

THE PARASITIC COPEPODS OF THE LONG-JAWED ROCKFISH,
SEBASTODES ALUTUS (GILBERT)

by

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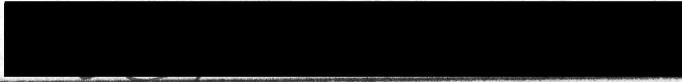


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INTRODUCTION

A review of the literature reveals no reference to any instance in which parasitic copepods have been recovered from the long-jawed rockfish, Sebastes alutus (Gilbert), however, some of those found in this investigation have been previously reported from other fishes, predominantly scorpaenids.

This work was undertaken to ascertain the numbers and kinds of copepods which are parasitic on the long-jawed rockfish.

MATERIALS AND METHODS

During the period June 21, 1955 to August 16, 1955, 100 specimens of the long-jawed rockfish were acquired from "drag boats" which delivered their catches to the Oregon Mink Farmers' Cooperative processing plant in Newport, Oregon. The fish were caught by means of otter trawl gear at a depth of some 100 fathoms in an area lying off of the central Oregon coast, bounded in the north by Cascade Head in Tillamook County and in the south by Yaquina Head in Lincoln County. I obtained the fish as they were being unloaded, which meant that they had been dead from 18 to 24 hours. They were, however, in a good state of preservation as they were always well iced. After gently washing

each fish and examining the wash water for any parasites which might have come off at that time, they were enclosed in plastic bags and stored in a refrigerator until such time as they could be posted, usually within 48 hours. Washing the slime off of the fish is helpful in reducing decomposition although this is not such an important consideration with copepods as it is with some of the helminth parasites.

The fish were thoroughly examined throughout all of the body regions in which parasitic copepods might exist including the surface of the head, body, tail, and fins; the external nares and nasal passages; the lateral line or mucus canals; the buccal and anal cavities; and the gill chamber and gills.

The copepods collected in this investigation were fixed in Lavdowsky's solution (alcohol-formalin-acetic acid) and stored in 70% ethyl alcohol. Before clearing, the specimens were pierced several times with a sharp teasing needle in an effort to prevent shriveling after being placed in the mounting medium. The most satisfactory mounting medium proved to be Canada balsam. Turtox CMC 10 was a somewhat less successful mounting medium. Unmounted specimens were used for most of the drawings.

All of the drawings were made by the author with the assistance of a camera lucida and a Bausch and Lomb triple purpose projector.

DATA

Caligoida

Peniculus sp. (Fig. 5). Eight females of an unidentified species of this genus were collected during this investigation. No more than a single specimen of this parasite was found on an individual fish and with one exception they were imbedded in the skin at the base of the pelvic fins or occasionally one of the other fins. This lone exception was imbedded in the skin of the lateral body surface. Mounted specimens of this copepod are in the collection of fish parasites in the Zoology Department of Oregon State College and are listed as being recovered from both the priest fish, Sebastodes mystinus (Jordan and Gilbert) and the bass rockfish, S. serranoides Eigenmann. No further data is available on habitat, etc., on these specimens. Dr. Paul L. Illg confirmed the generic designation and stated that this form probably represents an undescribed species. In many respects, this species bears a close resemblance to P. clavatus (Müller) (5, p. 46-47). The cephalothorax is wedge-shaped, depressed dorsoventrally, about twice as wide as long, and terminates in a slightly pointed rostrum. There is one major point of difference between my specimens and the type genus as set forth by Nordman (5, p. 44-45). My specimens definitely bear horns on the

cephalothorax. These horns are bipartite and originate just posterior to the two pairs of antennae, one on each lateral margin of the cephalothorax. Each consists of a dorsal and a ventral lobe with the dorsal slightly the larger. The second and third thoracic segments form a slender, cylindrical neck which enlarges somewhat at the insertion of the third pair of swimming legs. Just anterior to the enlargement, the neck bends forward at an angle of about 45° . The fourth thoracic segment is fused into the body although it is well demarcated by a deep groove. The trunk is cylindrical, 6-7 times as long as wide, same diameter throughout except the anterior portion, and rounded posteriorly. The abdomen is a very minute tubercle close to the dorsal surface. It bears a pair of anal laminae, each armed with 3 long and 2 shorter setae. The egg strings are one fifth the width of the body and about one half again as long. The first antennae are attached to the lateral margin of the rostrum, projected posteriorly, and bordering the outer edges of the larger, bulbous, chelate second antennae. The first antennae are 3-jointed with the last 2 segments profusely armed with setae. The second antennae have strong claws attached to large basal joints which are fused at their origin. The proboscis is short in comparison with the neck and the terminal mouth opening is enclosed by a

delicate fringed membrane. The first maxillae are small 1-jointed appendages located on the sides of the proboscis. The second maxillae are also attached laterally to the proboscis, are 2-jointed, and armed with a rather weak terminal claw. The 4 pairs of swimming legs consist merely of lappet-like basal plates which are notched near the distal end. The first 2 pairs are located just posterior to the horns in a ventral position, the third at the junction of the neck and body, and the fourth in the groove between the fourth thoracic segment and the rest of the body. Maximum and minimum measurements are based on 4 individuals. Total length, 12.50 mm to 14.50 mm. Body, 9.50 mm to 11.00 mm long, and 1.5 mm wide. Egg strings, 14.00 mm to 17.00 mm long, and 0.25 mm to 0.33 mm wide.

Haemobaphes theragrae Yamaguti (Fig 6) was described from a single female found on a whiting, Theragra chalcogramma (Pallas), taken from Toyama Bay, Japan (6, p. 480-481). In addition to the single female I recovered during this study, I have also, on two separate occasions, taken solitary females from the olive-backed rockfish, Sebastes saxicola (Gilbert). These recoveries establish two new hosts as well as greatly extending the range of this parasite. When found in the host, this copepod had its head and long neck completely buried in one of the gill arches. Its blood-red color at the time of removal

from the host would seem to indicate that the head was in direct contact with a major blood vessel, probably one of the aortic arches.

Lernaeopodoida

Chondracanthus pinguis Wilson (Figs. 1 and 2) was first taken from the brown rockfish, Sebastes dallii (Eigenmann and Beeson) in marine waters off the coast of Western Canada. The brown rockfish was formerly listed under the name S. auriculatus (Girard) and was known by that name when Wilson described C. pinguis. This parasite appears to be common in the long-jawed rockfish with as many as 24 females being recovered from a single fish. As is characteristic of several of the parasitic copepods, the male is a pigmy which clings to the body of the female. In this species the male is always attached to the genital segment. On several occasions, I have also taken this copepod from the orange rockfish, S. pinniger (Gill), the olive-backed rockfish, S. saxicola (Gilbert), and the Spanish flag, S. rubrivinctus (Jordan and Gilbert). Thus 4 new hosts of C. pinguis are herein named with the concurrent extension of the southern limit of its range. Chondracanthus pinguis occupies a fairly restricted habitat within the host, being found exclusively in those areas inside the gill cover which are immediately adjacent

to the upper and lower termini of the gill arches. Herein are included the maximum and minimum measurements of 30 females and 10 males. Since Wilson described C. pinguis from only two specimens of each sex, I feel that the following measurements are more indicative of the dimensions of this parasite. The outstanding discrepancy between my measurements and those which appear in the original descriptions (3, p. 94-95) occur in the egg sac lengths where the average of my specimens is 2.7 times that of Wilson's. Female. Total length, 5.00 mm to 7.10 mm. Cephalothorax, 1.50 mm to 2.10 mm long, and 2.20 mm to 2.50 mm wide. Body, 3.50 mm to 5.00 mm long, and 1.75 mm to 2.60 mm wide. Egg sacs, 5.00 mm to 9.00 mm long, and 0.50 mm to 1.00 mm wide. Male. Total length, 0.57 mm to 0.72 mm. Cephalothorax, 0.36 mm to 0.49 mm long, and 0.23 mm to 0.32 mm wide. Genital segment, 0.06 mm to 0.12 mm dorsoventrally.

Chondracanthus sp. (Figs 3, 4, 12, 15) Although a common inhabitant of Sebastodes alutus, this parasite apparently is a new species. As many as 15 female specimens of this copepod have been recovered from a single fish. As in C. pinguis, the pigmy male is attached to the genital segment. This parasite appears to be limited solely to the nasal passages adjoining the external nares, a habitat rarely utilized by parasitic copepods.

Description. Female. The general body form is slender and elongate. The cephalothorax is club-shaped and more than twice as long as wide. It has a pair of long conical lobes originating at a midventral position on the head portion which extends posterio-laterally. Made up of the second, third, and fourth thoracic segments, the body is somewhat wider than the cephalothorax and is about twice as long. The segments are plainly demarcated by constrictions and each bears a pair of lateral processes similar to those found on the cephalothorax. The processes attached to the fourth segment extend posteriorly on either side of the genital segment and abdomen to a point considerably beyond them. The genital segment is about one fourth as wide as the last thoracic segment and is somewhat shorter than wide. Seemingly a single structure, the genital segment is actually made up of two equal parts which are bound together longitudinally by a loose connection. The abdomen is very small and somewhat knobby in appearance. It is attached directly to the genital segment and bears a pair of anal laminae. Although giving the appearance of being short because of their coiled shape, the egg sacs are just a little shorter than the body. They are of fairly uniform thickness throughout their length. The eggs are arranged in 8-9 rows, numbering 30 or more in each row. The first antennae are large and swollen, covering the

entire anterior margin of the cephalothorax and extending beyond its lateral margins. The joints of the first antennae are so fused as to be indistinguishable and each antenna is armed with 5 small spines at the distal tip and 2 single spines on the posterior margin. The second antennae are also large with strong terminal claws bent abruptly near the ends. The mandible consists of a basal joint and a curved cutting blade with sharp spines on both margins. The mandibular appendage possesses no palp. The maxilla has a long and slender cutting blade which is armed with several spines on its posterior margin and a palp which is about one half as long as the cutting blade. The large maxilliped has a short terminal crescentic-shaped claw which bends posteriorly over a rounded knob. Both the inner margin of the claw and the surface of the knob are armed with short spines. There are 2 pairs of swimming legs, each consisting of a single flattened joint, bilobed toward the distal end, and unarmed either with setae or a claw. Measurements. Below are listed the maximum and minimum measurements of 30 specimens. Total length, 3.7 mm to 9.00 mm. Cephalothorax, 1.00 mm to 3.00 mm long, and 0.90 mm to 1.50 mm wide. Body, 3.50 mm to 7.00 mm long, and 0.55 mm to 1.80 mm wide. Egg sacs (measurements from 21 specimens), 3.00 mm to 6.00 mm long, and 0.40 mm to 0.60 mm wide. Male. In general the male

anatomy of this species closely resembles that of the male of Chondracanthus pinguis, however, it is considerably smaller. The body form is slender and elongate with the cephalothorax about twice as thick as the genital region. The anterior region terminates in a point. The first and second thoracic segments are only partially annulated and each bears a pair of swimming legs. The legs are 2-jointed and each possesses 2 equal-sized spines at the distal terminus. Immediately posterior to the last pair of swimming legs are 2 free segments of about equal size and without appendages. In back of these free segments is the conical-shaped genital segment which approximates the combined size of the 2 preceeding segments. The abdomen is short, conical, and made up of a single segment. Attached to the abdomen are a pair of anal laminae of about the same length as the abdomen. These laminae are slender and lacking of setae. Unlike those of the female, the first antennae of the male are relatively small, of uniform width throughout, and are very distinctly jointed. The other appendages are similar to those of the female with some variation in size. The following maximum and minimum measurements were taken from 11 specimens. Total length, 0.46 mm to 0.58 mm. Cephalothorax, 0.29 mm to 0.39 mm long, and 0.17 mm to 0.24 mm wide. Genital segment, 0.06 mm to 0.10 mm dorsoventrally.

Clavella recta Wilson (Fig. 8) was described from specimens which came from a black sea bass, Sebastes melanops (Girard), caught in the vicinity of Sitka, Alaska (4, p. 684-685).

This copepod is a fairly common parasite of S. alutus. I found C. recta on the distal margin of all of the fins with one exception, that being the pectoral fins. In addition, one specimen was taken from inside the gill chamber where it was attached to a gill filament. Only female specimens were recovered. As yet, the male of this species is unknown.

An unidentified species probably belonging to Clavellopsis (Figs. 9, 10, 11 and 14) or some closely allied genus was present in most of the fish examined. This copepod was discovered in 2 different habitats on the host, being taken commonly from the gill rakers and occasionally from the buccal cavity. In addition to Sebastes alutus, I have found that the orange rockfish, S. pinniger (Gill), and the olive-backed rockfish, S. saxicola (Gilbert), are also hosts of this parasite. In these 2 fish, the gill rakers served as the point of attachment. With the recoveries from these fish, as well as those from S. alutus, 3 hosts are hereby established. Although the description of my specimens does not coincide perfectly with that of Clavellopsis, (4, p. 686-687) it

appears to fit this genus reasonably well. There are also several points of similarity between my specimens and those of the genera Branchiella (4, p. 698-699) and Probrachiella (4, p. 716). In a personal conversation on this matter, Dr. Paul L. Illg commented on the fact that several of the genera in the subfamily Clavellinae are in need of revision, so possibly the description of Clavellopsis should be altered to include this species.

Description. Female. The general appearance is short, squat, and stocky. The entire body is covered with a tough, translucent, chitinous integument. The cephalothorax is nearly in line with the trunk and has a neck which is about 3 times as long as the head. The head is covered by a distinct dorsal carapace. The cephalothorax is clearly separated from the quadrilaterally shaped trunk which is a little wider than long. This species resembles Probrachiella anserina (Wilson) (4, p. 716; 2, p. 467-469) in the possession and location of 4 pairs of distinctive posterior processes which are attached to the trunk. On the median dorsal line there is a small, almost completely fused pair which is flanked by a larger and longer pair. The other 2 pairs are intermediate in size and are located at the dorsolateral and ventrolateral extremities. Located between the posterior projections on each side are small genital processes. Attached to them are the relatively

short egg sacs. The egg sacs contain 9-12 rows of 8-15 eggs each. There is a small abdominal segment on the median posterior line directly between the 2 genital processes. There appear to be no anal laminae. The first antenna is 4-jointed and its distal segment bears a number of small setae. The proximal segment is enlarged. The second antennae are biramose; the endopod is 1-jointed, the exopod 2-jointed. The distal segment of the exopod possesses 1 or 2 small setae. The first maxillae are bipartite and each has a palp which bears 2 small setae. Located far down on the neck, the large second maxillae fuse at their distal extremities and connect to the pedicel of the small bulla. The maxillipeds are relatively much smaller than the second maxillae and are situated quite near the other mouth parts. They each bear strong terminal claws and an accessory claw. Measurements. These figures are based on the maximum and minimum measurements of 10 specimens. Total length, 6.10 mm to 7.25 mm. Head, 0.80 mm to 1.10 mm long, and 0.65 mm to 0.75 mm wide. Neck, 2.50 mm to 3.75 mm long, and 0.60 mm to 1.00 mm wide. Trunk, 2.00 mm to 2.50 mm long, and 0.65 mm to 1.00 mm wide. Male. Here again the male is a pigmy attached to the female. Although usually fastened to the neck near the head, the male is often times found attached at some point on the lower body regions. The general body form is

atypical from the viewpoint that it more nearly resembles that of the type males of the genera Brachiella and Probrachiella than it does that of Clavellopsis. The cephalothorax is inclined at about a 45° angle in relation to the body axis. Several of the specimens appear to have a structure which resembles a carapace but it is indistinct. Posteriorly the cephalothorax constricts into a narrow wasp-like waist and then joins an ovate trunk. Attached to the trunk are a pair of small anal laminae the presence of which is not a characteristic of the genus Clavellopsis. If there is a genital process, it isn't readily apparent. The first antennae are 3-jointed and usually bear 4 setae on the distal segment. The second antennae are biramose and the rami are unsegmented. The first maxillae are tripartite and flank the mouth tube which extends ventrally at right angles with the main body axis. The second maxillae are the largest of the appendages and originate just anterior to the narrow waist of the cephalothorax. Each bears single, long, curved claws. Just anterior to the second maxillae are maxillipeds which are nearly the same size. Each also possesses a single, strong claw.

Measurements. The following maximum and minimum measurements were taken from ten specimens. Total length, 1.17 mm to 1.58 mm. Cephalothorax, 0.48 mm to 0.74 mm long, and 0.51 mm to 0.84 mm dorsoventrally. Trunk, 0.63 mm to 0.84 mm long, and 0.42 mm to 0.74 mm dorsoventrally.

Colobomatus sp. (Figs. 7 and 13) appears to be a common parasite of the long-jawed rockfish. According to Dr. Paul L. Illg this find probably represents a new species and may be the first known occurrence of the family Philichthyidae on the Pacific Coast. All recoveries of this copepod were made from the lateral line canals in the region around the eyes. Only female specimens were found. Although fitting the rather loose generic description (1, p. 599), the appearance of my specimens appears to be unique with little resemblance to other members of the genus. The head is somewhat conical in shape and bears 3 large projections, one anterior and 2 lateral. These projections bear no setae and are unsegmented. The two pairs of antennae do originate, however, from the lower portion of the anterior projection. The first antennae are 5-segmented and protrude between the anterior and lateral projections. Immediately posterior to the first antennae are the relatively simple second antennae composed of 2 segments. The distal segment bears a fairly strong claw and a spine, the latter about half the length of the former. The mouth parts are rudimentary and indistinct. There is no segmentation of the thoracic region. This anatomical division bears 2 pairs of fleshy, unsegmented lobes. There is a larger ventrolateral pair and a smaller dorsolateral pair. The trunk or abdominal region consists of 5 segments,

the second of which bears a pair of small dorsolateral lobes, to which are attached the egg sacs. The egg sacs are composed of 8-10 rows each containing about 25 eggs. The sacs are straight and usually extend posteriorly no further than the end of the large anal laminae. Measurements. The following figures are based on the maximum and minimum measurements of 20 specimens. Total length, 4.65 mm to 6.60 mm. Head width, 0.60 mm to 0.90 mm. Cephalothorax, 3.15 mm to 4.25 mm long, and 1.25 mm to 2.00 mm wide. Trunk, 1.50 mm to 2.30 mm long and 0.40 mm to 0.70 mm wide. Egg sacs 2.3 mm long, and 0.70 mm wide.

Incidence of Parasitism

A total of 1,598 parasitic copepods were recovered from 100 fish during this study and the bulk of this total consists of but 3 species; Chondracanthus sp., Chondracanthus pinguis, and an unidentified form probably Clavelloopsis sp. These 3 species of parasites were present in over 80% of the fish posted and can be considered as the only abundant parasitic copepods of Sebastodes alutus. Of the fish examined, 53% carried Colobomatus sp. and 36% had Clavella recta, so these 2 copepods are classed as common parasites of this host. Peniculus sp. is only an occasional parasite and Haemobaphes theragrae appears to be rare. The foregoing generalizations are based solely on the findings of this study.

Table 1. Incidence of parasitism in 100 long-jawed rockfish, Sebastodes alutus (Gilbert). Data included are: Total incidence of each species, largest number of individuals for any one fish, and per cent of infection for infection for each species.

Copepod	Total Incidence	Largest #/fish	% of Infection
<u>Chondracanthus</u> sp.	438	15	88
<u>Chondracanthus pinguis</u>	531	24	85
*	394	17	82
<u>Colobomatus</u> sp.	162	12	53
<u>Clavella recta</u>	64	5	36
<u>Peniculus</u> sp.	8	1	8
<u>Haemobaphes theragrae</u>	1	1	1

* Unidentified form, probably Clavellopsis sp.

DISCUSSION

On reviewing the individual parasitic copepods dealt with in this survey, it is noted that several of the forms appear to be new species. Although these copepods are discussed at some length in this thesis, a more detailed description will be prepared for publication at a later date, probably in collaboration with Dr. Paul L. Illg

of the University of Washington.

There appear to be several points of difference between my specimens and those referred to in the original descriptions. These are mainly differences in anatomical measurements which may be attributed to any or all of the following reasons: (1) differences in method of making measurements, (2) differences in methods of preservation, (3) variations of host within its range resulting in size variations of parasite, and (4) differences in hosts. It is sometimes difficult to determine what part of the animal is included in which measurement as reported in the original descriptions, so I have included in the appendix, where needed, outline drawings which show the location of my various measurements. Of less importance are some morphological differences. These again might be due to difference in methods of preservation. However, I am of the opinion that the differences are the result of the original description having been made from too few specimens, thus not accounting for a normal amount of variation.

On the basis of the findings of this study, the parasitic copepods herein discussed are grouped as to their relative abundance.

Abundant: Chondracanthus pinguis, Chondracanthus sp.,
Unidentified form probably Clavelloopsis sp.

Common: Colobomatus sp., Clavella recta

Occasional: Peniculus sp.

Rare: Haemobaphes theragrae

The information presented in Table 1 probably gives quite an accurate picture of parasitism of the long-jawed rockfish by copepods for the area sampled: however, it must be kept in mind that this area comprises but a small portion of the range of Sebastes alutus which extends from Southern California to Southeastern Alaska. Therefore it is possible and quite probable that a comprehensive study throughout the entire range, as mentioned above, would result in quite a different set of figures, not to mention the distinct possibility that it might bolster the number of species by one or more additional forms. Because the fish were obtained from the dock several hours after being caught, there is the possibility that some copepods were lost in handling. Also the extreme pressure change involved in bringing the fish up from the bottom of the sea might cause some types of copepods to drop off. This may be the reason that none of the "sea louse" types belonging to the Caligus - Lepiophtheirus complex were found.

SUMMARY AND CONCLUSION

1. A survey of parasitism by copepods in 100 long-jawed rockfish, Sebastes alutus (Gilbert), was completed. The recoveries were made from fish taken in marine waters off

Lincoln and Tillamook counties.

2. Seven species of parasitic copepods were collected and identified as far as possible. All of them represent new host records and extensions of range.

Caligoida

Haemobaphes theragrae Yamaguti

Peniculus sp.

Lernaeopodoida

Chondracanthus pinguis Wilson

Chondracanthus sp.

Clavella recta Wilson

Unidentified species probably Clavelloopsis sp.

Colobomatus sp.

3. Preliminary descriptions for 4 probable new species were given: Chondracanthus sp., Peniculus sp., Colobomatus sp., and an unidentified form probably Clavelloopsis sp.

4. Original figures were presented to illustrate all parasitic forms dealt with in this paper.

5. Table 1 included total incidence of parasitic copepods, largest number of each species in one fish, and per cent of incidence.

6. A description supplementing that of the original author regarding the presence of horns on the cephalothorax was presented for the genus Peniculus.

7. The parasitic copepods were categorized as to whether they were abundant, common, occasional, or rare.
8. A more comprehensive study throughout the entire range of the host fish might present a different set of statistics regarding total incidence and per cent of infection as well as possibly increasing the number of species of copepods found to be parasitic on the long-jawed rockfish.
9. These descriptions are tentative and do not constitute official new species.

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PLATE I.

Parasitic copepods from the long-jawed rockfish
Sebastodes alutus (Gilbert).

- Figure 1. Female Chondracanthus pinguis Wilson from the gill chamber.
- Figure 2. Male Chondracanthus pinguis Wilson from the genital segment of the female.
- Figure 3. Female Chondracanthus sp. from the nasal passages.
- Figure 4. Male Chondracanthus sp. from the genital segment of the female.

APPENDIX

ADVANCE BOND

PLATE I

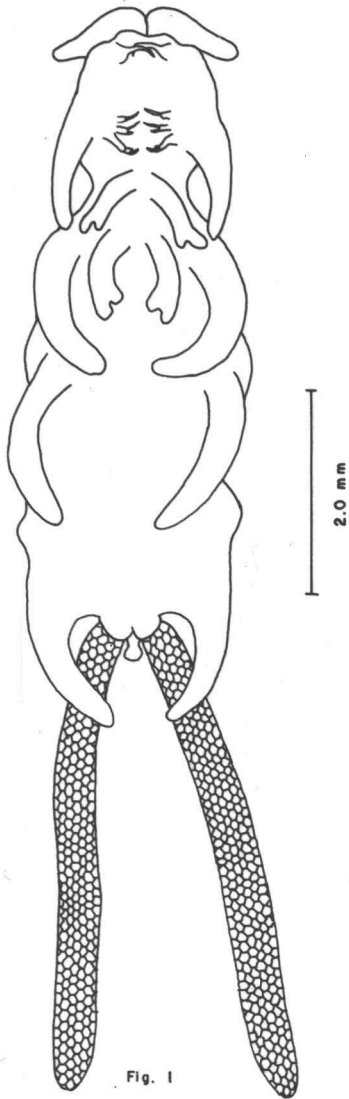


Fig. 1

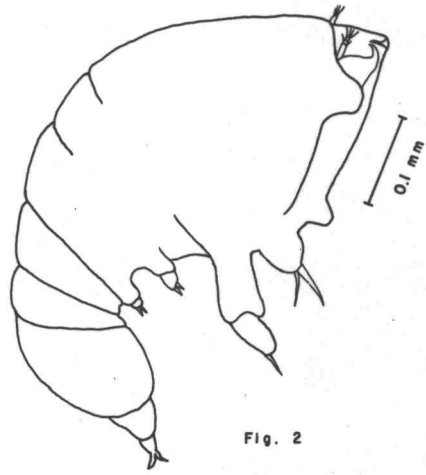


Fig. 2



Fig. 4

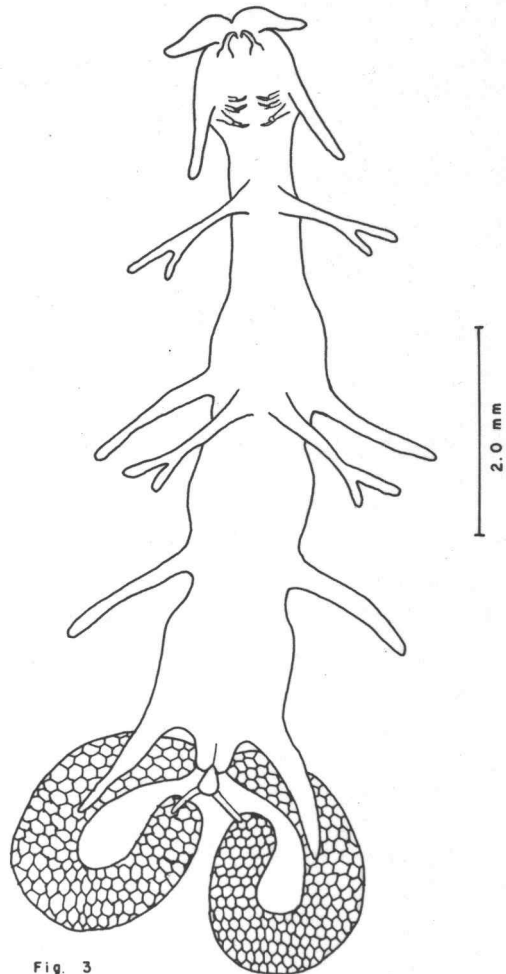


Fig. 3

PLATE II.

Parasitic copepods from the long-jawed rockfish
Sebastodes alutus (Gilbert).

- Figure 5. Female Peniculus sp from the fins and the body surface.
- Figure 6. Female Haemobaphes theragrae Yamaguti from the gill arches.
- Figure 7. Female Colobomatus sp. from the lateral line canals near the eyes.
- Figure 8. Female Clavella recta Wilson from the outer margins of the fins.
- Figure 9. Male of an unidentified form probably Clavelloopsis sp. from various points of attachment on the female.
- Figure 10. Female of an unidentified form probably Clavelloopsis sp. from the gill rakers and the buccal cavity.

PLATE II

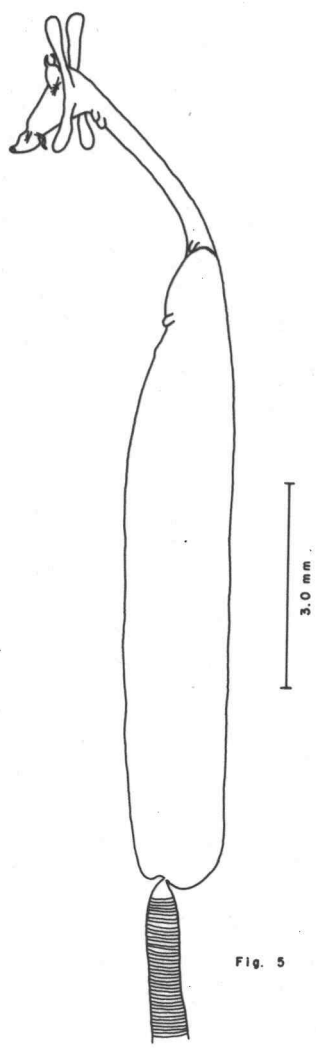


Fig. 5

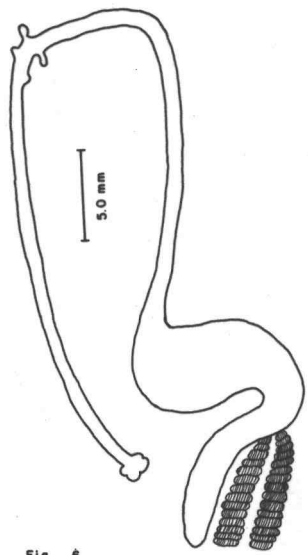


Fig. 6

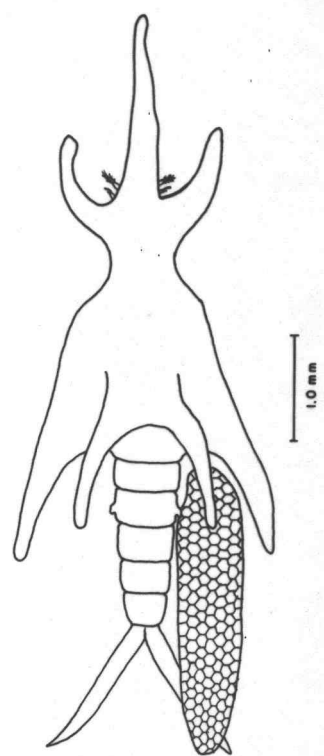


Fig. 7

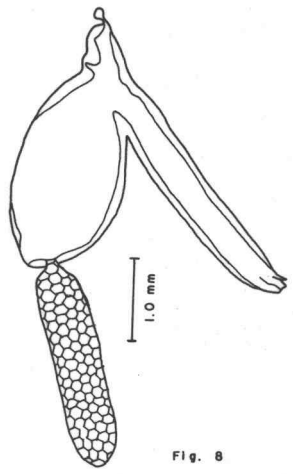


Fig. 8

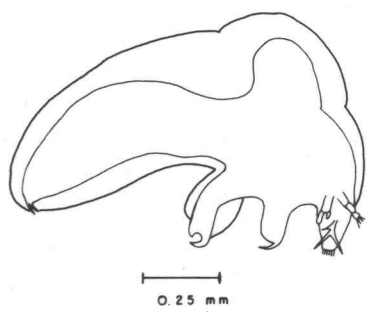


Fig. 9

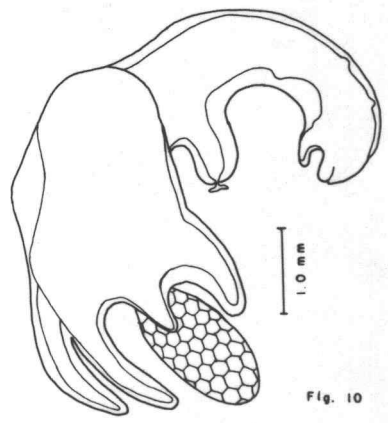


Fig. 10

PLATE III.

Parasitic copepods from the long-jawed rockfish, Sebastodes alutus (Gilbert, showing points at which measurements were taken.

- Figure 11. Female of an unidentified form probably Clavelloopsis sp. A, head length. B, neck length. C, body length.
- Figure 12. Female Chondracanthus sp. A, cephalothorax length. B, cephalothorax width. C, body length. D, body width.
- Figure 13. Female Colobomatus sp. A, cephalothorax length. B, head width. C, thorax width. D, body length. E, body width.
- Figure 14. Male of an unidentified form probably Clavelloopsis sp. A, cephalothorax length. B, cephalothorax dorsoventral measurement. C, Body length. D, Body dorsoventral measurement.
- Figure 15. Male Chondracanthus sp. A, cephalothorax length. B, cephalothorax dorsoventral measurement. C, body length. D, genital segment dorwoventral measurement.

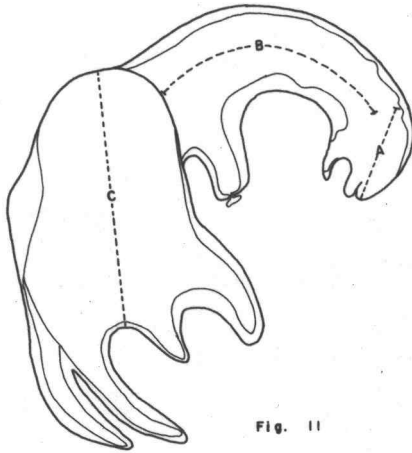


Fig. 11

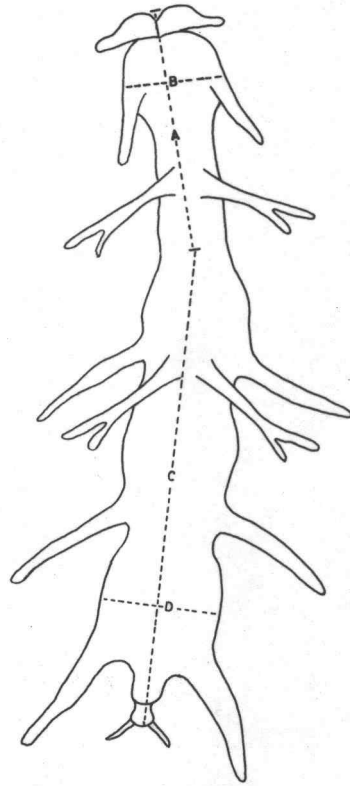


Fig. 12

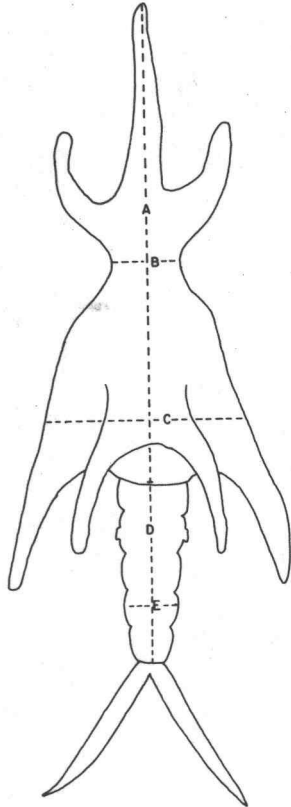


Fig. 13

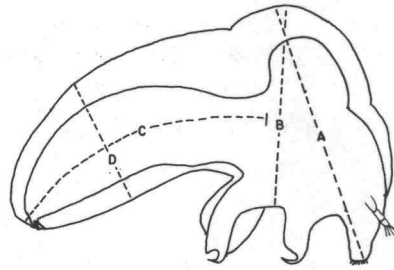


Fig. 14

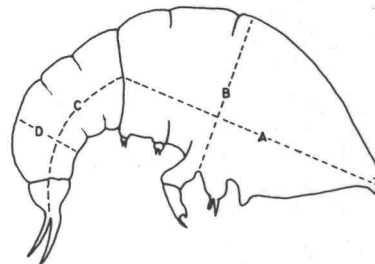


Fig. 15