

# NEW SPECIES OF BOTTOM-LIVING CALANOID COPEPODS COLLECTED IN DEEPWATER BY THE DSRV ALVIN<sup>1</sup>

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## ABSTRACT

The use of a deep sea submersible for collecting near bottom copepods is described. Thirteen new species of calanoid copepods were found in a plankton sample collected within 30 cm of the bottom at a depth of approximately 1800 meters on the continental slope south of Woods Hole, Massachusetts. The species are described and illustrated.

## INTRODUCTION

Several families of calanoid copepods have species which live in proximity to the bottom. These species, termed planktobenthos by Hutchinson (1967), are not usually collected in abundance by ordinary plankton collecting techniques, as it is not prudent to permit a towed plankton net to get very near to the bottom, especially in deepwater, where it might be fouled, torn or lost. Specialized collecting apparatus have been devised for collecting animals that live near the seabed. Matthews (1964) described three types of gear that he used to sample bottom-living calanoid copepods

which he referred to as epibenthos, at a depth of 240 m south of Bergen, Norway. In addition to Matthews' methods, planktobenthos have also been collected by attaching a tow net above a bottom dredge or to a bottom trawl as Farran (1905), for example, did in his investigations of the copepods of the slope area off Ireland. Farran's deepest bottom plankton collection was obtained by a trawl in 382 fathoms. Frolander and Pratt (1962) have described a "bottom skimmer" which they used for collecting planktobenthos at a depth of 40 feet in a lake.

The recent acquisition of the Deep Submergence Research Vehicle ALVIN by the Woods Hole Oceanographic Institution provided us with a means to sample planktobenthos with greater precision and in greater depths than we believe to have been hitherto practical. With plankton nets attached to ALVIN as shown in Figures 1 and 2, the pilot, by visual observation, can keep the nets just above the bottom for prolonged sampling periods in depths down to approximately 1900 m, the maximum operational depth of ALVIN.

## SAMPLING PROCEDURE

In the initial attempt to sample the planktobenthos from ALVIN, samples were collected by means of two nets attached to the submersible. The mouth opening of the nets (.233 mm aperture size) were "D" shaped with the straight side fastened

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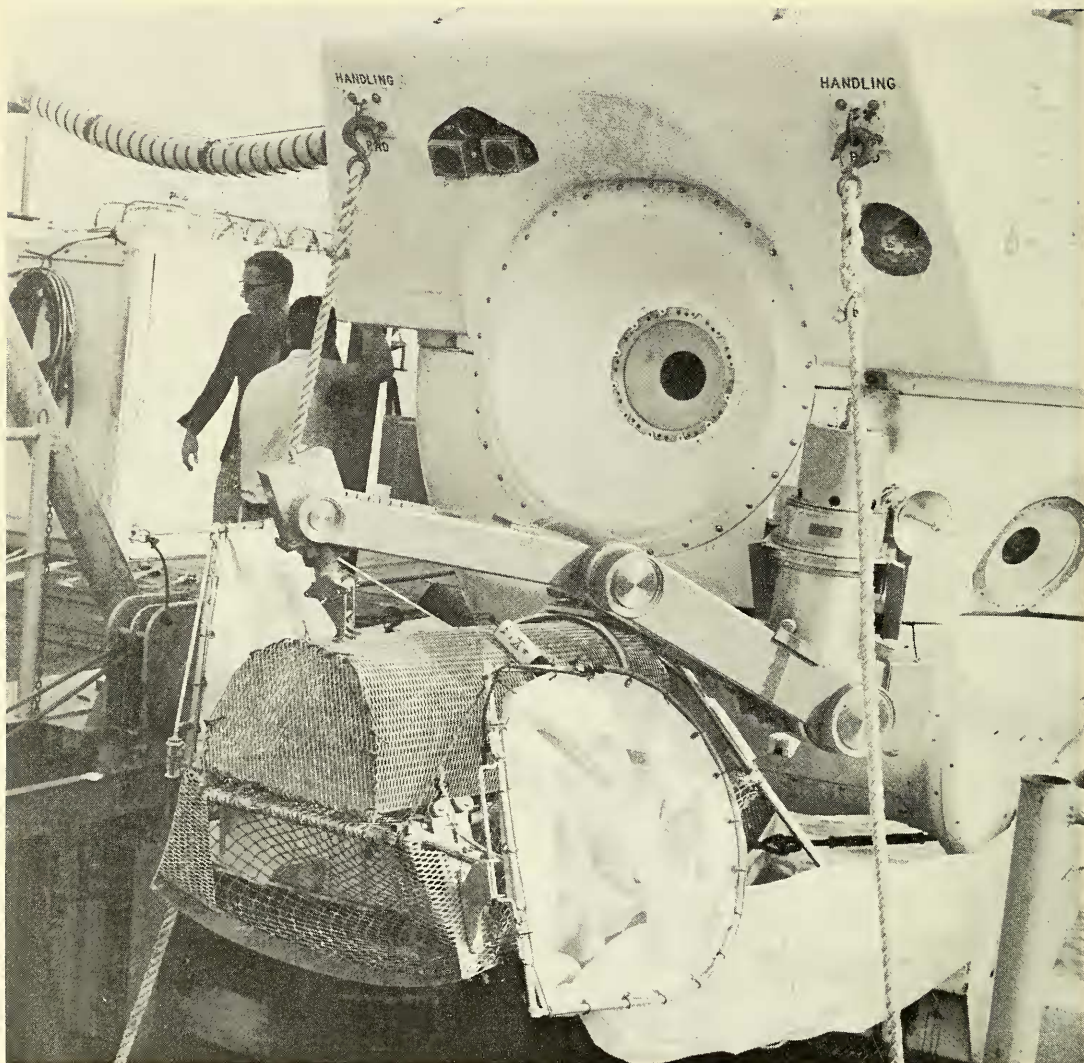


Figure 1. Position of plankton nets during descent of ALVIN.

vertically to a hinge located on the forward end of the submersible's collecting basket (Figs. 1, 2). During the descent of the submersible, the mouth was held sideways (Fig. 1) in order to reduce the possibility of obtaining plankton while on the way to the bottom. Upon reaching the bottom, the mechanical arm of ALVIN was used to swing the mouth of one net into the sampling position (Fig. 2) and to hold it there for the duration of the sampling period.

The net was kept within 30 cm of the bottom while the submersible cruised at approximately 1 1/2 knots. At the end of one hour the mouth was allowed to swing back to its original position and the pursing line was tightly drawn around the net by means of the mechanical arm. The other net was then opened and a sample collected in the same manner as described for the first net. The collections were obtained by Dr. Howard Sanders and his associates.

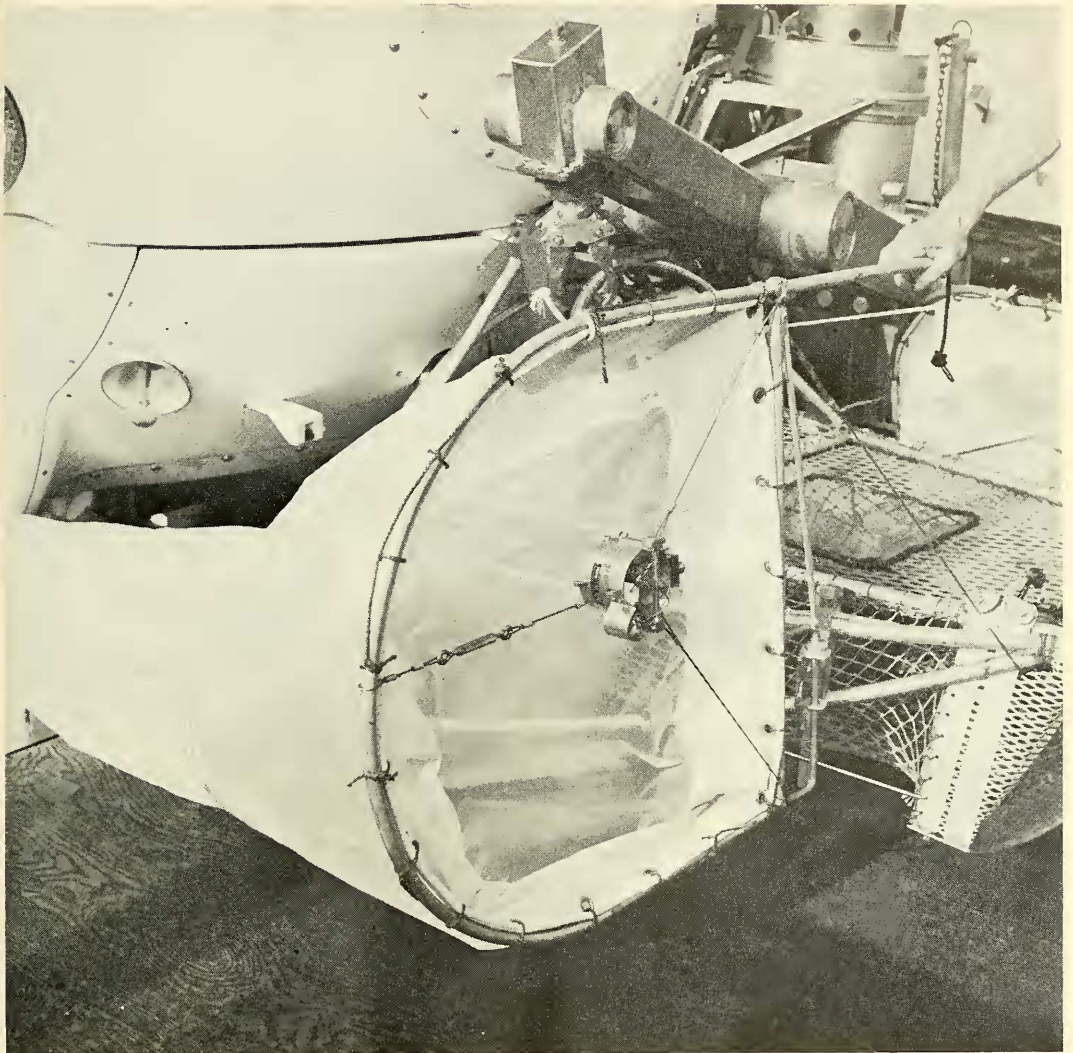


Figure 2. One plankton net in sampling position.

#### DESCRIPTION OF COLLECTING AREA

The collections were made south of Woods Hole, Massachusetts, at  $39^{\circ}45.2'N$   $70^{\circ}33.8'W$  on September 19, 1967 (ALVIN Dive 220). The water depth in the area varied between 1750 and 1822 m and the temperature was  $3^{\circ}C$ . The bottom was composed of fine sediment with a flocculent zone at the surface which was readily stirred up. A slight current was noticeable near the bottom.

#### RESULTS

Since the two samples came from approximately the same depths and since the bottom topography appeared homogeneous in the area, the two are here treated as one. Sixty-five species of calanoid copepods were identified, including 13 new species that will be described below.

These 13 species with the possible exception of *Aetideopsis magna*, probably live in proximity to the seabed. From

dredge collections made near Norway, Sars (1902) described bottom-living species of *Bryaxis* (= *Comantenna*), *Diaixis*, *Tharybis*, and *Xanthocalanus*, the first three being established as new genera. Except for *Tharybis*, we encountered undescribed species referable to these genera. *Tharybis* is now considered to be one of three genera in the Family Tharybidae. We found undescribed species of the other two genera of Tharybidae, *Undinella* and *Parundinella*. *Comantenna* is closely associated with the seabed (Matthews, 1964), as are some species of *Xanthocalanus* (Sars, 1925). Species of *Amalophora*, of which we found two undescribed ones, have not been taken in abundance in mid-water plankton samples. Perhaps this genus, too, has bottom affinities.

Representatives of typically planktonic species were also noted and include, for example, *Calanus finmarchicus*, *C. hyperboreus*, *Eucalanus elongatus*, *Clausocalanus furcatus*, *Microcalanus pygmaeus*, *Pseudocalanus elongatus*, *Temoropia mayumbaensis*, *Metridia curticauda*, *Pleuromamma robusta*, *Centropages typicus*, and *Acartia danae*. Some of these may have entered the net during the descent of the submersible. As may be noted in Figure 2, the net is folded back (not pursed) during this phase of the collection. However, several of these very same species together with some others were reported from samples collected just over the sea floor by Matthews (1964) in his study on bottom-living copepods off western Norway.

Type specimens have been deposited in the U. S. National Museum.

#### FAMILY AETIDEIDAE

##### *Aetideopsis magna* n. sp.

Pl. I, figs. 3-19

Material examined: 6 males

*Diagnosis* (male). Head and first thoracic segment fused, fourth and fifth thoracic segments partially fused. Abdomen consisting of five segments, second segment

largest, anal segment very short. Rostrum 2-pointed, small. Posterolateral margin of fifth thoracic segment more or less rounded with posteriorly directed small spine. Antennule reaching third thoracic segment. In right antennule segments 8 and 9, 20 and 21 fused; in left antennule segments 8 and 9 only fused. Large aesthetascs on segments 2 to 9. Exopod of antenna shorter than endopod. Basal segment of mandible palpus devoid of setae. Mandible blade rudimentary. Maxillule and maxilla reduced. Second basipodal segment of maxilliped slender, slightly longer than first. Endopod of first leg 1-segmented, of second leg 2-segmented, of fourth leg 3-segmented. Exopod of first leg 3-segmented, of other legs broken short. Posterior side of second and fourth legs with patches of short hair. Fifth legs asymmetrical, left side longer than right. Endopods slender, 1-segmented. Exopod of right fifth leg ending with slender point. Second exopodal segment of left fifth leg with setae distally, third segment small, with hair at tip. Total lengths 4.20-4.56 mm. Holotype No. 125135.

The female is unknown.

*Remarks.* *Aetideopsis magna* resembles *A. multiserrata* (Wolfenden), but is distinguished by its larger size, the relatively shorter spine in the fifth thoracic segment, and the longer left fifth leg. No female belonging to this genus was found in the sample.

The name *magna* refers to the relative size of this species.

##### *Comantenna recurvata* n. sp.

Pl. I, figs. 20-24; Pl. II, figs. 25-35

Material examined: 4 females

*Diagnosis* (female). Head and first thoracic segment fused. Fourth and fifth thoracic segments separate. Abdomen 4-segmented, anal segment small. Rostrum absent. Posterolateral corners of cephalothorax pointed and curved upward. Antennules 23-segmented, reaching to third thoracic segment. Antennules with numer-

ous, highly plumose setae throughout their length and 1 sensory seta on the second segment. Exopod of antenna three-fourths the length of endopod. Distal segment of exopod with 2 long and 1 short plumose setae. Endopod of mandible very small, exopod robust. Mandible blade with strong teeth and scattered spines. Maxillule with 14 spines on first inner lobe, 4 setae on second inner lobe, 3 setae on third inner lobe, 4 setae on second basal segment, 11 setae on endopod, and 11 setae on exopod. Maxilla with 5 lobes. Maxilliped with elongate, club-shaped sensory structure arising from distal end of first basal segment. Exopods of swimming legs 3-segmented, endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented. Rudimentary fifth legs present on 2 of 4 specimens. Total lengths 3.72–4.00 mm. Holotype No. 125136.

The male is unknown.

*Remarks.* The large size of the present species and the presence of long plumose setae on the terminal segment of the exopod of the antenna will distinguish it from *C. brevicornis* (Sars). This latter species, known from the Northeast Atlantic (near the bottom) is smaller (1.7–2.6 mm) and has poorly developed terminal setae on the distal segment of the exopod of the antennae. In other respects the two species closely resemble each other and, with the finding of additional specimens in shallower depths in the Northeast Atlantic, may prove to be conspecific. *C. brevicornis* has been collected off Norway in bottom samples to depths of about 300 m.

The specific name *recurvata* refers to the shape of the points on the posterior end of the cephalothorax.

#### FAMILY PHAENNIDAE

##### *Xanthocalanus alvinae* n. sp.

Pl. II, figs. 36–40; Pl. III, figs. 41–54

Material examined: 5 females

*Diagnosis* (female). Cephalothorax slender. Head and first thoracic segment fused, but trace of segmentation visible.

Fourth and fifth thoracic segments separate. Abdomen 4-segmented, anal segment very short. Rostrum with two filaments of moderate length. Posterolateral corner of fifth thoracic segment angular, little produced. Antennules with 22 free segments, segments 8–10 and 24 and 25 fused; reaching end of third abdominal segment. Exopod of antenna consisting of 7 segments, slightly longer than endopod. Basal segment of mandible palpus carrying 3 setae, mandible blade with rather simple teeth. Two setae on second inner lobe of maxillule, 4 setae on third inner lobe, 4 setae on second basal segment, 2 and 5 setae on endopod, 7 setae on exopod. First lobe of maxilla with 3, second to fourth lobes with 2, fifth lobe with 3 setae, one of them spinelike, and a sensory appendage; endopod carrying sensory filaments. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs and exopods of first to third legs 3-segmented, exopod of fourth leg broken. Posterior sides of both rami of second and third legs spinulose, of endopod of fourth leg covered with hairlike spines. Fifth leg composed of 3 segments of about equal length equipped with conspicuous hair and spinules. Second segment slightly wider than long, distal segment carrying 1 external, 1 internal, and 1 terminal spine, the latter being the shortest. One female had 2 terminal spines. Internal spine strong, exceeding distal segment in length, directed more or less at right angle to segment. Total lengths 2.10–2.34 mm. Holotype No. 125137.

*Remarks.* *Xanthocalanus alvinae* closely resembles *X. echinatus* Sars. It can, however, be distinguished by its fifth leg which is 3-segmented, has dense, long hair on the second segment and 1 (or 2) jointed terminal spines on the distal segment. The fifth leg of *X. echinatus* is 2-segmented, the short proximal segment is devoid of hair, and the distal segment ends in a conical protrusion.

The male is unknown.

This species is named for the DSRV ALVIN.

*Xanthocalanus distinctus* n. sp.

Pl. III, figs. 55–57; Pl. IV, figs. 58–73

Material examined: 3 males

*Diagnosis* (male). Head and first thoracic segment incompletely fused. Fourth and fifth thoracic segments separate. Abdomen 5-segmented, anal segment very short. Rostrum well developed with 2 filaments. Posterolateral margin of fifth thoracic segment angular. Antennule reaching end of furca, segments 8–12 and 13 and 14 fused. Endopod of antenna slightly shorter than exopod. Basal segment of mandible palpus with 2 setae; blade with a number of complex teeth. In maxillule 2 setae on second inner lobe, 4 setae on third inner lobe, 4 setae on second basal segment, 2 and 5 setae on endopod, 7 setae on exopod. Fifth lobe of maxilla with strong spine; third and fourth lobe each with 1 sensory appendage. Endopod carrying 2 types of sensory filaments. Basipods of maxilliped nearly equal in size, second segment of endopod longest. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs as well as exopods of first to fourth legs 3-segmented. Posterior sides of most of second to fourth legs covered with spinules and hair. Fifth legs asymmetrical, left side about 3 times the length of right side. Both sides 5-segmented, endopods absent. Total lengths 2.44–2.56 mm. Holotype No. 125138.

The female is unknown.

*Remarks.* The male of *Xanthocalanus distinctus* resembles the male of *X. fallax* Sars. It differs, however, in the separate fourth and fifth thoracic segment, the longer antennule, and the relatively longer right fifth leg. In *X. fallax*, the fourth and fifth thoracic segments are fused, the antennule overreaches the end of the thorax only slightly, and the right fifth leg is only about one-fourth of the length of the left leg.

The meaning of the name of this species is obvious.

*Xanthocalanus elongatus* n. sp.

Pl. IV, figs. 74–78; Pl. V, figs. 79–96; Pl. VI, figs. 97–110

Material examined: 25 females, 17 males

*Diagnosis* (female). Head and first thoracic segment fused, fourth and fifth thoracic segments separate. Abdomen 4-segmented. Genital segment with short hair mainly distributed on sides and posterior margin; anal segment very short. Rostrum of moderate size with 2 filaments. Posterolateral margin with small point. Antennule reaching to middle of genital segment; composed of 24 free segments, segments 8 and 9 fused. Endopod of antenna nearly as long as exopod. Basal segment of mandible palpus bearing 3 setae; blade with 8 teeth and 1 seta. In maxillule, 2 setae on second inner lobe, 3 setae on third inner lobe, 5 setae on second basal segment, 3 and 5 setae on endopod, 7 setae on exopod. Fifth lobe with 2 strong spines and 1 seta; 1 seta each modified as sensory structure on third and fifth lobes. Endopod with 3 ribbonlike and 5 smaller sensory appendages. First and second basal segments of maxilliped of about equal length, in endopod second segment longest. Endopods of first leg 1-segmented, of second leg 2-segmented, of third and fourth as well as exopods of first to fourth legs 3-segmented. Posterior sides of rami of second to fourth legs covered with spinules, especially dense on fourth leg including both basipodal segments. Fifth leg 3-segmented, second and third segments with many spinules mainly on outer side. Distal segment with 1 short terminal and 1 long internal spine. Internal spine inserting close to terminal spine, exceeding distal segment of fifth leg in length.

Total lengths (12 females) 2.48–2.80 mm. Holotype No. 125139.

*Diagnosis* (male). Head and first thoracic segment fused, fourth and fifth thoracic segments separate. Abdomen con-

sisting of 5 segments, anal segment very small. Rostrum of moderate size with 2 filaments. Posterolateral margin of fifth thoracic segment with small, blunt corner. Antennule reaching third abdominal segment; segments 8 and 9, 10 and 12, and on right side 20 and 21 fused. Sensory structures on segments 2 and 3. Endopod of antenna little shorter than exopod. Basal segment of mandible palpus carrying 2 very small setae; exopod and endopod of about equal length. Mandible blade with 7 teeth and 1 strong seta. Two setae on second inner lobe of maxillule, 3 setae on third inner lobe, 4 setae on second basal segment, 3 setae on first, 2 setae on second, 3 setae on third endopodal segment, 7 setae on exopod. Maxilla stout, fifth lobe with coarse spine, endopod with 2 kinds of sensory filaments. Basal segments of maxilliped of nearly equal length, in endopod second segment longest. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs as well as exopods of first to fourth legs 3-segmented. Posterior sides of endopods and exopods of second to fourth legs beset with spines, very thickset in the fourth leg. Endopod of left fourth leg devoid of spinules. Fifth legs very asymmetrical. Left side 5-segmented, extremely long, exceeding half the total length of animal; first 4 segments slender, terminal segment short, bearing several setae. Right side 3-segmented, small, slightly longer than first segment of left side. Endopods absent. Total lengths (9 males) 2.56–2.84 mm. Allotype No. 125140.

*Remarks.* The female of *Xanthocalanus elongatus* shows some relationship to *X. echinatus* Sars, but is easily distinguished from it, as well as from all other species in the genus, by the heavy spinulation of the fourth leg and the structure of the fifth leg. The male differs from all other known males of *Xanthocalanus* by the enormous length of its left fifth leg.

The name *elongatus* alludes to the shape of the left fifth leg of the male.

*Xanthocalanus macrocephalon* n. sp.

Pl. VI, figs. 111–116; Pl. VII, figs. 117–127

Material examined: 4 females

*Diagnosis.* (female.) Head and first thoracic segment fused, separation indicated laterally by short line. Fourth and fifth thoracic segments incompletely separated. Abdomen 4-segmented. Rostrum small without filaments. Posterolateral margin of fifth thoracic segment angular. Antennule reaching end of cephalothorax, segments 8 and 9 fused. Exopod of antenna twice the length of endopod. Basal segment of mandible palpus with 3 setae; conspicuous hump on external side of mandible blade; teeth on chewing edge small. First inner lobe of maxillule bearing 10 spines, second and third inner lobes and second basal segment each with 2 setae, 2 and 5 setae on endopod, 4 setae on exopod. In maxilla first lobe with 4 setae, second to fourth lobes each with 3 setae, fifth lobe with 3 setae, 1 small spine and 1 sensory appendage, endopod with 2 types of sensory appendages. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented; exopods of all four legs 3-segmented. In second to fourth legs posterior sides of endopods armed with spinules, in fourth leg also basipod and exopod. Fifth leg 3-segmented, on posterior side, mainly externally, covered with small spines. Terminal segment with 1 small external spine, 1 long internal spine and 2 terminal points, not articulating with the segment. Total lengths 1.06–1.12 mm. Holotype No. 125141.

The male is unknown.

*Remarks.* *Xanthocalanus macrocephalon* is similar to *X. paraincertus* Grice and Hülsemann. *X. macrocephalon* can be distinguished from the latter mainly by its more slender body in lateral view, the absence of rostral filaments, the angular fifth thoracic segment, and the shorter spines on the exopod of the first leg. In *X. paraincertus* there are long rostral fila-

ments, the posterolateral margin of the fifth thoracic segment is rounded, and the spines of the exopod of the first leg are very long and curved.

The name *macrocephalon* refers to the relatively wide anterior portion of the head as seen in lateral view.

*Amallophora macilenta* n. sp.

Pl. VII, figs. 128–141; Pl. VIII, figs. 142–149

Material examined: 3 males

*Diagnosis* (male). Cephalothorax elongate. Head separated from first thoracic segment by fine line, dorsally extending posteriorly close to anterior margin of second thoracic segment. Fourth and fifth thoracic segments fused. Abdomen 5-segmented. Rostrum of moderate size with 2 rostral filaments. Posterolateral margin of fifth thoracic segment rectangular with rounded corner. Second abdominal segment largest, about as wide as long; anal segment very short; second to fourth abdominal segments covered with slitlike pores. Antennule reaching posterior end of third abdominal segment. In right antennule segments 8–14 and 20 and 21 fused, on left side segments 7–14 fused and 20 and 21 incompletely separate. Exopod of antenna 1.5 times as long as endopod. Basal segment of mandibular palpus broad, carrying 2 slender setae. Teeth on mandible blade simple, on posterior side short, on anterior side longer. Spines on first inner lobe of maxillule modified; 2 setae on second inner lobe, 4 setae on third inner lobe, 5 setae on second basal segment, 2 and 6 setae on endopod, 10 setae on exopod. Maxilla small; 1 large amalla on endopod and 5 slender sensory appendages. Second basipodal segment of maxilliped slender, longer than first basipodal segment; second segment of endopod longest. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented. Exopods of first to fourth legs 3-segmented. Posterior sides of endopods of second to fourth legs armed with spines and spinules. Fifth legs slender;

left side stronger than right, rudimentary endopods 1-segmented; first and second exopodal segments of right fifth leg separated by fine line and equipped with minute spines; terminal spine on third segment long and slender. Distal end of second exopodal segment of left fifth leg with 4 or 5 setae, third segment with several horizontal rows of short hair and several terminal spines. Total lengths 5.16–5.41 mm. Holotype No. 125142.

The female is unknown.

*Remarks.* *Amallophora macilenta* is similar to *A. oculata* Tanaka, but differs mainly in its larger size, the absence of a lense below the rostrum, its rounded forehead (in lateral view), and in the nearly rectangular posterolateral margin of the fifth thoracic segment. *A. oculata* measures 3.40 mm, has a lense below the rostrum, a hollowed forehead near the base of the rostrum, and a narrowly rounded posterolateral margin on the fifth thoracic segment.

The name *macilenta* makes reference to the relatively slender body of this species.

*Amallophora rotunda* n. sp.

Pl. VIII, figs. 150–165; Pl. IX, figs. 166–171

Material examined: 3 males

*Diagnosis* (male). Head and first thoracic segment and fourth and fifth thoracic segments separate. Abdomen 5-segmented. Rostrum bifurcate with 2 filaments of moderate length. Posterolateral margin rounded ventrally and rather straight posteriorly. Antennule overreaching end of furca by about last 3 segments, segments 8 and 9 fused on both sides, incompletely fused with segment 10, segments 20 and 21 partly fused. Endopod of antenna about two-thirds the length of exopod. Basal segment of mandible palpus with 2 setae, mandible blade very small, edge with 5 teeth and 1 seta. Spines on first inner lobe of maxillule modified, 2 setae on second inner lobe, 4 setae on third inner lobe, 5 setae on second basal segment, 2, 2, and 4 setae on endopod, 10 setae on exopod.



Five lobes on maxilla relatively small, endopod carrying 1 large amalla. First basipodal segment of maxilliped with prominent hump proximally on anterior edge, segment widest distally, second basipodal segment widest proximally. Second segment of endopod longest. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs as well as exopods of first to fourth legs 3-segmented. Posterior sides of endopods of second to fourth legs and second exopodal segment of fourth leg with spinules. First basipodal segment of third leg with row of spinules, of fourth leg with row and patch of spinules. Fifth legs asymmetrical, both sides uniramous, 5-segmented. Left leg about 3 times as long as right leg. Third segment of right fifth leg with 1 small outer spine, distal segment with 2 small terminal spines. Third segment of left fifth leg with 1 small outer spine, distal end of fourth segment with fan of setae, terminal segment bearing some short hair on inner side and a patch of hair on the distal end. Total lengths 3.04–3.28 mm. Holotype No. 125143.

The female is unknown.

*Remarks.* *Amalophora rotunda* is closely related to *A. typica* A. Scott. It can, however, be distinguished by its slightly larger size, the less protruded fifth thoracic segment, the relatively shorter right fifth leg, and differences in the distal portion of the left fifth leg.

The name *rotunda* alludes to the body shape of this copepod, which is fuller than in the preceding species.

#### FAMILY DIAIXIDAE

*Diaixis asymmetrica* n. sp.

Pl. IX, figs. 172–190

Material examined: 1 female

*Diagnosis* (female). Head and first thoracic segment separate, fourth and fifth thoracic segments separate. Abdomen 4-segmented, anal segment very small. Rostrum divided, without filaments. Posterolateral corners of cephalothorax asym-

metrical, left side pointed, right side lobate. Genital segment with two protrusions dorsally and one protrusion ventrally. Second abdominal segment with cuticular elevations ventrally and laterally. Antennules reaching to fourth thoracic segment; 24-segmented, segments 8 and 9 fused. Segment 1 through 21 with 1 or more rows of small spines. Antenna with endopod less than one-half of length of exopod. Basal segment of mandible palpus with 2 setae, blade elongate and bearing 4 rounded teeth and 2 slender setaelike structures. Maxillule with exopod bearing 2 sensory and 4 normal setae. Setae on first inner lobe very fine and elongate. Distal end of maxilla with 3 bulbous and 6 wormlike sensory setae. Basal segment of maxilliped bearing 4 sensory setae. Leg 1 with 3 exopodal segments each bearing 1 spine. Endopod 1-segmented. Rami of legs 2–4 elongate and bearing numerous small spines on anterior and posterior surfaces as well as on basal segments. First basal segment of fourth leg bearing proximally one large spine on right side and 2 smaller spines on left side. Total length 1.22 mm. Holotype No. 125144.

The male is unknown.

*Remarks.* This species differs from *Diaixis hibernica* (A. Scott) and *D. pygmaea* (T. Scott), the other two species in the genus, by 1) the lobate shape of the right posterolateral corner of the cephalothorax, 2) the numerous spines on the surface of the antennules and swimming legs, and 3) the presence of several large spines on the first basal segments of the fourth legs. The presence of two sensory setae on the exopod of the maxillule is also a distinctive characteristic of this species, and one which we have not observed in truly pelagic species.

#### FAMILY THARYBIDAE

*Parundinella emarginata* n. sp.

Pl. X, figs. 191–210

Material examined: 2 males

*Diagnosis* (male). Head and first tho-

racic segment fused, fourth and fifth thoracic segments partially fused. Abdomen 5-segmented, anal segment small. Rostrum bifurcate, each side bearing a filament. Posterolateral corners of cephalothorax symmetrical and emarginate. Antennules asymmetrical and broken distally in both specimens. Right antennule with segments 8–10 fused and apparently segments 21 and 22 fused. Left antennule with segments 8–10 only fused. Numerous aesthetascs proximally. Endopod of antenna approximately one-half length of exopod. Mandible palpus large, blade elongate and bearing 4 large teeth, several needlelike spines and a seta. Maxillule with 10 spines on first inner lobe, 3 setae on second inner lobe, 4 setae on third inner lobe, 4 setae on second basal segment, 7 setae on endopod, 7 setae on exopod, and 7 setae on first outer lobe. Distal end of maxilla bearing 3 bulbous and several wormlike sensory setae. Maxilliped with sensory setae on first basal segment. First leg with 3-segmented exopod and 1-segmented endopod. Second leg with 3-segmented exopod and 2-segmented endopod. Third and fourth legs with 3-segmented exopods and endopods. Numerous spines on endopod of third leg and basal segments and rami of fourth leg. Fifth legs biramous, reaching to end of furca. Right exopod 1-segmented, endopod fused with basal segment. Left exopod 3-segmented, proximal segment with large rounded protuberance. Left endopod elongate and 1-segmented. Total lengths .84 mm and .86 mm. Holotype No. 125145.

The female is unknown.

*Remarks.* The genus *Parundinella* was established by Fleminger (1957) to accommodate two species, *P. spinodenticula* and *P. mannicula*, that he found in the Gulf of Mexico. The male of the latter species is not known. The segmentation of the fifth feet and the rounded posterolateral corner of the cephalothorax of *P. spinodenticula* are quite different from those in *P. emarginata*. Although the distal end of the

right antennule of *P. emarginata* is broken off at segment 21, it appears that segments 21 and 22 are fused rather than segments 20 and 21 as in *P. spinodenticula*. *P. emarginata* could be the undescribed male of *P. mannicula*. Since no females of *P. mannicula* were found and since the species is known only from the Gulf of Mexico, we are not referring our specimens to this species.

The specific name *emarginata* refers to the shape of the posterolateral margin of the fifth thoracic segment.

*Undinella altera* n. sp.

Pl. X, figs. 211–214; Pl. XI, figs. 215–227

Material examined: 1 male

*Diagnosis* (male). Head and first thoracic segment fused, fourth and fifth thoracic segments fused. Abdomen 5-segmented, anal segment very small. Rostrum absent. Posterolateral corner of thorax truncate. Right antennule consists of 22 free segments, segments 8–10, 20–21 fused. Left antennule consists of 23 segments, segments 8–10 fused. Aesthetascs numerous proximally on both antennules. Endopod of antenna approximately one-half the length of exopod. Mandible blade robust, cutting edge with coarse teeth and needlelike spines. Exopod of mandible smaller than endopod, basal segment bearing 2 coarse and 1 fine setae. First inner lobe of maxillule large, 2 and 5 setae on second and third inner lobes, respectively, 3 setae on second basal segment, 6 setae on endopod, 2 setae on exopod, and 7 setae on first outer lobe. Maxilla with 5 lobes arising distally. Second segment of maxilliped somewhat swollen. Exopods of first to fourth legs 3-segmented, endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented. Scattered spines on distal exopodal and endopodal segments of legs 2 and 3. Right fifth leg uniramous, 2-segmented. Proximal segment twice the length of distal segment. Endopod of left fifth leg elongate, reaching beyond end of right leg.

Exopod 3-segmented, distal segment with conspicuous lamella. Total length 1.60 mm. Holotype No. 125146.

The female is unknown.

*Remarks.* The males of *Undinella* are distinguished by the shape of the postero-lateral corners of the cephalothorax and the structure of the fifth legs. In lateral view, the posterior end of the cephalothorax is truncate in *U. altera*. It is rounded, angular, or pointed in the other species. A distinct lamella is present on the distal segment of the exopod of the left fifth leg only in *U. compacta* and *U. altera*. In *U. compacta* the distal end of the first endopodal segment of the right leg reaches to the distal end of the exopod of the left leg. In *U. altera*, the distal end of the first endopodal segment reaches to about the mid point of the exopod.

The name *altera* should merely express that the described species is another species.

*Undinella compacta* n. sp.

Pl. XII, figs. 228–241; Pl. XIII, figs. 242–257

Material examined: 17 females, 40 males

*Diagnosis* (female). Anterior portion of head in dorsal view smoothly ovate, separated dorsally from first thoracic segment by fine line. Fourth and fifth thoracic segments fused. Abdomen 4-segmented. Rostrum or filaments absent. Posterolateral margin of fifth thoracic segment rounded with shallow indentation. Antennules not quite reaching end of cephalothorax, with 24 free segments, segments 8 and 9 fused, incompletely separated from segment 10. Exopod of antenna two times the length of endopod. Basal segment of mandible palpus with 2 coarse and 1 long slender setae; endopod longer than exopod. Mandible blade with about 7 monocuspidate teeth and 1 thick seta. Twelve spines on first inner lobe of maxillule, 3 setae on second inner lobe, 4 setae on third inner lobe, 3 setae on second basal segment, 2 and 5 setae on endopod, 3 setae on exopod.

Lobes and endopod of maxilla located in distal half of appendage. Second basal segment of maxilliped about as long as first, thickened in proximal half. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs and exopods of first to fourth legs 3-segmented. Posterior sides of second to fourth legs with few spinules. Fifth leg 3-segmented; distal segment slender with 1 coarse terminal spine and 1 terminal spinelike point; distal segment, measured to the insertion of the spine, 1.5 times the length of preceding segment. Total lengths 1.16–1.28 mm. Holotype No. 125147.

*Diagnosis* (male). Anterior portion of head in dorsal view truncate, separated dorsally from first thoracic segment by fine line. Fourth and fifth thoracic segments fused. Abdomen consisting of 5 segments, anal segment very short. Rostrum or filaments absent. Posterolateral margin of fifth thoracic segment angular with rounded tip. Antennules reaching posterior end of second abdominal segment; segments 8–10 and 20 and 21 fused in right antennule, segments 8–10 only fused in left antennule. Sensory appendages on segments 2, 3, 5, 7, 9. Other head appendages and swimming legs as in the female. Fifth leg large, exceeding end of furca. In right fifth leg second and third exopodal segments fused to one slender segment bearing a hump posteriorly in the distal half, terminal segment flattened; endopod lacking. In left fifth leg basipod large; endopod 1-segmented, about twice as long as 3-segmented exopod; terminal segment of exopod slender, with lamella reinforced by “veins,” especially at the tip. Total lengths 1.00–1.22 mm. Allotype No. 125148.

*Remarks.* *Undinella compacta* approaches the genus *Tharybis* in the relatively large first inner lobe of the maxillule, the swollen second basipodal segment of the maxilliped, and the elongate terminal segment of the fifth leg. However, the present species is placed in the genus *Undinella* because the head and first thoracic segment and

racic segment fused, fourth and fifth thoracic segments partially fused. Abdomen 5-segmented, anal segment small. Rostrum bifurcate, each side bearing a filament. Posterolateral corners of cephalothorax symmetrical and emarginate. Antennules asymmetrical and broken distally in both specimens. Right antennule with segments 8–10 fused and apparently segments 21 and 22 fused. Left antennule with segments 8–10 only fused. Numerous aesthetascs proximally. Endopod of antenna approximately one-half length of exopod. Mandible palpus large, blade elongate and bearing 4 large teeth, several needlelike spines and a seta. Maxillule with 10 spines on first inner lobe, 3 setae on second inner lobe, 4 setae on third inner lobe, 4 setae on second basal segment, 7 setae on endopod, 7 setae on exopod, and 7 setae on first outer lobe. Distal end of maxilla bearing 3 bulbous and several wormlike sensory setae. Maxilliped with sensory setae on first basal segment. First leg with 3-segmented exopod and 1-segmented endopod. Second leg with 3-segmented exopod and 2-segmented endopod. Third and fourth legs with 3-segmented exopods and endopods. Numerous spines on endopod of third leg and basal segments and rami of fourth leg. Fifth legs biramous, reaching to end of furca. Right exopod 1-segmented, endopod fused with basal segment. Left exopod 3-segmented, proximal segment with large rounded protuberance. Left endopod elongate and 1-segmented. Total lengths .84 mm and .86 mm. Holotype No. 125145.

The female is unknown.

*Remarks.* The genus *Parundinella* was established by Fleminger (1957) to accommodate two species, *P. spinodenticula* and *P. manicula*, that he found in the Gulf of Mexico. The male of the latter species is not known. The segmentation of the fifth feet and the rounded posterolateral corner of the cephalothorax of *P. spinodenticula* are quite different from those in *P. emarginata*. Although the distal end of the

right antennule of *P. emarginata* is broken off at segment 21, it appears that segments 21 and 22 are fused rather than segments 20 and 21 as in *P. spinodenticula*. *P. emarginata* could be the undescribed male of *P. manicula*. Since no females of *P. manicula* were found and since the species is known only from the Gulf of Mexico, we are not referring our specimens to this species.

The specific name *emarginata* refers to the shape of the posterolateral margin of the fifth thoracic segment.

*Undinella altera* n. sp.

Pl. X, figs. 211–214; Pl. XI, figs. 215–227

Material examined: 1 male

*Diagnosis* (male). Head and first thoracic segment fused, fourth and fifth thoracic segments fused. Abdomen 5-segmented, anal segment very small. Rostrum absent. Posterolateral corner of thorax truncate. Right antennule consists of 22 free segments, segments 8–10, 20–21 fused. Left antennule consists of 23 segments, segments 8–10 fused. Aesthetascs numerous proximally on both antennules. Endopod of antenna approximately one-half the length of exopod. Mandible blade robust, cutting edge with coarse teeth and needlelike spines. Exopod of mandible smaller than endopod, basal segment bearing 2 coarse and 1 fine setae. First inner lobe of maxillule large, 2 and 5 setae on second and third inner lobes, respectively, 3 setae on second basal segment, 6 setae on endopod, 2 setae on exopod, and 7 setae on first outer lobe. Maxilla with 5 lobes arising distally. Second segment of maxilliped somewhat swollen. Exopods of first to fourth legs 3-segmented, endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented. Scattered spines on distal exopodal and endopodal segments of legs 2 and 3. Right fifth leg uniramous, 2-segmented. Proximal segment twice the length of distal segment. Endopod of left fifth leg elongate, reaching beyond end of right leg.

Exopod 3-segmented, distal segment with conspicuous lamella. Total length 1.60 mm. Holotype No. 125146.

The female is unknown.

*Remarks.* The males of *Undinella* are distinguished by the shape of the postero-lateral corners of the cephalothorax and the structure of the fifth legs. In lateral view, the posterior end of the cephalothorax is truncate in *U. altera*. It is rounded, angular, or pointed in the other species. A distinct lamella is present on the distal segment of the exopod of the left fifth leg only in *U. compacta* and *U. altera*. In *U. compacta* the distal end of the first endopodal segment of the right leg reaches to the distal end of the exopod of the left leg. In *U. altera*, the distal end of the first endopodal segment reaches to about the mid point of the exopod.

The name *altera* should merely express that the described species is another species.

*Undinella compacta* n. sp.

Pl. XII, figs. 228–241; Pl. XIII, figs. 242–257

Material examined: 17 females, 40 males

*Diagnosis* (female). Anterior portion of head in dorsal view smoothly ovate, separated dorsally from first thoracic segment by fine line. Fourth and fifth thoracic segments fused. Abdomen 4-segmented. Rostrum or filaments absent. Posterolateral margin of fifth thoracic segment rounded with shallow indentation. Antennules not quite reaching end of cephalothorax, with 24 free segments, segments 8 and 9 fused, incompletely separated from segment 10. Exopod of antenna two times the length of endopod. Basal segment of mandible palpus with 2 coarse and 1 long slender setae; endopod longer than exopod. Mandible blade with about 7 monocuspidate teeth and 1 thick seta. Twelve spines on first inner lobe of maxillule, 3 setae on second inner lobe, 4 setae on third inner lobe, 3 setae on second basal segment, 2 and 5 setae on endopod, 3 setae on exopod.

Lobes and endopod of maxilla located in distal half of appendage. Second basal segment of maxilliped about as long as first, thickened in proximal half. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs and exopods of first to fourth legs 3-segmented. Posterior sides of second to fourth legs with few spinules. Fifth leg 3-segmented; distal segment slender with 1 coarse terminal spine and 1 terminal spinelike point; distal segment, measured to the insertion of the spine, 1.5 times the length of preceding segment. Total lengths 1.16–1.28 mm. Holotype No. 125147.

*Diagnosis* (male). Anterior portion of head in dorsal view truncate, separated dorsally from first thoracic segment by fine line. Fourth and fifth thoracic segments fused. Abdomen consisting of 5 segments, anal segment very short. Rostrum or filaments absent. Posterolateral margin of fifth thoracic segment angular with rounded tip. Antennules reaching posterior end of second abdominal segment; segments 8–10 and 20 and 21 fused in right antennule, segments 8–10 only fused in left antennule. Sensory appendages on segments 2, 3, 5, 7, 9. Other head appendages and swimming legs as in the female. Fifth leg large, exceeding end of furca. In right fifth leg second and third exopodal segments fused to one slender segment bearing a hump posteriorly in the distal half, terminal segment flattened; endopod lacking. In left fifth leg basipod large; endopod 1-segmented, about twice as long as 3-segmented exopod; terminal segment of exopod slender, with lamella reinforced by "veins," especially at the tip. Total lengths 1.00–1.22 mm. Allotype No. 125148.

*Remarks.* *Undinella compacta* approaches the genus *Tharybis* in the relatively large first inner lobe of the maxillule, the swollen second basipodal segment of the maxilliped, and the elongate terminal segment of the fifth leg. However, the present species is placed in the genus *Undinella* because the head and first thoracic segment and

fourth and fifth thoracic segments are partially separate, the exopod of the maxillule bears 3 setae, and the lobes of the maxilla are crowded within the distal half of the appendage. The absence of a rostrum and rostral filaments is unique in the family Tharybidae.

The female of *Undinella compacta* can be distinguished from the other species of the genus by the rounded posterolateral margin of the fifth thoracic segment and the shape and armature of the fifth leg. The male resembles *U. altera*, but it can be distinguished by the angular shape of the posterolateral margin of the fifth thoracic segment that is truncate in *altera* and by the longer fused second and third exopodal segments of the right fifth leg that reach to the distal end of the left exopod; in *altera* this segment is shorter.

The name *compacta* refers to the relatively stout body of this copepod.

*Undinella hamponsi* n. sp.

Pl. XIV, figs. 258–272; Pl. XV, figs. 273–285

Material examined: 11 females, 2 males

*Diagnosis* (female). Head and first thoracic segment partially separate, fourth and fifth thoracic segments partially separate. Abdomen 4-segmented, anal segment small. Rostrum bifurcate, each side bearing a slender filament. Posterolateral corners of cephalothorax asymmetrical. In dorsal view, right side with fingerlike protrusion, left side more evenly rounded. Genital segment with prominent bulge on dorsal side near posterior end. Antennules reaching to middle of abdomen, with 24 free segments, aesthetascs more numerous proximally. Exopod of antenna approximately twice the length of endopod. Exopod of mandible reduced, basal segment with 2 setae. Mandible blade with coarse cusped and spiniform teeth. Maxillule with enlarged first inner lobe, 2 and 4 setae on second and third inner lobes respectively, 4 setae on second basal segment, 6 setae on endopod, 2 setae on exopod, and 6 setae

on first outer lobe. Lobes on maxilla arise from distal end. Second segment of maxilliped elongate. Exopod of first leg 2-segmented, of second to fourth legs 3-segmented. Endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented. Fifth legs asymmetrical, right leg longer than left and reaching beyond genital segment. Terminal segment of right leg twice the length of the preceding segment. Distal segment of both legs each with 1 lateral and 3 terminal spines. Total lengths 1.90–2.12 mm. Holotype No. 125149.

*Diagnosis* (male). Head and first thoracic segment fused, fourth and fifth thoracic segments fused. Abdomen 5-segmented. Right first antennule consists of 22 free segments, segments 8–10, 20 and 21 fused. Left first antennule consists of 23 free segments, segments 8–10 fused. Rostrum, mouth appendages, and segmentation of first four pairs of legs as in female. Fifth legs asymmetrical, complex. Right leg uniramous, 2-segmented. Left exopod 3-segmented, terminal segment with group of setae. Distal protuberance of second segment provided with hair and a raised, rounded process. Total lengths 1.98–2.00 mm. Allotype No. 125150.

*Remarks.* The female of *U. hamponsi* is similar to *U. frontalis* (Tanaka) which was first described from a female specimen collected in Suruga Bay, Japan, and subsequently from specimens (female and male) obtained in the North Pacific (Brodsky, 1950) and in Sagami Bay, Japan (Tanaka, 1960). The two females of these species are best distinguished by the structure of the genital segment and fifth pair of legs. In *U. hamponsi* there is a marked bulge on the dorsal surface of the genital segment near the posterior end, and the distal segment of the right fifth leg is much longer than the penultimate segment. In *U. frontalis* there is no protuberance on the genital segment, and the two distal segments of the right fifth leg are subequal. The males of the two species are readily

distinguished by the structure and ornamentation of the protrusion of the second segment of the left exopod. In *U. hampsoni* this protrusion has a raised depression and is pubescent. In *U. frontalis* it is naked.

The species is named for Mr. George Hampson, Biology Department, Woods Hole Oceanographic Institution, who participated in the collection of the samples.

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Plate I

*Aetideopsis magna* n. sp., male

- Figure 3. Dorsal
- Figure 4. Lateral
- Figure 5. Fourth and fifth thoracic segments and first abdominal segment, lateral
- Figure 6. Anterior portion of head, lateral
- Figure 7. Rostrum, ventral
- Figure 8. Right antennule
- Figure 9. Antenna
- Figure 10. Mandible palpus
- Figure 11. Maxillule
- Figure 12. Maxilla
- Figure 13. Maxilliped
- Figure 14. First leg
- Figure 15. Second leg, exopod broken short
- Figure 16. Third leg, exopod and endopod broken short
- Figure 17. Fourth leg, exopod broken short
- Figure 18. Fifth legs
- Figure 19. Tip of left fifth leg

*Comantenna recurvata* n. sp., female

- Figure 20. Dorsal
- Figure 21. Lateral
- Figure 22. Antenna
- Figure 23. Mandible palpus
- Figure 24. Mandible blade



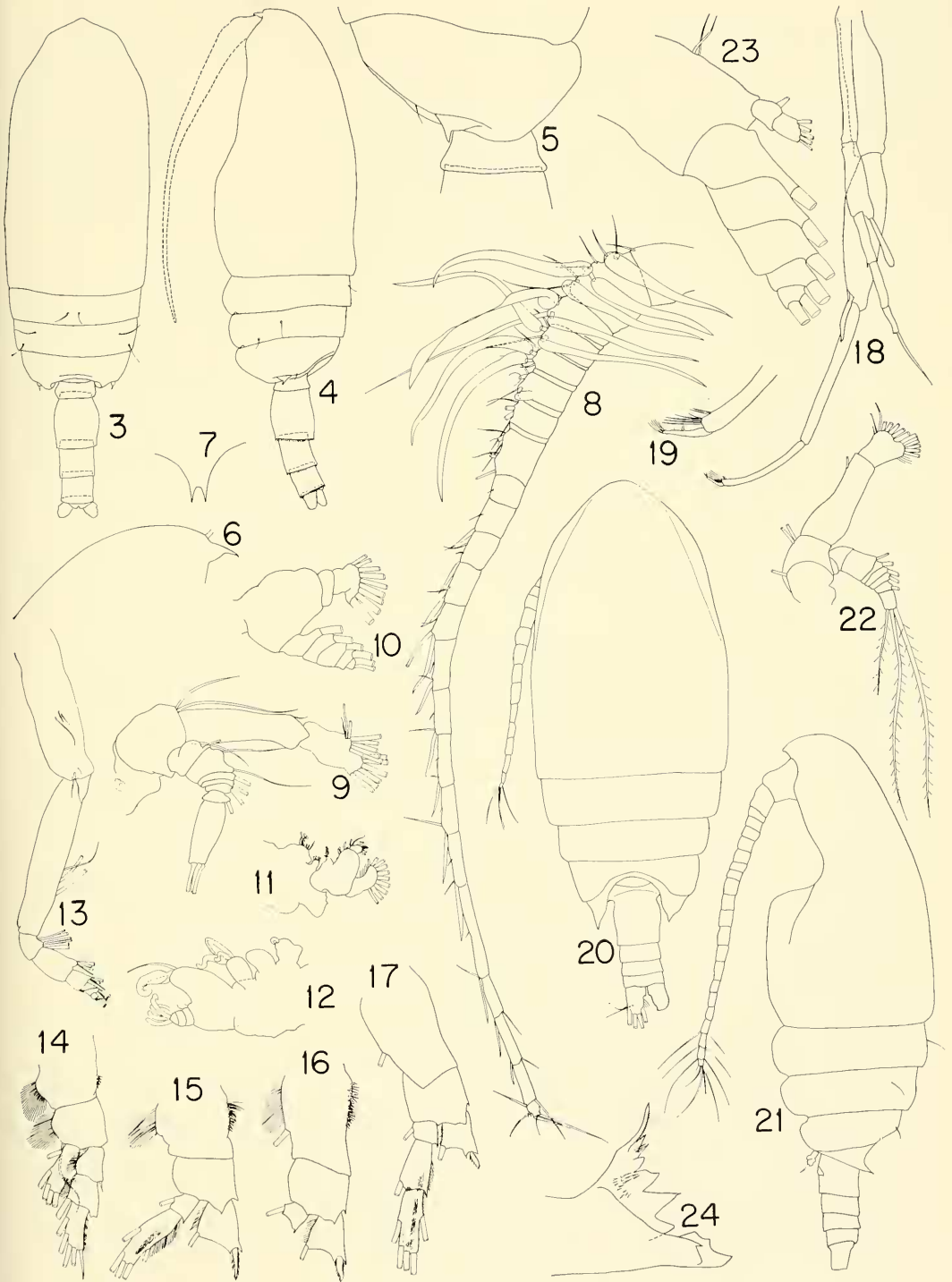


Plate II

*Comantenna recurvata* n. sp., female (continued)

- Figure 25. Antennule
- Figure 26. Maxillule
- Figure 27. Maxillule, third inner lobe
- Figure 28. Maxilla
- Figure 29. Maxilla, distal lobe, other side
- Figure 30. Maxilliped
- Figure 31. First leg
- Figure 32. Second leg
- Figure 33. Third leg
- Figure 34. Fourth leg
- Figure 35. Fifth legs

*Xanthocalanus alvinae* n. sp., female

- Figure 36. Fourth and fifth thoracic segments and abdomen, lateral
- Figure 37. Anterior portion of head, lateral
- Figure 38. Fifth thoracic segment and abdomen, dorsal
- Figure 39. Rostrum, ventral
- Figure 40. Antenna

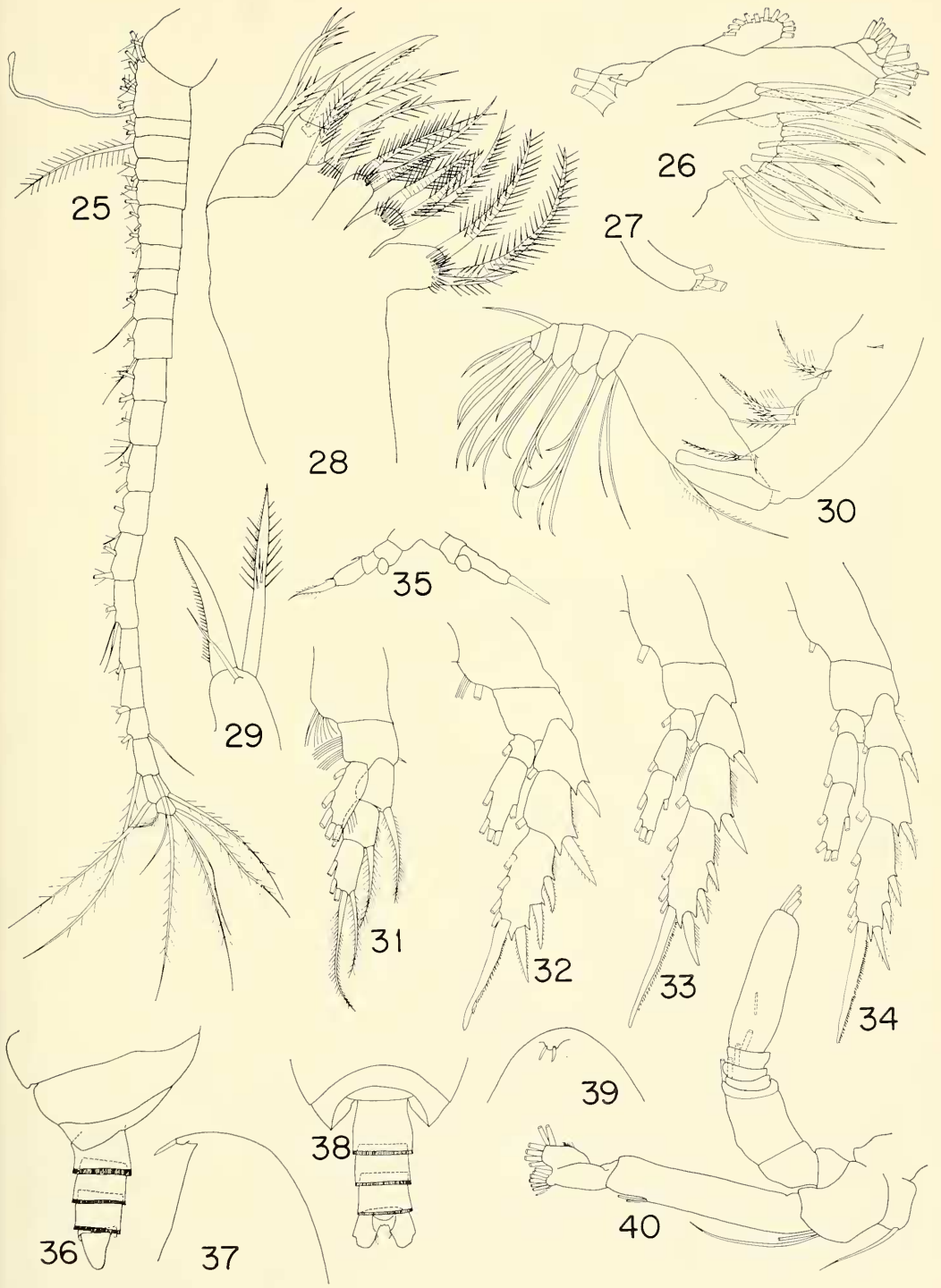


Plate IV

*Xanthocalanus distinctus* n. sp., male (continued)

- Figure 58. Anterior portion of head
- Figure 59. Left antennule, lateral
- Figure 60. Antenna
- Figure 61. Mandible palpus
- Figure 62. Mandible blade
- Figure 63. Maxillule
- Figure 64. Maxilla
- Figure 65. Maxilliped
- Figure 66. First leg
- Figure 67. Second leg
- Figure 68. Third leg
- Figure 69. Terminal spine of third leg
- Figure 70. Fourth leg
- Figure 71. Fifth legs
- Figure 72. Right fifth leg, posterior side
- Figure 73. Tip of left fifth leg

*Xanthocalanus elongatus* n. sp., female

- Figure 74. Lateral
- Figure 75. Dorsal
- Figure 76. Fifth thoracic segment and abdomen, lateral
- Figure 77. Fifth thoracic segment and abdomen, dorsal
- Figure 78. Fourth and fifth abdominal segments and furca, ventral

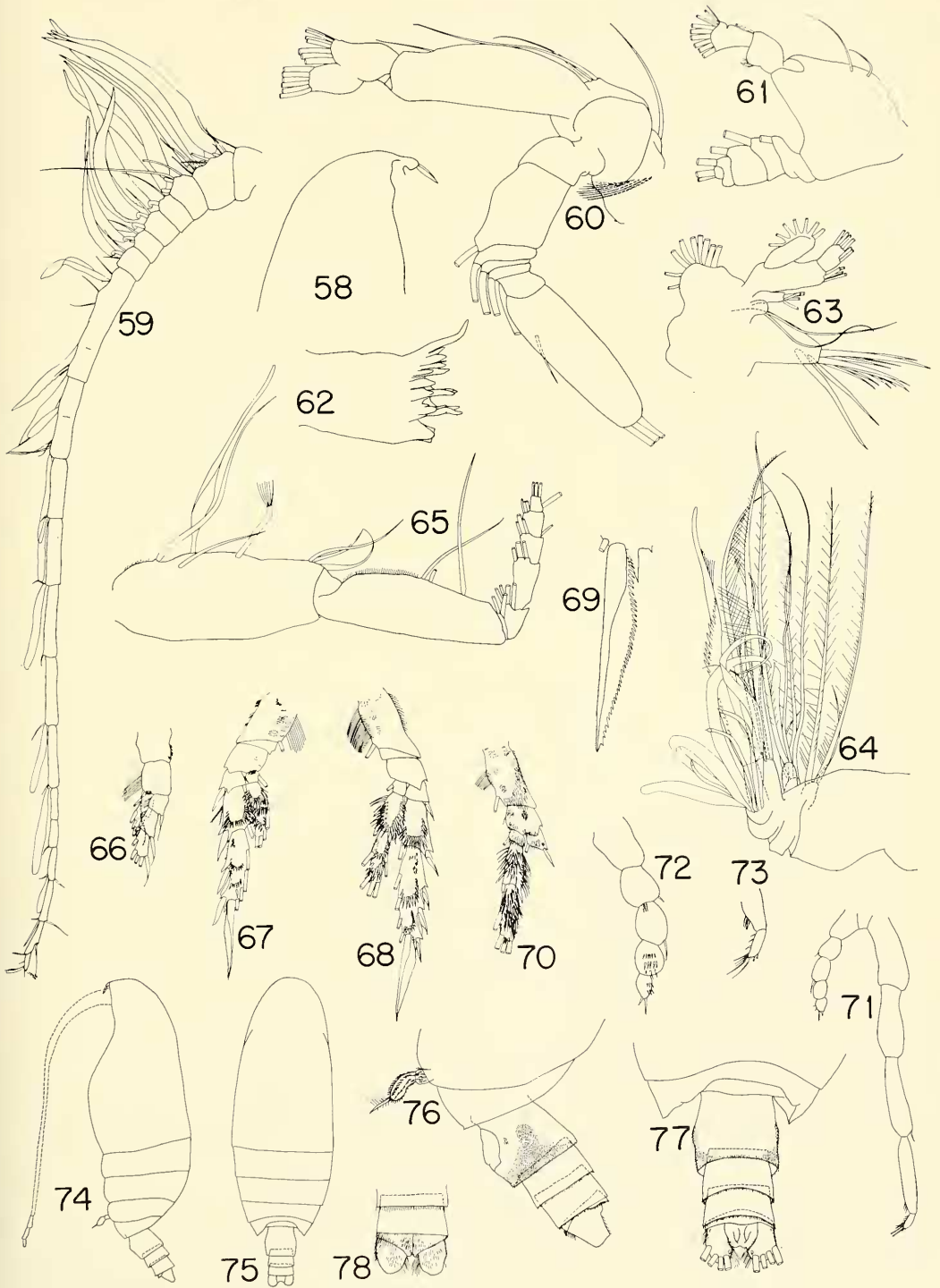


Plate V

*Xanthocalanus elongatus* n. sp., female (continued)

- Figure 79. Left antennule
- Figure 80. Antenna
- Figure 81. Mandible palpus
- Figure 82. Mandible blade
- Figure 83. Maxillule
- Figure 84. Maxilla
- Figure 85. Maxilliped
- Figure 86. First leg
- Figure 87. Second leg, terminal spine omitted
- Figure 88. Third leg
- Figure 89. External spine of second exopodal segment of third leg
- Figure 90. Fourth leg
- Figure 91. Fifth leg

*Xanthocalanus elongatus* n. sp., male

- Figure 92. Lateral
- Figure 93. Dorsal
- Figure 94. Anterior portion of head, lateral
- Figure 95. Fourth and fifth thoracic segments and genital segment, lateral
- Figure 96. Antenna

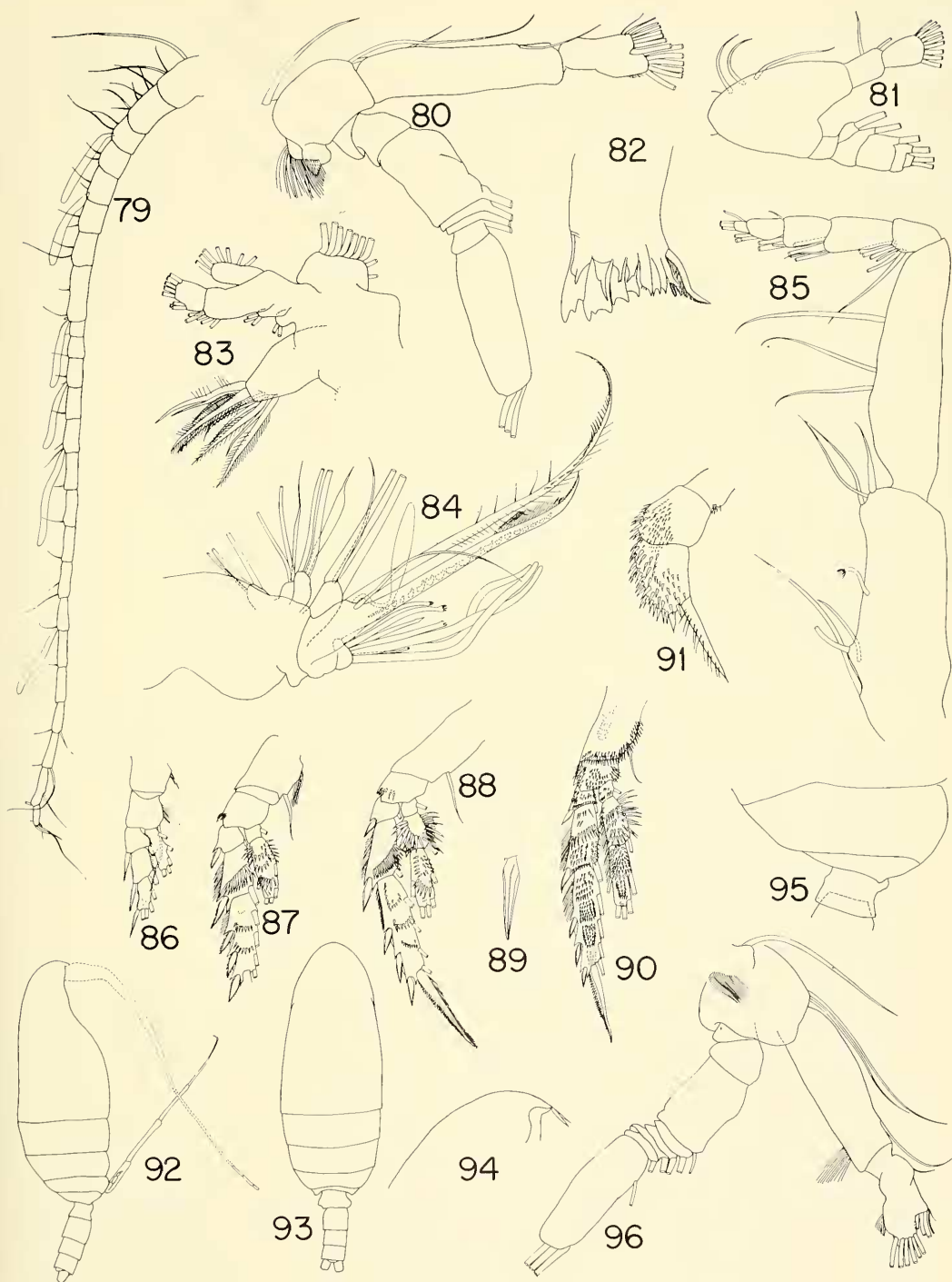


Plate VI

*Xanthocalanus elongatus* n. sp., male (continued)

- Figure 97. Right antennule
- Figure 98. Mandible palpus
- Figure 99. Mandible blade
- Figure 100. Maxillule
- Figure 101. Maxilla
- Figure 102. Maxilliped
- Figure 103. First leg
- Figure 104. Second leg
- Figure 105. Third leg
- Figure 106. Fourth leg
- Figure 107. Fifth legs
- Figure 108. Right fifth leg and first segment of left fifth leg
- Figure 109. Tip of left fifth leg, posterior side
- Figure 110. Tip of right fifth leg, anterior side

*Xanthocalanus macrocephalon* n. sp., female

- Figure 111. Lateral
- Figure 112. Dorsal
- Figure 113. Anterior portion of head, lateral
- Figure 114. Anterior portion of head, ventral
- Figure 115. Fifth thoracic segment and abdomen, lateral
- Figure 116. Right antennule



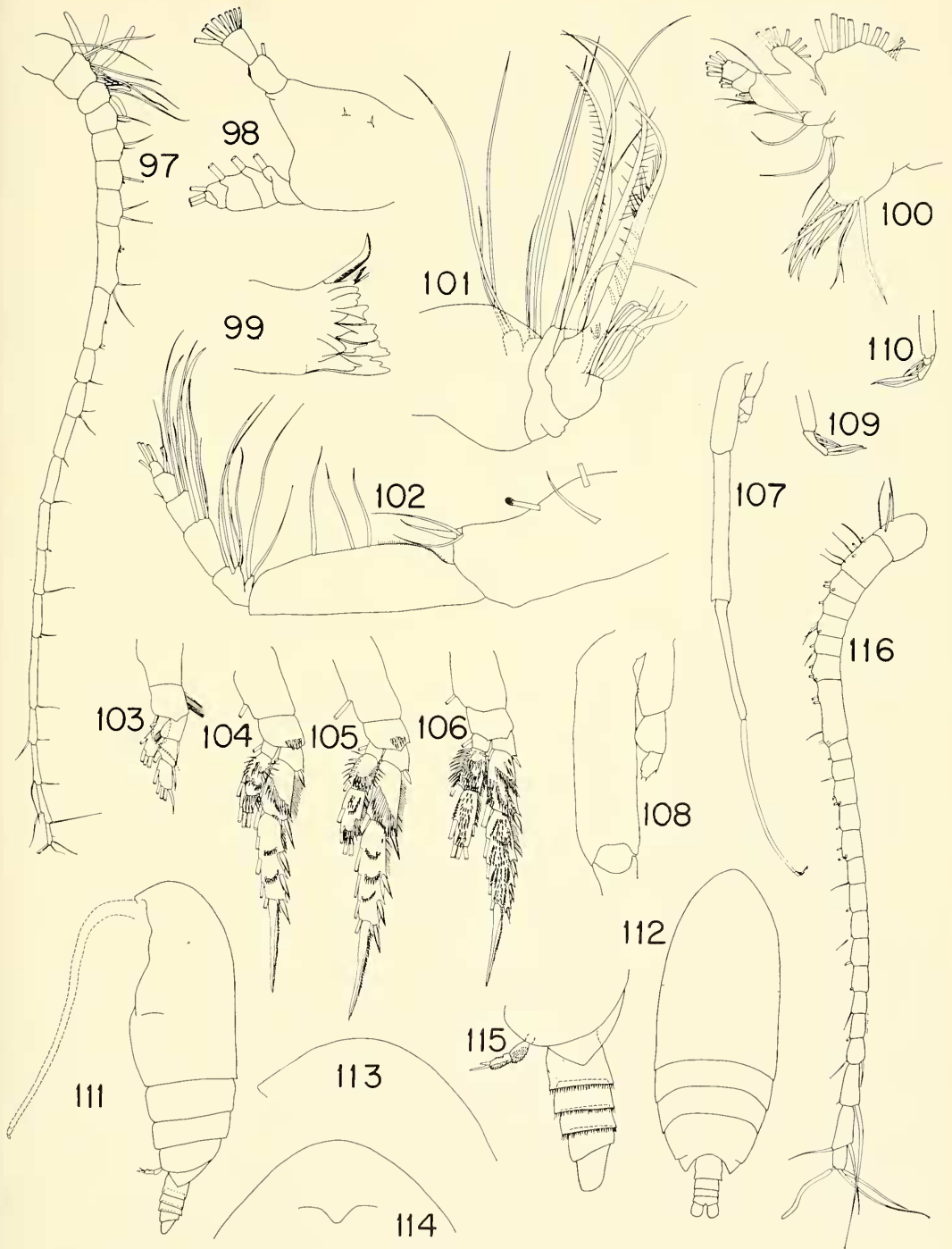


Plate VII

*Xanthocalanus macracephalon* n. sp., female (continued)

- Figure 117. Antenna
- Figure 118. Mandible palpus
- Figure 119. Mandible blade
- Figure 120. Maxillule
- Figure 121. Maxilla
- Figure 122. Maxilliped
- Figure 123. First leg
- Figure 124. Second leg
- Figure 125. Third leg
- Figure 126. Fourth leg
- Figure 127. Fifth leg

*Amalophora macilentia* n. sp., male

- Figure 128. Dorsal
- Figure 129. Lateral
- Figure 130. Rostrum
- Figure 131. Portion of genital segment, enlarged
- Figure 132. Right antennule
- Figure 133. Exopod of antenna
- Figure 134. Endopod and basipod of antenna
- Figure 135. Mandible palpus
- Figure 136. Mandible blade
- Figure 137. Maxillule
- Figure 138. Modified spine of first inner lobe of maxillule
- Figure 139. Maxilla
- Figure 140. Maxilla, other side
- Figure 141. Maxilliped

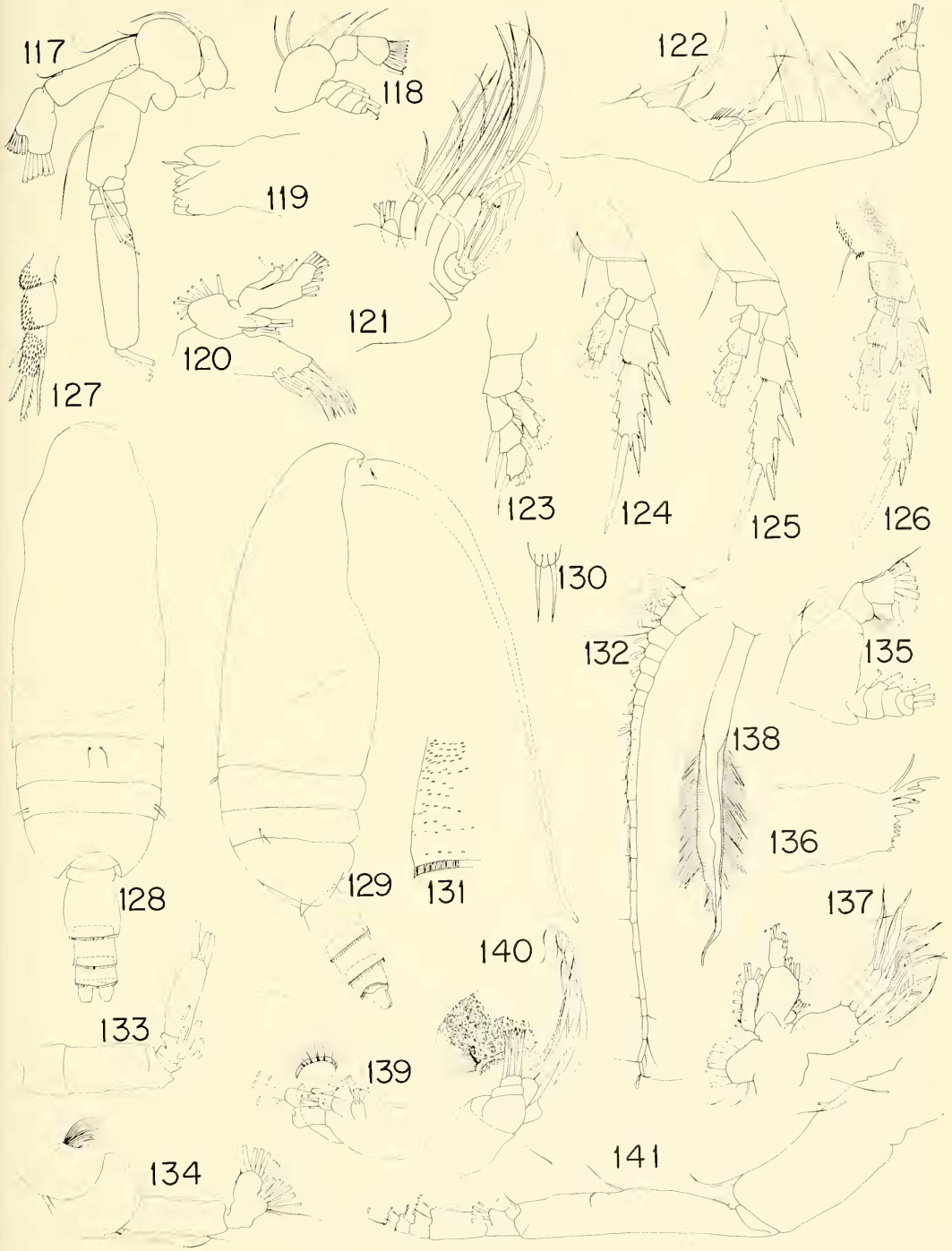


Plate VIII

*Amalophora macilenta* n. sp., male (continued)

- Figure 142. First leg
- Figure 143. Second leg, exopod broken off
- Figure 144. Third leg, exopod broken off
- Figure 145. Fourth leg
- Figure 146. Fifth legs
- Figure 147. Endopod of left fifth leg
- Figure 148. Tip of left fifth leg, posterior side
- Figure 149. Tip of left fifth leg, anterior side

*Amalophora rotunda* n. sp., male

- Figure 150. Lateral
- Figure 151. Dorsal
- Figure 152. Ventral margin of second and third thoracic segments
- Figure 153. Anterior portion of head, lateral
- Figure 154. Anterior portion of head, ventral
- Figure 155. Right antennule
- Figure 156. Antenna
- Figure 157. Mandible palpus
- Figure 158. Mandible blade
- Figure 159. Maxillule
- Figure 160. Modified spine of first inner lobe of maxillule
- Figure 161. Maxilla
- Figure 162. Maxilliped
- Figure 163. Right maxilliped, slightly turned outward
- Figure 164. First leg, posterior
- Figure 165. Endopod of first leg, anterior

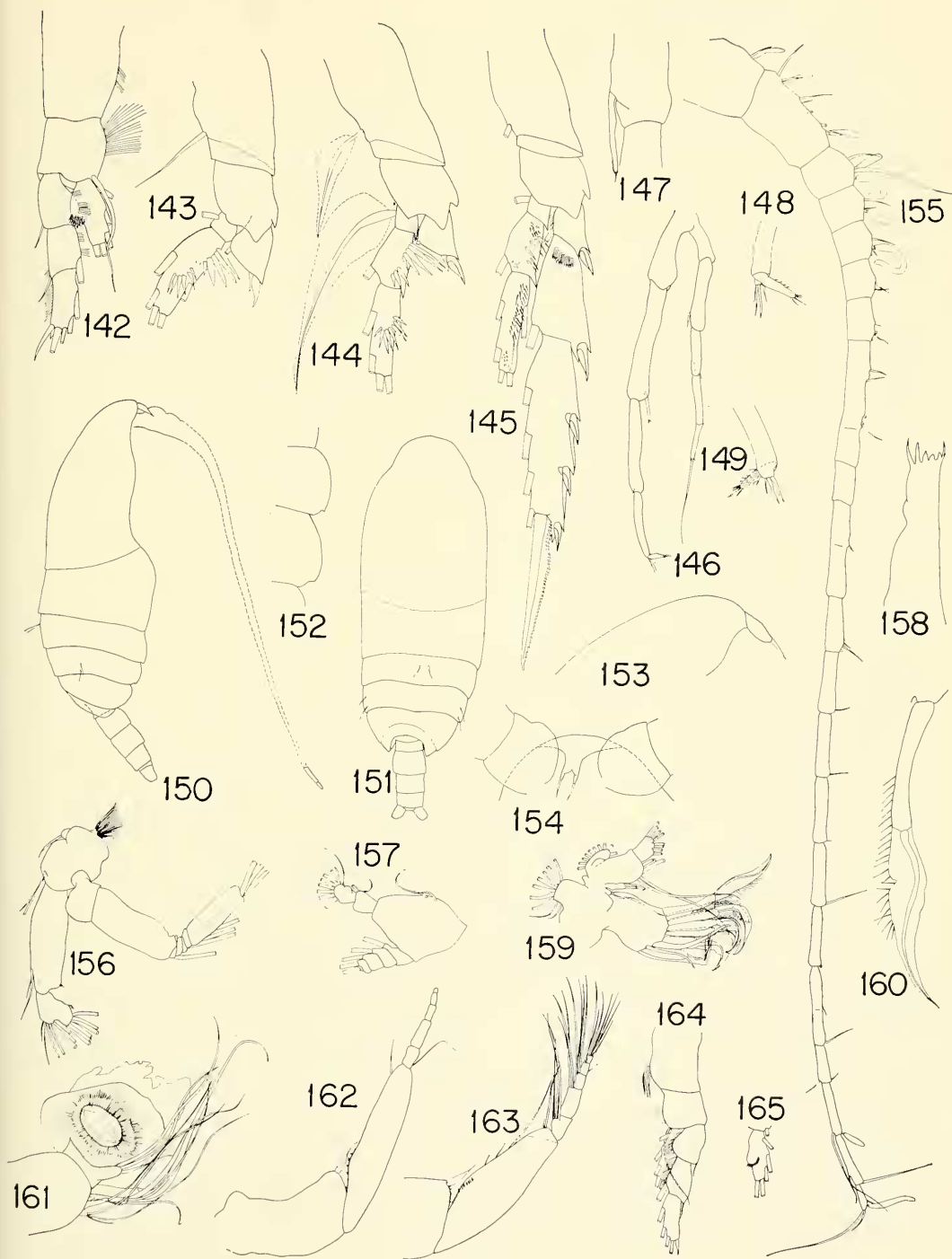


Plate IX

*Amalophora rotunda* n. sp., male (continued)

- Figure 166. Second leg
- Figure 167. Third leg
- Figure 168. Fourth leg
- Figure 169. External spine of second exopodal segment of fourth leg
- Figure 170. Fifth legs
- Figure 171. Tip of left fifth leg, posterior side

*Diaixis asymmetrica*, n. sp., female

- Figure 172. Lateral
- Figure 173. Dorsol
- Figure 174. Abdomen, ventrol
- Figure 175. Fourth and fifth thoracic segments and abdomen, left side
- Figure 176. Fifth thoracic segment and genital segment, right side
- Figure 177. Left antennule
- Figure 178. Antenna
- Figure 179. Mandible polpus
- Figure 180. Mandible blade
- Figure 181. Maxillule
- Figure 182. Maxilla, only sensory setae shown
- Figure 183. Maxilla, other side, sensory setae omitted
- Figure 184. Maxilliped, setae on endopod omitted
- Figure 185. Endopod of maxilliped
- Figure 186. First leg
- Figure 187. Second leg, exopod broken off
- Figure 188. Left third leg, endopod broken off
- Figure 189. Endopod of right third leg
- Figure 190. Fourth legs, incomplete

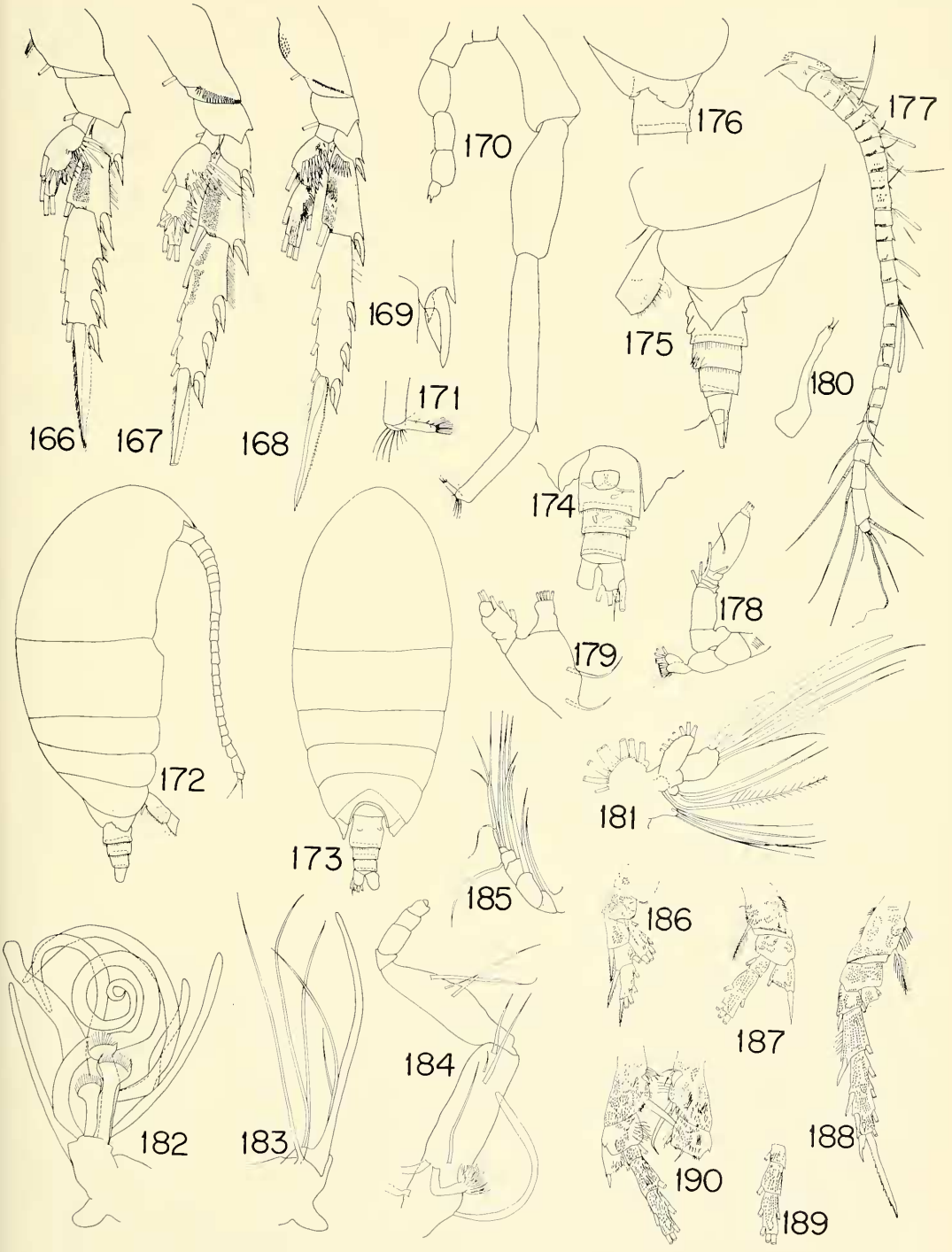


Plate X

*Parundinella emarginata* n. sp., female

- Figure 191. Dorsal
- Figure 192. Lateral
- Figure 193. Fifth thoracic segment and genital segment, dorsal
- Figure 194. Fifth thoracic segment, abdomen and fifth leg, right side
- Figure 195. Fifth thoracic segment, abdomen and fifth leg, left side
- Figure 196. Rostrum
- Figure 197. Right antennule, broken short
- Figure 198. Antenna
- Figure 199. Mandible palpus
- Figure 200. Mandible blade
- Figure 201. Maxillule
- Figure 202. Maxilla
- Figure 203. Maxilliped
- Figure 204. First leg
- Figure 205. Second leg
- Figure 206. Third leg
- Figure 207. Fourth leg
- Figure 208. Fifth legs, anterior side
- Figure 209. Fifth legs, posterior side
- Figure 210. Left fifth leg, second and third segments of exopod

*Undinella altera* n. sp., male

- Figure 211. Antenna
- Figure 212. Fourth and fifth thoracic segments and genital segment
- Figure 213. Mandible
- Figure 214. Maxillule



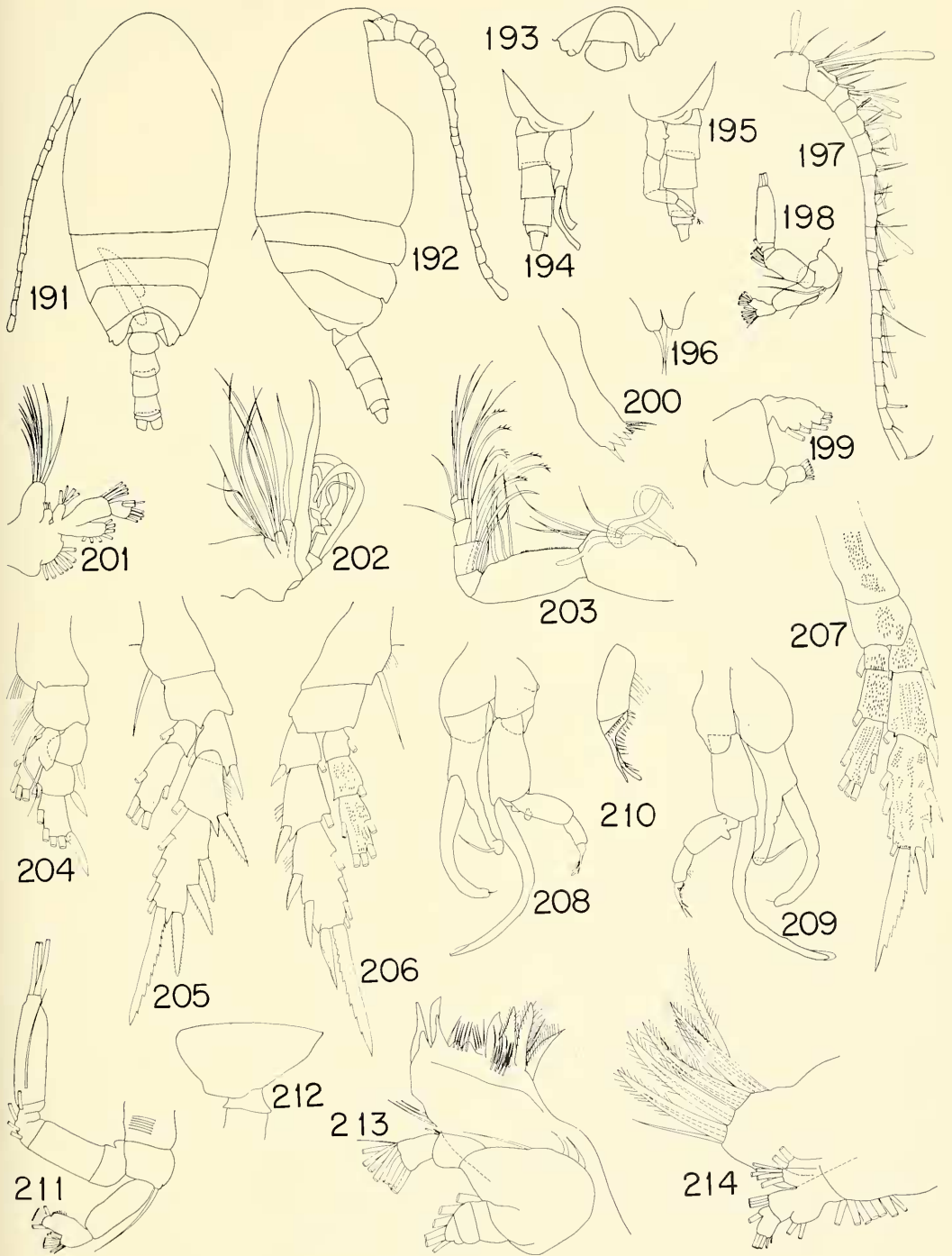


Plate XI

*Undinella altera* n. sp., male (continued)

- Figure 215. Dorsal
- Figure 216. Lateral
- Figure 217. Left antennule
- Figure 218. Maxilla
- Figure 219. Maxilliped
- Figure 220. First leg
- Figure 221. Second leg
- Figure 222. Terminal spine of second leg
- Figure 223. Third leg
- Figure 224. Fourth leg
- Figure 225. Fifth legs, anterior side
- Figure 226. Distal portion of fifth legs, posterior side
- Figure 227. Exopod of left fifth leg

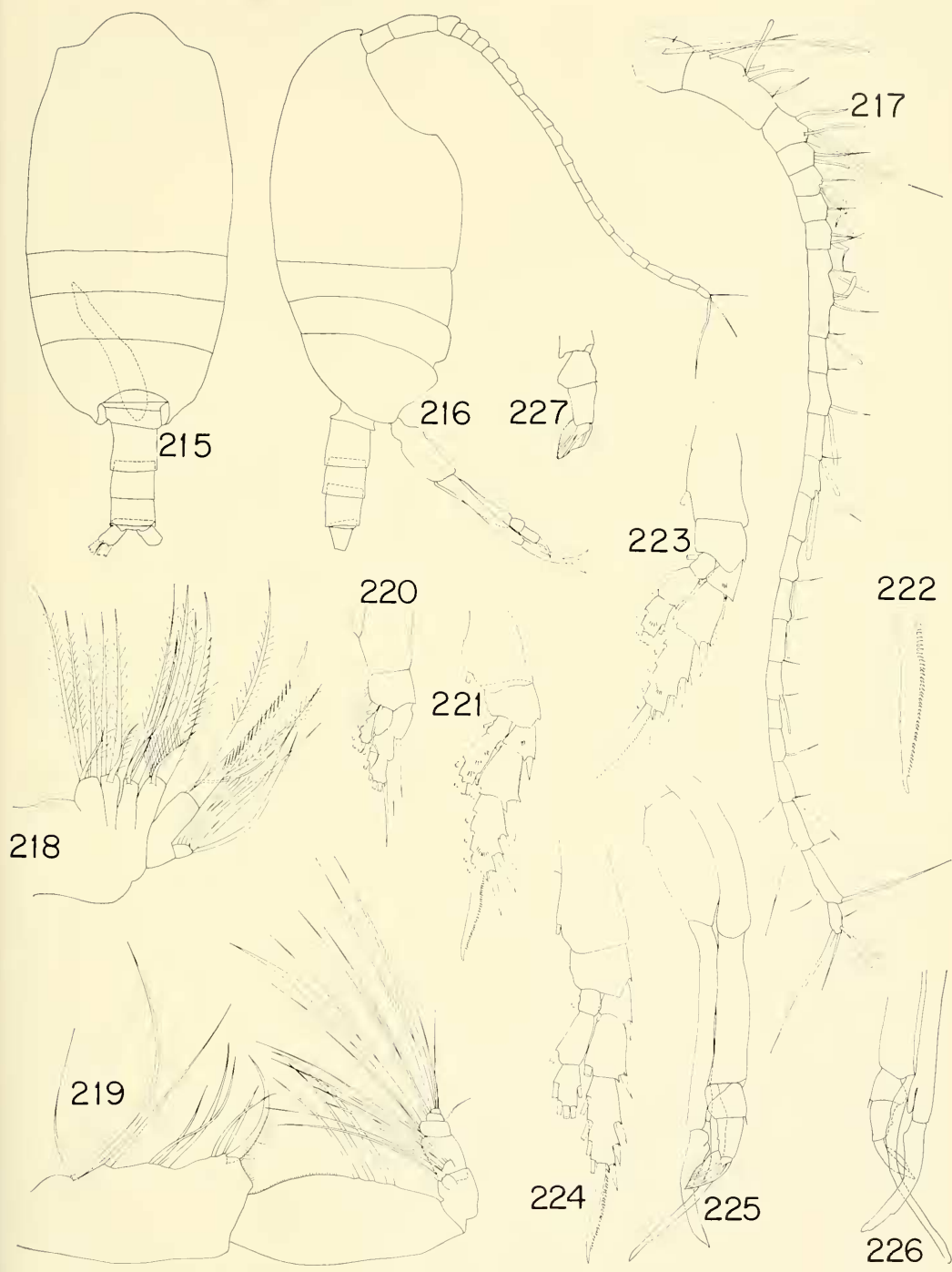


Plate XII

*Undinella compacta* n. sp., female

- Figure 228. Dorsal
- Figure 229. Lateral
- Figure 230. Right antennule
- Figure 231. Antenna
- Figure 232. Mandible palpus
- Figure 233. Mandible blade
- Figure 234. Maxillule
- Figure 235. Maxilla
- Figure 236. Maxilliped
- Figure 237. First leg
- Figure 238. Second leg
- Figure 239. Third leg
- Figure 240. Fourth leg
- Figure 241. Fifth legs

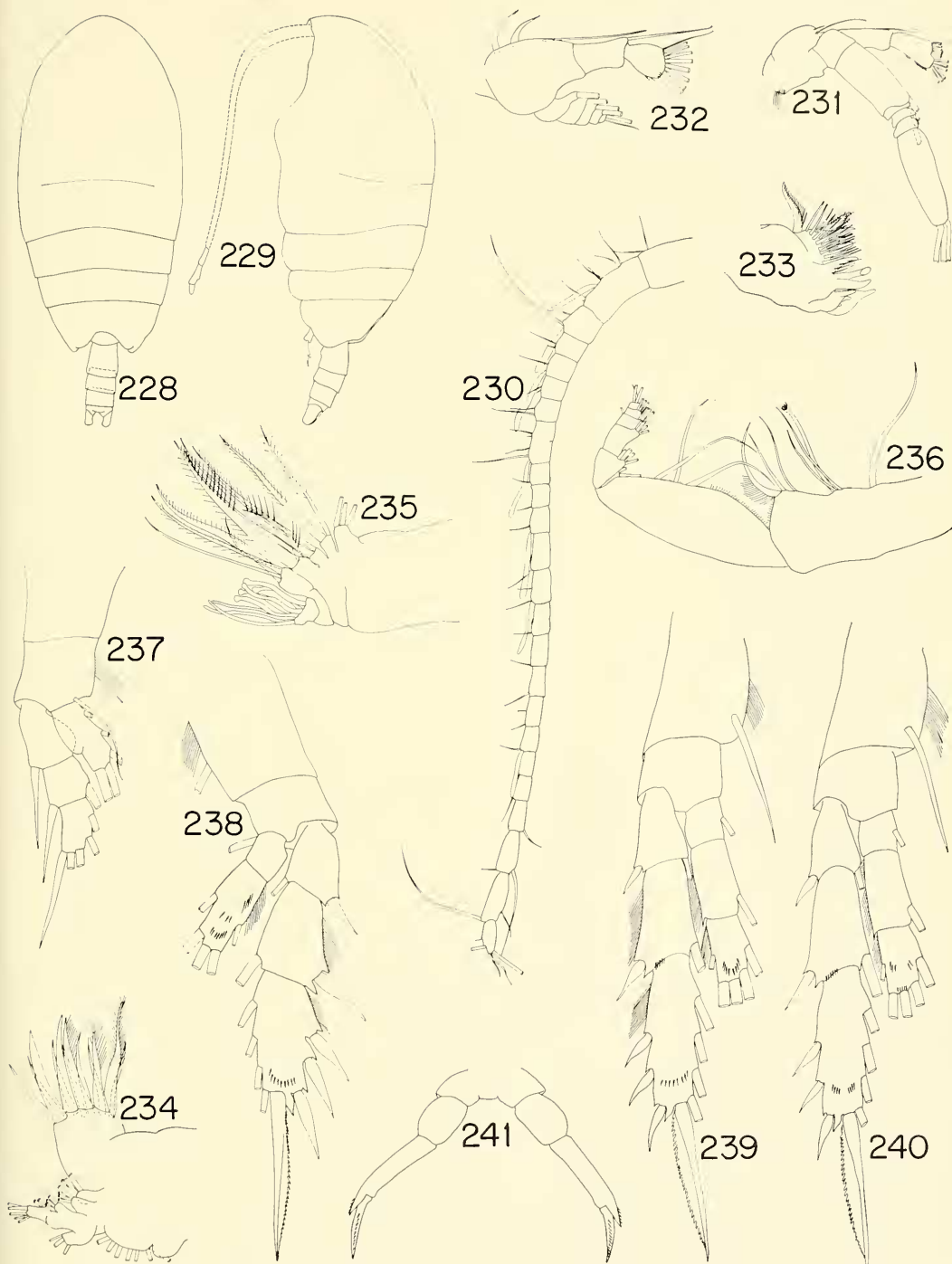


Plate XIII

*Undinella compacta* n. sp., male

- Figure 242. Dorsal
- Figure 243. Lateral
- Figure 244. Left antennule
- Figure 245. Antenna
- Figure 246. Mandible palpus
- Figure 247. Mandible blade
- Figure 248. Maxillule
- Figure 249. Maxilla
- Figure 250. Maxilliped
- Figure 251. First leg.
- Figure 252. Second leg
- Figure 253. Third leg
- Figure 254. Fourth leg
- Figure 255. Fifth legs
- Figure 256. Exopod of left fifth leg
- Figure 257. Distal portion of right fifth leg

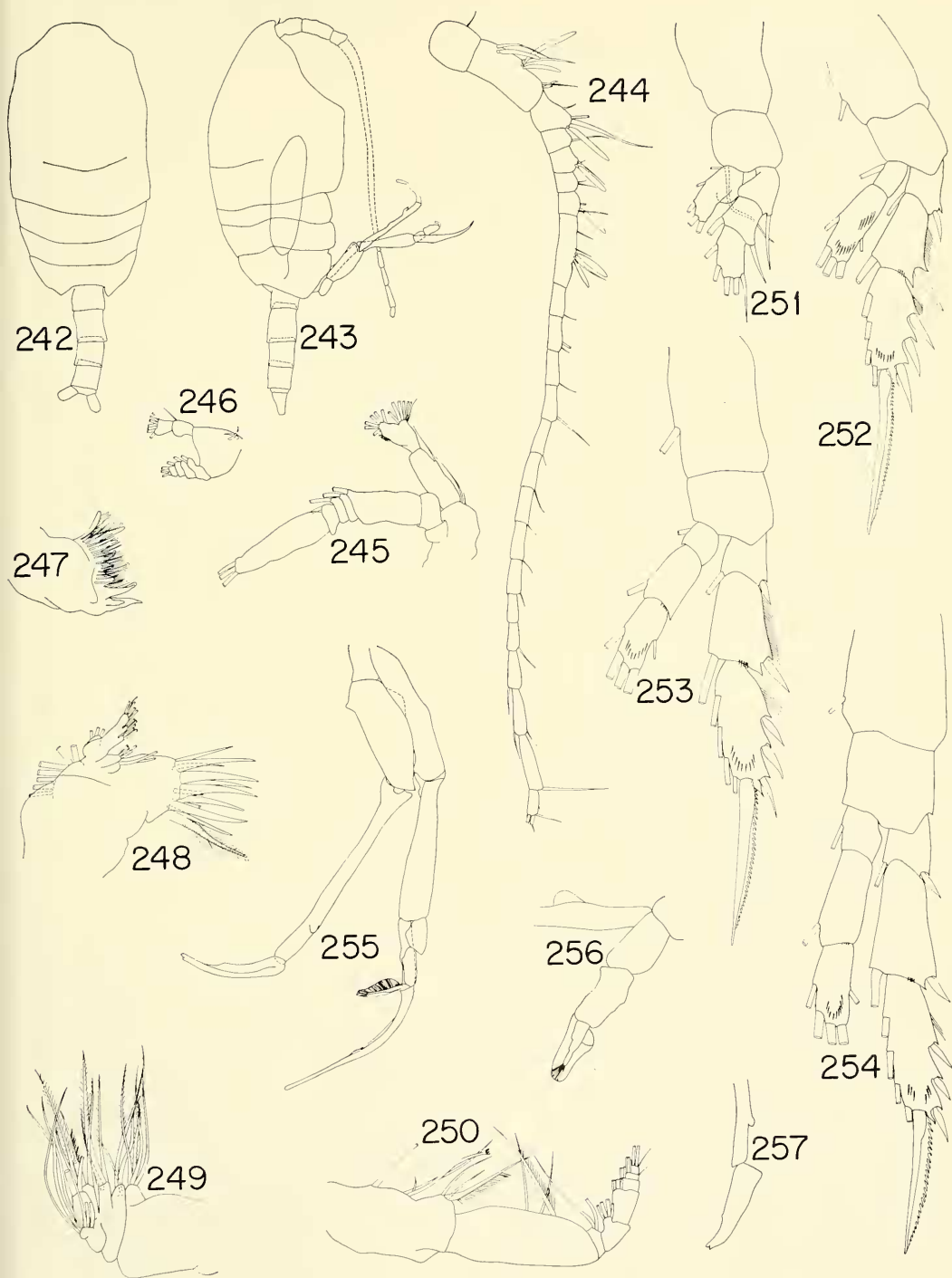


Plate XIV

*Undinella hamptoni* n. sp., female

- Figure 258. Lateral
- Figure 259. Second to fifth thoracic segments and abdomen, left side
- Figure 260. Fifth thoracic segment and genital segment, ventral
- Figure 261. Fourth and fifth thoracic segments and abdomen, right side
- Figure 262. Fourth and fifth thoracic segments and abdomen dorsal
- Figure 263. Anterior portion of head, lateral
- Figure 264. Rostrum
- Figure 265. Antennule
- Figure 266. Antenna
- Figure 267. Mandible palpus
- Figure 268. Mandible blade
- Figure 269. Maxillule
- Figure 270. Maxillule, other side, spines on first inner lobe omitted
- Figure 271. Maxilla
- Figure 272. Fourth lobe of maxilla, other side



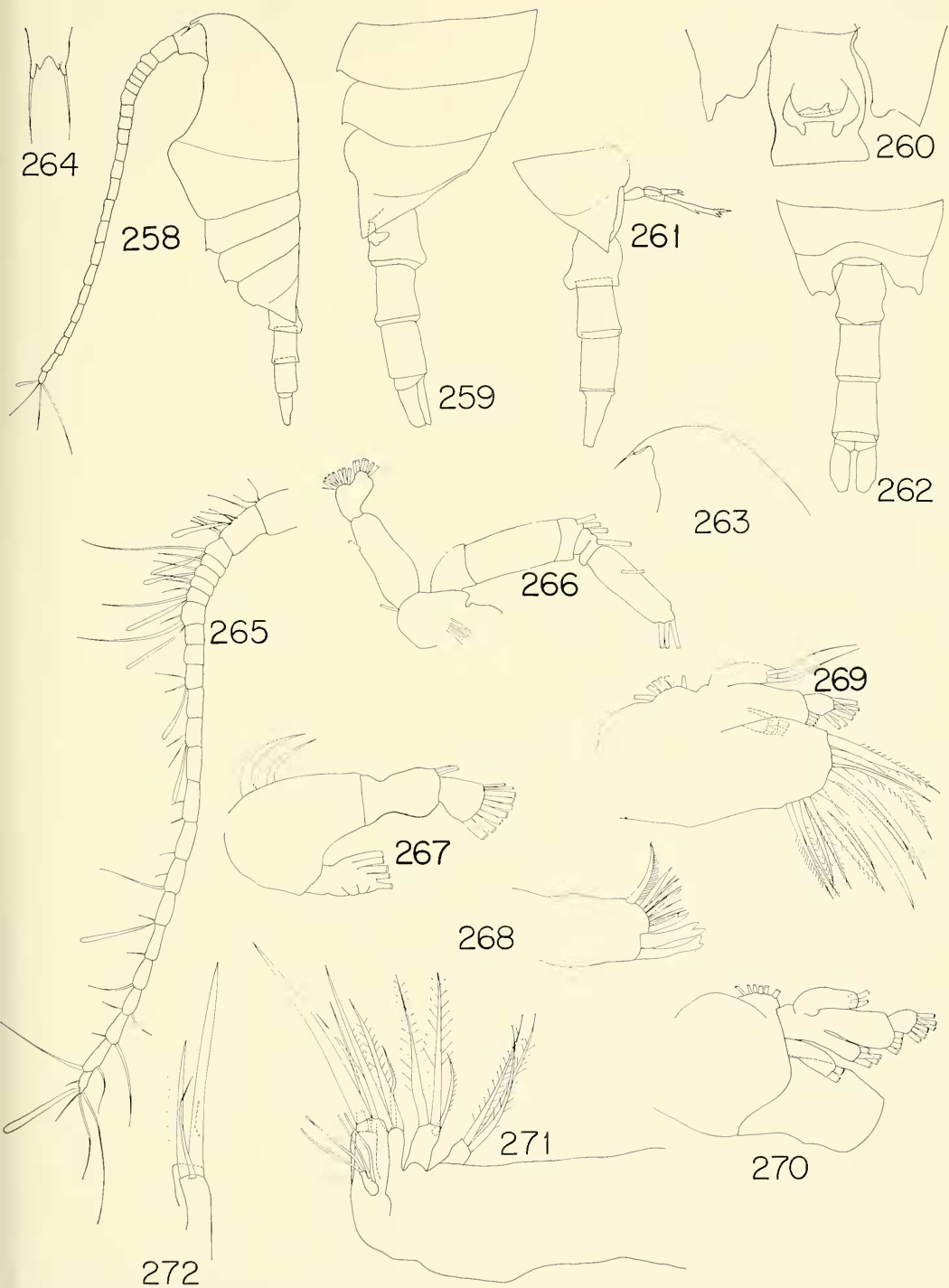


Plate XV

*Undinella hampsoni* n. sp., female (continued)

- Figure 273. Maxilliped
- Figure 274. First leg
- Figure 275. Endopod of first leg, anterior
- Figure 276. Second legs, anterior, exopod of left leg omitted, one endopod normal
- Figure 277. Third leg
- Figure 278. Fourth leg
- Figure 279. Terminal spine of fourth leg
- Figure 280. Fifth legs, posterior

*Undinella hampsoni* n. sp., male

- Figure 281. Dorsal
- Figure 282. Lateral
- Figure 283. Fifth legs, from left
- Figure 284. Fifth legs, another view
- Figure 285. Right fifth leg

