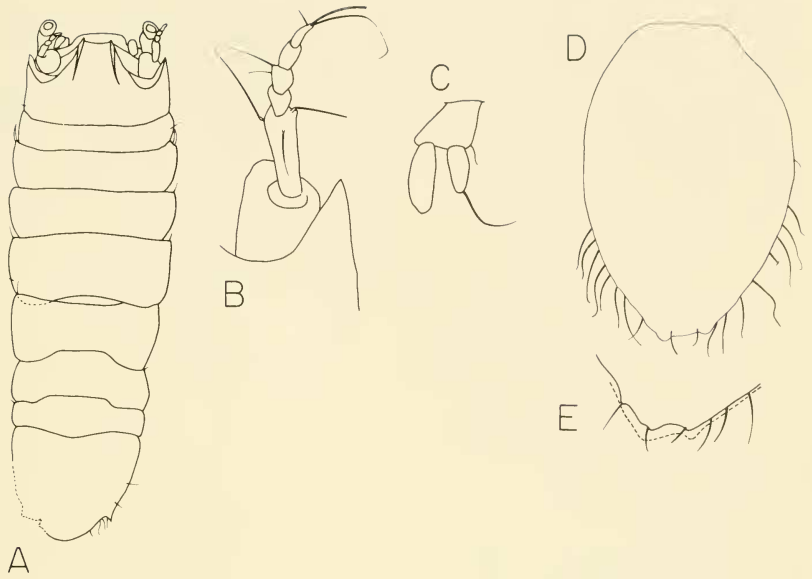

Figure 5. *Nannoniscoides coronarius* n. sp., WHOI 162. A. brooding female (holotype), dorsal view; B. brooding female (holotype) right antenna I; C. brooding female (holotype) left uropod, *in situ;* D. brooding female (holotype) operculum; E. posterior margin of operculum.

Body length 3.1 times tergal width of pereonite 2.

Remarks.—The medially positioned paired keels on the surface of the frons are thus far unique to this species. It and *N. biscutatus* n. sp. may be readily distinguished from all others of the genus by the lack of medial fusion of pereonites 6 and 7. *Nannoniscoides coronarius* differs from *N. biscutatus* in having more closely spaced cephalic keels, more compact uropodal rami and articles of antenna I, and a less elongate body form.

Nannoniscoides latediffusus n. sp.

Figure 6

Holotype.—WHOI 169, brooding female, 2.0 mm long, USNM 169390.

Paratype.—WHOI 169, male, 1.7 mm long, USNM 169391, and preparatory female, USNM 169404; WHOI 169, 10 spec., SIO.

Other material.—WHOI 122, 1 spec.; WHOI 126, 1 spec.; WHOI 159, 1 spec.; WHOI 167, 2 spec.; WHOI Chain 35, Dredge 12, 1 spec., SIO.

Distribution.—Northwest Atlantic Ocean, 587-4833 m.

Etymology.—late, Latin, broadly or widely; *diffusus,* Latin, distributed or spread out.

Diagnosis.—Antenna I 6-segmented (holotype), 7-segmented in adult male (see Remarks); length to width ratio (l/w) of terminal segment 3.1 (holotype). Segment 6, 0.7 times length of segment 2. Combined length of segments 3-6, 1.4 times length of segment 2.

Pereonites 6 and 7 fused.

Pleon with posterolateral processes (teeth) 0.55 (holotype), 0.59 (allotype) removed from anterior edge. Width of pleon between midpoints of concavities formed by teeth 0.79 (holotype), 0.90 (allotype) times width of pleon; pleon l/w 0.93

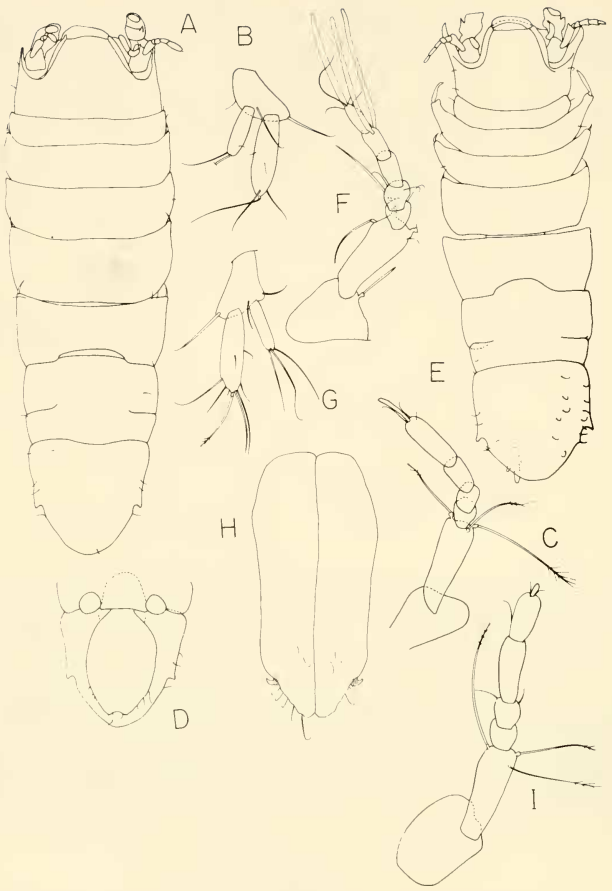

Figure 6. *Nannoniscoides latediffusus* n. sp., WHOI 169. A. brooding female (holotype), dorsal view; B. preparatory female (paratype) right uropod, *in situ;* C. brooding female (holotype) right antenna I, dorsolateral view; D. brooding female (holotype) pleon, ventral view; E. male (paratype), dorsal view; F. male (paratype) right antenna I, dorsal view; G. male (paratype) left uropod, *in situ;* H. male (paratype) pleopods I, *in situ;* I. WHOI 167 juvenile male, right antenna I, dorsal view.

(holotype), 1.0 (allotype). Pleon 0.73 (holotype and allotype) times width of pereonite 2.

Female operculum 1/w 1.6; 0.9 length of pleon.

Male pleopods I narrowly rounded distally; lateral lobes with hook-like process; 1/w 4.4; pleopod 0.8 times length of pleon.

Uropod length 0.3 (paratype female and paratype male) times length of pleon. Endopod 1/w 3.4 (paratype female), 3.8 (paratype male). Exopod 1/w 3.2 (paratype female), 4.3 (paratype male). Endopod length 1.5 (paratype female and male) times protopod length.

Cephalic keels (on inner margins bordering antennae) well developed (see Remarks). Cephalic lappets of male highly developed. Cephalic width 0.9 times that of pereonite 2 (holotype and allotype).

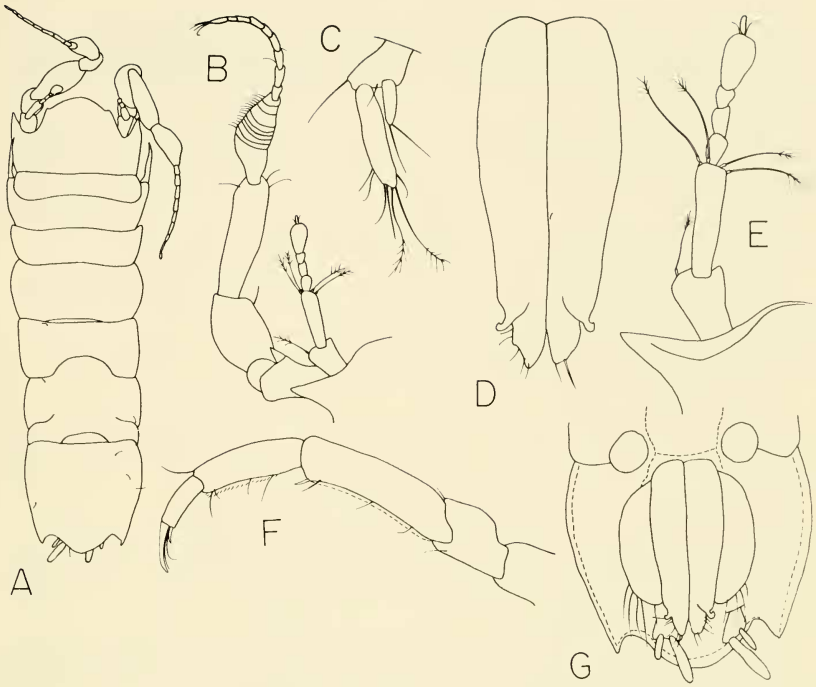

Figure 7. *Nannoniscoides* No. 5, WHOI 245, undescribed male. A. dorsal view; B. left antennae I and II, dorsolateral view; C. left uropod; D. pleopods I; E. left antenna I, dorsolateral view; F. left pereopod I, *in situ*; G. pleon, ventral view.

Body length 3.2 (holotype), 2.9 (allotype) times tergal width of pereonite 2.

Remarks.—The uropods are broken off the holotype female. The male differs markedly from the female in its well-developed cephalon (keels and lappets), antenna I (7-segmented with 3 aesthetascs, one from segment 7 and two from segment 6, rather than 6-segmented with 1 aesthetasc in the female) and in the development of pereonites 2 and 3 (the projecting lobes and setae). This dimorphism of the first antenna is unusual in the Nannoniscidae. In other nannoniscid genera the only antennal dimorphism is expressed in the robustness and setation of antenna II.

The male specimens of this species (WHOI 169 and WHOI 167) are of particular note. They display a continuum of body form from that of the female to that characteristic of the adult male of the generic type species (a single male), *N. angulatus*. Pleopods I also show a transition to more highly developed lateral lobes and hook-like processes in the mature male of *N. latediffusus*. There is also a transition from the 6-segmented female antenna to the 7-segmented copulatory male antenna through the 6-segmented antenna of the juvenile male of WHOI 167.

This species has an exceptionally broad geographic and bathymetric range. The possibility remains that *N. latediffusus* consists of sibling species possessing more restricted depth ranges; however, no clear-cut morphological evidence permits such a differentiation.

Hebefustis n. gen.

Diagnosis.—First antenna 5-segmented, distal segment elongate and somewhat inflated; segment 4 lacks a lateral projection, segments 3 and 4 well developed, not hidden.

Pleon with posterolateral spines.

Operculum (female pleopod II) ovoid to pear-shaped; length about 0.66 of length of pleon (measured in dorsal view); distal margin straight without calcareous fringing margin.

Anterior three pereopods lack epimeres; pereopods of medium robustness. Pereopod I: ventral surface of carpus and propodus have robust setae.

Rounded cephalic lappets.

Male pleopod I widest proximally; sides convex proximally, concave to straight distally; limb often flared distally.

Uropods relatively short; uropod length about 0.25 length of pleon.

Pereonites 6 and 7 fused medially.

Body depressed; length about 3.8 tergal width of pereonite 2.

Type species.—Hebefustis vafer n. sp.

Etymology.—Hebes, Latin, meaning blunt; *fustis,* Latin, meaning club. The name is masculine, and was suggested by the shape of the terminal articles of the first antenna.

Remarks.—One cannot tell from Menzies' (1962b) descriptions whether *H. hirsutus* and *H. primitivus* have pointed or rounded cephalic lappets. The holotype (sole specimen) of *H. hirsutus* cannot be found (R. J. Menzies, pers. comm.). The condition of the sole specimen of *H. primitivus* does not allow a judgment as to the shape of the cephalic lappets.

The females of this genus are similar to those of *Nannoniscoides,* particularly in the overall body shape, the posterolateral processes on the pleon, and the general robustness of the first pereopods. The two genera may be distinguished on the basis of the structure of the first antenna (6-segmented in *Nannoniscoides,* 5-segmented in *Hebefustis),* the type of setae on the propodus and carpus of pereopod I (thin in *Nannoniscoides,* robust in *Hebefustis),* the shape of the female operculum (elongate, with a distal concavity at the midline in *Nannoniscoides;* pear-shaped to ovoid in *Hebefustis,* with a straight distal margin), and the shape of the lateral lappets of the cephalon (pointed in *Nannoniscoides,* rounded in *Hebefustis).*

Several species of *Nannoniscus* also closely resemble *Hebefustis (N. bidens* Vanhöffen, 1914, *N. camayae* Menzies, 1962b, and *N. minutus* Hansen, 1916). These species have acute posterolateral pleonal processes and a 5-segmented antenna I. However, the first antennae of these species differ from *Hebefustis* in that the fourth segment of the *Nannoniscus* species has a large lateral projection. In addition, *N. minutus* bears a large recurved ventral medial spine anterior to the operculum.

This genus contains the following species: *Hebefustis vafer* n. sp., type species; *H. primitivus (= Nannoniscus primitivus* Menzies, 1962b); *H. robustus (= Nannoniscus robustus* Birstein, 1963a); *H. mollicellus* n. sp.; *H. par* n. sp.; *H. alleni* n. sp.; *H. hirsutus (= Nannoniscoides hirsutus* Menzies, 1962b); *H. cornutus* n. sp.; *H. dispar* n. sp.; *H. hexadentium* n. sp.

These species can be subdivided into two groups, one comprised of the first six species, and the other of the remaining four.

The cluster containing *H. cornutus, H. dispar, H. hexadentium,* and *H. hirsutus* has acute processes on the posterolateral margins of pereonites 6 and 7. These species differ from one another in the following ways: *H. hexadentium* lacks a robust seta on the corners of pereonite 2; the other species have a robust seta. They also differ in the shape of segment 5 of antenna I, and in the ratios formed describing the pleonal features.

The remaining species *(H. vafer, H. primitivus, H. robustus, H. mollicellus, H. par,* and *H. alleni)* do not have acute posterolateral processes on the corners of pereonites 6 and 7. Within this group the species display a high degree of similarity. Where pereopod I is available on the specimens, differences often occur in the setation patterns of the propodus and carpus between species. However, there may be differences in the number of setae between the right and left pereopods of the same individual, as well as intraspecific differences. For this reason, the setation pattern is not a reliable diagnostic character for specific differences. Differentiation among these species must be made on the somewhat subtle basis of ratios of the dimensions of body parts, particularly of the antenna I and the pleon.

Nannoniscus primitivus Menzies (1962b), *N. robustus* Birstein (1963a), and *Nannoniscoides hirsutus* Menzies (1962b) should be transferred to *Hebefustis.*

Nannoniscus robustus: The complete set of drawings given by Birstein allows unambiguous placement in *Hebefustis. Inter alia,* the structure of the 5-segmented antenna I, the robust setae of the carpus and propodus of pereopod I, and the shapes of the pleon and the female pleopod II match precisely the diagnostic characters of the genus.

Nannoniscus primitivus: The structure of the 5-segmented antenna I and the shape of the male pleopod I are clearly characteristic of *Hebefustis.* The pleon is somewhat unusual in having two pairs of acute processes. However, this feature is similar to the double vertices on the pleon of the male of *H. cornutus.*

Nannoniscoides hirsutus: The type specimen cannot be found (R. J. Menzies, pers. comm.), and hence, certain difficulties arise in placing this species in *Hebefustis.* The primary difficulty is the number of segments in antenna I. In Menzies' figure (1962b, fig. 30c), a dorsal view of the holotype, the first antenna is drawn 5-segmented, the condition in *Hebefustis.* Supporting evidence for the placement of this species in *Hebefustis* is found in the robust setae of the propodus of pereopod I, the acute posterolateral processes on pereonites 6 and 7 (similar to *H. cornutus, H. dispar,* and *H. hexadentium),* and the structure of the distal end of the male pleopod I, which is somewhat squared-off.

Distribution.—Hebefustis alleni: Bay of Biscay and northeast Atlantic, 1623-1796 m. *Hebefustis cornutus:* northwest Atlantic, 3753-3806 m. *Hebefustis dispar:* southeast Atlantic, 1427-1643 m. *Hebefustis hexadentium:* Argentine Basin, South Atlantic Ocean, 5024 m (Menzies, 1962b). *Hebefustis hirsutus:* South Atlantic Ocean, 5024 m (Menzies, 1962b). *Hebefustis mollicellus:* equatorial South Atlantic, 943-1007 m. *Hebefustis par:* northeast, equatorial and South Atlantic, 3459-4435 m. *Hebefustis primitivus:* Caribbean, North Atlantic, 2868-2875 m (Menzies, 1962b). *Hebefustis robustus:* northwest Pacific, 5461-5690 m (Birstein, 1963a). *Hebefustis vafer:* equatorial southwest Atlantic, 587 m.

The map in Fig. 2 shows the distribution of the species of *Hebefustis* occurring in the Atlantic Ocean.

Hebefustis vafer n. sp.

Figures 8 and 9

Holotype.—WHOI 169 (type locality), preparatory female, 2.3 mm long, USNM 169392.

Paratype.—WHOI 169, copulatory (?) male, 1.8 mm long, USNM 169393; WHOI 169, 18 other spec., ZMUC, SIO.

Distribution.—Equatorial southwest Atlantic Ocean, 587 m.

Etymology.—Latin, artful, sly or crafty.

Diagnosis.—Antenna I segment 5 thin and elongate; length to width ratio (1/w) 4.1 (holotype), 4.0 (allotype); length segment 5, 0.8 (holotype), 0.9 (allotype) length segment 2. Pereonites 6 and 7 with no posterolateral projection. Pereonite 4 1/w 0.6

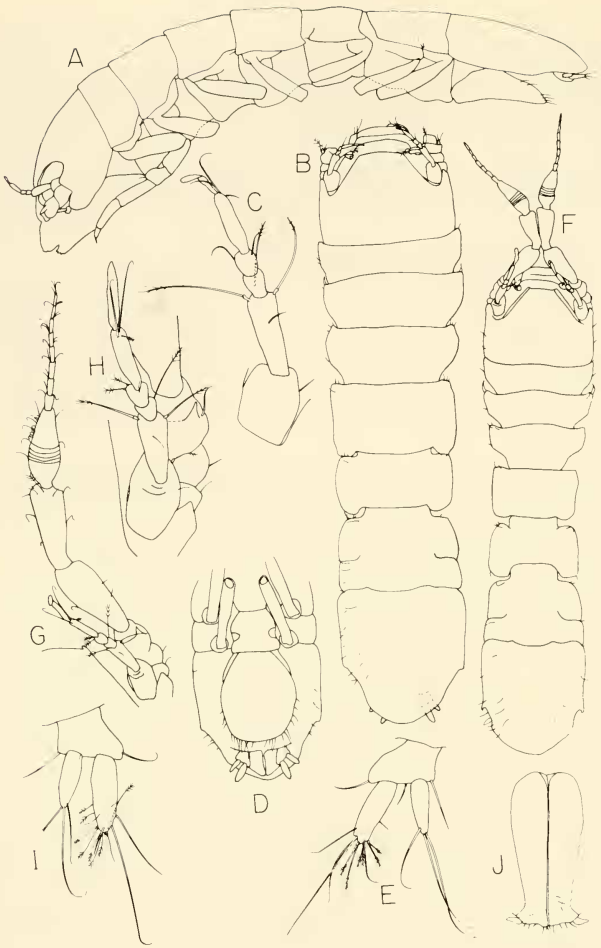

Figure 8. *Hebefustis vafer* n. sp., WHOI 169. A. preparatory female (holotype), lateral view; B. preparatory female (holotype), dorsal view; C. preparatory female (holotype) right antenna I, dorsal view; D. preparatory female (holotype) pleon, ventral view; E. preparatory female (holotype) right uropod, *in situ;* F. male (paratype), dorsal view; G. male (paratype) right antennae I and II, dorsal view; H. male (paratype) right antenna I, dorsal view; I. male (paratype) left uropod, *in situ;* J. male (paratype) pleopods I.

(holotype), 0.5 (allotype); width 0.9 (holotype), 0.8 (allotype) times tergal width of pereonite 2; sides approximately straight. Pereonite 2 with robust seta on anterolateral corners.

Pleon with acute posterolateral processes (teeth) approximately 0.6 (holotype and allotype) distant from anterior edge; sides of pleon anterior to teeth relatively straight (straight with slight concavity before teeth in male). Pleon width between midpoints of concavities formed by teeth 0.9 (holotype), 1.0 (allotype) pleon width. Pleon l/w 1.1 (holotype and allotype). Pleon width 0.9 (holotype and allotype) times width of pereonite 2.

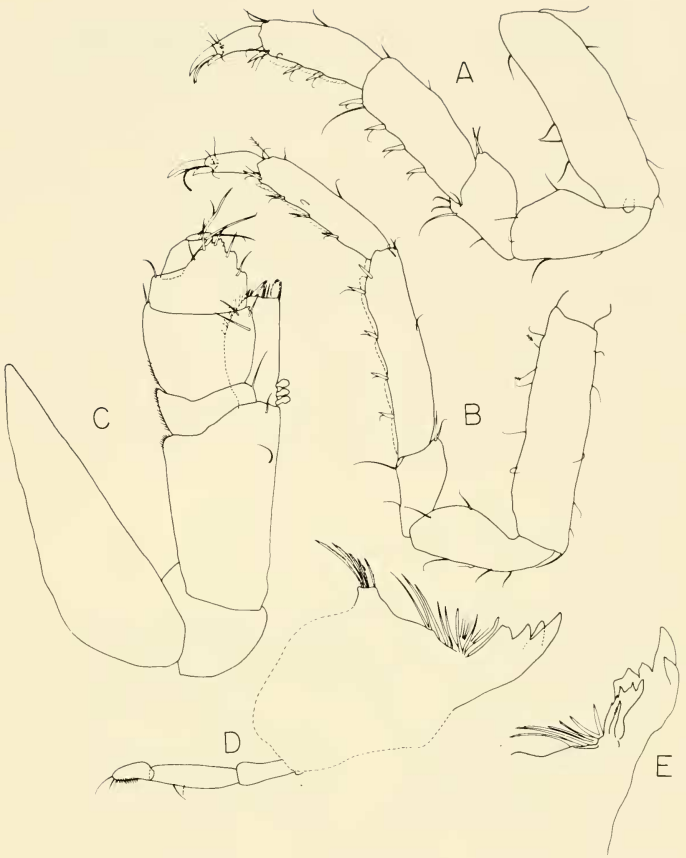

Figure 9. *Hebefustis vafer* n. sp., WHOI 169, brooding female. A. left pereopod I; B. left pereopod II; C. right maxilliped; D. right mandible; E. distal portion of left mandible.

Female operculum somewhat ovoid; 1/w 1.2; 0.7 length of pleon (measured in dorsal view).

Male pleopod I 1/w 4.3; 0.7 length of pleon; sides constricted proximal to lateral lobes, which are broadly flared.

Body length 4.2 (holotype), 4.3 (allotype) times tergal width of pereonite 2.

Remarks.—Of the species which lack posterolateral spines on pereonites 6 and 7, *H. vafer* n. sp. is most similar to *H. mollicellus* n. sp. The bodies of these two species are somewhat more elongate than those of *H. par* n. sp. and *H. alleni* n. sp. *Hebefustis vafer* differs from *H. mollicellus* in having a more elongate article 5 of antenna I; the pleonal posterolateral teeth are more anteriorly placed in the female and the posterior portion of the pleon does not taper as sharply. The male of *H. vafer* is much narrower in pereonites 4-5 relative to the female and the male pleopods differ between the two species in length-width ratios. The distal margin of pleopods I are broadly flared in *H. vafer*.

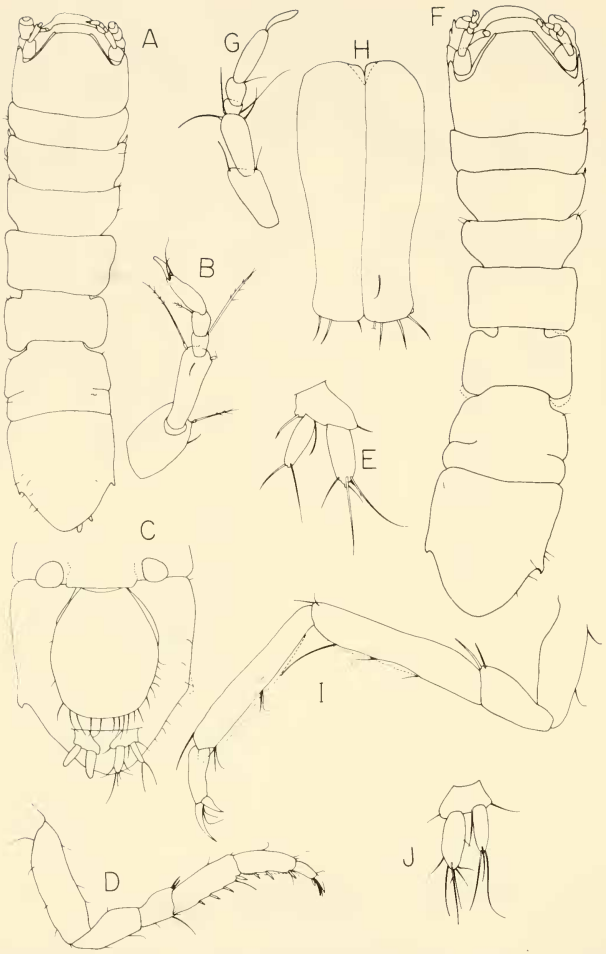

Figure 10. *Hebefustis mollicellus* n. sp., WHOI 167. A. brooding female (holotype), dorsal view; B. brooding female (holotype) right antenna I, dorsal view; C. brooding female (holotype) pleon, ventral view; D. preparatory female right pereopod I; E. brooding female (holotype) right uropod, *in situ;* F. male (paratype), dorsal view; G. male (paratype) left antenna I, lateral view; H. immature male (paratype) pleopods I; I. male (paratype) right pereopod VI, *in situ;* J. male (paratype) left uropod, *in situ.*

Hebefustis mollicellus n. sp.

Figure 10

Holotype.—WHOI 167, brooding female, 2.0 mm long, USNM 169394.

Paratype.—WHOI 167, immature male, 1.5 mm long, USNM 169395; WHOI 167, 2 spec. and 1 frag., SIO.

Distribution.—Equatorial South Atlantic Ocean, 943-1007 m.

Etymology.—Latin, dainty or little.

Diagnosis.—Antenna I segment 5 length to width ratio (1/w) 3.2 (holotype), 3.3 (allotype); 0.7 (holotype), 0.9 (allotype) times length of segment 2.

Pereonites 6 and 7 without acute posterolateral processes. Pereonite 4 1/w 0.55 (holotype and allotype); sides gently concave; slightly broader anteriorly. Width 0.9 (holotype), 0.85 (allotype) width of pereonite 2. Pereonite 2 with robust seta on anterolateral corners.

Pleon with acute posterolateral processes (teeth) 0.7 (holotype), 0.6 (allotype) removed from anterior edge. Sides of pleon anterior to teeth straight, nearly parallel. Pleonal width between midpoints of concavities formed by teeth 0.85 (holotype), 0.87 (allotype) times width of pleon. Pleon 1/w 1.2 (holotype), 1.1 (allotype). Width of pleon 0.9 (holotype), 1.0 (allotype) times width of pereonite 2.

Female operculum 1/w 1.2; 0.6 length of pleon (measured in dorsal view).

Male pleopod I 1/w 3.9; 0.7 length of pleon. Distal corner of limb with slight bulbous process (immature male).

Body length 4.3 (holotype), 4.7 (allotype) times tergal width of pereonite 2.

Remarks.—This species is most similar to *H. vafer* n. sp. These two species differ in the shape of the distal article of antenna I, and the positioning of the pleonal posterolateral processes. The males of the two species differ in the degree of narrowing of pereonites 4 and 5 relative to the female and in the morphology of pleopods I.

Hebefustis par n. sp.

Figure 11

Holotype.—WHOI 328, preparatory female, 2.4 mm long, USNM 169396.

Paratype.—WHOI 328, male, 1.8 mm long, USNM 169397.

Other material.—WHOI 156, 21 spec.; WHOI 256, 8 spec., SIO, ZMUC.

Distribution.—Northeast, equatorial, and South Atlantic Ocean, 3459-4435 m.

Etymology.—Latin, equal, a match.

Diagnosis.—Antenna I segment 5 elongate and bulbous, widest distally; length 3.3 (holotype), 3.2 (allotype) times greater than width (1/w). Segment 5 (holotype and allotype) length approximately equal to length of segment 2.

Pereonites 6 and 7 without posterolateral processes. Pereonite 4 1/w 0.5. Width 0.9 (holotype), 0.7 (allotype) times width of pereonite 2. Pereonite 2 with robust seta on anterolateral corner.

Pleon with acute processes (teeth) 0.8 (holotype), 0.9 (allotype) distant from anterior edge. Anterior to teeth, sides of pleon slightly convex, tapering inward in front of teeth. Pleon width between midpoints of concavities formed by teeth 0.7 times width of pleon. Pleon width 0.8 (holotype), 0.9 (allotype) times width of pereonite 2. Pleon 1/w 1.0 (holotype and allotype).

Female operculum length approximately equal to width; 0.66 length of pleon.

Male pleopod I 1/w 4.2; 0.8 times length of pleon. Lateral lobes with oblique ridge.

Body length 3.7 (holotype), 3.0 (allotype) times tergal width of pereonite 2.

Remarks.—This species has a rather broad geographic range. There are subtle differences among individuals of the three stations in the first antennae and in the shape of pereonite 4. However, the range of this variability is not appreciably greater than that within any one population. The paucity of copulatory males at these stations may preclude recognition of specific differences among the populations. Of the species lacking posterolateral projections on pereonites 6 and 7, *H. par* n. sp. is most similar to *H. alleni* n. sp. These two differ from the other species of this cluster in having more robust bodies relative to their length. *Hebefustis par* differs from *H. alleni* in having a more elongate distal segment of antenna I,

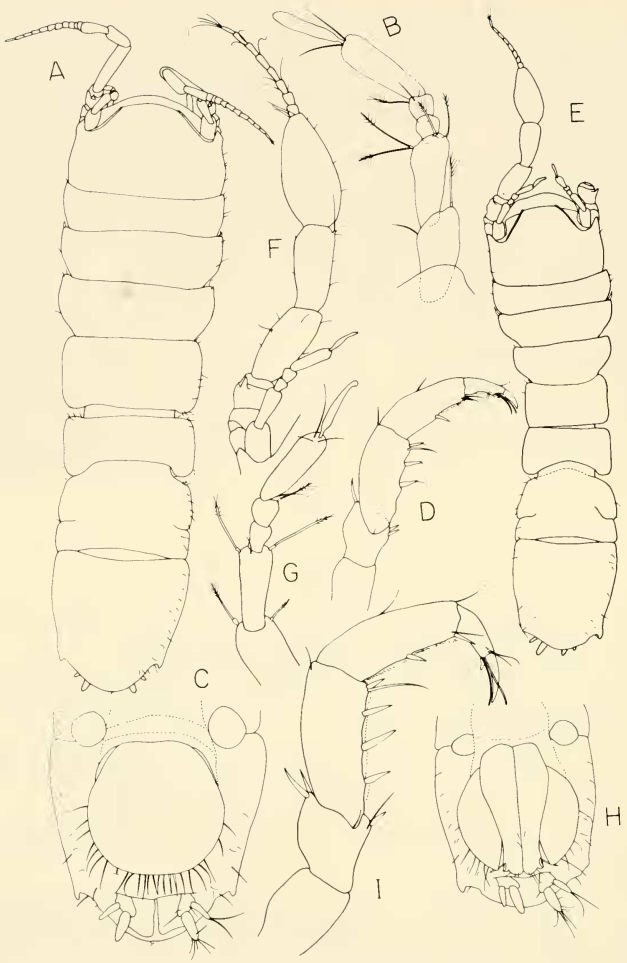

Figure 11. *Hebefustis par* n. sp., WHOI 328. A. preparatory female (holotype), dorsal view; B. preparatory female (holotype) right antenna I, lateral view; C. preparatory female (holotype) pleon, ventral view; D. preparatory female right pereopod I, *in situ;* E. male (paratype), dorsal view; F. male (paratype) left antennae I and II, dorsal view; G. male (paratype) left antenna I, dorsal view; H. male (paratype) pleon, ventral view; I. male (paratype) right pereopod I, *in situ.*

approximately equal in length to article 2, and in the more anterior placement of the pleonal posterolateral teeth.

The setation of the merus may differ between the right and left first pereopods of the same individual. In Figure 11, the differences in setation of the right first pereopods of the female and male are shown. The setation on the ventral surface of the merus of the left female first pereopod is the same as that on the merus of the right male first pereopod.

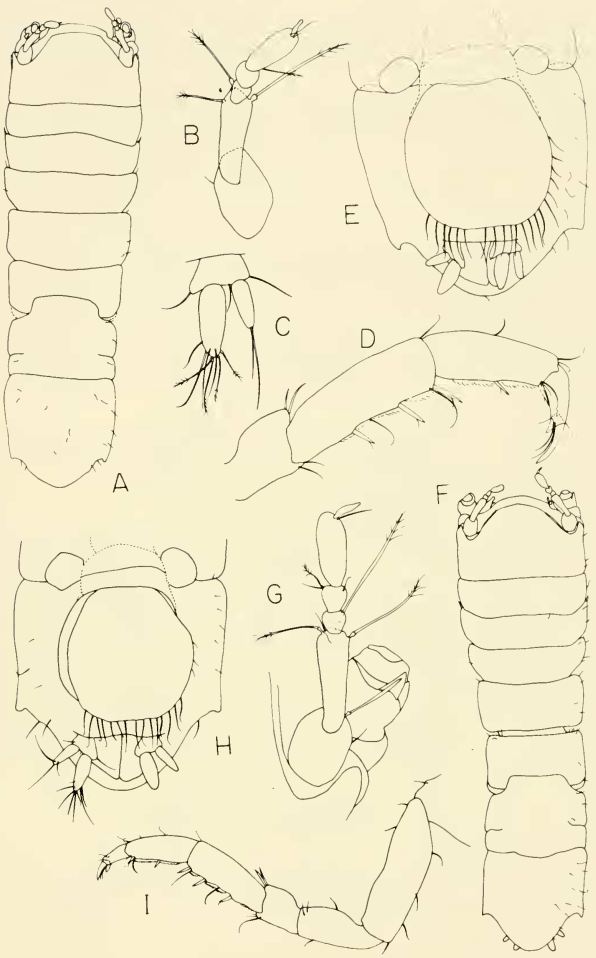

Figure 12. *Hebefustis alleni* n. sp., Allen S33. A. preparatory female (holotype), dorsal view; B. preparatory female (holotype) left antenna I, dorsal view; C. preparatory female (holotype) left uropod, *in situ;* D. preparatory female (holotype) right pereopod I, *in situ;* E. preparatory female (holotype) pleon, ventral view. WHOI 142. F. female, dorsal view; G. female right antenna I; H. female pleon, ventral view; I. female left pereopod I.

Hebefustis alleni n. sp.

Figure 12

Holotype.—Allen S33, preparatory female, 1.8 mm long, USNM 169398.

Other material.—WHOI 142, 6 spec., 1 frag.

Distribution.—Bay of Biscay and northeast Atlantic Ocean, 1623-1796 m.

Etymology.—After John Allen.

Diagnosis.—Antenna I segment 5, 2.4 times longer than wide (1/w); 0.6 times length of segment 2.

Pereonites 6 and 7 without posterolateral processes. Pereonite 4 l/w 0.5. Sides relatively straight; width 0.9 times width of pereonite 2. Pereonite 2 with robust seta on anterolateral corners.

Pleon with acute processes (teeth) 0.7 removed from anterior edge. Sides anterior to acute processes gently convex. Pleon width between midpoints of concavities formed by teeth 0.8 times width of pleon; length approximately equal to width.

Female opercular length approximately equal to width. Length of pleopod II 0.6 times length of pleon.

Body length 3.4 times tergal width of pereonite 2.

Remarks.—There are subtle differences in the shape of the pleon in specimens taken from the two localities (see Fig. 12E and 12H). *Hebefustis alleni* n. sp. can be differentiated from other species of the genus, which lack posterolateral projections on pereonites 6 and 7, on the basis of the robust body form, the relatively compact distal article of antenna I and the more posterior placement of the pleonal processes.

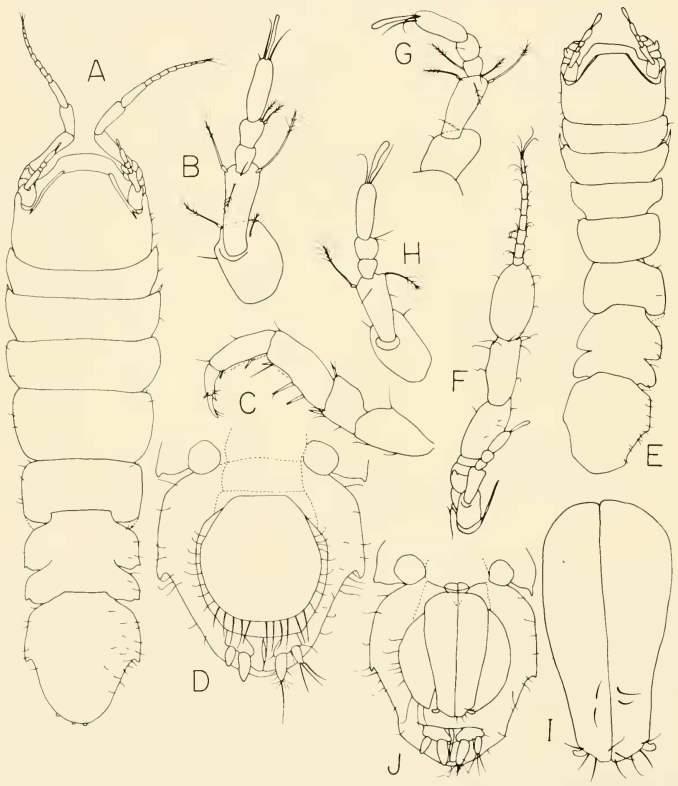

Figure 13. *Hebefustis cornutus* n. sp., WHOI 126. A. preparatory female (holotype), dorsal view; B. preparatory female (holotype) left antenna I, dorsal view; C. preparatory female (holotype) left pereopod I; D. preparatory female (holotype) pleon, ventral view; E. male (paratype), dorsal view; F. male (paratype) left antennae I and II, dorsal view; G. male (paratype) right antenna I, lateral view; H. male (paratype) left antenna I, dorsal view; I. immature male (paratype) pleopods I; J. male (paratype) pleon, ventral view.

Hebefustis cornutus n. sp.

Figure 13

Holotype.—WHOI 126, preparatory female, 2.0 mm long. USNM 169399.

Paratype.—WHOI 126, immature male, 1.5 mm long, USNM 169400; WHOI 126, 5 spec., SIO.

Other material.—WHOI 95, 1 spec.

Distribution.—Northwest Atlantic Ocean, 3753-3608 m.

Etymology.—Latin, horned.

Diagnosis.—Antenna I segment 5 somewhat bulbous; length to width ratio (l/w) 3.1 (holotype), 2.8 (allotype); sides nearly parallel; length 0.8 (holotype and allotype) times length of segment 2.

Pereonites 6 and 7 with acute processes on posterolateral corners. Pereonite 4 l/w 0.6 (holotype), 0.5 (allotype); sides convex, broadest anteriorly. Width 0.8 (holotype and allotype) times width of pereonite 2. Pereonite 2 with robust setae on anterolateral corners.

Pleon with acute processes (teeth) approximately 0.5 (holotype and allotype) way back from anterior edge. Sides of pleon just anterior to teeth parallel. Width of pleon between concavities formed by teeth 0.9 (holotype and allotype) times width of pleon; l/w 1.2 (holotype and allotype), 0.8 times width of pereonite 2 (holotype and allotype). Male pleon with angular margin posterior to posterolateral teeth.

Female operculum l/w 1.1; 0.6 times length of pleon (measured in dorsal view).

Male pleopod I l/w 4.0; 0.6 times length of pleon (measured in dorsal view); limb tapers distally, without lateral oblique ridge.

Body length 3.6 (holotype), 4.0 (allotype) times tergal width of pereonite 2.

Remarks.—Note the double angles of the male pleon, somewhat similar to the pleon of *H. primitivus. Hebefustis cornutus* belongs to the cluster of species having acute processes on the posterolateral corners of pereonites 6 and 7. *Hebefustis cornutus* is readily discriminated on the basis of rather anterior placement of the posterolateral spines on the pleon; the pleon is distinctly longer than wide, and pereonite 4 narrow.

Hebefustis hexadentium n. sp.

Figure 14

Holotype.—WHOI 247, preparatory female, 2.2 mm long, USNM 169401.

Paratype.—WHOI 247, male, 1.7 mm long, USNM 169402; WHOI 247, 1 brooding female, SIO.

Distribution.—Argentine Basin, South Atlantic Ocean, 5208-5223 m.

Etymology.—*hexa,* Latin, six; *dens,* Latin, tooth.

Diagnosis.—Antenna I segment 5 broadest proximally, tapering distally. Length to width ratio (l/w) 3.1 (holotype), 2.6 (allotype); length 0.6 (holotype), 0.8 (allotype) length of segment 2.

Pereonites 6 and 7 with posterolateral spines on posterior corners. Pereonite 4 l/w 0.5 (holotype and allotype); broader anteriorly; width 1.0 (holotype), 0.8 (allotype) times width of pereonite 2. Pereonite 2 lacks robust seta on anterolateral corner.

Pleon with acute processes (teeth) 0.6 (holotype and allotype) removed from anterior edge. Sides of pleon parallel anterior to teeth. Width of pleon between midpoints of concavities formed by teeth 0.9 (holotype and allotype) times width of pleon. Pleonal width 0.8 (holotype), 0.9 (allotype) times width of pereonite 2. Pleon l/w 1.05 (holotype and allotype).

Female operculum l/w 1.1; 0.6 length of pleon.

Male pleopod I l/w 3.6, 0.7 length of pleon; not flaring distally; without oblique ridge.

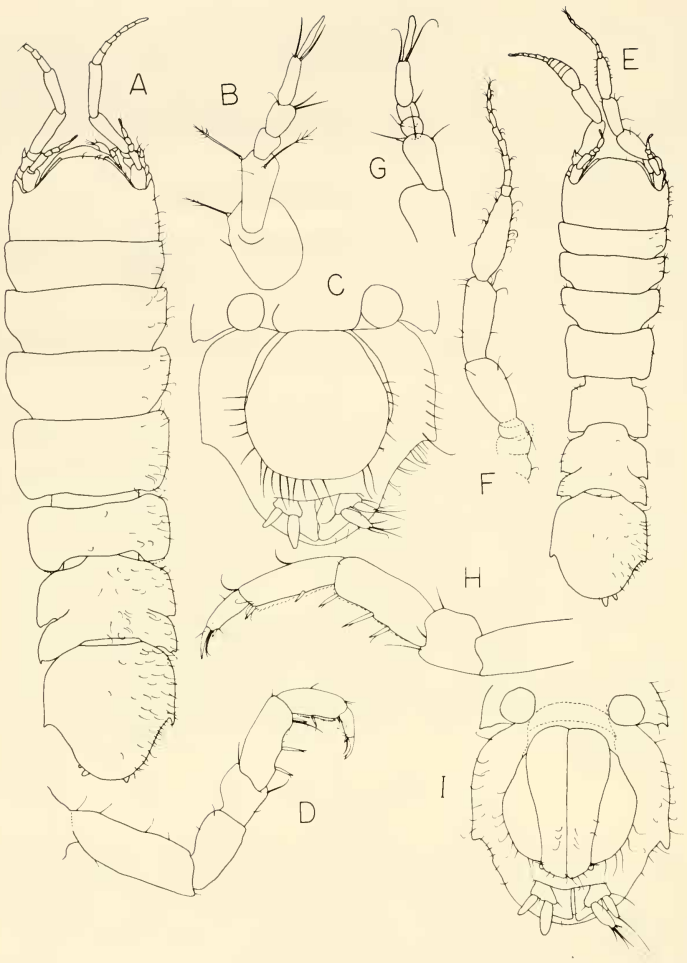

Figure 14. *Hebefustis hexadentium* n. sp., WHOI 247. A. preparatory female (holotype), dorsal view; B. preparatory female (holotype) left antenna I, dorsal view; C. preparatory female (holotype) pleon, ventral view; D. brooding female right pereopod I; E. male (paratype), dorsal view; F. male (paratype) right antenna II, dorsal view; G. male (paratype) left antenna I, lateral view; H. male (paratype) left pereopod I, *in situ;* I. male (paratype) pleon, ventral view.

Body length 3.9 (holotype), 4.2 (allotype) times tergal width of pereonite 2.

Remarks.—The lack of a robust seta on the anterolateral corner of pereonite 2 is unique among the species of this genus.

Hebefustis hexadentium n. sp. is strikingly similar to *H. hirsutus* (Menzies, 1962b). It differs in lacking a robust seta on the anterolateral corner of pereonite 2, in having a less rounded pleon anterior to the teeth, and in having a uropodal endopod that is somewhat longer relative to its width. Because the holotype of *H. hirsutus* is lost, the relationships of these two species cannot be explored.

Hebefustis hexadentium differs from the other new species possessing acute

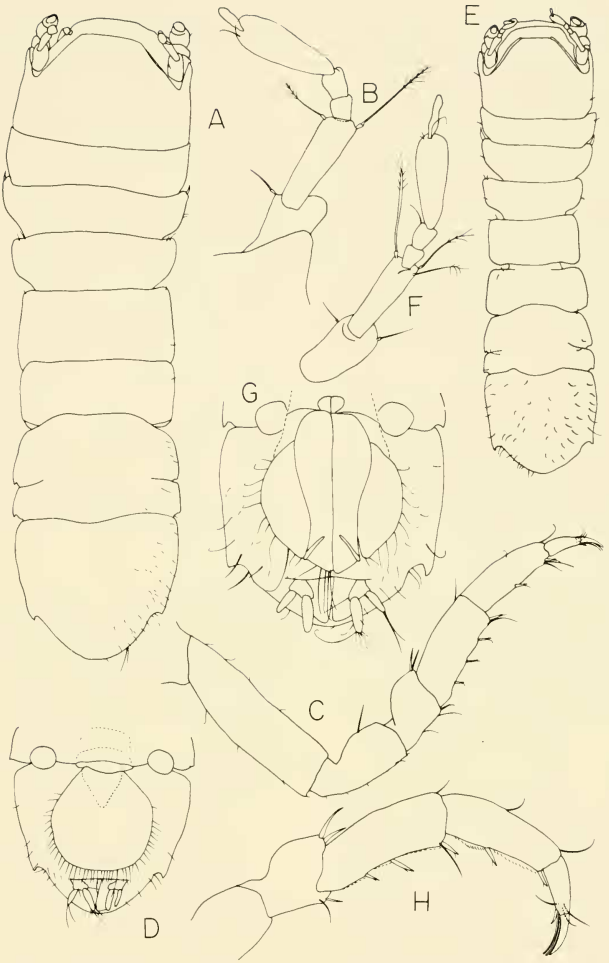

Figure 15. *Hebefustis dispar* n. sp., WHOI 202. A. preparatory female (holotype), dorsal view; B. preparatory female (holotype) right antenna I, lateral view; C. brooding female right pereopod I; D. preparatory female (holotype) pleon, ventral view; E. male (paratype), dorsal view; F. male (paratype) right antenna I, lateral view; G. male (paratype) pleon, ventral view; H. male (paratype) right pereopod I.

processes on pereonites 6 and 7 in the intermediate placement of the pleonal posterolateral spines and the relative shortness of the second article of antenna I.

Hebefustis dispar n. sp.

Figure 15

Holotype.—WHOI 202, preparatory female, 2.4 mm long, USNM 169403.

Paratype.—WHOI 202, male, 1.8 mm long, USNM 169405; WHOI 202, 103 spec. and frag., SIO, ZMUC.

Distribution.—Southeast Atlantic Ocean, 1427-1643 m.

Etymology.—Latin, unequal, dissimilar.

Diagnosis.—Antenna I segment 5 increases in width distally, length to width ratio (l/w) 2.8 (holotype), 3.0 (allotype); 1.1 (holotype and allotype) times longer than segment 2.

Pereonites 6 and 7 with posterolateral acute processes on posterior corners. Pereonite 4 l/w 0.4 (holotype), 0.5 (allotype); segment broadest posteriorly or with parallel sides; width 0.8 (holotype and allotype) times width of pereonite 2. Pereonite 2 with robust seta on anterolateral corners.

Pleon with acute posterolateral processes (teeth) 0.7 (holotype and allotype) removed from anterior edge. Sides of pleon anterior to teeth converge posteriorly; width of pleon between midpoints of concavities formed by teeth 0.7 (holotype), 0.8 (allotype) times pleonal width. Pleonal width 0.9 (holotype), 1.0 (allotype) times width of pereonite 2. Pleon l/w 0.84 (holotype), 0.89 (allotype).

Female operculum l/w approximately 1.0; 0.7 times length of pleon (measured in dorsal view).

Male pleopod I l/w 4.2, 0.8 length of pleon; somewhat flared distally, with oblique ridge on surface, terminating at lateral lobe.

Body length 3.4 (holotype), 3.9 (allotype) times tergal width of pereonite 2.

Remarks.—This species belongs to that cluster possessing acute processes on the posterolateral margins of pereonites 6 and 7. *Hebefustis dispar* is readily distinguished by its distinctive first antenna, and the converging sides of the pleon anterior to the teeth. Male pleopods I possess distinctive ridges on the distal surface.

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