ZOOLOGY.—*Some parasitic copepods from Panama Bay.*¹ CHARLES B. WILSON, State Teachers College, Westfield, Massachusetts. (Communicated by WALDO L. SCHMITT.)

A small collection of parasitic copepods taken from marine fish in Panama Bay by Dr. A. O. Foster was recently sent to the author for identification. Dr. Foster is helminthologist at the Gorgas Memorial Laboratory of Panama and the copepods were captured during various laboratory investigations. Although the collection includes but eleven species, two of them prove to be new to science, and the male of a third species is here described for the first time. In addition, the host or the locality or both are new for every one of the species.

The Bay of Panama lies off the Pacific end of the Panama Canal and hence is traversed by such shipping as makes use of the canal. In recent years the Galapagos Islands have been a sort of Mecca for many scientific expeditions, the great majority of which have passed through the canal. But, as a rule, the scientists have been so intent upon reaching their ultimate goal that they have made but few investigations enroute.

A notable exception is the Third Hancock Expedition to the Galapagos Islands recently made by the University of Southern California. This expedition did not go through the canal, but went down the Pacific coast of Mexico, Central America, and South

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America, stopping at many places along the way and securing valuable specimens. The parasitic copepods of that expedition have been reported elsewhere\(^2\) and included some from the Panama coast. This local collection from Panama Bay admirably supplements that list and should serve as an incentive to similar collections from the Pacific coasts of Mexico, Central and South America.

**Caligus bonito** Wilson

Taken in considerable numbers from the mouth and gill cavity of a bonito (*Sarda* sp.), and in a single instance from the mouth of another bonito identified as *Sarda velax*. The former host is probably the California bonito, *Sarda chilensis*, found on the Pacific coast from San Francisco to Patagonia.

**Caligus coryphaenae** Steenstrup & Lütken

Three females were taken from the mouth of a bonito (*Sarda* sp.) in company with the preceding species. This copepod is well distributed and has been reported from both sides of the Atlantic, as well as the Pacific.

**Caligus diaphanus** Nordmann

A single female was taken from the body of the common jack, *Caranx hippos*. This species is even more widely distributed than either of the preceding and infests a great variety of hosts, to which the present record adds one more.

**Caligus monacanthi** Krøyer

Krøyer founded his new species, *monacanthi*, in 1863 upon a single specimen taken from the skin of a leather fish (*Monacanthus* sp.) in the West Indies. He identified the specimen as a male and gave a detailed description accompanied by 5 figures. Up to the time of the present collection, no further specimens had been obtained during the seventy odd years since the original discovery. Krøyer was in error as to the sex of his specimen, which was certainly a female without egg strings, rather than a male. This mistake, coupled with the entire lack of further specimens, induced the present author, when dealing with the parasites of West Indian fish, to suggest that Krøyer’s specimen might well be the undeveloped female of another species.\(^3\) But twenty specimens, including both sexes, taken from the gills of a bonito (*Sarda* sp.) and included in the present collection, definitely prohibit such an inference. The females agree with Krøyer’s description and figures in every detail with one exception and, in addition, carry ovisacs to show that they are fully developed. The exception lies in the fact that these Panama specimens have a two-segmented abdomen, while Krøyer’s figure represents the abdomen as one-segmented and the text states that it shows no trace of segmentation. But Krøyer does say in parentheses that the abdomen is contracted for a distance at its base and then widens. The jointing is at the

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point where the diameter changes and might easily escape notice, and is scarcely visible in some of the present specimens. A female and male have been selected and given Cat. No. 69867 U.S.N.M.

**Female.**—Krøyer's statement that this species is marked by an elongation of the carapace, genital segment, and abdomen applies to both sexes. Carapace of female three-sevenths of the entire length and considerably narrowed anteriorly; lunules of medium size and not projecting. Median posterior lobe half the entire width of the carapace, its margin not evenly rounded but with the tip projecting a little. Lateral lobes curved inward and not quite reaching the tip of the median lobe. Free segment two-thirds as wide as the genital segment and strongly narrowed in front of the fourth legs. Genital segment elongate elliptical, three-fourths as long as the carapace, narrowed anteriorly into a short neck and lobed posteriorly. Each of the lobes is as wide as the abdomen, broadly rounded, and does not quite reach the joint in the abdomen. The latter is one-third as wide and nearly as long as the genital segment, and indistinctly two-segmented, the distal segment the longer. Caudal rami nearly as wide as long and well separated. Ovisacs attached to the ventral surface of the genital segment just inside the base of each posterior lobe and as long as the genital segment.

Second antenna large and sickle-shaped; terminal segment of second maxilla slender, longer than the basal segment, with two terminal setae but no lateral spine. Maxillipeds with a swollen basal segment and a stout terminal claw. Basipod of first leg with a minute process representing the endopod; terminal segment of the exopod with 3 end spines and a long naked seta, but without plumose setae on its posterior margin. The armature of the second legs is very peculiar; the basal segment of the exopod carries a long filose spine at the center of the outer margin and a stout spine at the distal corner, bent down across the ventral surface, with a fringe of long hairs between the two spines. The distal segment has 3 setae at its outer corner, flanged on their outer margins and plumed on their inner margins. The basal segment of the endopod has a fringe of small curved spines on the distal half of its outer margin. The second segment has a row of 6 stout spines along its outer margin; the bases of these spines are swollen, cover the whole length of the margin, and are somewhat imbricated. In the third legs, the spine on the basal segment of the exopod is nearly straight and reaches the entire length of the second segment. The fourth legs are three-segmented with 5 spines, the second segment as long as the third and the two combined as long as the basal segment, which is moderately swollen. There are no rudiments of fifth legs anywhere visible. Small spherical spermatophores are attached in pairs at the opening of the sperm receptacle.

Total length 4.40 mm. Carapace 2 mm long, 1.90 mm wide. Ovisacs 2 mm long.

**Male.**—Carapace similar in shape to that of the female, but relatively longer, being just half of the entire length; lunules larger and suborbicular, but scarcely projecting. Posterior median lobe a little more than half the entire width and evenly rounded, extending a little beyond the lateral lobes. Free segment wider than the genital segment, greatly narrowed in front of the fourth legs. Genital segment barrel-shaped, not narrowed to a neck anteriorly and without posterior lobes. Abdomen distinctly two-segmented, the distal segment nearly twice the length of the basal, both segments of the same width throughout with straight sides. Caudal rami nearly twice as long as wide and curved inward. Appendages like those of the female with the following differences.
Maxillary hooks considerably enlarged and strongly curved; maxillipeds with a row of 3 short triangular spines on the inner margin of the basal segment, the terminal claw shutting down against the two distal spines. The claw itself has a slender spine at the center of its concave margin, which is close to the distal spine of the basal segment when the claw is closed. The terminal segment of the first legs carries the usual 3 plumose setae on its posterior margin. In the second legs the fringe of spines on the outer margin of the second segment of the endopod is here replaced by a row of 8 to 10 chitin scales closely imbricated.

Total length 4.50 mm. Carapace 2.25 mm long, 1.90 mm wide.

Remarks.—The armature of the second endopod segment of the second legs in both sexes is not known in any other species of the genus and evidently escaped Krøyer's notice. It lends a distinctive character to the species and with the other details fully establishes its validity after 75 years of waiting.

Caligus patulus, n. sp.

Twelve females were obtained from the outer skin of a milkfish (Chanos sp.) captured in the Bay. One of them bearing ovisae has been chosen as the type of the species with Cat. No. 69869 U.S.N.M.

Female.—Carapace five-eighths of the entire length, almost as wide as long; frontal plates wide and separated by a deep median incision; lamules of moderate size and not projecting. Posterior median lobe half the entire width, with prominent posterior corners; lateral lobes broadly rounded and the same length as the median lobe. Free segment two-fifths as wide as the carapace and thickened through the bases of the fourth legs. Genital segment two-thirds as wide as the carapace and almost twice as wide as long, contracted to the width of the free segment where it joins the latter. Its posterior lobes are broadly rounded and carry rudiments of the fifth and sixth pairs of legs and wide processes at their inner corners, giving them a sinuous outline. The abdomen is quadrangular and one-segmented, as wide as long; the caudal rami are also as wide as long and well separated at the posterior corners of the abdomen. The ovisae are a little narrower than the abdomen and two-thirds as long as the entire body.

The antennae and maxillae are of the usual pattern; the claw of the maxilliped is as long as the basal segment and abruptly bent near the tip. The basal segment of the first leg has at its posterior distal corner a finger process tipped with a short spine representing the endopod. The proximal segment of the exopod has a fringe of hairs on its posterior margin, and a spiny process at its anterior distal corner; the end segment has two terminal claws and three stout plumose setae. In the third legs the spine on the basal segment of the exopod is short and blunt, and the two rami are close together. The fourth legs are three-segmented with four spines; the second segment is longer than the third and the two combined are the same length as the basal segment. The fifth and sixth legs are represented by small processes tipped with minute setae. The base of the furca is longer than wide, the arms are shorter than the base, nearly parallel and flattened.

Total length 6 mm. Carapace 3.60 mm long, 3.59 mm wide.

Remarks.—The distinguishing characters of this species are the large and roomy genital segment (whence the specific name) with its sinuous posterior
lobes, and the long fourth legs, which reach beyond the posterior margin of the genital segment. The relative lengths of the second and third segments in these fourth legs are also useful for identification since it is usual for the third segment to be the longer.
Caligus constrictus Heller

Nine females were obtained from the gills of the crevalle, *Caranx hippos*, and three females from the gills of the dolphin, *Coryphaena hippurus*. This species, established by Heller 72 years ago upon a single male and not reported since then, was confirmed in the paper on the parasitic copepods of the Third Hancock Expedition, to which reference has already been made. It is pleasing to obtain so promptly these additional specimens from the same host and locality, and also the others from a new host. It is evident that the crevalle is to be regarded as the chief host and that the parasite is by no means as rare as the long intervals between its appearances would seem to suggest. These new specimens vary somewhat from those already described and the differences are as follows.

In the carapace the eye is visible, while it could not be located in previous specimens. The posterior corners of the median lobe project laterally and overlap the tips of the incurved lateral lobes. The genital segment has no attached spermatothoraces, the abdomen is as wide as long and the caudal rami are relatively larger. The base of the terminal claw of the second antenna is armed with two minute spines on its inner margin. The basal segment of the maxilliped has a small seta on its posterior margin near the proximal end. The basal segment of the fourth leg has a spine at its distal end similar to those on the other three segments.

These slight differences simply emphasize the validity of the species and show that it does exhibit certain variations.

Caligus tenuifurcatus, n. sp.

Nine specimens, including both sexes, were obtained from the gill cavity of the papagallo, *Nematistes pectoralis* Gill. A male and female have been selected for types with Cat. No. 69874 U.S.N.M.

Female.—Carapace ovate, narrowed anteriorly, a trifle longer than wide and 40 per cent of the entire length; frontal plates wide and without a central incision; lunules large, circular and projecting considerably. Median posterior lobe more than half the entire width and evenly rounded; lateral lobes curved inward but not meeting the median lobe. Free segment short and one-fourth as wide as the carapace; genital segment a little longer than wide, subquadrangular, with rounded anterior and pointed posterior corners, and slightly convex sides. There are no posterior lobes and no visible leg rudiments. Abdomen nearly as long as the genital segment, tapering a little posteriorly and two-segmented, the distal segment longer than the proximal. Caudal rami twice as long as wide, close together and curved inward. Ovisacs as long as the urosome and somewhat divergent.

First antennae short and turned backward; second antenna stout, its terminal claw bent into a half circle. Basal segment of maxilliped also stout, the terminal claw half as long as the segment with two unequal small spines near the center of its concave margin. Rudimentary endopod of the first legs a very small triangular spine; end segment of exopod with three terminal claws and a much longer spine, and three plumose setae. Fourth leg three-segmented with six spines, including the very small one at the tip of the basal segment. Second and third segments of equal length and together as long as the basal segment.
Total length 5 mm. Carapace 2.10 mm long, 2 mm wide.

**Male.**—Carapace proportionally larger, a little more than half the entire length and longer than wide; frontal plates with even larger lunules than in the female. Free segment wider than the genital segment and strongly contracted anteriorly. Genital segment a parallelogram, one-half longer than wide, with straight sides. Abdomen a trifle longer than the genital segment and two-segmented, the distal segment one-third longer than the proximal. Caudal rami twice as long as wide and curved inward at their tips.

The antennae, mouth parts, and legs are like those of the female with minor differences. The furca, like that of the female, is more than four times as long as wide, with slender and slightly divergent arms about as long as the base.

Total length 5.40 mm. Carapace 2.81 mm long, 2.50 mm wide.

**Remarks.**—The relative size and shape of the genital segment and abdomen in both sexes are characteristic of this new species and will serve well for identification.

**Gloioptes costatus** Wilson

Thirty specimens, including both sexes, were taken from the outside surface of a sailfish, *Istiophorus greyi*. Some of these were larger than the dimensions originally given for the species, but not otherwise different.

**Lernaeenicus longiventris** Wilson

Two mature females and a development stage were taken from the body wall of the common jack, *Caranx hippos*. As this is the first development stage of the female after attachment to the host to be reported for the entire genus, two figures and a brief description are here given.

**Young female.**—Head elliptical, narrowed anteriorly, slightly projecting on either side at the center, swollen and evenly rounded posteriorly and extended backward a little over the anterior thorax. The latter joins the head not at its posterior end but on the ventral surface a little in front of it, and without definite segmentation. Nearly as wide as the head where it joins the latter, and somewhat flattened dorsoventrally, it quickly tapers backward into a narrow cylinder and passes insensibly into the abdomen. This abdomen is cylindrical and exceptionally elongated to more than forty times the length of the head. It maintains the same diameter throughout its entire length without any traces of segmentation, and the posterior end is smoothly rounded with no caudal rami.

The first antennae are turned back along the surface of the head and are almost invisible. The second antennae have two short and stout basal joints and a strong terminal claw. They are situated just beneath the frontal margin of the head, and behind them on the midline of the ventral surface projects the short mouth tube, on either side of which is a maxilla with very long setae. Farther back the second maxillae project from the ventral surface of the head, each tipped with a bifid claw. The anterior thorax carries four pairs of legs which diminish in size backward; the first two pairs are biramous, the last two pairs uniramous, all the rami two-segmented.

Total length 25 mm. Head 0.50 mm long, 0.25 mm wide.

**Remarks.**—Evidently the first thing that happens to the young female after attachment to the host is the excessive elongation of the body behind the head. In this there is no differentiation of body regions; thorax, genital
segment, and abdomen are all the same diameter and just alike. Later, with the development of the ovaries, oviducts, and cement glands, the center of the long cylinder is swollen into the genital segment, while the anterior and posterior portions remain unchanged.
Pennella species

Two adult females were taken from the body wall of the same sailfish *Istiophorus greyi*, that yielded the Gloiopotes specimens. These were a large species, 150 mm in length or more, but as the heads were lacking in both specimens, the species could not be determined with certainty.