

NORTH AMERICAN PARASITIC COPEPODS: A
LIST OF THOSE FOUND UPON THE FISHES
OF THE PACIFIC COAST, WITH DE-
SCRIPTIONS OF NEW GENERA
AND SPECIES

BY

CHARLES BRANCH WILSON

Department of Biology, State Normal School, Westfield, Massachusetts

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NORTH AMERICAN PARASITIC COPEPODS: A LIST OF
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INTRODUCTION.

From time to time for several years past there has been accumulating in the author's possession a collection of fish parasites from the Pacific coast. These have been obtained from a variety of sources. Some of them are the result of work done upon different expeditions of the steamer *Albatross*, of the U. S. Bureau of Fisheries. Others have been obtained during investigations made by this same Bureau into the life and habits of various food fishes of the Northwest under the direction of such men as Dr. T. H. Bean and others.

Some have been sent from investigators at Stanford University and the University of California, and were presumably collected during summer work at the seashore, but by far the larger number of species and those of the most importance have come either directly or indirectly from the new marine laboratory of the University of California at La Jolla.

It was the reception from Dr. J. C. McClendon, of the University of Missouri, of a very interesting series of these parasites, collected by him during the summer of 1907 at La Jolla, that finally decided the advisability of publishing a Pacific coast list.

The author desires to acknowledge his great indebtedness to Doctor McClendon for this and many other favors received at his hands. There was enough new and interesting material in this one collection (which has since been deposited in the U. S. National Museum) to warrant its immediate publication, and when the specimens from other sources are added to it it far more than justifies the undertaking.

With the exception of a lot of material sent by Dr. C. A. Kofoid and another lot, comprising the results obtained by the steamer *Albatross* during her Pacific cruise in 1904, sent by Dr. William E. Ritter, all the specimens collected under the auspices of the Bureau of Fisheries had been turned over to the U. S. National Museum, and came to the author in the collection sent from that institution.

It has been the aim to include all this material in the present list together with those copepod parasites which have been described by other authors as occurring on the Pacific coast fishes. But it must be remembered that this is the first attempt at anything of the sort, and that such primary collections are more or less defective. It is hoped, however, that it may serve as a basis for future investigations. In those cases in which the parasites have already been acceptably described elsewhere it has been considered necessary to give merely the name and a reference to the literature which tells of their occurrence on Pacific coast fishes, or which describes and figures them.

The sources from which have been received the material illustrating each species have been given as far as known, with the addition of such brief comments as seemed advisable.

On the other hand, those genera and species which have proved new to science have been fully described and figured.

While the proportion of these new species is apparently very large, this is no more than should be expected in changing from one ocean to another, or even from the Asiatic to the American side of the Pacific. But the novelty of the characters of these new forms is of much less importance than the close relationship which they show between species inhabiting widely remote localities. He who really cares to go into details will find that there are close correspondences between the Atlantic and Pacific copepods similar to those found in other groups of animals, particularly, perhaps, in the fishes which serve as hosts for these parasites. As at present prepared the list includes 41 species, of which 17 are new to science, including 5 new genera.

Family ARGULIDÆ.

ARGULUS PUGETTENSIS Dana.

Argulus pugettensis DANA, 1852, p. 1351, pl. xciv, fig. 2.—WILSON, 1902, p. 711, pl. xv.

Host and record of specimens.—The host of the specimens obtained by Dana was unrecorded. A single female was taken from a Coho salmon, *Oncorhynchus kisutch*, at Union Bay in June, 1903, and was obtained and sent with the other material by Doctor McClendon. It is Cat. No. 38561, U.S.N.M.

ARGULUS NIGER Wilson.

Argulus niger WILSON, 1902, p. 714, pl. xviii.

Host and record of specimens.—The two specimens on which this species was founded were obtained by the steamer *Albatross* in October, 1899, from the Pacific coast near Portland, Oregon. The name of the host was not given.

Family ERGASILIDÆ.

Genus ARTACOLAX, new.

First thorax segment united with the head to form the carapace, which is much wider than it is long. Second thorax segment free and as wide as the carapace or nearly so. Third and fourth segments fused and the same width as the second segment or but little narrower. Fifth segment free and abruptly narrowed to a half or even a third of the width of the preceding fused segments. Genital segment enlarged but little; abdomen narrow and linear.

First antennæ very large; basal joint often armed with large spinous processes. Second antennæ two-jointed. Mouth organs close to the antennæ; second maxillipeds large and attached outside the other organs as in *Bomolochus*; furnished, as in that genus, with S-shaped terminal claws, but without any plumose setæ. First swimming legs with very wide rami, armed with large flattened plumose setæ; exopod one-jointed, endopod three-jointed.

Male like the female, but with the second maxillipeds in normal position behind the other mouth parts and armed with the usual terminal curved claw.

Type-species.—*Artacolax (Bomolochus) ardeolæ* Kröyer.

(*Artacolax*, ἀρτάω, to hang on, and κῶλαξ, a parasite).

This genus is distinguished from *Bomolochus* by the great comparative width of the first four thorax segments, by the fusion of the third and fourth segments, so that there are apparently but three free segments in front of the genital segment instead of four, as in *Bomolochus*, by the lack of plumose setæ on the second maxillipeds, by the increased width of the rami of the first swimming legs, and the fact that the exopod has but a single joint.

This new genus will include the following species in addition to the type: *Bomolochus chatoessi* Kröyer; *B. cornutus* Claus; *B. scomberesocis* Kröyer; and probably *B. hirsutus* Hesse, although the last mentioned species is so poorly described that it is impossible to locate it exactly.

ARTACOLAX (BOMOLOCHUS) ARDEOLÆ Kröyer, new genus name.

Artacolax (Bomolochus) ardeolæ KRÖYER, 1863, p. 220, pl. XI, figs. 3 a to e.

Host and record of specimens.—A single female was taken from the gills of the little garibaldi, *Hypsypops rubicundus*, at La Jolla, by Doctor McClendon, and is Cat. No. 38597, U.S.N.M.

On examining the described species of *Bomolochus* it is found that there are differences between them which can not consistently be included in a single genus. These differences are found in the body segmentation and in the structure and arrangement of the mouth parts and the first swimming legs. The same rule must be applied here that is used in dealing with other genera. In all the species really belonging to the genus *Bomolochus* there must be the same number of thoracic segments, however much those of the abdomen may vary. The appendages must also be of the same general character and similarly arranged. But this is not found to be true, and, accordingly, the preceding new genus must be established for certain species hitherto included in the genus *Bomolochus*, which agree among themselves, but do not agree with the original *Bomolochus* type.

Family CHONDRACANTHIDÆ.

CHONDRACANTHUS EPACTHES, new species.

Plate LXVI.

Host and record of specimens.—Five females and two males were taken by Doctor McClendon from a chimæra or elephant fish, *Hydrolagus collicii*, at La Jolla, and are Cat. No. 38580, U.S.N.M. These are made the types of the new species.

Female.—General body form elongate with rounded outlines and without any horns or processes. Head small and ovate, considerably narrowed anteriorly and covered with a carapace of the same shape but smaller, not reaching the posterior margin of the head.

First thorax segment only three-fifths the diameter of the head, twice as wide as long, and distinctly separated from the following segment. Second segment twice the width of the first, narrowed anteriorly, and also distinctly separated from the following segments. Genital portion divided at its center by a marked constriction on either margin and a well-defined groove; the two halves very different in form, the anterior one oblong with straight and parallel sides and but slightly rounded corners, the posterior half elliptical, with strongly convex sides and long club-shaped processes at the posterior corners. Abdomen small and conical, bluntly rounded at the tip, less than half the length of the posterior processes, and without anal laminae. Egg strings one-fourth the diameter of the genital portion and a little longer than the entire body, tapering toward the posterior ends; eggs small, about ten longitudinal rows.

First antennæ swollen and two-jointed, terminal joint much smaller than the basal, as wide as long and armed with a few minute spines. Second antennæ in the form of large sickle-shaped hooks, their bases enlarged into hemispherical knobs and articulated directly with the ventral surface of the head. Mouth and mouth parts at the extreme posterior border of the head; mouth opening a transverse slit partially covered by the upper lip, which is ribbon-shaped, much wider than long, and has a straight posterior margin.

Maxillæ and maxillipeds visible at the sides of the mouth opening, mandibles concealed beneath the upper lip. Mandibles of the usual shape, a flattened and curved lamina, twice as long as wide, pointed at the tip, and armed along either margin with a row of large bluntly pointed teeth, about 30 on the convex margin and 25 on the concave. Maxillæ two-jointed, the basal joint swollen and cylindrical and attached just at the posterior margin of the upper lip; the terminal joint an elongate pointed lamina, with six or seven large rounded teeth on its posterior margin near the tip. Maxillipeds also two-jointed, the basal joint swollen and attached close to the maxillæ, the terminal joint smaller and divided at the tip into a dorsal and ventral knob. The former is covered with small spines, the latter carries a single large conical spine.

Total length, 10.5 mm. Length of head, 1.5 mm. Width at posterior margin, 1.5 mm. Length of first two thorax joints, 1.75 mm.; of genital portion, 7.25 mm. Width of latter, 2.75 mm. Length of egg strings, 11.5 mm.

Color.—This is of a muddy gray, somewhat mottled on the dorsal surface, lighter beneath. Egg strings a sulphur yellow.

Male.—Head joined with the first thorax segment and swollen into an ovoid mass much larger than the rest of the body. Free thorax distinctly segmented and curved over ventrally; genital segment slightly enlarged and evenly rounded; no abdomen; two narrow conical anal laminae attached directly to the genital segment, each tipped with two minute spines.

First antennæ in the form of small finger-like projections just over the bases of the second pair. Other mouth parts similar to those of the female. Two pairs of rudimentary legs on the first two thorax joints, each consisting of a short cylindrical basal joint tipped with two conical spines.

Total length, 1.6 mm. Length of carapace, 0.88 mm. Width of same, 0.6 mm.

Color, a clear yellow, much lighter than the female; found attached to the abdomen of the latter between the posterior processes of the genital portion.

(*epachthes*, *ἐπαχθής*, troublesome, annoying.)

All the specimens are excellently preserved and each of the females carries a pair of fully developed egg strings.

Genus PSEUDOCHONDRACANTHUS, new.

Diagnosis.—Head distinctly separated from the rest of the body and covered dorsally with a small carapace. First thorax segment only free, the others fused into the elongate genital portion, which is without any traces of segmentation. Abdomen small and two-jointed. Egg strings long; eggs multiseriate. Second antennæ in the form of stout falcate hooks. Mouth parts at the posterior margin of the head. Mandibles similar to those of *Chondracanthus*. Maxillæ sickle-shaped laminae like the mandibles, armed with a row of broad blunt teeth along either margin, and carrying at the base on the dorsal surface a blade-like palp. Maxillipeds relatively very large and attached to the extreme lateral margins of the head; their basal joints are flattened laminae, strongly muscular and bordered by muscular flaps on either side; their terminal joints are bilobed, one lobe armed with a stout claw, the other covered with short spines.

When closed these organs cover the bases of the other mouth parts and the entire sides of the face, giving to the latter a swollen appearance; when open they expose the front of the face to its extreme lateral margins. There is but a single pair of rudimentary swimming legs, flattened and bilobed at their tips.

Type-species.—*Pseudochondracanthus diceraus*.
(*pseudo*, and *Chondracanthus*.)

PSEUDOCHONDRACANTHUS DICERAUS, new species.

Plate LXVII.

Host and record of specimens.—Two females with fully developed egg strings, and each with a male attached to its abdomen, were taken from a species of puffer at La Jolla, California, by Doctor McClendon and are Cat. No. 38581, U.S.N.M. (See also p. 477.)

It has been found on the Atlantic coast as well as the Pacific; a fine lot of specimens were obtained from the gills of the common puffer, *Spharoides maculatus*, by Doctor McClendon at Woods Hole, Massachusetts, in 1906, and these have been made the types of the species; they are Cat. No. 38603, U.S.N.M.

Another lot, Cat. No. 38604, U.S.N.M., was obtained from the same fish by Doctor Linton, also at Woods Hole.

The author was fortunate enough to obtain some living specimens while at Beaufort, North Carolina, in the summer of 1905.

Female.—General body form short and plump; head as long as wide, the anterior margin convex, the lateral and posterior margins concave, all four corners projecting and well rounded. From each anterior corner a short and bluntly rounded horn extends out later-

ally. The head is partially covered with a carapace, ovate in shape, much narrowed anteriorly, and with a deep groove along the mid-line for two-thirds of its length. There is but a single free thorax segment behind the head; this is nearly as wide as the head and carries a single pair of rudimentary legs.

The genital portion of the body is elliptical, slightly narrowed posteriorly, one-third wider than the head, and entirely covered with small triangular flattened spines. It shows no traces of segmentation, not even in the form of indentations along the lateral margins. At its posterior corners it is produced into broad conical processes, short and bluntly rounded at their tips. Egg-tubes one-third the diameter of the genital portion and as long as the entire body; eggs quite large and arranged in five or six longitudinal rows. Abdomen small, about as long as the posterior processes, and either conical, with a triangular outline similar to that of the processes, or sometimes in the shape of a trefoil, the base swollen on either side.

First antennæ small, with a swollen base and a much narrower terminal portion, tipped with two setæ. Second antennæ in the form of sickle-shaped claws, very sharp and having their bases articulated directly with the ventral surface of the head.

Mouth and mouth parts at the posterior margin of the head as in *Chondracanthus*, but in the present genus the sides of the head opposite the mouth (the cheeks) are swollen out into a hemisphere on either side, as though suffering from a bad attack of the mumps. This swelling is due to the enlargement of the basal joints of the maxillipeds. Mouth opening narrow and covered with a semicircular upper lip, very different from the long and ribbon-like one usually found in *Chondracanthus*. To increase the difference, the upper lip of the present genus is armed with a row of short hairs around its margin.

The mandibles are curved rather strongly, especially at the tips, and are furnished with a row of sharp teeth along either margin, as in *Chondracanthus*. The maxillæ are similarly curved and are armed with a row of large, blunt teeth on either margin and a long spur or palp at the base on the dorsal surface, shaped like a knife blade and directed diagonally backward and inward. The maxillipeds are very different from those in *Chondracanthus*; instead of being slender, but little larger than the maxillæ, and attached to the front of the face close to the mid-line, they are so much enlarged that they cover the bases of the other mouth parts and occupy the whole side of the face. Their swollen basal joints are filled with powerful muscles, as can be seen in fig. 15, which must render them useful organs of prehension. Their terminal joint is bilobed, each lobe forming a knob; the dorsal one is covered with short spines and is much larger than the ventral, which is armed

with a single strongly curved claw. These organs are articulated with the face at its extreme lateral margins, so that on opening they expose the entire width of the face.

There is but a single pair of rudimentary swimming legs, which are short, narrow, and bluntly rounded at their tips.

Total length, 3 mm. Length of head, 0.8 mm.; width the same. Length of genital portion, 2 mm. Width, 1.1 mm. Length of egg strings, 3 mm.

Color.—That of transparent cartilage, with the exception of the coiled oviducts in the genital portion, which are white and opaque. The small spines which cover the genital portion break the light and give this part of the body a grayish appearance. The eggs are snow white when first laid, becoming yellow as they ripen and afterwards a beautiful rose red or pink. There is so much of this pigment in the matured nauplius that the entire egg strings assume a deep rose color.

Male.—A pigmy attached to the abdomen of the female; the first thorax segment united with the head to form a cephalothorax much larger than the rest of the body, and covered with a three-lobed carapace whose lateral margins are broadly rounded and project some distance back of the central portion. Free thorax not distinctly segmented; no abdomen; anal laminae in the form of long conical processes, divided at the ends for half their length. Second antennae and mouth parts similar to those of the female; maxillipeds relatively as large and opening similarly; rudimentary legs entirely lacking.

Total length, 0.43 mm. Width of cephalothorax, 0.2 mm.

Color.—A uniform light yellow.

Nauplius.—Body broadly elliptical, with an evenly curved outline unbroken either at the anterior or posterior ends. The usual three pairs of appendages, all of which are relatively large for the size of the body. Eyes three in number and arranged in the form of a triangle close to the anterior margin, the apex of the triangle pointing forward. Balancers short, stout, and close together on either side of the mid-line; each is conical in form and curves outward and backward away from its fellow.

Total length of body, 0.15 mm. Width of same, 0.12 mm.

Color.—A deep rose red, filling the entire anterior four-fifths of the body. Not only the yolk, which is the portion usually taking the pigment, but the entire anterior half of the body, which in most nauplii is clear and transparent and without pigment, is here covered with a heavy rose wash, nearly concealing the muscles and eyes.

(diceraus, *δῖς*, double, and *κεράτος*, horned.)

This new genus is sufficiently distinguished from *Chondracanthus* by the fact that there is only one free thorax segment and a single

pair of rudimentary legs, and by the structure and attachment of the second maxillipeds. They do not have a very strong hold on the gill filaments, but are easily removed without taking any of the tissues with them. On being placed in an aquarium they lie helplessly upon their backs, writhing about violently, but unable to move from the place where they are put. The single thorax joint is very pliable and allows great freedom of motion in every direction. The head can be bent over forward, backward, or even sidewise until it touches the genital portion. The sidewise movement is practiced more frequently than the others, and specimens usually die and remain out of shape in this direction unless straightened just after death. The mouth parts, particularly the maxillæ and maxillipeds, are also capable of considerable motion, and the horn on either side of the head can be moved within restricted limits. The lower lip is apparently rigid.

Family CALIGIDÆ.

Subfamily CALIGINÆ.

CALIGUS GURNARDI Krøyer.

Caligus gurnardi KRØYER, 1863, p. 76, pl. II, figs. 3 a to g.

Host and record of specimens.—One lot obtained by the steamer *Albatross* May 29, 1904, from a king salmon, *Oncorhynchus tshawytscha*, at Monterey, California; Cat. No. 38562, U.S.N.M. A single female was obtained by Doctor McClendon from the elephant fish *Hydrolagus colliei* at La Jolla, California; Cat. No. 38579, U.S.N.M.

LEPEOPHTEIRUS NORDMANNII Milne Edwards.

Lepeophtheirus nordmannii MILNE EDWARDS, 1840, p. 455.

Host and record of specimens.—A lot consisting of ten females and fifteen males was obtained by the steamer *Albatross* March 31, 1904, from a sunfish, *Mola mola*, off Santa Catalina Island; Cat. No. 38563, U.S.N.M. In this lot was found a chalimus of the species attached to one of the males; these two have been separated and are Cat. No. 38564, U.S.N.M.

LEPEOPHTEIRUS PARVIVENTRIS Wilson.

Lepeophtheirus parviventris WILSON, 1905, p. 635, pl. XXIII, figs. 275 to 284.

Host and record of specimens.—Five females were obtained by the steamer *Albatross* from the spanish flag, *Sebastes rubrivinctus*, 6½ miles northwest of Santa Barbara Island, in 1904; Cat. No. 38566, U.S.N.M.

Twenty females and one male were obtained by the same steamer from the atka fish, *Pleurogrammus monopterygius*, at Agattu, Alaska, June 7, 1906, and are Cat. No. 38582, U.S.N.M.

Several lots had been previously obtained by the same steamer in 1888 from the northern Pacific, and were recorded in the reference

given above. A part of them came from the American shore and the rest from the Asiatic coast.

The hosts included the common cod of the region, *Gadus macrocephalus*, the atka fish, *Pleurogrammus monoptygius*, and a species of *Lepidopsetta*.

The new specimens are better preserved than the old ones and not as badly bleached, and from their examination the following notes on color may be added to those already given:

Carapace and free segment a yellowish horn color, quite transparent; genital segment a deep orange yellow; egg strings a light straw yellow in early development, turning to a deep orange. Dorsal surface of the entire body often covered with small circular spots of a dark Venetian red.

LEPEOPHTHEIRUS LONGIPES Wilson.

Lepeophtheirus longipes WILSON, 1905, p. 618, pl. xviii, figs. 206 to 211, and 222.

Host and record of specimens.—A lot containing twenty females, excellently preserved, were obtained from the jew fish, *Stereolepis gigas*, at La Jolla by Doctor McClendon, and are Cat. No. 38567, U.S.N.M.

The record of these specimens renders it probable that the two females upon which the species was founded, and for which there were no data as to locality or host, were from the Pacific coast.

LEPEOPHTHEIRUS BIFURCATUS Wilson.

Lepeophtheirus bifurcatus WILSON, 1905, p. 637, pl. xxiii, figs. 285 to 293.

Host and record of specimens.—A single lot, consisting of two females, upon which the species was founded, was obtained from one of the common flounders of the Pacific coast, *Psettichthys melanostictus*, in San Francisco Bay.

LEPEOPHTHEIRUS PACIFICUS Gissler.

Lepeophtheirus pacificus GISSLER, 1883, p. 885, text figures.—WILSON, 1905, p. 642, pl. xxv, figs. 304 to 310.

Host and record of specimens.—Twenty-three females were obtained from the blueback salmon, *Oncorhynchus nerka*, on the Pacific coast, the exact locality not being given.

LEPEOPHTHEIRUS SALMONIS Kröyer.

Lepeophtheirus salmonis WILSON, 1905, p. 640, pl. xxiv.

Host and record of specimens.—Ten females obtained from a blueback salmon, *Oncorhynchus nerka*, at Karla Bay in 1903, and sent with the other material by Doctor McClendon; Cat. No. 38568, U.S.N.M.

Six females from the king salmon, *Oncorhynchus tshawytscha*, at Monterey, California, May, 1904, taken by the steamer *Albatross*; Cat. No. 38569, U.S.N.M.

Five females from the hump-backed salmon, *Oncorhynchus gorbuscha*, at Karluk, Alaska, by Dr. T. H. Bean; Cat. No. 38570, U.S.N.M.

An excellent lot of one hundred females and twenty males, with many young females in different stages of development, taken from the Dolly Varden trout, *Salvelinus malma*, at Karluk, Alaska, in August, 1889, by Dr. T. H. Bean; Cat. No. 38571, U.S.N.M.

Ten females from "salmon" at Karluk, Alaska; Cat. No. 38572, U.S.N.M.

Fifteen males and females from "red salmon" and "black batte," at Karluk, Alaska, by Dr. T. H. Bean; Cat. No. 38573, U.S.N.M.

Twenty-five females from *Oncorhynchus gorbuscha*, at St. Paul Kodiak, Karluk, Alaska, by Dr. T. H. Bean; Cat. No. 38574, U.S.N.M.

The lot mentioned above as taken from the Dolly Varden trout is of especial value on account of the large number of males and development stages it contains.

As is stated in the reference given under this species, the entire National Museum collection has hitherto yielded but a single male of this species, and even that one proved to be new to science and was then described and figured for the first time. In the present lot there are more than twenty males, together with development stages of the female down to 2 mm. in length.

LEPEOPHTHEIRUS BRACHYURUS Heller.

Lepcephtheirus brachyurus HELLER, 1865, p. 185, pl. XVI, fig. 4.

Host and record of specimens.—A single female was obtained from *Scorpena guttata* by Doctor McClendon, at La Jolla, California. It has been injured somewhat so that its identity is not perfectly certain; it is Cat. No. 38575, U.S.N.M.

LEPEOPHTHEIRUS THOMPSONI Baird.

Lepcephtheirus thompsoni BAIRD, 1850, p. 278, pl. XXXIII, fig. 2.

Host and record of specimens.—A single female was obtained from the mouth of the white sea bass, *Cynoscion nobilis*, at La Jolla, California, by Doctor McClendon, and is Cat. No. 38576, U.S.N.M.

LEPEOPHTHEIRUS PARVUS, new species.

Plate LXVIII.

Host and record of specimens.—About a dozen females were obtained by Doctor McClendon from the California red fish, *Pimelometopon pulcher*, at San Diego, California. Every specimen is fully

developed and nearly all carry complete egg strings. This lot is taken as the type of the species and is Cat. No. 32815, U.S.N.M.

Female.—Carapace orbicular, slightly wider than long, its lateral margins strongly convex, the posterior margin nearly straight. Frontal plates projecting strongly with a deep incision at the center. Grooving of the dorsal surface of the carapace peculiar in that the anterior ends of the lateral grooves are bent abruptly inward toward the midline and do not run forward toward the bases of the first antennæ as in most species. A similar arrangement was found in *Caligus aliuncus*.^a But in the present instance there is an additional groove running outward from the anterior end of the lateral groove almost at right angles to the median axis. Where this groove strikes the lateral margin of the carapace it produces a well-defined incision.

A similar incision was found on the carapace of *Caligus schistonyæ*,^b but in that species the arrangement of the grooves was radically different. The median posterior lobe is considerably more than half the entire width, with a nearly straight posterior margin. The lateral lobes are broad and well rounded, but so short that they do not reach the posterior margin of the median lobe. The fourth segment is about half the width of the genital segment, and is abruptly narrowed just in front of the bases of the fourth legs. The genital segment is barrel-shaped, as long as wide, with nearly straight anterior and posterior margins and strongly convex lateral margins. The posterior corners project slightly as blunt lobes, but there are no rudimentary legs visible on either dorsal or ventral surfaces. The abdomen has but a single segment, one-fourth the width and one-third the length of the genital segment. The anal laminae are small and each is armed with four very long setæ. The egg cases are nearly twice the diameter of the abdomen and four times its length; the eggs are large and much flattened, about twenty-five in each string.

The first antennæ are slender, the terminal joint longer than the basal and both well armed with setæ; the second antennæ are small, with a slender terminal claw. The first maxillæ also are small, the basal portion enlarged and nearly circular, the terminal part short, narrow, and strongly curved. The second maxillæ are relatively large; they project well beyond the tip of the mouth tube, and are divided for more than half their length, the two branches being of the same size and length.

The mouth tube is short and wide with a constriction near the center. The furca is long and slender, its base slightly enlarged and circular in outline, its branches conical, much longer than the base and divergent. The second maxillipeds have a stout basal joint, carrying on its ventral surface near the center a larger flattened

^a Proc. U. S. Nat. Mus., XXVIII, pl. ix, fig. 103.

^b Idem, pl. vi, figs. 65 and 66.

spine; the terminal claw is two-thirds the length of the basal joint, moderately curved, and armed with an accessory spine on its ventral surface near the base. The swimming legs are of the usual pattern; the terminal claws on the first pair are about as long as the terminal joint; the spines on the exopod of the second pair are exceptionally long and sharp; the rami of the third pair are close together and small, but are armed with very long setæ. The fourth legs are four-jointed, the basal joint with a small spine at the outer distal corner, a minute spine on the second joint, and three spines in a row at the tip of the terminal joint, the two inner ones being twice the length of the outer.

Total length, 4 mm. Length of carapace, 2.25 mm. Width of same, 2.37 mm. Length of free segment, 0.4 mm.; of genital segment, 1 mm.; of abdomen, 0.4 mm.; of egg strings, 1.6 mm.

Color (preserved material).—A light straw yellow, deepening on the thicker portions of the body; genital segment and egg strings orange.

(*parvus*, small.)

LEPEOPHTHEIRUS CONSTRICTUS, new species.

Plate LXIX.

Host and record of specimens.—A single female specimen was obtained by Doctor McClendon from the outside surface of the spotted cabrilla, *Paralabrax maculato-fasciatus*, at La Jolla, California. Fortunately the specimen is excellently preserved and bears a pair of fully developed egg strings. It is made the type of the species and is Cat. No. 38559, U.S.N.M.

Female.—Carapace orbicular, of nearly the same length and width, and narrowed a little anteriorly. Frontal plates less than half the entire width; lateral areas wide, pushing the lateral grooves far inward on either side. Median posterior lobe a little more than one-third the entire width, evenly rounded and projecting somewhat behind the broad and well rounded lateral lobes. Eyes large and placed well forward. Free segment three-fifths of the width of the genital segment, narrowed abruptly to half that diameter in front of the bases of the fourth legs.

Genital segment barrel-shaped, narrowed anteriorly, with nearly straight anterior and posterior margins, and the lateral margins only slightly convex. Its posterior corners are bluntly squared with no lobes. Abdomen about one-fourth the width and three-fifths the length of the genital segment, one-jointed, with its lateral margins concave. Anal laminae small, each bearing three long terminal setæ and another of the same length on the outer margin at the center. Egg-tubes of the same width as the abdomen and two-thirds as long as the entire body; eggs small and numerous.

The two joints of the first antennæ of the same length, but the terminal one much the narrower. Second antennæ of good size, with a stout terminal claw. First maxillæ nearly as long as the terminal claw of the second antennæ and consisting of a very short basal portion which is not enlarged, and a long terminal claw, of the same width throughout and bluntly rounded at the tip. Second maxillæ considerably enlarged at the base, the terminal half divided into two branches, of which the outer one is longer and wider than the inner. Second maxillipeds with a long and moderately swollen basal joint, without spines or projections, and a terminal claw half the length of the basal joint, stout at the base but tapering to a slender and sharp point.

Furca short and very stout, the basal portion trapezoidal, the posterior corners of the trapezoid forming triangular projections on either side, the terminal portion elliptical, cut a little beyond the center, the branches nearly parallel, much flattened and bluntly rounded, the central sinus wide and squarely cut at its base.

Swimming legs of the usual pattern; the three terminal claws on the tip of the first pair diminish regularly in size from in front backwards; the rami of the third pair are close together and the basal joint of the exopod with its claw is exceptionally large. The fourth legs are four-jointed, the basal joint stout and two-thirds as long as the other three, the claw on the second joint minute and blunt, while the three terminal claws are turned outward nearly at right angles to the joint itself, the two inner ones being more than three times as long as the outer one. The sixth legs appear as good sized papillæ on the ventral surface of the genital segment close to the bases of the egg strings; each is armed with three setæ on its outer margin.

Total length, 6.6 mm. Length of carapace, 3.8 mm.; of genital segment, 1.7 mm.; of abdomen, 1 mm.; of egg strings, 4.4 mm. Width of carapace, 3.8 mm.; of genital segment, 1.5 mm.

Color (preserved material).—A pale yellowish white, without pigment of any sort; egg strings a deeper yellow.
(*constrictus*, contracted, alluding to the narrowed fourth segment.)

LEPEOPHTHEIRUS INSIGNIS, new species.

Plates LXX, LXXI.

Host and record of specimens.—A large number of both sexes of this species were obtained by Doctor McClendon from a sunfish, *Mola mola*, off the coast of Southern California. About a dozen of the best specimens have been selected and are Cat. No. 32814, U.S.N.M., types of the species. There are also cotypes in the Museum of the University of California.

Female.—Carapace orbicular, a trifle wider than long; lateral areas wide, each about one-third the entire width; posterior corners broadly

rounded and curved slightly inward; the two thoracic areas approximately the same size. Frontal plates well fused with the carapace and less than half the width of the latter, with a shallow central incision. Eyes minute and situated one-third the distance from the anterior margin. The muscles which flex the margins of the carapace and which radiate outward from either side of the eyes are very prominent and show clearly, even in a surface view. The median posterior lobe is the same length as the lateral lobes and has rather squarish corners, making the posterior margin nearly straight.

The fourth or free segment is half the length of the genital segment and two-thirds its width, projecting prominently on either side at the bases of the fourth legs. Genital segment ovate, with an evenly rounded outline and prominent posterior corners, showing on the ventral surface a pair of large triangular sixth legs, each armed with three spines. A sixth segment is also partially differentiated in front of the base of the abdomen in mature specimens. Abdomen one-jointed, oblong or trapezoidal in form, wider anteriorly than posteriorly and about one-half the length of the genital segment.

Anal laminae of medium size and curved inward toward each other. Second antennae stout, with a long terminal claw bent at right angles near its tip and armed with a small accessory spine at the center of its anterior margin.

First maxillae prominent, the circular basal portion three or four times the diameter of the straight terminal part. The second maxillae project far beyond the tip of the mouth tube; each is fully as long as the tube itself and strongly bifurcate, the branches being slender, bluntly pointed, divergent, and as long as the rest of the maxilla. On the basal portion of each is a small papilla, the rudimentary exopod, bearing a pair of setae. Mouth tube rather slender and bluntly rounded. Second maxillipeds stout, the basal joint bearing a small protuberance on its anterior margin, the terminal claw about the same length as the basal joint and armed with an accessory spine on its ventral surface near the base.

The basal joint of the first swimming legs is armed with two spines on its posterior margin, the outer of which is flattened and bluntly rounded, and a single spine on its inner margin. The spine on the basal joint of the exopods of the third legs is very large and is curved around inward into the form of a sickle. The three terminal joints of the fourth legs are about the same length; the last one bears two spines, nearly twice as long as the joint itself and toothed along their outer margins, and a third, much smaller spine.

The coiling of the oviducts is different from that in most species belonging to the genus *Lepeophtheirus*. The oviducts open just in front of the sixth legs on either side; the external egg strings are slender and about the same length as the body. The cement glands

rounded and curved slightly inward; the two thoracic areas approximately the same size. Frontal plates well fused with the carapace and less than half the width of the latter, with a shallow central incision. Eyes minute and situated one-third the distance from the anterior margin. The muscles which flex the margins of the carapace and which radiate outward from either side of the eyes are very prominent and show clearly, even in a surface view. The median posterior lobe is the same length as the lateral lobes and has rather squarish corners, making the posterior margin nearly straight.

The fourth or free segment is half the length of the genital segment and two-thirds its width, projecting prominently on either side at the bases of the fourth legs. Genital segment ovate, with an evenly rounded outline and prominent posterior corners, showing on the ventral surface a pair of large triangular sixth legs, each armed with three spines. A sixth segment is also partially differentiated in front of the base of the abdomen in mature specimens. Abdomen one-jointed, oblong or trapezoidal in form, wider anteriorly than posteriorly and about one-half the length of the genital segment.

Anal laminae of medium size and curved inward toward each other. Second antennae stout, with a long terminal claw bent at right angles near its tip and armed with a small accessory spine at the center of its anterior margin.

First maxillae prominent, the circular basal portion three of four times the diameter of the straight terminal part. The second maxillae project far beyond the tip of the mouth tube; each is fully as long as the tube itself and strongly bifurcate, the branches being slender, bluntly pointed, divergent, and as long as the rest of the maxilla. On the basal portion of each is a small papilla, the rudimentary exopod, bearing a pair of setae. Mouth tube rather slender and bluntly rounded. Second maxillipeds stout, the basal joint bearing a small protuberance on its anterior margin, the terminal claw about the same length as the basal joint and armed with an accessory spine on its ventral surface near the base.

The basal joint of the first swimming legs is armed with two spines on its posterior margin, the outer of which is flattened and bluntly rounded, and a single spine on its inner margin. The spine on the basal joint of the exopods of the third legs is very large and is curved around inward into the form of a sickle. The three terminal joints of the fourth legs are about the same length; the last one bears two spines, nearly twice as long as the joint itself and toothed along their outer margins, and a third, much smaller spine.

The coiling of the oviducts is different from that in most species belonging to the genus *Lepeophtheirus*. The oviducts open just in front of the sixth legs on either side; the external egg strings are slender and about the same length as the body. The cement glands

are very large and arranged in the form of parenthesis marks; the individual cells are also large, and there are about twelve in each gland. The spermatophores are large, more or less spherical, and are fastened to the ventral surface of the genital segment; their ducts lie side by side in the space between the posterior lobes and apparently do not cross each other at the mid line.

Total length, 11.75 mm. Length of carapace, 6.5 mm.; of the genital segment, 2.75 mm.; of the egg strings, 10.5 mm. Width of carapace, 7 mm.; of genital segment, 2.6 mm.

Color.—A delicate yellowish pink, the chitin ribs and thickenings of the carapace a dark purple, the internal oviducts a light orange, the external egg cases a straw yellow. These colors are blended harmoniously and make the species at once the most highly colored and the most beautiful of its genus.

Male.—Carapace similar to that of the female, but relatively much larger, three-fifths of the entire length and four times as wide as the genital segment. Eyes also relatively larger; posterior lobes of the carapace narrower and longer.

Free segment three-quarters as wide as the genital segment, but shorter than in the female. Genital segment ovate, with the fifth and sixth segments distinctly differentiated on both dorsal and ventral surfaces, each of the two bearing a pair of large rudimentary legs armed with spines.

The sixth legs are at the posterior corners and project backward as large lobes; the fifth pair are just in front of them and project as equally large lateral lobes from the sides of the segment. Abdomen two-jointed, the basal joint only one-fourth the length of the terminal; anal laminae larger than in the female and armed with longer setae. Appendages similar to those of the female, with the usual sexual differences in the second antennae, first maxillae, and second maxillipeds. The latter are especially large and powerful, as can be seen in fig. 46. The second maxillae are very unlike those of the female in that they show scarcely any bifurcation except at the very tip (fig. 45).

The mouth tube is more slender and fully as long as the second maxillae. The structure of the genital segment is well shown in the ventral view given in fig. 48. The coiling of the sperm duct just before entering the receptacle is especially noteworthy.

Total length, 6.6 mm. Length of carapace, 4.1 mm.; of genital segment, 1.2 mm. Width of carapace, 4.2 mm.; of genital segment, 1.1 mm.

Color.—The same as in the female.

Young female.—Carapace more elliptical than in the adult, longer than wide. Free segment as wide as the genital segment and more than half as long, its sides not protruding much at the bases of the

fourth legs. Genital segment rectangular, its margins very straight, and bearing a pair of huge sixth legs at its posterior corners. These are larger than the anal laminae and much more prominent than in any other known species, and each is armed with three large spines. The second maxillae are just showing bifurcate tips, similar to those in the adult male, while the furca has a fat globular base from which project a pair of tiny spines, which represent the prongs or rami.

The mouth-tube is more triangular than in the adult and shows a distinct constriction near the center as in some other species. The other appendages are like those of the adult.

(*insignis*, noteworthy or remarkable, in the particulars just given.) This new species is of peculiar interest by reason of its striking coloration and also by the structure of the thorax in both sexes. It furnishes another link in the chain of evidence, and by far the most conclusive of any which has yet appeared, that the genital segment in the Caliginæ is really a fusion of two segments, the fifth and sixth of the thorax. Here we not only have the two pairs of legs in both sexes, but the boundaries of the segments are also clearly indicated by means of grooves. The size of the sixth legs, particularly in young females, is also much greater than that in any other known species or genus of the Caliginæ.

Subfamily TREBINÆ.

TREBIUS TENUIFURCATUS Rathbun.

Plate LXXII.

Trebius tenuifurcatus RATHBUN, 1887, p. 559, pl. xxxix, figs. 1 to 3.—WILSON, 1907, p. 679, pl. xv, figs. 8 to 10.

Host and record of specimens.—Eight specimens, including both sexes, were obtained from the round sting ray, *Urolophus halleri*, by Doctor McClendon, at San Diego, California, and are Cat. No. 38600, U.S.N.M.

Female.—Carapace horseshoe-shaped, one-third wider than long, and, including the third thorax segment, about two-fifths the entire length. Frontal plates less than half the width of the carapace, with a shallow central sinus; lateral lobes wide and bluntly rounded. Transverse grooves, separating the lateral areas situated far back, leaving the thoracic portion shorter than the cephalic as in *caudatus*. These grooves do not quite reach the lateral margins and there are no notches in the latter, as in other species.

Eyes large and well fused on the mid-line about one-third the distance from the anterior margin, dark reddish brown in color. Second and third thorax segments about the same length, but the third (the first free) segment is considerably the narrower. The sides of this third segment are strongly inclined toward the central axis, so

that the posterior margin is only half the width of the anterior. Fourth segment nearly as long as wide, and considerably swollen between the bases of the fourth legs.

Genital segment flask-shaped, considerably narrowed anteriorly, with well-rounded posterior corners. The latter are each armed on the dorsal surface with four large triangular spines like those in *caudatus*. On the ventral surface they show on either side two large spines similar to those on the dorsal surface, and a small but distinct rudimentary leg, tipped with three setæ. The egg cases are very short in all the available specimens, not reaching the end of the abdomen, but are fully as wide as the latter and each contains from fifteen to twenty eggs.

The abdomen is elongated, about one-third the width of the genital segment, and five times as long as wide; it is two-jointed, the joints being of the same length; the anal laminae are long and narrow and each is tipped with three setæ.

Of the appendages the first antennæ are long and slender, the two joints of the same length, but the terminal one much the narrower; both joints are well armed with setæ. The second antennæ are also long and slender, the basal joint armed with a stout spine on its posterior margin, the terminal claw bent at about its center, and carrying a small accessory spine on its posterior side near the base.

The first maxillæ have an enlarged and rounded base and a narrow terminal claw, bent abruptly near the center and more than half the length of the second antennæ. The second maxillæ are quite different from those of *exilis* or *caudatus*; in the former the endopod is simple to the very tip, in the latter it is slightly bifurcated, the inner branch being much smaller and shorter than the outer. Here in *tenuifurcatus* it is cut nearly to the center, the two branches being the same length. As in the other two species, these maxillæ project far beyond the tip of the mouth tube; the basal joint is armed with a small papilla carrying two setæ, which represents the exopod.

The mouth tube is similar to that in *caudatus* and *exilis*, but a little longer, the portion beyond the hinge being longer than the basal portion. The mandibles are stout, narrowed at the very tips, and curved in toward each other, with fine saw teeth along their inner margins. The furca is ovate, with the broad end outward, the sides being slightly reentrant between the base and the arms; the latter are of medium width, strongly flattened, and curve in toward each other at the tips which are bluntly rounded.

First maxillipeds of the usual pattern, the outer terminal claw less than half the length of the inner one. Second maxillipeds very weak, the terminal claw about half the length of the basal joint, slender, and carrying an accessory spine on its inner margin near the tip. Swimming legs of the usual pattern in this genus; endopod of the

first pair fairly stout and tipped with three long and stout setæ, the other legs of the same pattern seen in *caudatus*.

Total length, 4.65 mm. Length of carapace, 1.5 mm.; of free segments, 0.82 mm.; of genital segment, 1 mm.; of egg strings, 0.9 mm.; of abdomen, 1.45 mm. Width of carapace, 2 mm.

Color.—A dark yellowish or reddish white, thickly marked over the entire dorsal surface with a network of fine lines of a bright red-brown color. The latter tint can be plainly seen with the naked eye.

Male.—Carapace ovate, of about the same length and width, the grooves on the dorsal surface and the eyes being similar to those of the female. Third thorax segment considerably shorter than in the female; fourth segment wider than the genital segment, and two-thirds as long, its sides projecting in a sharp angle. Genital segment obovate, its sides indented at a point one-third the distance from the posterior border. It carries two pairs of well defined legs on its ventral surface, one at the posterior corners and the other opposite the lateral indentations (fig. 68).

Abdomen two-jointed, the terminal joint as long again as the basal; the latter is strongly constricted where it joins the genital segment. Appendages like those of the female except for the usual sexual differences and a change in the second maxillæ. These latter are contracted into narrow, bluntly pointed spines, with no trace of bifurcation at their tips.

Total length, 2.175 mm. Length of carapace, 1 mm.; of genital segment, 0.34 mm.; of abdomen, 0.9 mm. Width of carapace, 1 mm.

Color.—The same as that of the female, but paler and with the pigmented lines very much reduced in number.

This species has been twice described, first by Rathbun in 1887 and again by the present author in 1907. But both these descriptions were from the same single, poorly preserved female specimen taken from a sting ray in Vineyard Sound. Enough was visible in that specimen to establish its claim as a new species, but there were still many details which could not be made out definitely. These missing details have been supplied in the present description and the male is here portrayed for the first time.

There are several differences between these specimens and the original type, but they are no more than would naturally be expected in material from such widely different sources. They are all of minor importance and are certainly not of enough value to establish even a variety, to say nothing of a new species. The length of the egg-strings in any of the females, taken singly, would suggest that the copepod bearing them was not fully grown. But they are the same in each of the females, and this fact, coupled with the evidence of what can be seen inside the genital segment, make it practically certain that they are all adults.

Subfamily PANDARINÆ.

Genus ACHTHEINUS, new.

Diagnosis.—Female. First thorax segment joined with the head to form the carapace; second and third thorax segments fused and furnished with a single pair of large rounded dorsal plates. Fourth segment free and armed with a similar pair of plates. Genital segment much smaller than the carapace, its fused dorsal plate with a large median posterior sinus, enlarged at its base similar to that in *Perissopus*.

Abdomen small and wholly concealed beneath the genital segment, except what is visible through the posterior sinus of the latter. Anal laminae large, visible beyond the border of the genital segment. Frontal plates completely fused with the carapace; second antennae stout and armed with a powerful claw. Mouth-tube long and slender; first maxillae lacking; second pair close to the base of the mouth-tube, short and tipped with a minute spine. Second maxillipeds with a swollen basal joint and a slender terminal claw. All the swimming legs biramose, rami of first three pairs two-jointed, of fourth pair one-jointed. All the rami rudimentary and armed with spines only; each exopod reinforced on the outside by a well-defined papilla, tipped with a stout spine.

Type-species.—*Achtheinus oblongus*.

(*Achtheinus*, ἀχθεινός, annoying or troublesome.)

This new genus stands between Dana's *Pholidopus* (*Lepidopus*) and Steenstrup and Lüken's *Perissopus* and is closely related to both. It is like *Pholidopus* in possessing but two pairs of dorsal plates on the thoracic segments. It resembles the male of *Perissopus* in the structure of its swimming legs and some of the mouth parts, but it also differs materially from both these genera.

Pholidopus has the terminal joint of the second maxillipeds flattened into a broad lamina covered with scales; the first swimming legs are uniramous and three-jointed; second, third, and fourth pairs biramous, rami of third and fourth pairs one-jointed and rudimentary. *Perissopus* has three pairs of dorsal plates on the thorax segments; terminal joint of second maxillipeds enlarged into a kidney-shaped adhesion pad, destitute of pinchers, knobs, or claws; legs all biramous, rami of third and fourth pairs one-jointed, minute, and rudimentary. These radical differences make it necessary to establish a new genus for the present species.

ACHTHEINUS OBLONGUS, new species.

Plate LXXIII.

Host and record of specimens.—Two adults and one chalimus female were obtained from a leopard or cat shark, *Triakis semifascia-*

tum, by Doctor McClendon at La Jolla, California. These are the types of the new genus and species and are Cat. No. 38596, U.S.N.M.

Female.—Carapace subquadrangular, slightly swollen at the center, with the corners nearly square. Frontal plates so thoroughly fused with the carapace as to be indistinguishable in the adult, their anterior margin entire and only slightly rounded, with no trace of a central sinus.

Posterior margin of carapace evenly rounded with a slight incision at the center. Lateral areas narrow as in *Echthrogaleus*, with a transverse groove back of the center; posterior lobes short, not reaching beyond the posterior margin and bluntly rounded.

Second and third thorax segments fused and covered with a single pair of dorsal plates; these latter are fused at their base, but separated for the terminal three-fourths by a wide triangular sinus. Fourth segment free and furnished with a pair of dorsal plates very similar to the previous pair, but the central sinus separating them is considerably enlarged at the base.

Genital segment the same width as the two pairs of dorsal plates, a little longer than wide, with nearly parallel sides. Its posterior margin is rather evenly rounded and is divided at the center by a wide and deep sinus, very similar to that in *Perissopus*.

Abdomen one-jointed and triangular much wider than long, with a narrow slit-like posterior sinus. The wide and flattened anal laminae are attached to the inclined margins on either side of this sinus and some distance apart; each is armed with five short, nonplumose setae.

The first antennae are slender, the two joints of about the same length and well armed with setae. The second pair are stout, with a swollen basal joint and a large terminal claw bent in the form of a half circle.

Mouth tube long and narrow, lance-shaped as in *Pandarus* and allied genera. No first maxillae; second pair close to the base of the mouth tube, two-jointed and both joints swollen, the terminal one ellipsoidal, considerably narrower than the basal, and tipped with a short curved spine. On either side of the mouth tube at its tip is a large boot-shaped spine, like those found in the same position on *Echthrogaleus torpedinis*.

First maxillipeds of the usual pattern; second pair similar to those of *Pandarus*, with a swollen basal joint and a stout, curved terminal claw which shuts down against the squared end of the basal joint.

All four pairs of legs are biramose; the basal joints of the first pair are small, of the other pairs much enlarged and laminate. Each is furnished at its outer posterior corner, just outside of the exopod, with a projecting papilla tipped with a long and stout spine. A corresponding but relatively smaller spine is found outside the

exopod of the last three pairs of legs in *Perissopus*. The rami of the first three pairs of legs are two-jointed, of the fourth pair one-jointed. All the rami are short and rudimentary, but are much more like those of *Nesippus* than of *Perissopus*. They are armed only with spines, however, and have no plumose setæ. The fifth legs appear as large papillæ upon the ventral surface of the posterior lobes of the genital segment, each tipped with a single spine.

The cement glands are similar to those of *Perissopus*, but are larger, curved like parentheses marks, and considerably enlarged at the base. The semen receptacles are in the shape of inverted commas, one on either side near the base of the abdomen and between the bases of the cement glands.

Total length, 8.5 mm. Length of carapace, 4.25 mm.; of dorsal thorax plates, 2.25 mm.; of genital segment, 3 mm.; of abdomen, 1 mm. Width of carapace, 3.5 mm.; of genital segment, 2.6 mm.

Color (preserved material).—A clear cream color without pigment of any sort.

Chalimus.—Carapace acorn-shaped, a little longer than wide; frontal plates indistinctly separated from the carapace by grooves, their outer ends projecting considerably over the bases of the first antennæ. Gland at the base of the attachment filaments rather small and pushed forward to the very margin of the carapace. Attachment filaments two in number, narrow and ribbon-like. Posterior margin of the carapace nearly straight; posterior lobes narrow and pointed, and projecting far behind the central margin.

Second and third thorax segments not yet fused; the second segment much the shorter and sending out a lateral lobe on either side which is curved backward and downward closely over the anterior margin of the third segment. Third and fourth segments each with a pair of rudimentary dorsal plates; genital segment the same shape as in the adult, but relatively smaller. At the posterior corners it is prolonged into broad and rounded lobes which reach back nearly to the tip of the abdomen. The latter is entirely visible in dorsal view and is of the same shape as in the adult, but the anal laminae are furnished with much longer setæ, which are also plumose. Appendages the same as in the adult.

Total length, 3.8 mm. Length of carapace, 2 mm.; of free segments, 1 mm.; of genital segment, 1 mm.; of abdomen, 0.4 mm. Width of carapace, 1.75 mm.; of genital segment, 0.9 mm.

(*oblongus*, oblong, referring to the general shape of the body.)

ECHTHROGALEUS COLEOPTRATUS Guérin.

Echthrogaleus coleoptratus WILSON, 1907, p. 367, pl. XIX.

Host and record of specimens.—Both sexes were obtained from a shark captured near Unalaska, Alaska, and are Cat. No. 12056, U.S.N.M.

PANDARUS CRANCHII Leach.

Pandarus cranchii WILSON, 1907, p. 403, pl. xxviii.

Host and record of specimens.—A single young female was taken by Doctor McClendon from the fin of *Galeorhinus zyopterus* at La Jolla, California. Cat. No. 38602, U.S.N.M.

NESIPPUS CURTICAUDIS Dana.

Nesippus curticaudis WILSON, 1907, p. 434, pl. xxxvi.

Host and record of specimens.—Two males taken from a large shark off the coast of California, name of shark and locality not given.

NESIPPUS BOREALIS Steenstrup and Lutken.

Nesippus borealis WILSON, 1907, p. 437, pl. xxxvii.

Host and record of specimens.—A single specimen collected by Dr. W. H. Dall from Alaska, the name of the host and locality not given. Cat. No. 32789, U.S.N.M.

Subfamily CECROPINÆ.

CECROPS LATREILLII Leach.

Cecrops latreilli WILSON, 1907, p. 468, pls. xxxviii and xxxix.

Host and record of specimens.—Both sexes taken from the gills of *Mola mola* by the steamer *Albatross* 12 miles northeast of Point Loma Light, on the coast of California; Cat. No. 32797, U.S.N.M.

Family DICHELESTIIDÆ.

EUDACTYLINA UNCINATA, new species.

Plate LXXIV.

Host and record of specimens.—Six females taken by Doctor McClendon from the gills of the soup-fin shark, *Galeorhinus zyopterus*, at La Jolla, California; Cat. No. 38558, U.S.N.M. These are made the types of the new species.

Female.—Body elongated, largest at the anterior end and tapering thence regularly to the bluntly rounded posterior end.

Carapace subquadrangular, widest along the posterior margin, which is nearly straight; it does not reach the anterior margin, but leaves the broad bases of the first antennæ free; its sides are somewhat irregular and reentrant.

First thorax segment entirely concealed beneath the posterior margin of the carapace. Second and third segments about the same size, as wide as the carapace and three-fifths as long; fourth segment narrower and longer; fifth segment as long as the carapace, but only half as wide; sixth, or genital, segment the same width as the fifth, but only half its length.

Abdomen short and tapering rapidly from the base to the tip; indistinctly jointed. Anal laminae small, well separated and divergent, each armed with two short spines. Egg cases each as wide as the genital segment and one-third of the entire length; eggs very large, only six or eight in each case.

First antennae large and prominent, their bases meeting at the mid-line and forming a broad margin in front of the carapace. The jointing is indistinct and shows differently in different specimens. The basal portion consists of three joints—a rounded proximal joint nearly semicircular in outline and armed with a single stout spine on its anterior and posterior margins, a median joint much widened and armed with a row of eight or ten stout spines along its anterior margin and two huge curved claws or talons at the posterior distal corner, while the rest of the posterior margin projects as a wide rounded lamina, and a distal joint much narrower and shorter than the other two and armed with a large spine on its anterior margin.

The apical portion is cylindrical, about the same size throughout, and made up of four or five joints, sparsely sprinkled with setae, with a good-sized bunch of larger and longer ones at the tip of the last joint.

The second antennae are stout and three-jointed; basal and median joints about the same size, the latter carrying a large accessory spine on its inner margin near the base; terminal joint in the form of a stout claw, abruptly bent near its center. Mouth tube long and wide, with a bluntly rounded tip from which protrude the ends of the mandibles.

The second maxillae each consist of a large basal papilla tipped with two long plumose setae which reach beyond the end of the mouth tube. First maxillipeds three-jointed, the basal joint fairly stout, the median one a little shorter and much narrower and armed at its inner distal corner with a bunch of short and stout spines and a tuft of long, wavy hairs, the terminal joint in the form of a short conical claw. Second maxillipeds large and elliptical, set close to the lateral margin of the carapace and firmly anchored by a broad chitin band which extends across the mid-line. The basal joint is stout and tapers gradually outward; at the very base on the anterior margin is a large laminate projection, two-thirds of the width and nearly one-half the length of the joint itself; its surface is corrugated with radiating ridges and short spines. The terminal joint is cylindrical, the same diameter as the distal end of the basal joint and bent in the form of a sickle. It is so much longer than the basal joint that, even though curved, its enlarged tip shuts down along the entire outer edge of the lamina just described and reaches a little beyond the base of the basal joint.

The first four pairs of legs are biramose, the endopods longer than the exopods; the former are quite distinctly three-jointed, the basal joint carrying an immense sickle-shaped spine on its inner margin and another smaller one at the outer distal corner; the terminal joint ends in two or three long spines. The exopods carry a single long curved spine at their tip and a row of short and stout ones along their outer margin. From the arrangement of these spines we get the suggestion that the exopods are three-jointed as well as the endopods, but the joints themselves can not be distinguished. The fifth legs are rudimentary and consist of a mere stump, long and finger-like, and armed with a few short spines.

Total length, 2.5 mm. Length of carapace, 0.5 mm.; width of same, 0.375 mm. Length of egg tubes, 1 mm.

Color.—(preserved material) a uniform grayish white, without pigment markings of any sort; egg tubes yellowish or light orange.

(*uncinata*, furnished with claws, in allusion to the large claws on the first antennæ.)

This species is sufficiently distinguished from the others of the genus by its slender and tapering body form, by the large claws on the first antennæ, and by the immense size and the shape of the second maxillipeds.

HATSCHEKIA PINGUIS, new species.

Plate LXXV.

Host and record of specimens.—Both sexes were obtained by Doctor McClendon from the gills of the California conger eel, *Lycodontis mordax*, at La Jolla, California. They are taken as the types of the new species and are Cat. No. 38560, U.S.N.M.

Female.—Body short and stout, made up of three parts or regions, a head, a free thorax, and a rudimentary abdomen. Head covered with a carapace circular in outline with evenly rounded margins and dorsal grooves as shown in fig. 91. This carapace differs from that of recorded species in being wider anteriorly and somewhat narrowed posteriorly.

The so-called genital segment is really in the present species a fusion of all the thorax segments, as can be plainly seen in the male. It is almost a regular ellipse in outline, only a trifle longer than wide, and gives the animal a very plump appearance, another respect in which it differs markedly from recorded species. This free thorax is twice the length of the carapace and once and three-fifths its width. At the anterior end the two segments which bear the swimming legs are indistinguishably fused, but are separated from the remainder of the segments by a fairly well defined groove, which shows as a shallow notch on each lateral margin. At the posterior end between

the egg strings is the tiny projection representing the abdomen, which bears two minute papillæ, the anal laminae, each armed with a small spine. The egg strings are large and straight, nearly one-fourth the diameter of the free thorax, and twice the length of the entire body; the eggs also are large and there are from 36 to 40 in each string.

The first antennæ are long and cylindrical, tapering but slightly. The jointing is indistinct, but there appear to be five joints, the basal one the longest and thence diminishing regularly in length outwards. The setæ are all gathered in a bunch at the tip of the last joint. The second antennæ are stout and two-jointed, the basal joint much swollen and considerably longer than the terminal one which is in the form of a stout curved claw.

The mouth-tube is short, wide, and well rounded at the end; the maxillæ are in the form of minute papillæ, each bearing three small spines. The maxillipeds are large and project quite a little beyond the sides of the carapace; they are three-jointed, the basal joint long and stout, the median joint the same length but much narrower, the terminal joint in the form of a short and stout claw, usually much curved.

There are two pairs of swimming legs close behind the maxillipeds and very similar in structure; each is biramose and the rami are two-jointed with the joints the same length. The basal joint is armed with a stout spine on its outer margin; in the exopod the proximal joint is cut off diagonally toward the outer corner, where it ends in a long curved claw or spine, which is fully as long as the terminal joint. In the first legs the distal joint ends in a bunch of four large spines; in the second legs there is but a single spine.

The proximal joint of the endopod is unarmed, the distal joint ends in a single curved spine, nearly as long as the entire appendage. The ovaries occupy the entire lateral areas of the fused thorax joints; each is club-shaped, the larger end being anterior and ending close to the head; the posterior end tapers gradually into the short oviduct that leads to the external egg-tubes.

Total length, 1.8 mm. Length of carapace, 0.5 mm.; of fused thorax segments, 1.25 mm.; of egg strings, 3.35 mm. Width of carapace, 0.625 mm.; of fused thorax segments, 1 mm.

Color.—(preserved material) a uniform opaque white, the ovaries a light gray.

Male.—Much smaller than the female, the body nearly as wide as long. Head transversely elliptical, one-fourth wider than long, the anterior margin projecting slightly at the center, the posterior one nearly straight.

The grooving of the dorsal surface is similar to that in the female except for the slight projections at the center of the anterior margin.

Fused thorax segments also transversely elliptical, one-sixth wider than long. In the center over the digestive tube the jointing of this fused portion appears distinctly, and it can be seen that there are apparently five segments fused together, all of about the same length. The first of these, however, is itself really a fusion of the first and second segments and corresponds to the similarly fused section in the body of the female. This is attested by the fact that it bears on its ventral surface the two pairs of swimming legs.

The lateral areas project backward in two large rounded knobs at the posterior corners, between which is a narrow and shallow sinus. On each side there is a small spine projecting backward from the margin opposite the base of the abdomen. This latter is small and one-jointed; it is attached to the ventral surface of the thorax and is partly concealed by the posterior lobes. The anal laminae are narrow, divergent, and considerably longer than the abdomen. Each is five times as long as wide and is armed with a stout seta on its outer margin near the base and two others at the tip, one of which is much longer than the other and curved upward. The appendages are similar to those of the female save an increase in size in the maxillipeds which project much farther beyond the lateral margins of the carapace.

The testes occupy positions corresponding to those of the ovaries in the female, except that they are inclined toward the central axis rather than parallel with it. Each is cylindrical with rounded ends and starts from a point opposite and close to the base of the posterior sinus and extends diagonally outward and forward to about the center of the second of the fused segments, not reaching the first one at all.

Total length, 0.85 mm. Length of carapace, 0.33 mm.; of fused thorax segments, 0.45 mm. Width of carapace, 0.4 mm.; of fused thorax segments, 0.55 mm.

Color.—More of a cream or pink than in the female, the testes a deep reddish orange; digestive tract sprinkled with red or orange, especially at the anterior end of the fused thorax.

(*pinguis*, stout, corpulent, in allusion to the general body form.)

The only other species for which a male has been described is *H. hippoglossi* Kröyer. T. Scott found a single male of this species upon a halibut in the fish market at Aberdeen and has described it in one of his excellent memoirs.^a It conforms in its structure to the female, as do the two sexes of the present species. It also shows many points of generic resemblance to the male of the present species, particularly in the enlarged second antennæ, the more distinct segmentation of the thorax, the visibility of the abdomen, and the relative size and elongation of the anal laminae. It may be said of these

^a 1901, p. 126, pl. VII, fig. 11.

males also as Scott said of that one, that they are very small and easily overlooked. Their color also approaches more nearly to that of the gill filaments, and they have no egg strings to attract attention. It is probable that a careful examination of California congers will show both sexes of this species to be fairly common.

FAMILY LERNÆIDÆ.

HÆMOBAPHES CYCLOPTERINA Müller.

Hæmobaphes cycloptera MÜLLER, 1776, p. 2745.

Host and record of specimens.—Two females taken in Alaska by Lieut. G. M. Stoney, Cat. No. 14323, U.S.N.M. The name of the host is not given, nor the exact locality.

LERNÆENICUS MEDUSÆUS, new species.

Plate LXXVI, figs. 99 and 100.

Host and record of specimens.—A single female taken from the little *Nannobranchium leucopsarum* by the steamer *Albatross* in 1904 at Monterey Bay, California; it is Cat. No. 38598, U.S.N.M., and is made the type of the new species.

Female.—General body form plump; head but little enlarged, neck short and stout; genital portion cylindrical without posterior processes; no abdomen. Head covered anteriorly with a spherical mass of irregularly branched processes, which arise from a small area on the front of the head and branch in every direction like a mass of coral.

When buried in the tissues of the host this mass of processes forms a most effective attachment organ. In addition the head sends out a flat laminate process on either side, which is very short, curves forward, and ends in three or four knobs or laminate branches. These also aid in giving the head a firm hold upon the host.

The neck is one-third the diameter of the genital portion and with the head forms an S curve. At the anterior end it passes insensibly into the head and at the posterior end into the genital portion. The latter is cylindrical the same diameter throughout, and terminates posteriorly in a very short and blunt knob which represents the abdomen.

There are no processes or anal laminae. The egg strings are the same diameter as the neck, straight, and one-fourth longer than the body. The mouth opening is at the base of the coralline mass of processes and there is no visible mouth tube. There are two pairs of rudimentary legs on the anterior portion of the thorax, which consist of a basal joint and a single terminal ramus for each leg. No other appendages are visible.

Total length, 10 mm. Length of head, including the anterior processes, 2.35 mm.; of genital portion, 4 mm.; of egg strings, 13 mm. Width of head, 1.35 mm.; of genital portion, 1.45 mm.

Color.—(preserved material) a uniform light chocolate brown, the processes on the head yellowish white, the egg strings a light tan color.

(*medusæus*, medusa-like, alluding to the mass of anterior processes on the head.)

Genus OPIMIA, new.

Diagnosis.—General form elongate and slender; head swollen into a globe or sphere, smooth and without processes; neck cylindrical and two-thirds of the entire length; genital segment narrow, three times as long as wide, and carrying posterior processes; abdomen very short and rudimentary.

Mouth terminal, upper and under lips protruding; mouth parts reduced to finger-like projections; second maxillipeds well developed and evidently used for prehension. Only one pair of swimming legs close behind the maxillipeds. Male unknown.

Type-species.—*Opimia exilis*.

(*Opimia*, a vestal virgin who proved unfaithful to her vow and in consequence was buried alive.)

OPIMIA EXILIS, new species.

Plate LXXVI, figs. 102 to 104.

Host and record of specimens.—Two females were obtained by Doctor McClendon from the common soup-fin shark, *Galeorhinus zyopterus*, at La Jolla, California. They are made types of the genus and species and are Cat. No. 38601, U.S.N.M.

Female.—Cephalothorax orbicular, considerably swollen, with the mouth tube and mouth parts projecting from its anterior margin; its surface smooth and uniformly rounded, without any trace of lobes or processes. Free segments developed into a neck two-thirds of the entire length and about two-fifths of the diameter of the cephalothorax. This neck is straight, smooth, and free from wrinkles except at the very base where it joins the genital segment. The latter widens gradually to the same diameter as the cephalothorax. At its anterior end it is wrinkled similar to the adjacent portion of the neck; at its posterior end it is thrown into two or three much larger folds, but is smooth through the center. Attached to its posterior margin, a little nearer the dorsal than the ventral surface, are two slender cylindrical processes. Each is one-third the diameter of the genital segment and nearly straight, so that the two extend back side by side and look like short egg strings. Between them and on the extreme dorsal margin is the rudimentary abdomen, which consists of little more than a pair of tiny papillæ or knobs, represent-

ing the anal laminae. They scarcely project from the surface and can be easily overlooked. Neither of the females obtained carried egg strings, and so nothing is known of them.

The first antennae consist of a one-jointed papilla on either side of the mouth tube, a mere stump, apparently immovable. The second pair are three-jointed, stout, and terminate in a small curved claw; they are movable and evidently assist in prehension, particularly that part which is concerned with the burying of the head when the parasite first becomes fixed. The mouth tube is made up of the projecting upper and under lips; these are united at the base, but are separate for their terminal halves. The upper lip is semicylindrical and somewhat like a proboscis, while the under one is tongue-shaped and just covers the semicylinder, making thus when closed a tube through which nourishment can be conveyed. The mandibles and maxillae are reduced to mere finger-like processes, the former in the space between the two lips, the latter on either side of the lower lip.

There are no first maxillipeds; the second pair are two-jointed and well developed. They consist of a large swollen basal joint and a small terminal claw which closes down firmly against it. They are thus much better developed and more formidable organs of prehension than are common in this family of parasites. In most of the genera possessing a swollen cephalothorax and a long buried neck, these alone seem to attach the parasite securely to its host, and all the organs that serve for prehension in other forms are rudimentary or usually lacking. Here for some reason the second maxillipeds have retained fully their normal size.

There is but a single pair of swimming legs, one-jointed and very rudimentary, attached to the cephalothorax close behind the maxillipeds. The ovaries are in the form of oblong masses, one on either side of the digestive canal in the genital segment.

Total length, 38 mm. Length of head, 2.8 mm.; of neck, 22 mm.; of genital segment, 7 mm.; of posterior processes, 7 mm. Width of head, 2.2 mm.; of genital segment, 2.5 mm.; of neck, 0.7 mm.

Color.—Of preserved specimens snow white throughout except the mouth tube, mouth parts, and second antennae, which are tinged with red.

(*exilis*, slender.)

The presence of a mouth tube, however imperfectly formed, places this genus in the family Lernaeidae, but the male must be obtained and examined before this point can be finally settled. The author has taken a similar genus (as yet undescribed) from sharks along the Atlantic coast. While in the female there was little evidence of a mouth tube, in the male it was well developed and leaves no doubt as to the location of the genus. The same will probably be found to be true when the male of the present genus is obtained.

Genus PHRIXOCEPHALUS, new.

Diagnosis.—Female entirely destitute of segmentation, but with the different body regions fairly distinct. Head enlarged and club-shaped, with three pairs of horns, two pairs lateral, branched, and chitinous, one pair ventral, softer and nearly simple. Head passing insensibly into an elongate neck furnished with two pairs of lateral horns and one pair of ventral ones, the latter opposite the posterior pair of lateral ones. Neck bent at a right angle where it joins the genital segment; the latter straight, cylindrical, and enlarged to several times the diameter of the neck. No posterior lobes or processes. Abdomen very small and rudimentary, without anal laminae or setae. Egg tubes long, each coiled into a tight spiral nearly as long as the entire body; eggs uniseriate. Mouth terminal, with three pairs of rudimentary mouth parts. Two pairs of uniramous, three-jointed legs attached close to the mouth.

Type-species.—*Phrixocephalus cincinnatus*.

(*phrixocephalus*, φριξός, bristling and κεφαλή, head.)

PHRIXOCEPHALUS CINCINNATUS, new species.

Plate LXXVI, fig. 101.

Host and record of specimens.—Two females found attached to the eyes of a species of *Citharichthys*, one of the soft flounders, at Monterey Bay, California, by the steamer *Albatross* in 1904. These are made the types of the new genus and species and are Cat. No. 38599, U.S.N.M. Both specimens carry egg strings.

Female.—Head enlarged and club-shaped, with a pair of short branched horns on either side and a pair of softer and stouter ones, nearly simple, on the ventral surface at the frontal margin. The anterior pair of lateral horns is branched from the very base, the two branches forming an obtuse angle with each other, the inner one extending forward and inward parallel with the anterior margin of the head, while the outer one extends at right angles to the central axis of the body and parallel to the posterior horn. These latter are branched only at their tips and the rami are short and knob-like. The head passes insensibly into a narrow neck which tapers backward, its narrowest portion being just at its junction with the genital segment, where it is bent at right angles to the latter. It is also twisted a quarter of the way around, so that when the creature is lying on the side of its genital segment the head and neck present either their dorsal or ventral surfaces. In both of the females studied the twisting was sinistral, so that the left side of the genital segment appeared in connection with the ventral surface of the neck and head.

This neck carries on either side close to the head a stout horn somewhat longer than those on the side of the head and not quite as stiff and hard. Each of these horns is slightly enlarged at its tip, where it gives off three or four small knobs or branches. About halfway between these second horns and the genital segment is a third set, four in number, one on either side and a pair close together on the ventral surface. These are all very hard and chitinous, the two lateral ones a little longer than the second pair, the ventral ones considerably shorter, and all four profusely branched. The ventral pair are so close together that their bases are partly fused and at first glance they might easily be mistaken for a single horn; but a little examination shows them to be unmistakably a pair placed close together.

The genital segment enlarges abruptly from the base of the neck to fully five times the diameter of the latter. It is cylindrical, slightly enlarged posteriorly, a little curved, and smoothly rounded, without appendages of any sort, but with a small rudimentary lobe over the base of each egg string. The abdomen is also small and rudimentary, little more than a knob or lobe projecting slightly from the dorsal surface of the posterior margin between the egg strings. It is notched at the center, indicating the position of the anus, but carries no anal laminae or setae. The egg strings are about the same diameter as the narrowest part of the neck, and very long, but they are coiled in a tight spiral of about three times their own diameter, and thus actually project behind the genital segment a distance less than the length of the body. If straightened out, however, they would prove to be more than twice that length. The eggs are small and uniseriate, and each string contains between 1,200 and 1,500.

The mouth is terminal and is surrounded by mouth parts so degenerate that they have become mere spherical knobs. There are two pairs of these close together and close to the mouth and another pair at a little distance from them on the ventral surface. This last pair is somewhat asymmetrical in their position, being twisted around to the left side, but otherwise are exactly like the first two pairs.

The only other appendages visible are two pairs of rudimentary legs close together on the ventral surface about halfway between the lateral horns on the head and the first pair on the side of the neck. These legs are very short and slender, uniramose, three-jointed, and destitute of spines or setae.

Total length, including egg strings, 30 mm. Length of head and neck, 9 mm.; of genital segment, 8 mm.; of egg strings, 14 mm. Width of genital segment, 3 mm.; of the egg-tube coils, 1.12 mm.

Color.—Body and chitinous horns a rich cinnamon brown tinged with yellow; egg strings and soft horns a cream yellow.

(*cincinnatus*, having or wearing curls, in allusion to the coiled egg strings.)

The head and neck with all the anchor horns are buried in the tissues of the eye of the host, leaving simply the genital segment and egg coils visible on the exterior. The bend in the neck comes just at the outer surface of the eye and is no doubt caused by the friction of the water against the genital segment of the parasite as the flounder moves forward through the water and mud. The tissues of the eye in immediate contact with the head and neck of the parasite are hardened into a sort of cyst which increases the firmness of the parasite's hold, but of course renders the eye wholly blind. Whether the parasite ever infests both eyes of the same fish so as to render it totally blind is an interesting economic question which must be left to future observation to answer.

This new genus bears most resemblance to *Hæmobaphes*, but differs from it in many important particulars. The head in *Hæmobaphes* is without horns, while here it is supplied with six comparatively large ones, two pairs of which are chitinous like those on *Lernæa*. Again, the neck in *Hæmobaphes* is bent abruptly at an acute angle a little distance in front of its center, so that the head is brought back against the base of the neck; here the bending is simply at a right angle and at the very base of the neck, so that the head and neck stand out from the anterior end of the genital segment at right angles to the long axis of the latter.

Furthermore, while *Hæmobaphes* carries a pair of soft projections on the sides of the neck near the flexure, the present genus carries six branched horns upon the neck, the posterior four of which are hard, chitinous, and profusely multiramose. In *Hæmobaphes* the genital segment has a well-defined sigmoid flexure, while here it is practically straight; at least there are no traces of a double curve.

Hæmobaphes also has a large and well defined abdomen, in one species (*ambiguus* T. Scott) as long as the egg strings. Here the abdomen is so rudimentary as easily to escape notice. Finally in *Hæmobaphes* the mouth is ventral and there are two pairs of mouth parts at some distance behind it. Here the mouth is terminal, with three pairs of knob-like mouth parts close to it. In *Hæmobaphes* the rudimentary thorax legs are biramose and without joints; here they are uniramose and three-jointed.

In view of these essential differences the present specimens must constitute a genus by themselves.

Family LERNÆOPODIDÆ.

BRACHIELLA MALLEUS Rudolphi.

Brachiella malleus VOGT, 1877, p. 46, pl. III, figs. 1 to 8; pl. IV, fig. 1.

Host and record of specimens.—A single lot taken at Port Arthur by J. F. Abbott and sent to the author from Stanford University by Dr. C. H. Gilbert. There are no data as to the host. The lot is Cat. No. 38578, U.S.N.M.

BRACHIELLA GRACILIS, new species.

Plate LXXXVII.

Host and record of specimens.—A lot containing both sexes and several development stages was taken by Doctor McClendon from the mouth of the white sea bass, *Cynoscion nobilis*, at La Jolla, California. These are made the types of the new species and are Cat. No. 38577, U.S.N.M.

Female.—General body form elongate and slender; head, including the first maxillipeds, considerably enlarged and club-shaped. Space between the first and second maxillipeds occupied by a narrow cylindrical neck, two-thirds as long as the rest of the body. Second maxillipeds slender and longer than the head and neck, placed closely side by side and held together by the outer skin but not fused; this outer skin is wrinkled into transverse folds. The base of each maxilliped where it joins the body is enlarged to form a prominent knob, which projects considerably from the surface. From these knobs the maxillipeds taper gradually toward their tips, where they are thoroughly fused and furnished with an attachment disk in the shape of a mushroom. The head and neck are bent backward at the base of the second maxillipeds so as to form an acute angle with the rest of the body. Both are curved so that the two together form a smoothly arched half-moon or semioval.

The body below the base of the second maxillipeds is again constricted for a short distance to about the diameter of the neck. It then broadens abruptly into the genital portion, which has the shape of a tall bottle or elongated flask, the sides nearly parallel and the posterior margin squarely truncated. From this posterior margin project four slender, finger-like processes in two pairs, one ventral and one dorsal. The ventral and dorsal process on either side curve in toward each other like unequal parentheses marks, the dorsal process being only three-fifths as long as the ventral. The latter pair are as long as the entire body posterior to the base of the second maxillipeds. All four processes are slightly enlarged at their bases and taper gradually toward their tips which are bluntly rounded. Between the ventral processes lies the abdomen, which is cylindrical,

of smaller diameter than the processes, and about half their length. There are no traces of anal laminae.

The first antennae are short and indistinctly jointed; they curve in toward each other and are devoid of setae except at their very tips. The second pair are large and stout with broad and bluntly rounded tips. They curve in toward each other much more than the first pair, being so closely approximated to the anterior margin of the carapace as to form a half circle with their tips in actual contact. Each bears on its ventral surface near the end a short accessory branch much narrower than the main antenna and terminating in two small spines.

The mouth tube is broadly ovate, its narrowed tip projecting slightly beyond the anterior margin of the carapace, its base well rounded and constricted into a short neck where it joins the carapace. The mouth opening is at the very tip, but ventral rather than terminal; the lips flare out into a short funnel surrounded by a fringe of hairs. The mandibles are short and stout and furnished with powerful muscles; they are toothed only on the inner margin, but the teeth are large and curved at their tips like talons.

The maxillae are two-thirds as long as the mouth tube; each is biramose, the endopod much shorter than the exopod and curved over inward. Both rami are again bipartite, the two branches of the same length and ending in short and straight spines. The first maxillipeds are large and powerful; they are so large and stand in such a relation to the head as to appear like the lower jaw of a vertebrate in side view. Each consists of a swollen basal joint armed on its inner margin with two roughened areas, a small one at the extreme base and a much larger one toward the distal end; between these is a short spine. The terminal joint is slender and tipped with two claws, the inner one much smaller than the outer.

The ovaries are paired and occupy nearly the whole of the fused genital portion of the body; the external ovisacs are cylindrical, one-third the diameter of the genital portion and one-fourth longer than the longest posterior processes. The eggs are small and arranged in ten or twelve rows.

Total length, including the posterior processes, 12 to 15 mm. Length of second maxillipeds, 4.8 mm.; of head and neck, 3.6 mm.; of genital portion, 3.7 mm.; of egg cases, 4.25 mm. Width of genital portion, 2.6 mm.

Color.—(preserved material) a uniform yellowish white, lighter and more transparent in the second maxillipeds, deepening into dark yellow in the genital portion; egg strings orange.

Young female.—Two stages of development were obtained with the adults. The youngest of these was only 3 mm. in length, and is shown in fig. 111. The general structure is the same as that of the adult, but the second maxillipeds here are twice the length of the head and neck, and are entirely separate from each other for their full length. Then they are attached close behind the first pair and there is almost no interval between the two. The body posterior to the base of the second maxillipeds is indistinctly segmented; there are no posterior processes as yet, and the abdomen is very short and rudimentary, ending in two conical anal laminae, each of which is tipped with two short setae.

In the second stage, 4.5 mm. long, the second maxillipeds have diminished in relative length and thickened considerably. There is a greater space between the first and second maxillipeds, and the posterior processes appear as short knobs on either side of the abdomen.

Total length, 3 mm. Length of second maxillipeds, 1.85 mm.; of head, 0.8 mm.; of genital portion, 1.25 mm. Width of genital portion 0.3 mm.

Male.—Body of the usual form found in this genus, with a hump on the back opposite the maxillipeds and a constriction a little posterior to the hump. The first antennae are relatively longer and more distinctly segmented than in the female. The second antennae are much narrower, but otherwise similarly formed; they do not, however, bend around the anterior margin of the carapace, but stand out from the side of the mouth tube parallel with the first pair. The mouth tube is relatively much larger and embraces the whole anterior portion of the cephalon, dorsal as well as ventral. The mouth opening is terminal and surrounded by a fringe of hairs similar to that in the female. Second maxillipeds adapted for prehension and, like the first pair, armed with powerful claws. They are placed well back from the mouth tube, and in side view appear near the center of the body. Abdomen and anal laminae similar to those on the youngest female.

Total length, 1.6 mm. Length of head, 0.8 mm.; of genital portion behind the constriction, 0.7 mm. Width of body through the bases of the second maxillipeds, 0.65 mm.

Color.—Of preserved specimens a uniform snow white.
(*gracilis*, slender.)

This species may be distinguished from others of the genus by the length and slenderness of the second maxillipeds, by the fact that in the adult they are held together for their entire length, though not fused, and by the long abdomen, which resembles a fifth or odd anterior process.

BRACHELLE ANSERINA, new species.

Plates LXXVIII, LXXIX.

Host and record of specimens.—About a dozen specimens, including both sexes, were taken from the gills of the rockfish, *Sebastes glaucus*, at Bering Island, Siberia, by Governor N. Grebnitzky. They are made the types of the new species and are Cat. No. 13685, U.S.N.M.

Female.—Body elongate, the long and stout neck passing insensibly into the genital portion. Head not much enlarged, the anterior margin almost squarely truncated, the posterior margin well rounded. Neck thick and muscular, considerably longer than the body, gradually increasing in size as it passes toward the body, until at the base of the second maxillipeds the two join almost insensibly.

Second maxillipeds very short and flattened on the inner sides where they come together, giving each the shape of quarter of a sphere, one of the flat sides being attached to the body and the other facing its fellow on the other maxilliped. Between them and almost in contact with the ventral surface of the body is the small attachment bulla. This has a very short petiole and a nearly spherical umbrella.

Genital portion or body proper nearly quadrilateral in dorsal outline, slightly widened posteriorly, and flattened dorso-ventrally, so that its thickness is three-fifths of its width. This genital portion terminates posteriorly in eight processes arranged in four pairs; one pair at the ventral corners, which are mere knobs and project but little, a second pair at the dorsal corners, considerably larger and in the form of conical processes bluntly rounded at their tips.

The third and fourth pairs are on the dorsal posterior margin at the center, and are fused at their bases; the fourth pair is on the median line and the two processes are completely fused except at their very tips, which are enlarged into circular laminae, flattened dorso-ventrally and somewhat irregular around their margin. The third pair stand one on either side of the fourth, and are fused with the latter for their basal half. But their terminal halves are free and extend beyond the tips of the fourth pair as conical processes, which are curved slightly away from the mid-line.

The four processes thus arranged in a row are naturally much wider than thick, and they curve over ventrally between the egg strings, very similar to the feathers of the tail of a duck or goose. The egg cases are attached to the posterior margin of the genital segment between the second and third processes on either side. They are widely separated and ellipsoidal or often spherical in form; the eggs are large and there are 50 or 60 in each case. There is no

abdomen, the anus opening on the ventral surface of the genital segment near the bases of the fourth processes.

First antennæ short and indistinctly jointed; basal portion enlarged and flattened into a wide lamina from whose inner corner projects a distal portion which is cylindrical and of about the same length as the basal portion. There is one long seta outside the base of the distal portion and three at the tip, one of which is much shorter than the other two. Second antennæ in the form of flattened laminae, elliptical in outline and divided at the end into two short rami. The dorsal ramus is pointed and armed with a short spine; the ventral one is rounded and covered with corrugations.

The mouth tube is large and subterminal; the mouth opening is surrounded by a fringe of long hairs. The mandibles are long and narrow, enlarged at the base but of about the same width throughout the distal portion, and armed with eight or ten irregular teeth on the inner margin at the tip. The maxillæ are half the length of the mouth tube and fairly stout; they are divided into three rami, two at the tip, slender and of the same length, each ending in a long spine, and one much shorter and stouter on the ventral margin, ending in a short spine.

First maxillipeds with stoutly swollen basal joints and comparatively slender and weak terminal joints; the latter are less than half the length of the former and end in a tiny claw, evidently of no use for prehension.

Total length, 5.5 mm. Length of neck and head, 3.1 mm.; of genital portion, 2.4 mm.; of egg cases, 1.2 mm. Width of neck at its base, 1 mm.; of genital portion at its posterior end, 2 mm.; of egg cases, 1 mm.

Color.—(preserved material) a uniform dark orange, the egg strings inclining toward pink. Bulla and its pedicel very dark brown, almost black.

Male.—Body stout and strongly arched dorsally, with a slight constriction between the head and genital portion and almost no traces of segmentation. Mouth parts clustered at the anterior end close to the mouth tube.

First antennæ distinctly three jointed, basal joint considerably longer than the others and carrying on its outer distal corner a long spine; the two terminal joints about the same length, the last one ending in a bunch of setæ. Second antennæ cylindrical like the first pair instead of being flattened into laminae, as in the female; armed at their tip with a dorsal curved claw and a ventral corrugated knob.

First maxillipeds similar to those of the female; second pair developed into large, powerful prehensile organs, the basal joint swollen and projecting on the inner margin into a long and stout spine which

curves outward to meet the strong terminal claw, thus forming a sort of chela.

Total length, 1 mm. Width of cephalic portion, 0.5 mm.

Color.—A lighter orange than in the female, the yellow showing more plainly than the red.

(*anserina*, *anser*, a goose, and the ending *inus* denoting likeness, alluding to the form of the adult female.)

This species is readily distinguished from all others by the general shape of the body, which is that of a miniature goose or duck, by the fusion of the two median pairs of posterior processes and by the spherical egg cases. This first determination may then be confirmed by the relative size and shape of the various appendages.

LERNÆOPODA GIBBER, new species.

Plate LXXX.

Host and record of specimens.—A fine lot of specimens, including developmental stages, but no males, was obtained from the gill arches of the Dolly Varden trout, *Salvelinus malma*, at Attu, Alaska, June 9, 1906, by the steamer *Albatross*. They are made the types of the new species and are Cat. No. 38583, U.S.N.M.

Female.—Body strongly flattened dorso-ventrally and much wrinkled; head inclined at an acute angle with the rest of the body, and the space between the second maxillipeds raised into a large hump, which gives the creature a peculiar hunchbacked appearance. Head, exclusive of the second maxillipeds, elongate triangular in dorsal outline, with none of the appendages visible. First maxillipeds hidden between the bases of the second pair; the latter cylindrical, very thick and stout, especially at their bases. They are about half the length of the rest of the body, are united at their very tips, and furnished with a large mushroom-shaped bulla. The stem of the bulla is one-third the diameter of the maxillipeds themselves and nearly one-half their length, while the umbrella part is five times the diameter of the stem.

The genital portion of the body forms nearly a perfect circle in dorsal outline; it is indistinctly segmented, but the posterior margin is unbroken by any abdomen or anal laminae, or even by the attachment of the egg strings. The latter are one-fourth the diameter of the body and one and a half times its length, and are not much narrowed at the ends; the eggs are large and arranged in five or six longitudinal rows.

The first antennae have the shape of blunt unsegmented papillae tipped with three small processes arranged at the three corners of a triangle and inclined toward one another. Second antennae stout and flattened laterally into broad laminae; they are imperfectly segmented

by the distance between the first maxillipeds and the other mouth parts. Without exception, also, these parasites were attached to the tips of the gill filaments, while *L. gibber* attaches itself to the gill arches.

and divided at the tip into three parts—a ventral, a dorsal, and a lateral, the latter on the inner side. The ventral part is in the form of a two-jointed cylindrical process, the terminal joint much smaller than the basal. The dorsal part is a large flattened claw, armed on its concave margin with two small spines. The lateral part is a rounded knob covered with short spines. The mandibles have five coarse teeth on the inner margin at the tip; the maxillæ are narrow and unsegmented, with a protuberance on the inner margin at the center, and three small spines at the tip, the outer one much smaller than the other two.

The first maxillipeds are attached close to the mouth tube, and consist of a swollen basal joint and a short but stout terminal claw. The latter is only one-third the length of the basal joint and is straight except at the tip, where it curves slightly.

Total length, 6.2 mm. Length of genital portion, 4 mm.; of egg strings, 8 mm. Width of genital portion, 4 mm.

Color.—Body a uniform yellow, deeper at the center of the genital segment over the ovaries. Attachment bulla a deep brownish black. Egg strings light yellow in early development, becoming later a dark orange.

(*gibber*, hunchbacked.)

This species may be distinguished by the large hump on the back between the bases of the second maxillipeds, by the wide and strongly flattened genital portion, and the fact that the first maxillipeds are between the bases of the second pair and yet close behind the mouth tube.

There is a second lot of five females, taken also from the gill arches of *Salvelinus malma* at Bering Island by Governor N. Grebnitzky, and are Cat. No. 38591, U.S.N.M.

LERNEOPODA BEANI, new species.

Plate LXXXI.

Host and record of specimens.—A lot of twenty-five specimens, all females, were taken from the gill filaments of the Quinnet salmon, *Oncorhynchus tshawytscha*, captured in the McCloud River, California, August 4, 1881. These are taken as the types of the new species and are Cat. No. 29086, U.S.N.M.

There are also two other lots obtained by the U. S. Bureau of Fisheries from the same host, but in Battle Creek, Colorado. The first of these is Cat. No. 38584 and the other Cat. No. 38585, U.S.N.M.

A fourth lot was obtained by Dr. C. H. Gilbert from the rainbow trout, *Salmo iridens*, at a fish hatchery located at Sisson, California: Cat. No. 38605, U.S.N.M.

Female.—Body not much flattened; head often in line with the genital portion and never much inclined to it. Head, including the

bases of the second maxillipeds, triangular, one-eighth longer than wide, and rather pointed at the tip in dorsal view. Second maxillipeds stout, cylindrical, and only half as long as the body; bulla mushroom-shaped and twice the diameter of the maxillipeds, with a long and slender petiole. Genital portion nearly circular in outline in dorsal view, but only one-half wider than the head, with no trace of segmentation. Egg strings one-fourth the diameter of the genital portion and one-third longer than the entire body. Eggs of medium size and arranged in five or six longitudinal rows.

First antennæ in the form of short unsegmented processes, narrowed at the tip and armed with a single small spine. Second pair flattened laterally, imperfectly segmented, and split at the tip into two rami; the dorsal ramus is the smaller and is tipped with a conical process and a small spine. The ventral ramus is armed with a large spine, a small one close to it, and a rounded knob covered with small spines. The mandibles are longer and narrower than in *gibber*; they have the same number of teeth, but these are considerably different in pattern.

The maxillæ are also longer and narrower than in the preceding species, and are armed at their tip with a short, stout spine on either side and a central conical process or palp, which carries at its tip two short spines.

The first maxillipeds are removed from the mouth tube a distance nearly equal to their own length. Their basal joints are stout and swollen, but the terminal ones are slender and weak, the claw being abruptly narrowed near its base.

Total length, 4.6 mm. Length of head, 2 mm.; of genital portion, 2.6 mm.; of second maxillipeds, without the bulla, 2.4 mm.; of the egg strings, 6 mm. Width of head, 1.5 mm.; of genital portion, 2.85 mm.

Color.—(preserved material) a light straw yellow deepening to orange over the ovaries in the genital portion; bulla and its stem yellowish brown. Eggs at first light yellow, afterwards becoming orange.

(*beani*, to Dr. Tarleton H. Bean, who has accomplished excellent results in the investigations of the salmon industries of the Pacific coast.)

The label accompanying the types of this new species states that they were taken from a female fish that died of the disease prevailing among the salmon in the McCloud River during the summer of 1881. The species can be distinguished by the comparative length of the second maxillipeds, by the size and shape of the bulla, and the fact that it possesses a distinct stalk, and by the distance between the first maxillipeds and the other mouth parts. Without exception, also, these parasites were attached to the tips of the gill filaments, while *L. gibber* attaches itself to the gill arches.

LERNÆOPODA BICAULICULATA, new species.

Plate LXXXII.

Host and record of specimens.—Three females were taken from the tips of the gill filaments of the Dolly Varden trout, *Salvelinus malma*, at Bering Island by Governor N. Grebnitzky. They are made the species types and are Cat. No. 38594, U.S.N.M.

A second lot of two females was obtained by L. Stejneger in 1882, also from Bering Island, but the host is not given. This lot is Cat. No. 8453, U.S.N.M.

A single female was taken from a "trout" at Mapleton, Oregon, by Dr. S. E. Meek in 1896, and is Cat. No. 38575, U.S.N.M.

Female.—General body form short and stout, and but little flattened. Head long and narrow and as wide at the tip as at the base, where the second maxillipeds project on either side like a pair of veritable shoulders. This is markedly different from the other species examined and constitutes a good distinguishing character. In side view the bases of the first maxillipeds are seen to be placed well back, close to the second pair. The latter are nearly as long as the genital portion, of the same diameter throughout, and squarely truncated at their tips. They are not fused at the tips, but are entirely distinct, and each gives rise to a slender petiole. These two petioles then unite to form the common petiole of the bulla, which has the ordinary mushroom shape.

The bases of these second maxillipeds are fused across the body and project strongly on either side, their combined diameter being nearly twice that of the head. Behind them the flask-shaped genital portion is narrowed into a neck of about the same diameter as the head, and thus increases the prominence of the projecting maxillipeds. This genital portion is flattened on the ventral surface and strongly arched dorsally; it is one-half longer than wide and of about the same width and thickness, and is entirely without processes, abdomen, or anal laminae.

The egg cases are attached at the extreme ventral corners, as widely separated as possible, constituting another specific characteristic. Furthermore, the tube or neck by which each is attached to the body runs some little distance along a groove in the ventral surface of the genital portion, diagonally forward and inward, to the openings of the oviducts. Egg cases four-fifths the entire length of the body and half the diameter of the genital portion. Eggs large and arranged in eight to ten longitudinal rows.

First antennae slender and more distinctly jointed than in other species, but smooth and unarmed. Second pair flattened and laminate, divided at the tip into three parts, something like those of *gibber*. The two outside parts are rounded knobs covered with short

spines, the central part is a square projection having a short and stout spine at each of its distal corners. The maxillæ are stout and compact, conical in shape, and each terminating in a stout spine; each carries a short ramus or palp on its ventral surface near the center, also tipped with a stout spine; there is a third spine on the outer margin near the base, but this comes directly from the maxilla without any ramus.

The first maxillipeds have a stout basal joint which is armed with a large spine on its inner margin near the base of the terminal joint. The latter is slender and is terminated by a small curved claw and two minute spines.

Total length, 4.7 mm. Length of head, 1.45 mm.; of genital portion, 3 mm.; of egg cases, 3.42 mm. Width of head, 0.75 mm.; of bases of second maxillipeds, 2 mm.; of genital portion, 1.9 mm.; of egg cases, 1 mm.

Color.—Of preserved material a uniform light orange, darker over the ovaries in the genital portion.

(*bicauciculata*, furnished with two stems or stalks, in allusion to the double stem of the attachment bulla.)

This species may be recognized by these two stems of the attachment bulla, by the fact that the egg cases are attached at the extreme ventral corners in side view and as widely separated as possible in dorsal view, when really the openings of the oviducts are considerably farther forward and inward; by the narrowness of the base of the head and the anterior part of the genital portion and the contrasting width of the bases of the second maxillipeds, and by the fact that the parasites are found attached to the tips of the gill filaments and not to the arches or sides of the gill cavity.

LERNÆOPODA FALCULATA, new species.

Plate LXXXIII.

Host and record of specimens.—A lot of four females was obtained from the gills of the blue-back salmon, *Oncorhynchus nerka*, at Baker Lake, Washington, in 1902, by the U. S. Bureau of Fisheries. These are made the types of the new species and are Cat. No. 38586, U.S.N.M.

A single female was obtained at Bristol Bay, Alaska, for which no date or host was given; it is Cat. No. 8340, U.S.N.M.

Three lots were obtained by the U. S. Bureau of Fisheries from trout, one containing two females taken from the inside of the operculum at Hot Creek, Cassel, California, Cat. No. 38589, U.S.N.M.; another containing two females taken from the gills, in the west fork of Feather River, California, Cat. No. 38588, U.S.N.M., and the third containing a single female taken from the ventral fin, in the north fork of Feather River, Cat. No. 38590, U.S.N.M.

Female.—Body plump and only slightly flattened dorso-ventrally; head normally held at right angles to the body axis, as in the side view shown in fig. 150. Head elongate triangular, or pear-shaped in dorsal view, narrowed almost to a point anteriorly.

The first maxillipeds are close to the mouth tube and have exactly the appearance of an under jaw in side view, as was noted in the case of *Brachiella gracilis* (p. 465). The second maxillipeds are stout, cylindrical, and three-quarters as long as the entire body; they are not tapered, but are narrowed abruptly at the ends into a short petiole which connects with the bulla. The diameter of the petiole is one-third that of the second maxillipeds; the umbrella portion is more than six times the width of the petiole. The genital portion is elliptical, only a little longer than wide, and without any traces of segmentation. It is considerably wider than the head, but not much longer, and in alcoholic material is usually furrowed longitudinally along the outside of each ovary.

The egg strings are one-third the diameter of the genital portion, and as long as the entire body; the eggs are of medium size and are arranged in eight longitudinal rows.

The first antennæ are longer and more slender than in *beani* or *gibber*, and are tipped with one large spine and three small ones. The second antennæ are not as strongly flattened as in other species, and are bifurcate at their tips. The ventral ramus is a large flattened claw, with two accessory spines on its concave margin; the dorsal ramus is a conical process tipped with three small and strongly curved claws. The mandibles are much shorter than those of *beani* and not as slender as those of *gibber*, with the teeth considerably different in pattern from both.

The first maxillipeds have a strongly swollen basal joint like that in *gibber*, and a long and slender terminal joint. The terminal claw is stout and strongly curved, and there is an accessory spine on the inner margin of the joint near the base of the claw. These maxillipeds in their relation to the other appendages are between those of the species already described. They are not as close to the mouth tube as in *gibber*, but are considerably closer than in *beani* and *bicauliculata*.

Total length, 5 mm. Length of head, 2 mm.; of genital portion, 3 mm.; of egg strings, 5 mm. Width of head, 1.5 mm.; of genital portion, 2.6 mm.; of egg cases, 0.8 mm.

Color.—Of preserved material a light orange, deeper over the ovaries; bulla dark brown, sometimes black; egg strings deep orange.

(*falculata*, furnished with little claws or talons, alluding to those on the tips of the second antennæ.)

This new species may be recognized by the abruptly narrowed ends of the second maxillipeds, by the flattening of the genital portion, by the position of the first maxillipeds, and by the slenderness and length of the egg strings. These differences may then be confirmed by the structure of the various appendages.

LERNÆOPODA EXTUMESCENS Gadd.

Lernæopoda extumescens GADD, 1904, p. 31, pl. II, figs. 1 to 12.

Host and record of specimen.—A single female specimen was taken from the gill cavity of the hump-backed whitefish, *Coregonus nelsonii*, in the Yukon River, Alaska, by E. W. Nelson, and is Cat. No. 29900, U.S.N.M.

LERNÆOPODA CALIFORNIENSIS Dana.

Lernæopoda californiensis DANA, 1852, p. 1379, pl. xcvi, fig. 1 a to b.

Host and record of specimens.—Dana's original types were taken from the body of a salmon (*Oncorhynchus*) captured in the Klamath River, California. In some manuscript notes made by Dr. R. R. Gurley, of the U. S. Bureau of Fisheries (1896), upon the Parasites of the Fresh-water Fishes of North America, occurs the following:

Some specimens of a *Lernæopoda* from the Columbia River basin appear to belong to this species, as far as it is possible to tell from Dana's brief description and figure, which latter, being merely an outline, admits of no very satisfactory comparison. Four specimens were taken from the gills of *Oncorhynchus nerka* by Dr. B. W. Evermann, in an inlet to Big Payette Lake, Idaho, September 27, 1894. It may be noted that *O. nerka* also occurs in Klamath River, from which Dana's types were obtained.

The author has not seen the above-mentioned specimens and so can only quote the authority given for their identity with the present species.

ANCHORELLA UNCINATA Müller.

Anchorella uncinata BAIRD, 1850, p. 337, pl. xxxv, fig. 9.

Host and record of specimens.—A single female was obtained from *Gadus macrocephalus* by L. Stejneger, at Bering Island, Siberia, in 1882; Cat. No. 7991, U.S.N.M.

Another lot of five females from the same host and at the same time is Cat. No. 7992, U.S.N.M.

A third lot was obtained from the same host by N. Grebnitzky, the governor of the island, and is Cat. No. 13706, U.S.N.M.

A fourth lot was obtained by the steamer *Albatross* at Chignik Bay during the Alaska salmon investigation in 1903. It also came from the same host and is numbered 41840.

ACHTHERES COREGONI Smith.

Achtheres coregoni SMITH, 1874, p. 664, pl. III, fig. 17.

Host and record of specimens.—Several female specimens were taken from a species of *Coregonus* in the Yukon River, Alaska, and are Cat. No. 6113, U.S.N.M.

ALPHABETICAL LIST OF HOSTS, WITH THE PARASITES FOUND ON EACH.

Citharichthys, species. The soft flounders.

Phrixocephalus cincinnatus, new species, attached to eye.

Coregonus nelsonii Bean. The hump-backed whitefish.

Lernæopoda extumescens Gadd, fastened to the sides of the gill cavity.

Coregonus, species. The whitefish.

Achtheres coregoni Smith, from the gill cavity.

Cynoscion nobilis Ayres. The white sea bass.

Lepeophtheirus thompsoni Baird, from the outside of the body.

Brachiella gracilis, new species, from the mouth.

Gadus macrocephalus Tilesius. Alaska codfish.

Lepeophtheirus parviventris Wilson, from the outside surface.

Anchorella uncinata Müller, from the gills and mouth.

Galeorhinus zyopterus Jordan and Gilbert. The soup-fin shark.

Pandarus cranchii Leach, from the fins and skin.

Eudactylina uncinata, new species, from the gill filaments.

Opimia gracilis, new species, embedded in the flesh on the walls of the mouth and gill cavities.

Hydrolagus colliei Lay and Bennett. The elephant-fish.

Chondracanthus epachthes, new species, from the gill cavity.

Caligus gurnardi Kröyer, from the outside surface.

Hypsypops rubicundus Girard. The garibaldi.

Artacolax (Bomolochus) ardeola Kröyer, from the gill filaments.

Lepidopsetta bilineata Ayres.

Lepeophtheirus parviventris Wilson, from the outside surface.

Lycodontis mordax Ayres. The California conger eel.

Hatschekia pinguis, new species, from the gills.

Mola mola Linnæus. The sunfish.

Lepeophtheirus nordmannii Milne-Edwards, and *L. insignis*, new species, from the outside surface.

Cecrops latreillii Leach, from the gills.

- Oncorhynchus gorboscha** Walbaum. The humpbacked salmon.
Lepeophtheirus salmonis Kröyer, from the gills and gill cavity.
- Oncorhynchus kisutch** Walbaum. The Coho salmon.
Argulus pugettensis Dana, from the outside surface.
- Oncorhynchus nerka** Walbaum. The blue-back salmon.
Lepeophtheirus pacificus Gissler, from the outside surface.
Lepeophtheirus salmonis Kröyer, from the gills and gill cavity.
Lernaeopoda californiensis Dana, presumably from the gills or gill cavity.
Lernaeopoda falculata, new species, from the gills.
- Oncorhynchus tshawytscha** Walbaum. The Quinnet salmon.
Caligus gurnardi Kröyer, from the outside surface.
Lepeophtheirus salmonis Kröyer, from the gills.
Lernaeopoda beani, new species, from tips of the gill filaments.
- Paralabrax maculato-fasciatus** Steindachner. Spotted cabrilla.
Lepeophtheirus constrictus, new species, from the outside surface.
- Pimelometopon pulcher** Ayres. California redfish.
Lepeophtheirus parvus, new species, from the outside surface.
- Pleurogrammus monopterygius** Pallas. The Atka fish.
Lepeophtheirus parviventris Wilson, from the outside surface.
- Psettichthys melanostictus** Girard. A flounder.
Lepeophtheirus bifurcatus Wilson, from the outside surface.
- Salvelinus malma** Walbaum. The Dolly Varden trout.
Lepeophtheirus salmonis Kröyer, from the gills and gill cavity.
Lernaeopoda gibber, new species, from the inside of the gill arches.
Lernaeopoda bicauliculata, new species, from the tips of the gill filaments.
- Scorpaena guttata** Girard. The scorpion.
Lepeophtheirus brachyurus Heller, from the outside surface.
- Sebastes glaucus** Hilgendorf. The rockfish.
Brachiella anserina, new species, from the gills and gill arches.
- Sebastes rubrivinctus** Jordan and Gilbert. Spanish flag.
Lepeophtheirus parviventris Wilson, from the outside surface.
- Sphaeroides**, species. The puffers.
Pseudochondracanthus diceraus, new species, from the gills and gill cavity.
- Stereolepis gigas** Ayres. The jew fish.
Lepeophtheirus longipes Wilson, from the outside surface.

Triakis semifasciatum Girard. The leopard or cat shark.

Achtheinus oblongus, new species, from the outside surface and possibly from the fins.

Urolophus halleri Cooper. The round sting ray.

Trebius tenuifurcatus Rathbun, from the outside (upper) surface of the body.

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EXPLANATION OF PLATES.

PLATE LXVI.

The male and female of *Chondracanthus epachthes*, new species.

Fig. 1. Dorsal view of female. Fig. 2. First and second antennæ. Fig. 3. First antenna more highly magnified. Fig. 4. Mouth parts, the mandibles being concealed beneath the upper lip. Fig. 5. Mandible. Fig. 6. Maxilla. Fig. 7. Second maxilliped. Fig. 8. Lateral view of male. Fig. 9. Mandible of male, the same magnification as fig. 5. Fig. 10. Second maxilliped of male.

PLATE LXVII.

The male and female of *Pseudochondracanthus diceraus*, new species.

Fig. 11. Adult female, dorsal view. Fig. 12. Head and first thorax segment, ventral view, showing the first antenna (*a*), the second antenna (*a'*), the mandibles (*md.*), the maxillæ (*mx.*), the maxillipeds (*mxp.*), and the first swimming legs (*l*). Fig. 13. Mandible and maxilla, dorsal surface. Fig. 14. Maxilla, ventral surface. Fig. 15. Maxilliped, ventral surface. Fig. 16. Lateral view of the male. Fig. 17. Mouth parts of male, showing upper lip (*u. l.*), mandible (*md.*), and maxilla (*mx.*). Fig. 18. Maxilliped of male.

PLATE LXVIII.

The female of *Lepeophtheirus parvus*, new species.

Fig. 19. Dorsal view of female. Fig. 20. Second antenna and first maxilla. Fig. 21. Mouth tube and second maxillæ. Fig. 22. Furca. Fig. 23. Second maxilliped. Figs. 24 to 27. First, second, third, and fourth swimming legs.

PLATE LXIX.

The female of *Lepeophtheirus constrictus*, new species.

Fig. 28. Dorsal view of female. Fig. 29. Second antenna and first maxilla. Fig. 30. Second maxilla. Fig. 31. Furca. Fig. 32. Second maxilliped. Figs. 33 to 35. First, third, and fourth swimming legs. Fig. 36. Ventral view of genital segment and abdomen, showing the rudimentary fifth legs.

PLATE LXX.

The female of *Lepeophtheirus insignis*, new species.

Fig. 37. Dorsal view of female. Fig. 38. Second antenna. Fig. 39. Mouth tube and second maxilla. Fig. 40. Furca. Figs. 41 to 43. First, second, and third swimming legs. Fig. 44. Ventral surface of genital segment and abdomen, showing cement glands (*c. g.*), spermatophores (*s.*), and rudimentary fifth and sixth legs. Fig. 45. Mouth tube and second maxilla of male. Fig. 46. Second maxilliped of male. Fig. 47. Fourth swimming leg of male. Fig. 48. Ventral surface of genital segment of male, showing partial separation of a sixth segment.

PLATE LXXI.

The male and young female of *Lepeophtheirus insignis*, new species.

Fig. 49. Dorsal view of male. Fig. 50. Second antenna and first maxilla of male. Fig. 51. Dorsal view of young female. Fig. 52. Second antenna and first maxilla of same. Fig. 53. Furca, the branches just starting. Fig. 54. Mouth tube and second maxilla; contrast the latter with those of the adult in fig. 39. Fig. 55. Furca of a little older female.

PLATE LXXII.

The male and female of *Trebius tenuifurcatus* Rathbun.

Fig. 56. Dorsal view of female. Fig. 57. Second antenna and first maxilla. Fig. 58. Mouth tube and second maxillæ. Fig. 59. Furca. Fig. 60. First maxilliped. Fig. 61. Second maxilliped. Figs. 62 to 65. First, second, third, and

The female of *Lernæopoda falculata*, new species.

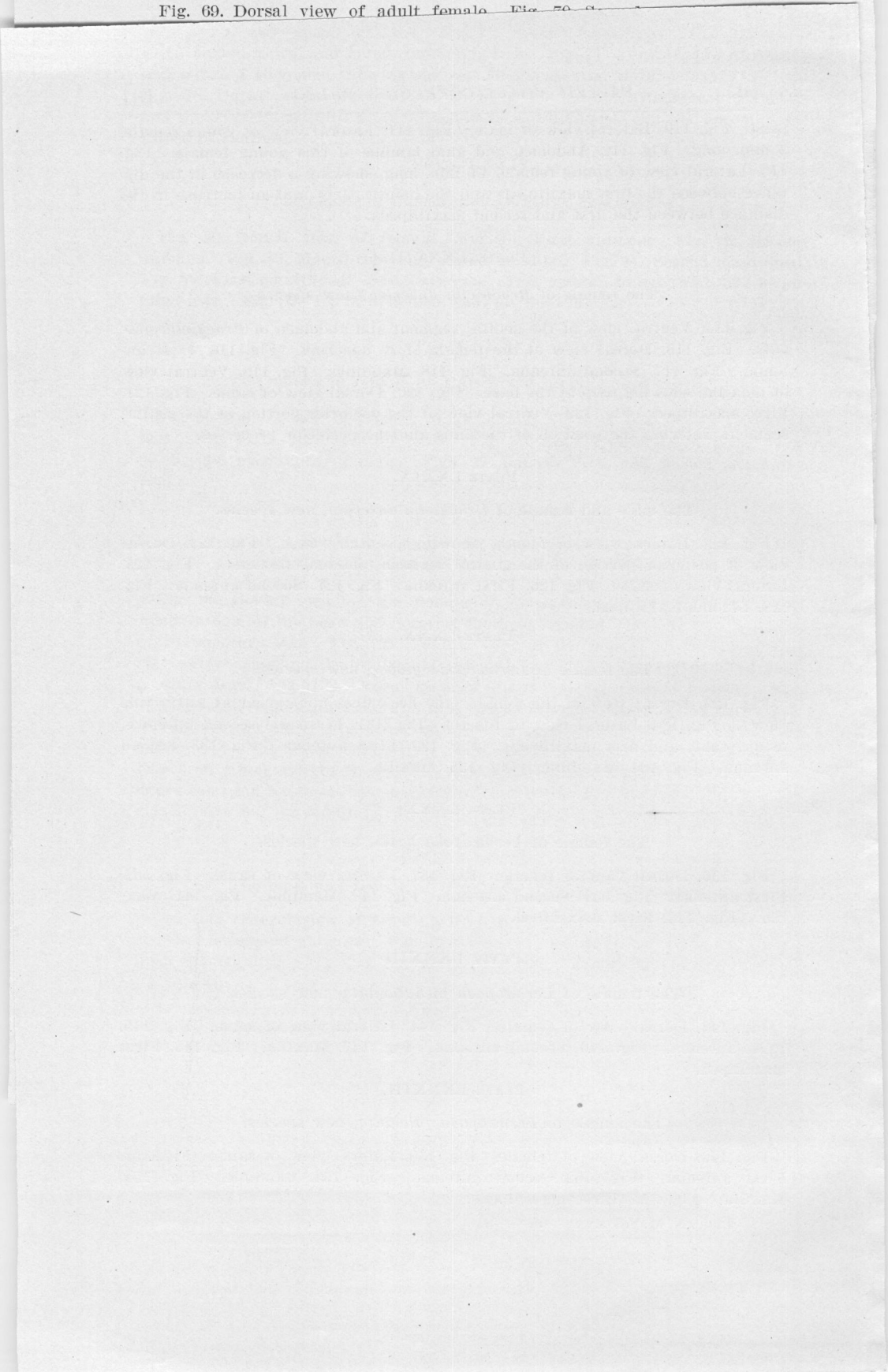
Fig. 149. Dorsal view of female. Fig. 150. Lateral view of same. Fig. 151. First antenna. Fig. 152. Second antenna. Fig. 153. Mandible. Fig. 154. Maxilla. Fig. 155. First maxillipeds.

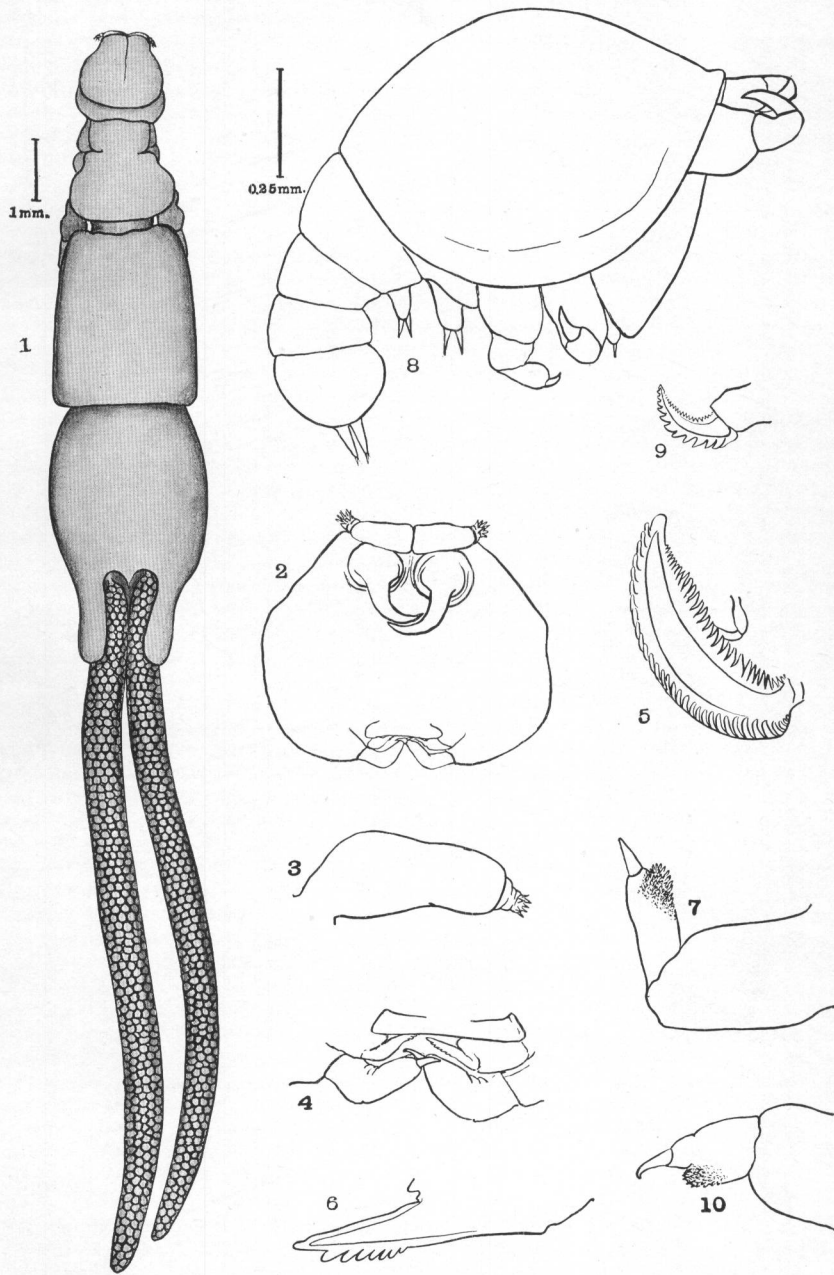
fourth swimming legs. Fig. 66. Dorsal view of male. Figs. 67. Furca of male. Fig. 68. One side of the ventral surface of the male, showing the rudimentary fifth and sixth swimming legs.

PLATE LXXIII.

The female and a chalimus of *Achtheinus oblongus*, new species.

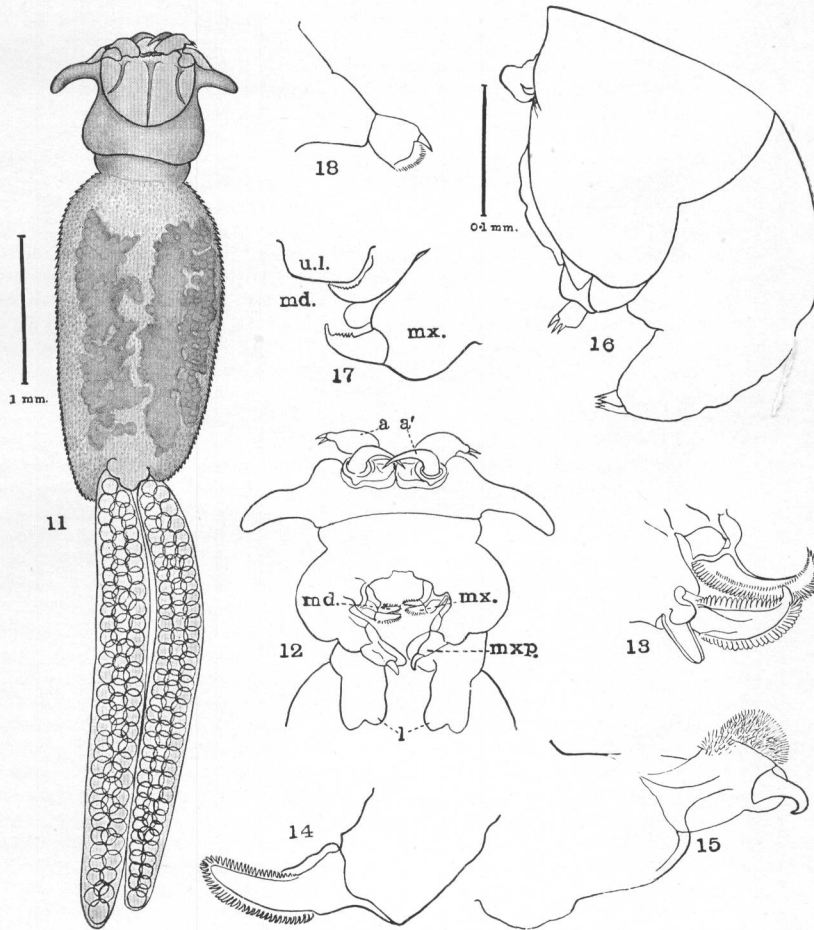
Fig. 69. Dorsal view of adult female. Fig. 70. Chalimus.





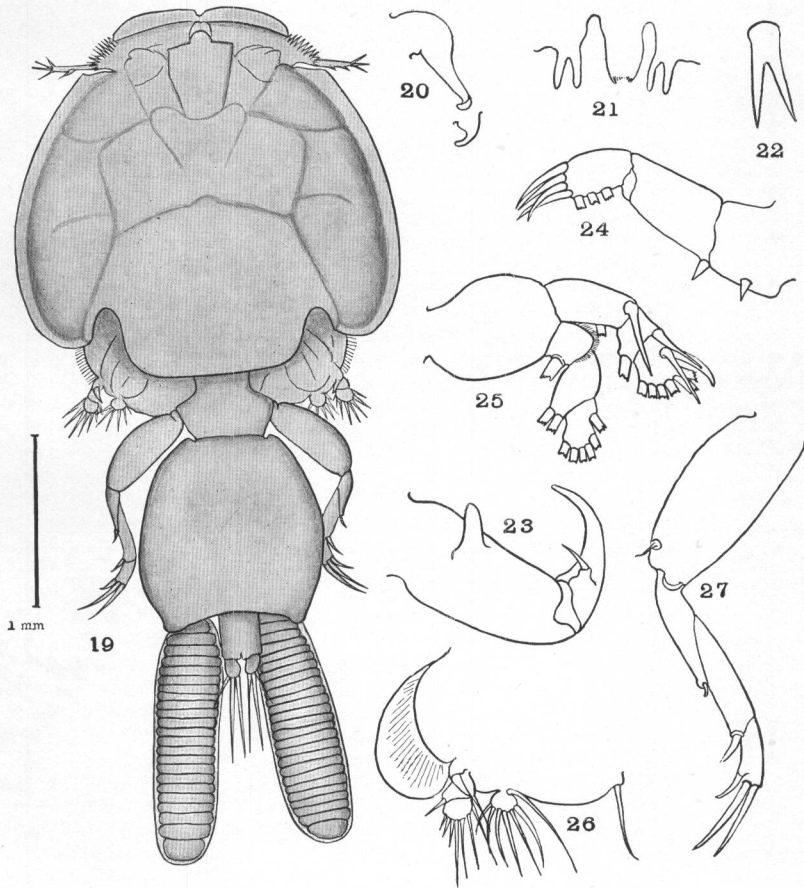
THE MALE AND FEMALE OF *CHONDRACANTHUS EPACHTHES*.

FOR EXPLANATION OF PLATE SEE PAGE 478.



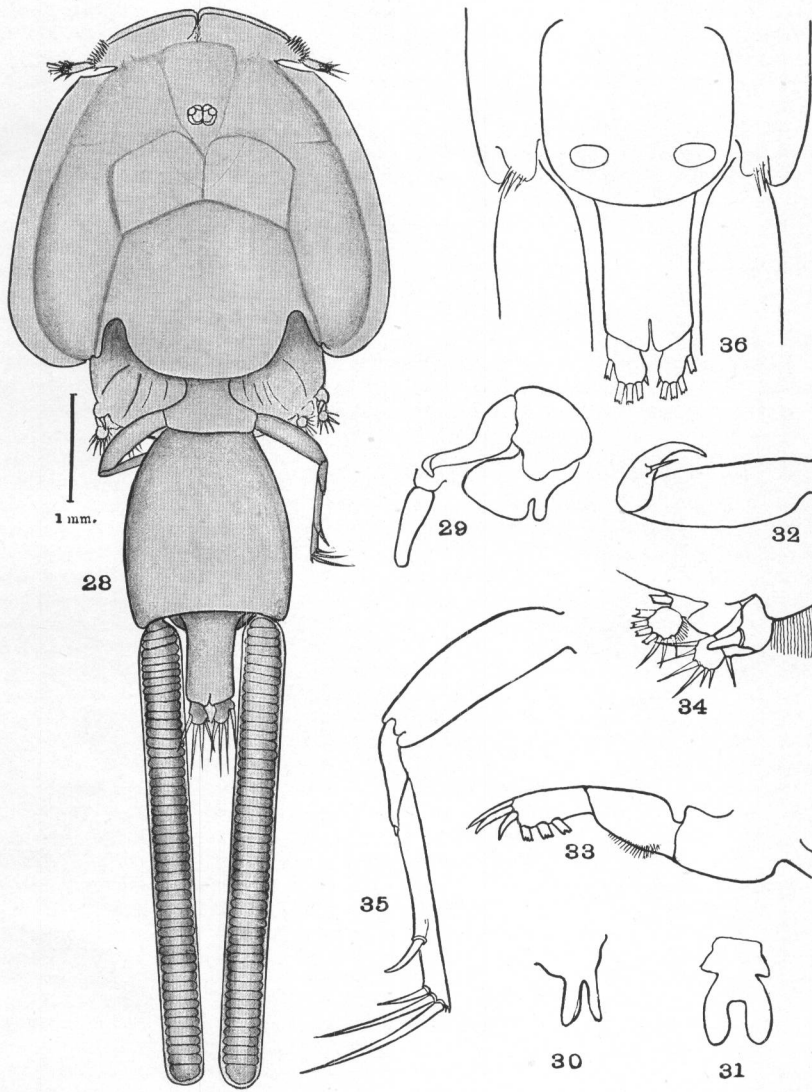
THE MALE AND FEMALE OF PSEUDOCHONDRACTHUS DICERAUS.

FOR EXPLANATION OF PLATE SEE PAGE 479.



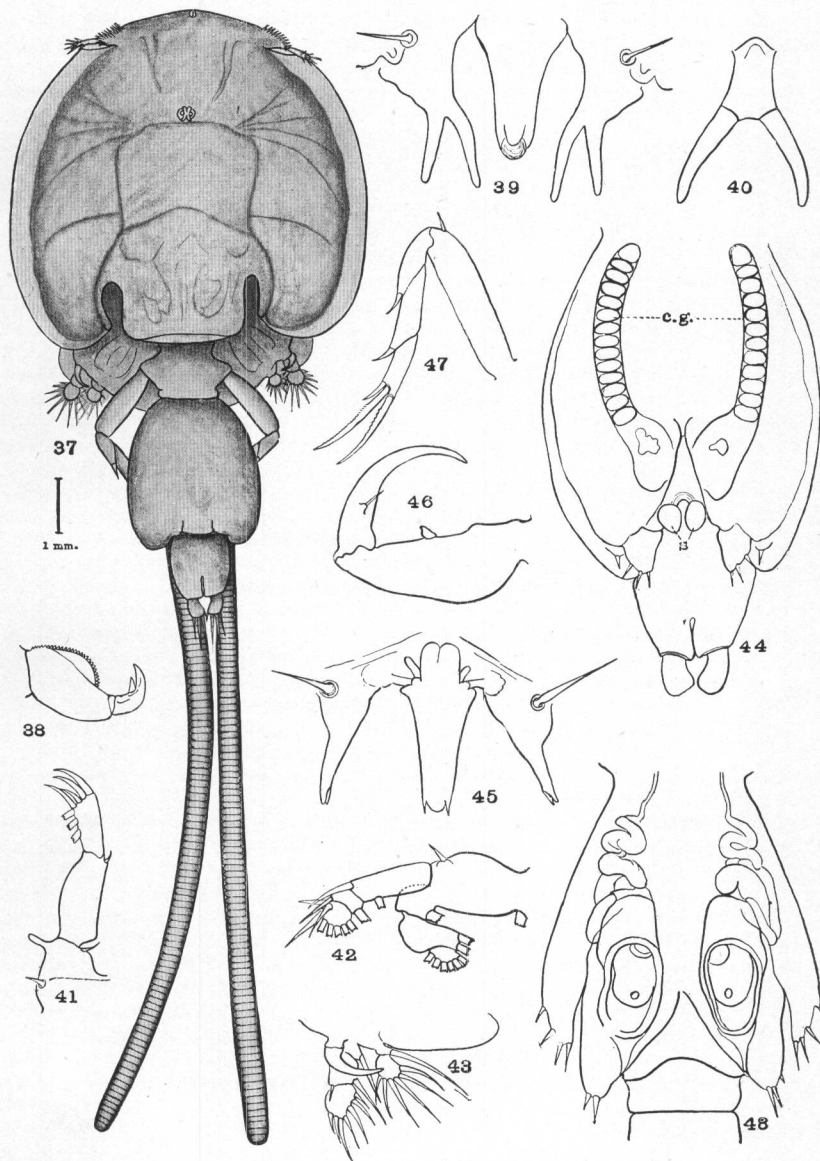
THE FEMALE OF *LEPEOPHTHEIRUS PARVUS*.

FOR EXPLANATION OF PLATE SEE PAGE 479.



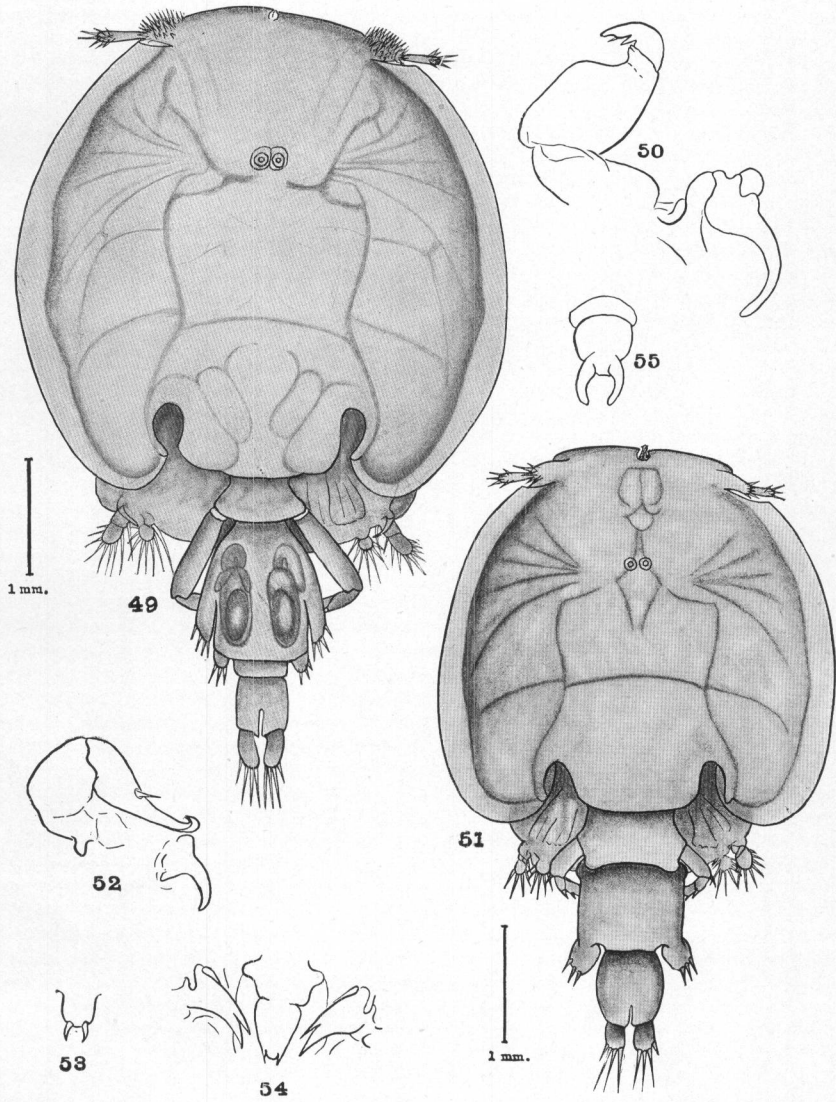
THE FEMALE OF *LEPEOPHTHEIRUS CONSTRICTUS*.

FOR EXPLANATION OF PLATE SEE PAGE 479.



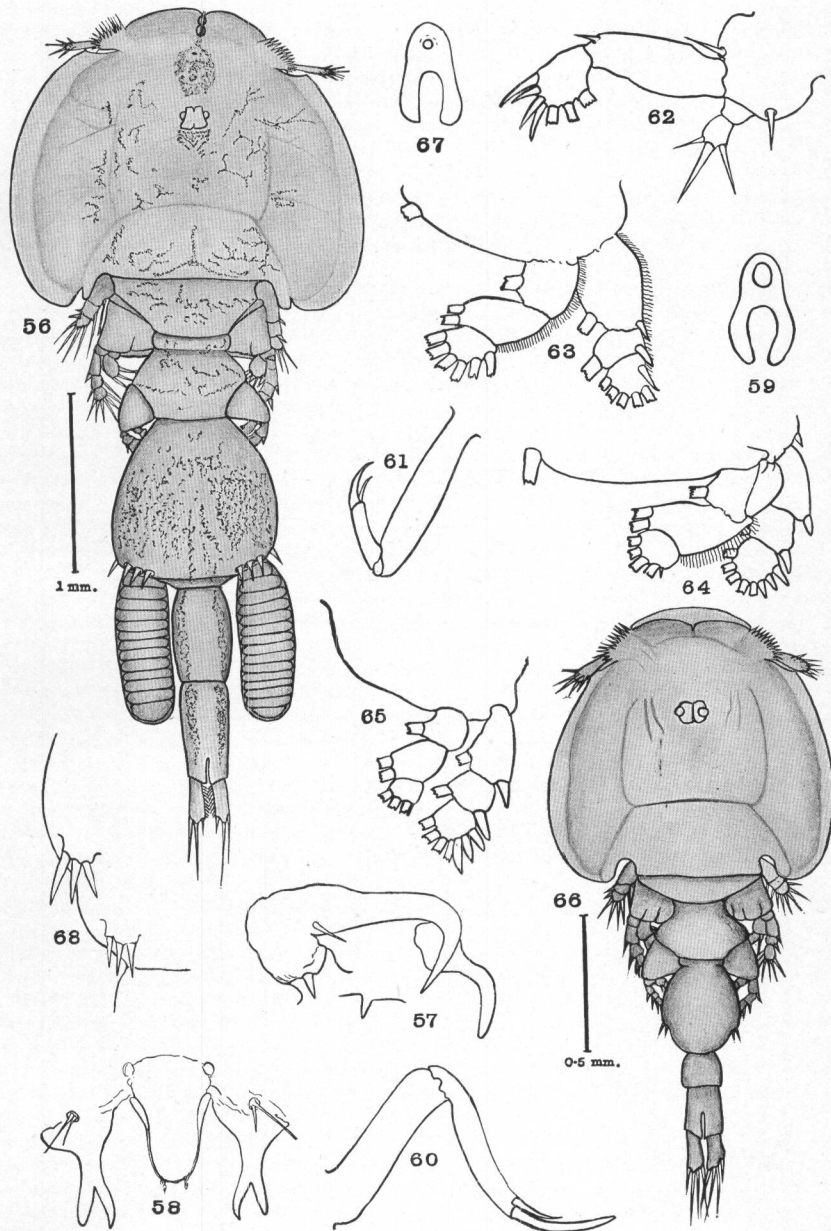
THE FEMALE OF *LEPEOPHTHEIRUS INSIGNIS*.

FOR EXPLANATION OF PLATE SEE PAGE 479.



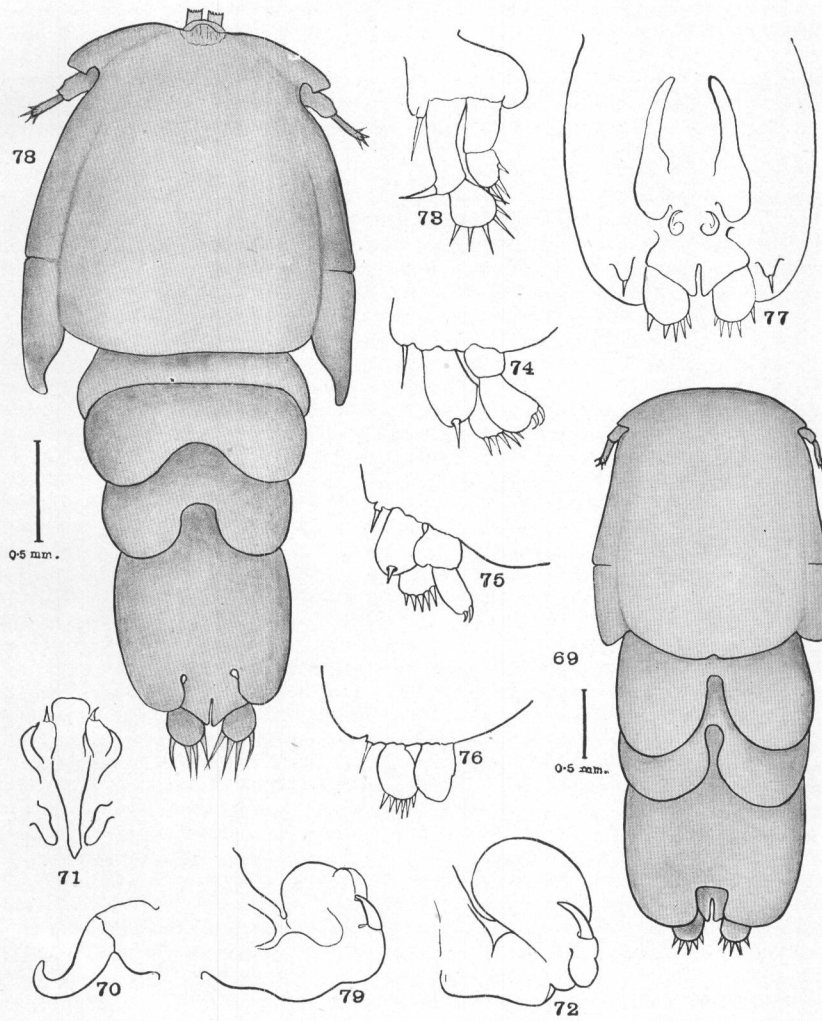
THE MALE AND YOUNG FEMALE OF *LEPEOPHTHEIRUS INSIGNIS*.

FOR EXPLANATION OF PLATE SEE PAGE 479.



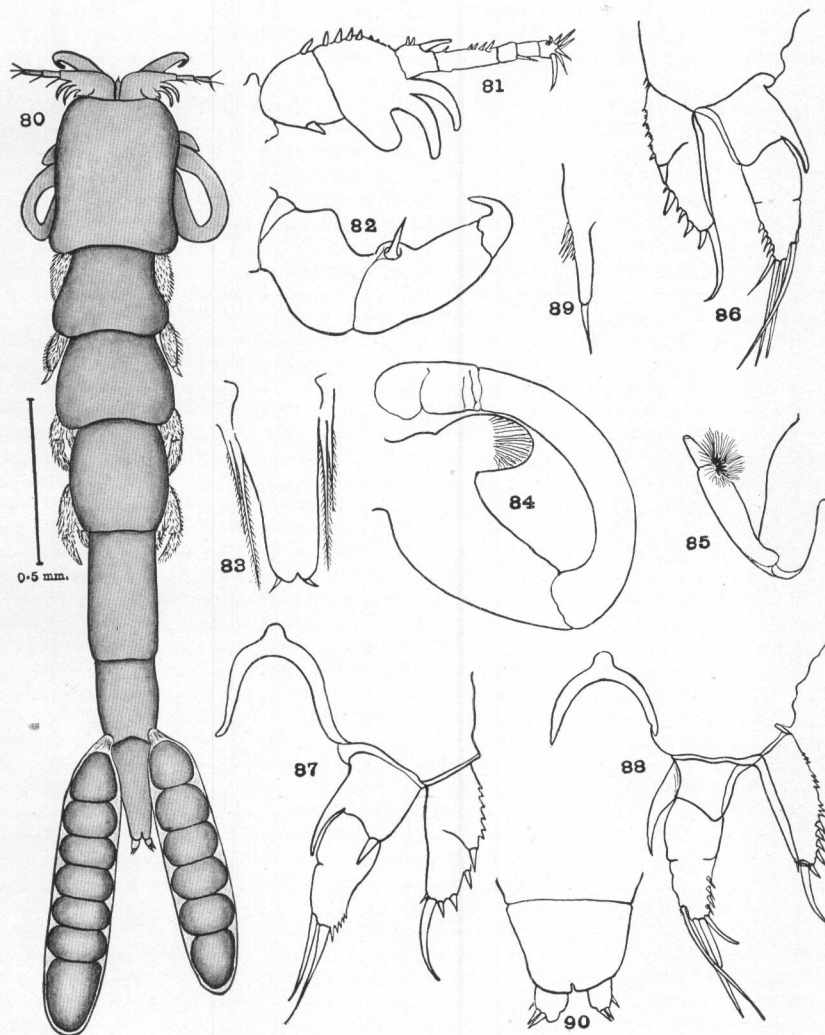
THE MALE AND FEMALE OF *TREBIUS TENUIFURCATUS*.

FOR EXPLANATION OF PLATE SEE PAGES 479, 480.



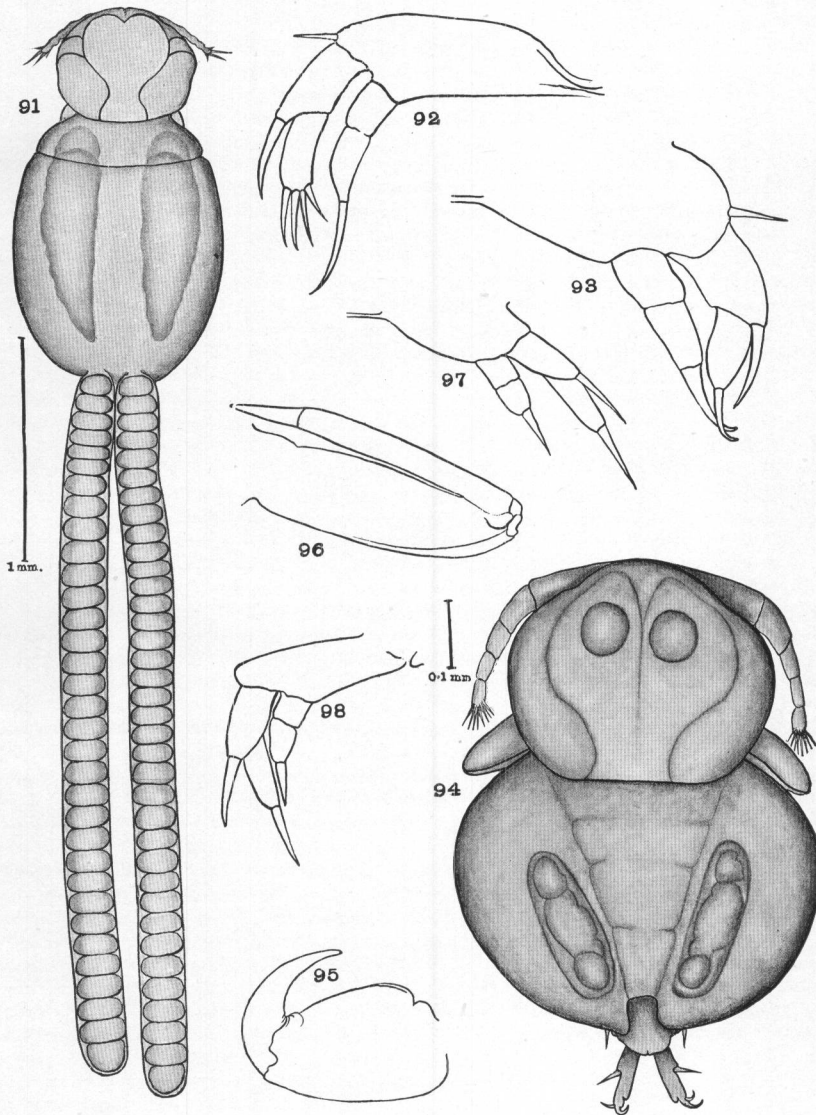
THE FEMALE AND A CHALIMUS OF *ACHTHEINUS OBLONGUS*.

FOR EXPLANATION OF PLATE SEE PAGE 480.



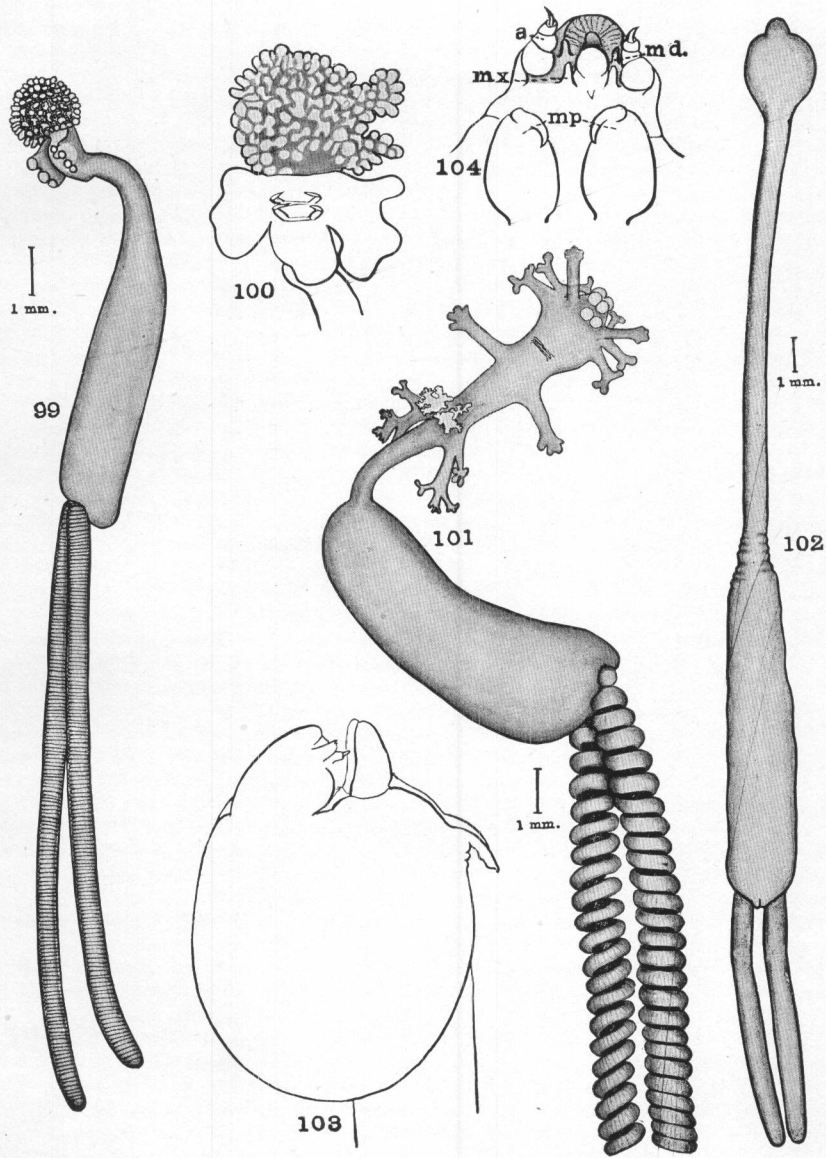
THE FEMALE OF EUDACTYLINA UNCINATA.

FOR EXPLANATION OF PLATE SEE PAGE 480.



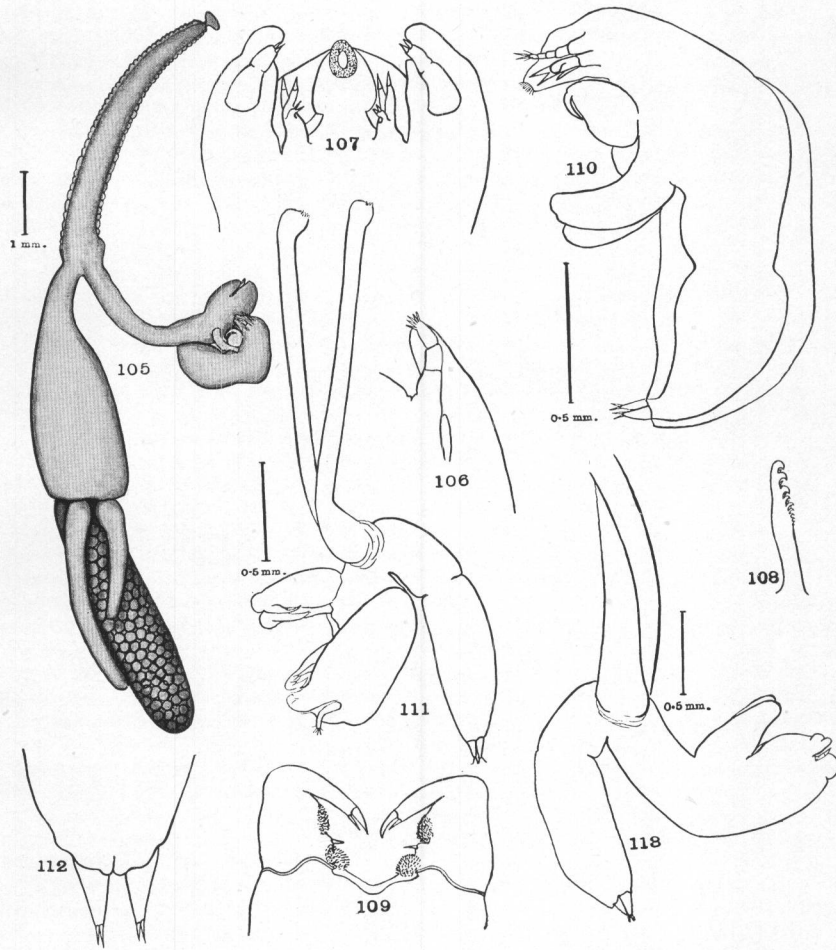
THE MALE AND FEMALE OF HATSHEKIA PINGUIS.

FOR EXPLANATION OF PLATE SEE PAGE 480.

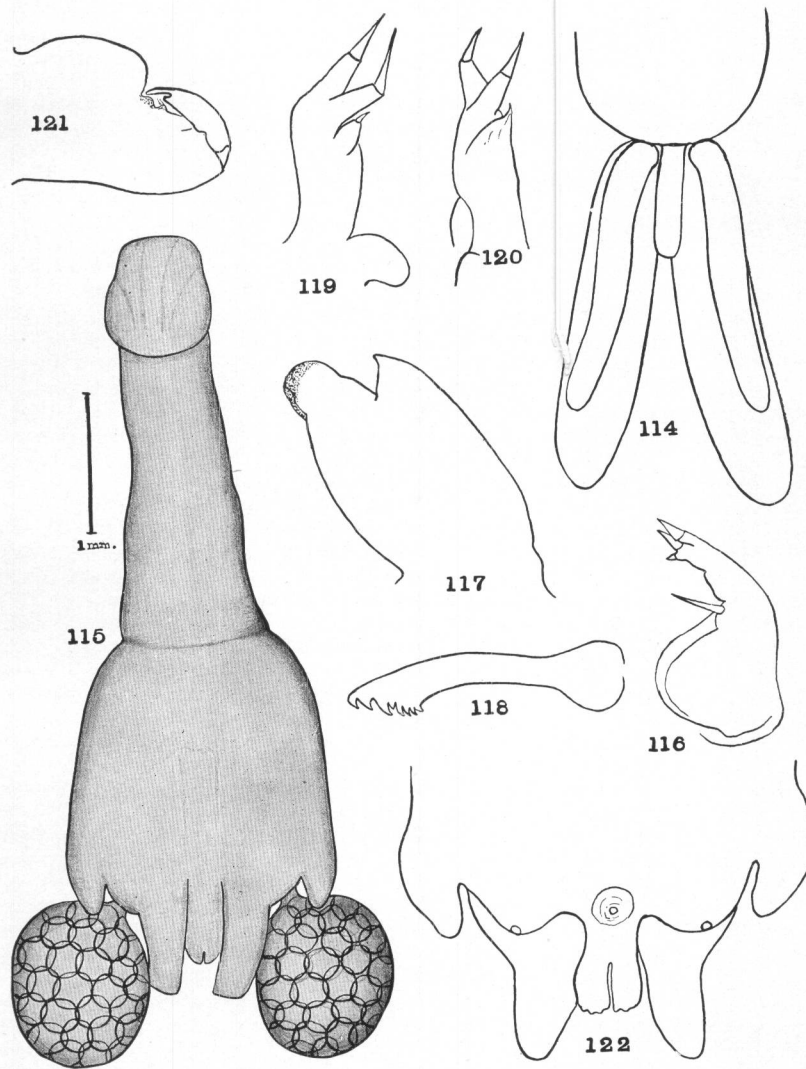


THE FEMALES OF LERNÆENICUS MEDUSÆUS, PHRIXOCEPHALUS CINCINNATUS,
AND OPIMIA EXILIS.

FOR EXPLANATION OF PLATE SEE PAGE 480.

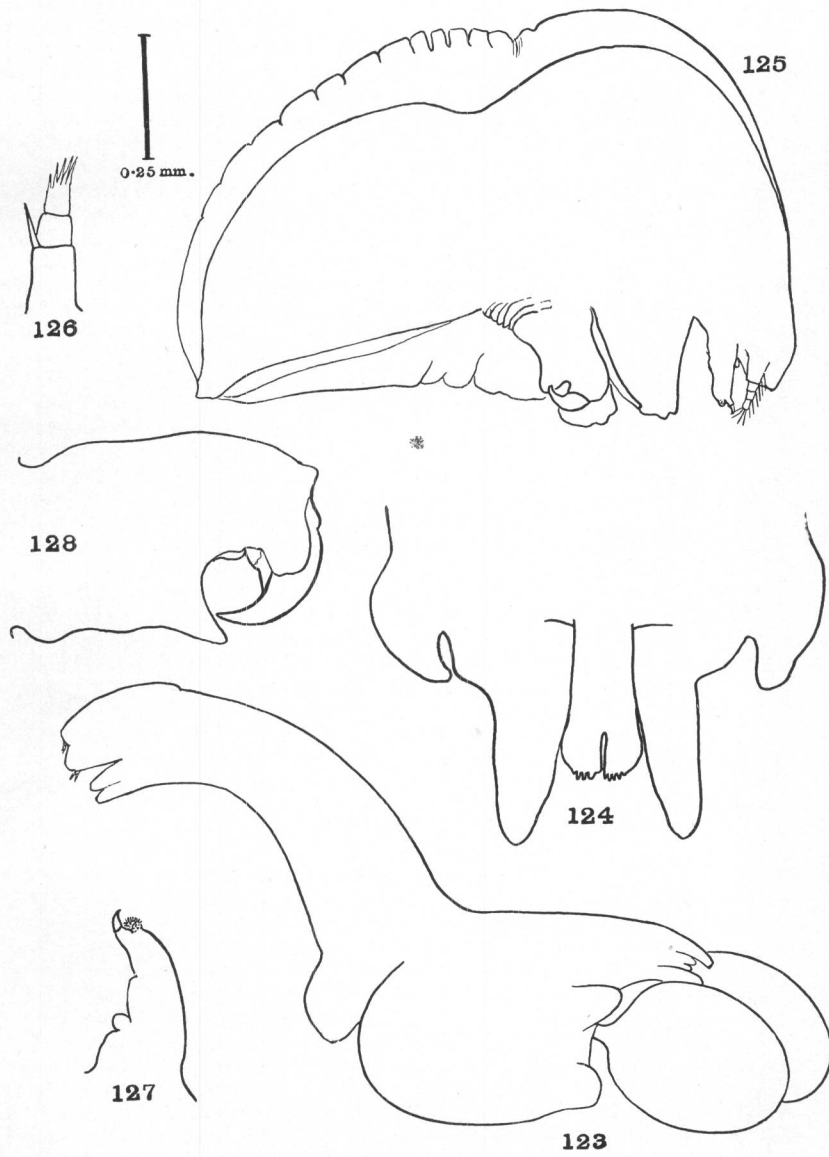


THE MALE AND FEMALE OF BRACHELLEA GRACILIS.
FOR EXPLANATION OF PLATE SEE PAGES 480, 481.



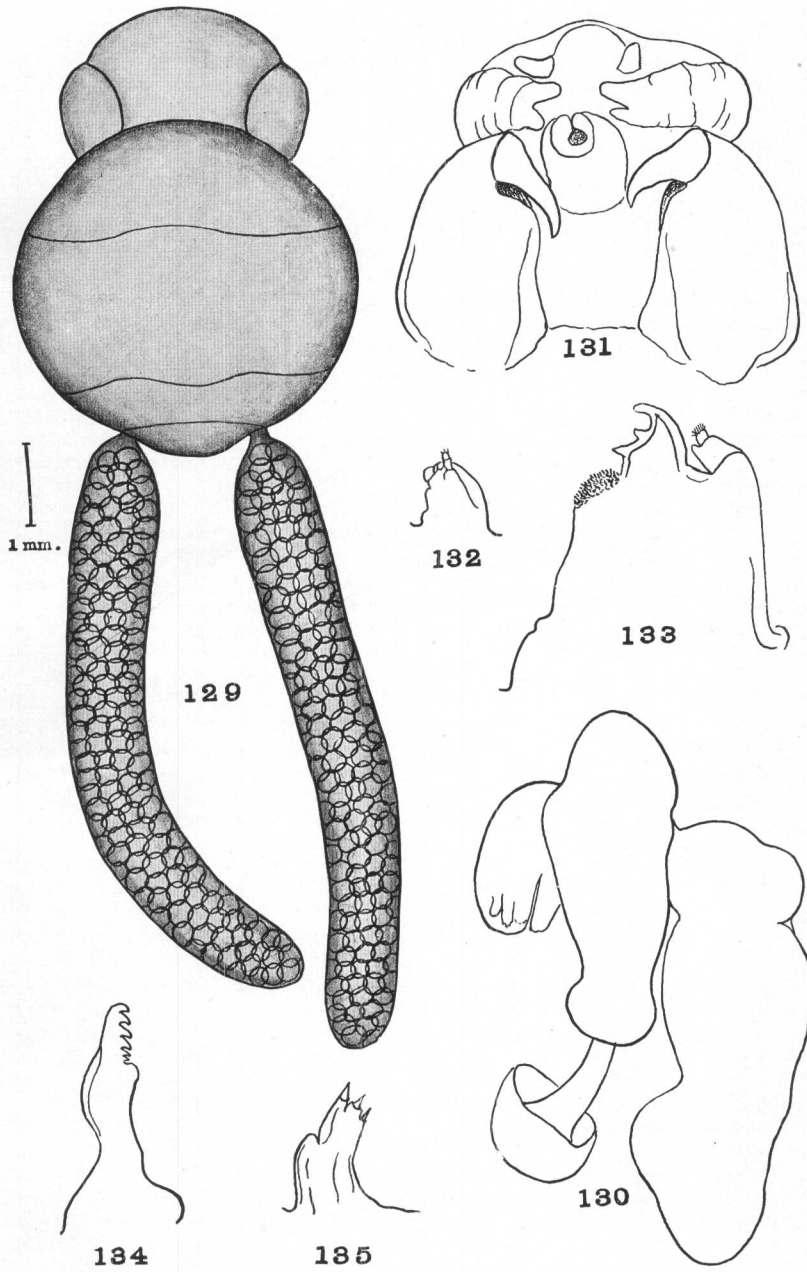
THE FEMALE OF BRACHELLEA ANSERINA.

FOR EXPLANATION OF PLATE SEE PAGE 481.



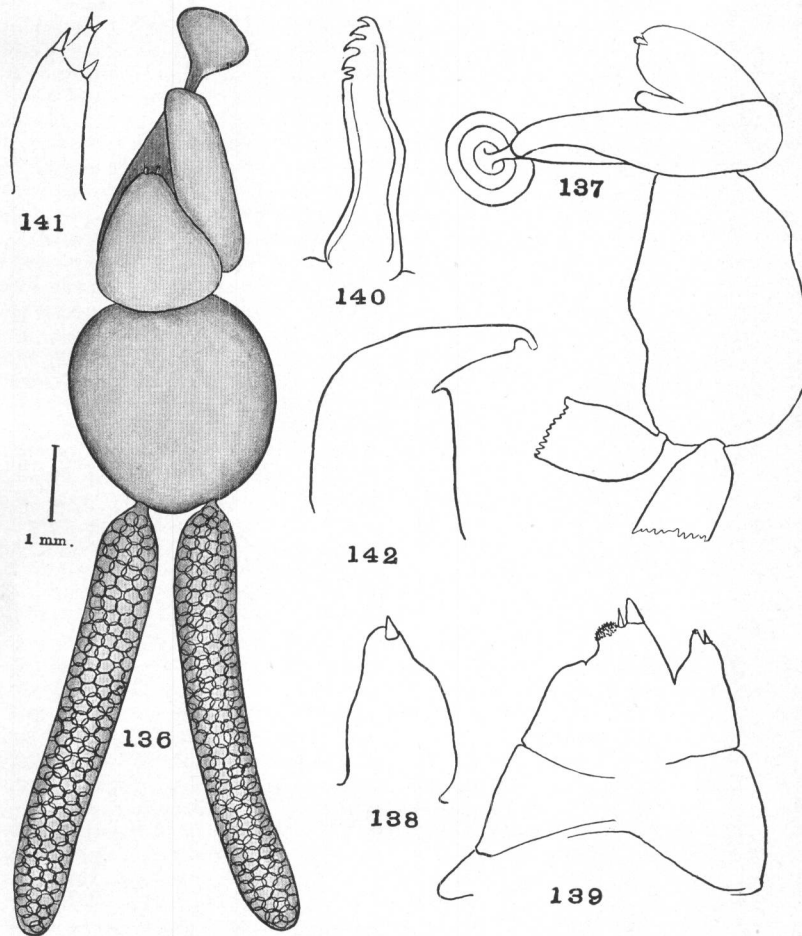
THE MALE AND FEMALE OF BRACHELLE ANSERINA.

FOR EXPLANATION OF PLATE SEE PAGE 481.



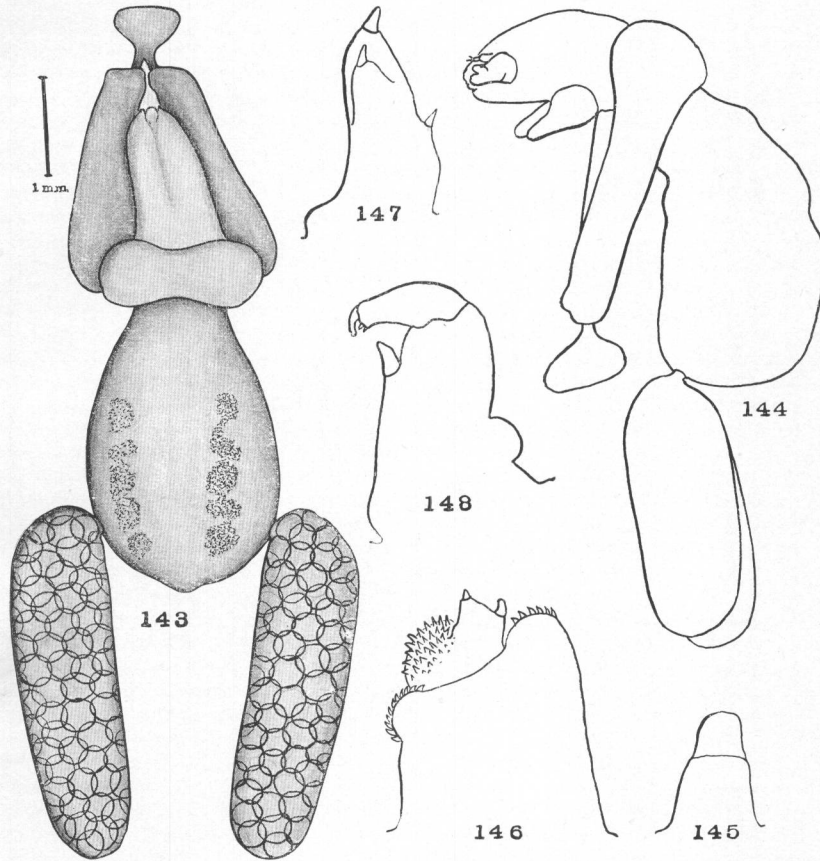
THE FEMALE OF LERNÆOPODA GIBBER

FOR EXPLANATION OF PLATE SEE PAGE 481.



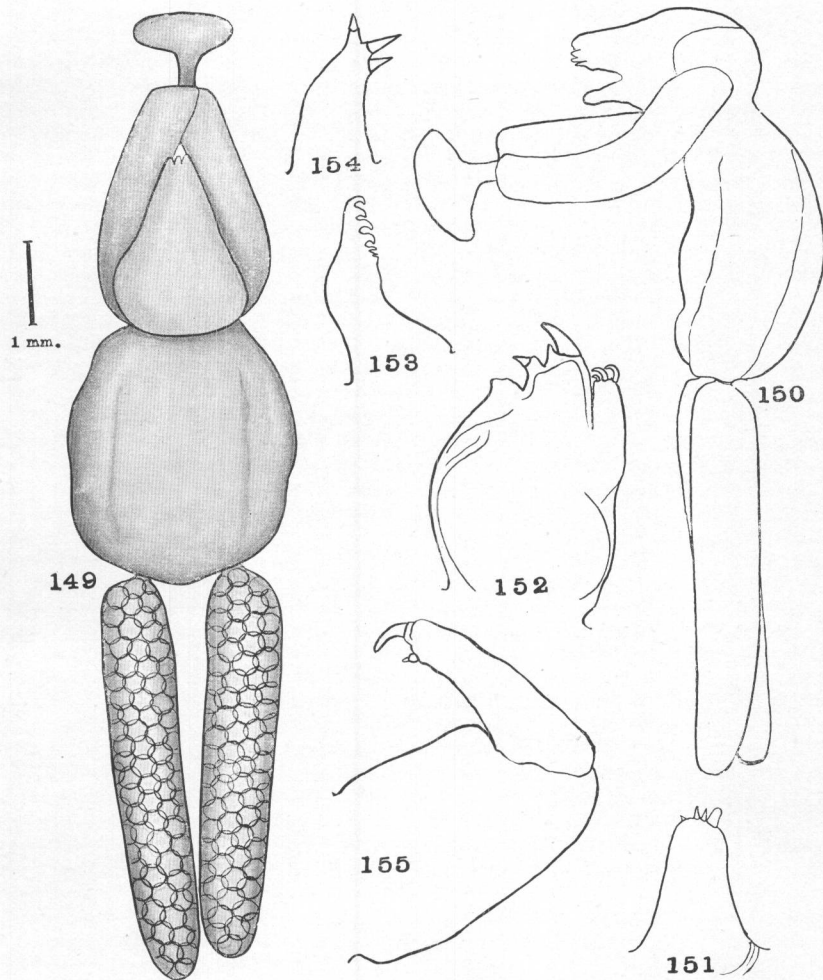
THE FEMALE OF LERNÆOPODA BEANI.

FOR EXPLANATION OF PLATE SEE PAGE 481.



THE FEMALE OF LERNÆOPODA BICAULICULATA.

FOR EXPLANATION OF PLATE SEE PAGE 481.



THE FEMALE OF LERNÆOPODA FALCULATA.

FOR EXPLANATION OF PLATE SEE PAGE 481.