

head is truncate. The creature is delicately coloured during life. The head is margined with white, has a submarginal black line and a white spot alongside the black eyes. The upper surface of the thorax and abdomen is closely covered with brown markings, so that the ground colour appears to be pale brown. A pair of dark stripes extend down the mid-line of the body from the front of the head to the fifth abdominal segment. On each

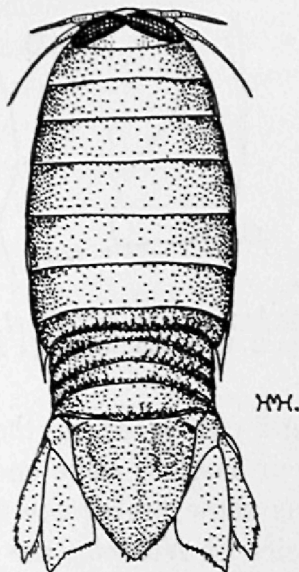


FIG. 249.—*Aega nodosa* (x 3½).

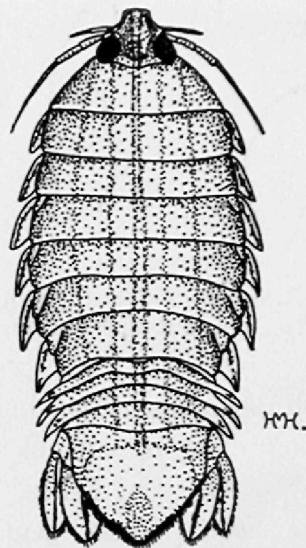


FIG. 250 —*Rocinela sila* (x 2½).

side of these markings are two other longitudinal dark stripes. The legs and antennae are almost transparent, with a few dark dots. The coxal plates and basal half of the uropods are orange. The telson has black postero-lateral margins, and each branch of the uropods has a median black streak on the hinder half. Length: 23.5 mm., or $1\frac{5}{16}$ in. (S.A.M.)

Family CYMOTHOIDAE (Fish-lice).

Both pairs of antennae are always of comparatively small size and are not clearly divided into peduncle and flagellum as in other families of the suborder. Owing to their mode of life the mature parasites are often twisted and distorted.

Parasites in general are usually viewed with disgust, and the so-called "degenerate" Isopods of this family are not, as a rule, regarded with much favour; the bloated and misshapen form of some species and their grasping movements when taken from their hosts may to some extent explain the antipathy. Nevertheless, an examination of the creatures offers no more unpleasant feature than does the study of butterflies. The legs and mouth parts of these parasites are very nicely modified in accordance with their habit of clinging to fishes and other animals, and sucking the "juices" therefrom. In almost all species the legs are provided with strong, sharp hooks for piercing and clinging to the skin (fig. 251, a). The mouth parts

are much as in the preceding family, but the mandibles have the first one or two joints of the palp inflated and the palp of the maxilliped is always composed of two joints (fig. 251, b).

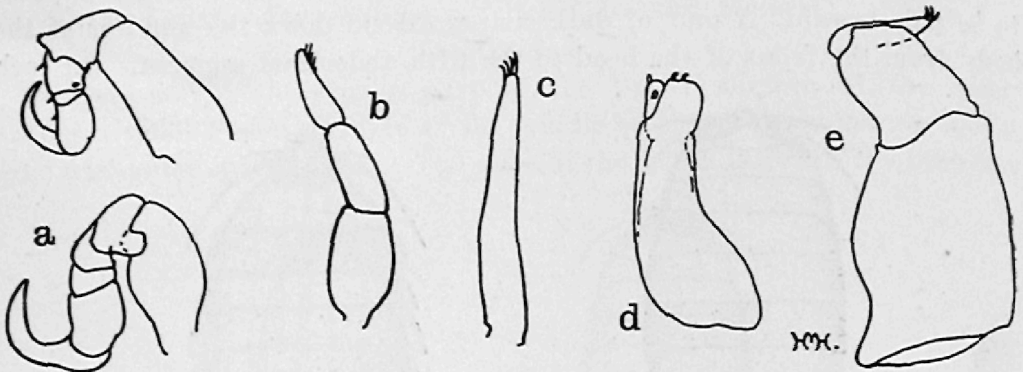


FIG. 251.—*Nerocila laticauda*; a, first and seventh legs (x 7); b, palp of mandible (x 27); c and d, first and second maxillae (x 27); e, maxilliped (x 27).

These fish-parasites lodge beneath the gill-covers or in the mouths of their hosts, or cling to various parts of their bodies; some species burrow into the body-cavities of fishes. Some forms show preference for a certain part of the host. Thus, Australian species of *Nerocila* are often found clinging to the fins (fig. 256), the Garfish-louse is found beneath the

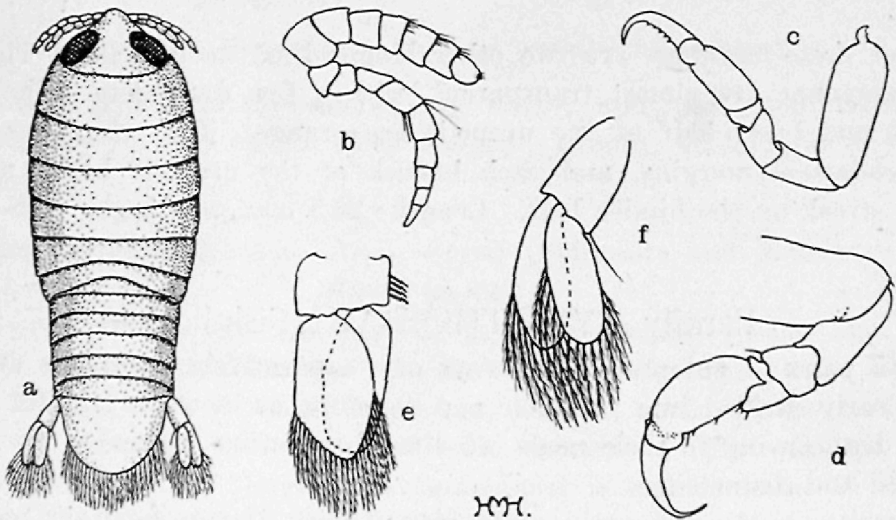


FIG. 252.—Juvenile fish-louse (*Codonophylus imbricatus*); a, dorsal view (x 13); b, antennae (x 39); c and d, first and sixth legs (x 29); e, second pleopod (x 39); f, uropod (x 39).

gill-covers of our Garfish, the Tongue-biter occurs under the gill-cover or in the mouths of fairly large fishes, and the Leatherjacket-louse burrows into the body-cavity of leatherjackets.

Reproduction and Development.—In their young stages Cymothoids are free-swimming, and then differ in some important characters from the adults. These differences are as follows:—The form is bilaterally sym-

metrical, the head is relatively large, and the eyes (which in the adult are small and sometimes entirely absent) are large and conspicuous. The claw, or dactylus, of the anterior legs is serrated on the inner edge, the swimming-fan (telson and uropods) is furnished with natatory hairs, and the pleopods are fringed with hairs (fig. 252).

In some species of the Cymothoidae the sexes are separate, but in certain genera protandrous hermaphroditism occurs; that is to say, each individual at first functions as a male and then later develops a brood-pouch, assumes other female characters, and produces a family; this condition obtains in at least one of the genera (*Nerocila*) represented in our waters, and it is extremely probable that the same thing happens in the Leatherjacket-louse (*Ourozeukes*) also. As in other Isopods, the second pleopod of the male bears a sexual appendage (fig. 233, e), and in some of the species in which protandrous hermaphroditism occurs the male characters do not always entirely disappear when an individual passes into the female phase.



FIG. 253.—Maxilliped of egg-bearing female of *Livoneca raynaudii* (x $6\frac{1}{2}$).

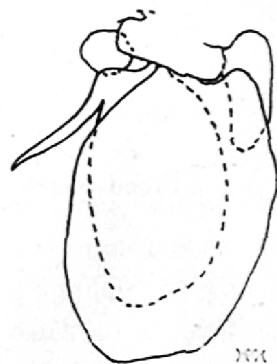


FIG. 254.—Second pleopod of egg-bearing female of *Nerocila laticauda*, showing persistent male appendage (x 5).

Thus it may happen that a female having a well-developed brood-pouch crammed with eggs or young still retains the male appendage in a thin and abbreviated form. The examination of Australian species of *Nerocila* indicated that this appendage is long in young male individuals, but does not increase in relative size as the animals grow; nevertheless, the reduced organ commonly persists in old females (fig. 254).

The brood-pouch is large, and accommodates a tremendous number of eggs, the egg-mass being sometimes considerably larger in bulk than the body of the mother, as shown in fig. 255, which illustrates a fish-louse taken off the east coast of Australia. As previously mentioned, in the Cymothoids, and in certain other Isopoda, the maxilliped of females bearing eggs or young is much expanded (fig. 253), and is used to fan a current of water through the marsupium.

An occurrence which throws a little additional light on the habits of the juveniles was recently observed at Long Bay, in New South Wales. Hundreds of young examples of a Cymothoid, comprising individuals of

several different stages, were observed attacking a shoal of surf-fishes (*Iso rothophilus*), a species which attains to only an inch or two in length. Many of the fishes were disabled by the attacks of the actively swimming little fish-lice, which evidently had no intention of utilising them as permanent hosts. It would be interesting to learn whether each Cymothoid species adopts a wholly sedentary existence at some definite stage of its life-cycle, or whether it attaches itself to different fishes for longer and longer periods until at last it becomes so modified that it is no longer able to swim. An interesting feature in connection with the above-mentioned happening at Long Bay was that numbers of Copepod fish-parasites

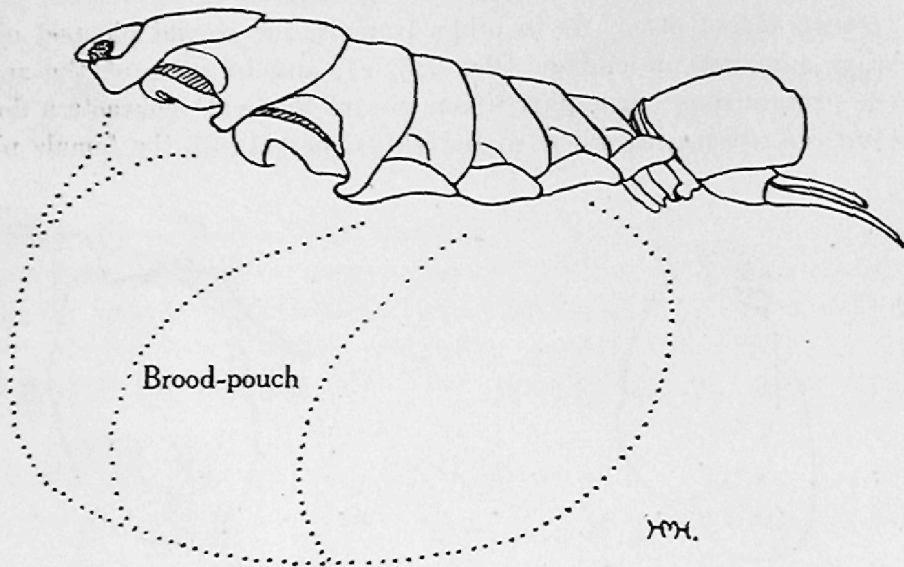


Fig. 255.—Egg-bearing female of *Isona renardi*, showing the great size of the brood-pouch; the legs are removed (x 3).

(*Caligus*) accompanied the Cymothoids and were also feeding upon the surf-fishes. This Copepod is free-swimming in the adult, but not in the young, stages, and the examples attacking the surf-fishes were all mature.

Representatives of five genera occur in South Australian seas.

- a. Abdomen composed of six distinct segments, and outer branches of first pair of pleopods soft, not curved over sides of abdomen.
- b. Head not immersed in (partly surrounded by) first thoracic segment, and with the hinder margin trilobate. Front edge of first thoracic segment trisinate *Nerocila*.
- bb. Head more or less immersed in first thoracic segment, with the hinder margin not trilobate. Front edge of first thoracic segment not trisinate.
- c. Antennae rather compressed, not at all dilated, the bases of the first pair widely separated.

- d. Abdomen rarely strongly immersed in thorax. Upper lip not prominently projecting. Basis of hinder legs with a more or less prominent ridge *Livoneca*.
- dd. Abdomen usually strongly immersed in thorax. Upper lip prominently projecting. Basis of hinder legs without a prominent ridge *Irona*.
- cc. Antennae much dilated, the first pair touching at base *Codonophilus*.
- aa. Abdominal segments fused together, and outer branches of first pair of pleopods hard and curved over sides of abdomen in the adult *Ourozeuktes*.

As only one species of each of the above genera has been found in our waters, further generic description is unnecessary here.

NEROCILA (Leach).

As mentioned above Australian species of this genus are often found attached to the fins of fishes (fig. 256).

Striped Fish-louse. *Nerocila laticauda* (Schioedte and Meinert). (with a wide tail).

The head of the adults is somewhat truncate in front, and the eyes are tiny. The body is usually wide, often with the lateral angles of the segments expanded and produced backwards, as shown in fig. 257 (a and b); the angles of the last segment are always produced back to at least the level

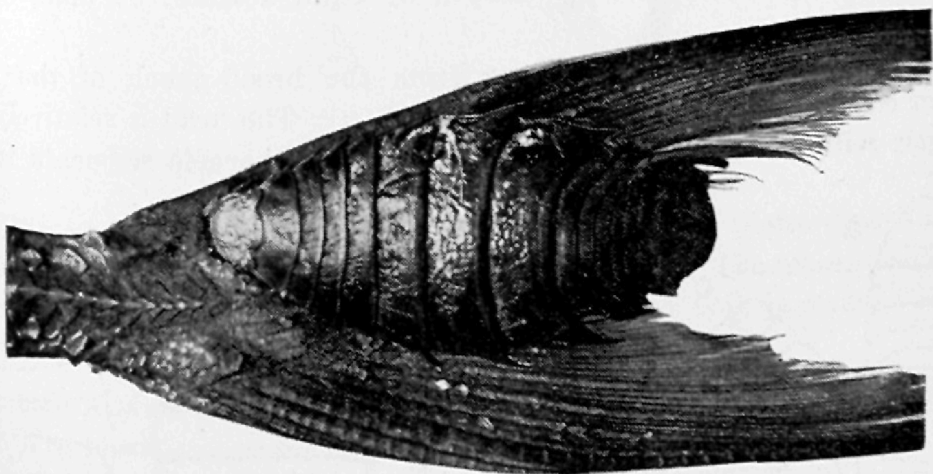


FIG. 256.—*Nerocila macleayi* clinging to tail of *Temnodon saltator*.

of the hinder angles of the third abdominal segment. In examples which have the lateral margins of all the thoracic segments expanded, the coxal plates are all hidden in dorsal view; the apices of the last pair of side-plates do not reach beyond the middle of the length of the lateral margin of the

seventh thoracic segment. The branches of the uropods are, as a rule, sub-oval, but occasionally the outer branch is rather acutely rounded at the apex; the uropods rarely reach beyond the level of the hinder margin of the telson. The upper surface of the body is dark olivaceous, with a diffused

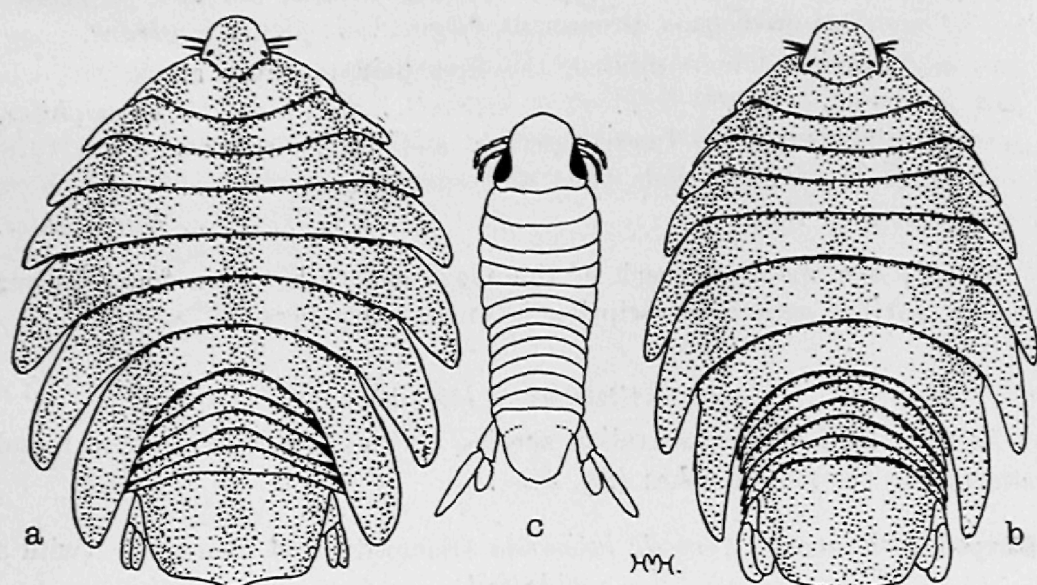


FIG. 257.—*Nerocila laticauda*; a, a large male (x 3); b, an egg-bearing female (x 2); c, a juvenile from the brood-pouch (x 14).

whitish stripe on each side of the mid-line. The underside is whitish, with the outer face of each coxal plate, and the outer half of the exopod of the first pair of pleopods, sooty. Length of adult female: 32 mm., or 1¼ in. (S.A.M.)

As in other Cymothoids, young from the brood-pouch of the mother differ considerably from the adult (fig. 257, c). The head is relatively much larger, with conspicuous eyes, and none of the thoracic segments is at all

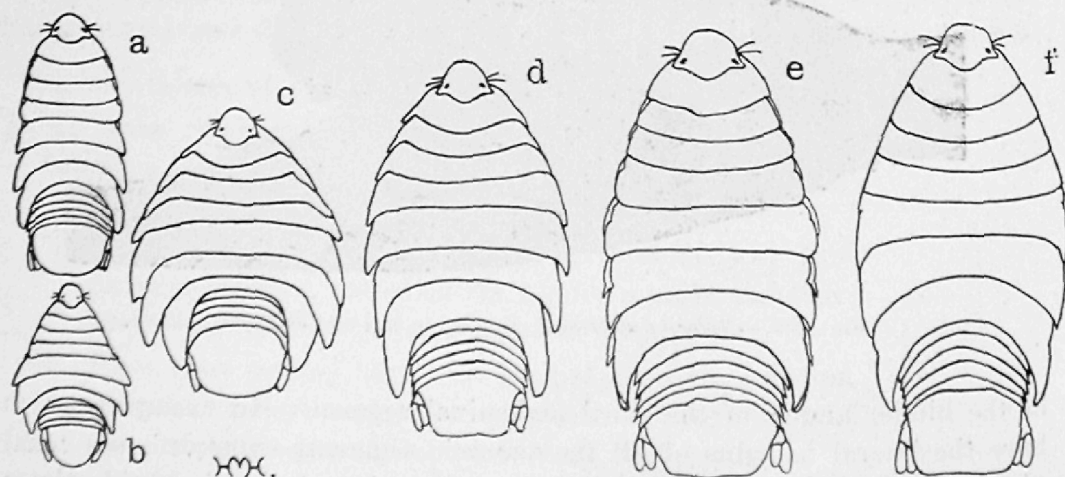


FIG. 258.—Variation in form of *Nerocila laticauda*; d, e, and f, are outlines of egg-bearing females (x 2).

expanded. The uropods are of interest in that the outer branch is long and lanceolate, not suboval, as in mature examples. As indicated above, there is a good deal of variation in the form of the adult owing to the lateral parts of the thoracic somites being less expanded in some specimens than in others (fig. 258). The species occurs off western, southern, and eastern Australia.

LIVONECA (Leach).

Broad Fish-louse. *Livoneca raynaudii* (M. Edwards). (personal name).

In adult females the body is broadly oval in shape. Some specimens are quite symmetrical; others are curved slightly to the right or left. The small head is a little concave on the upper surface, and suddenly narrows near its

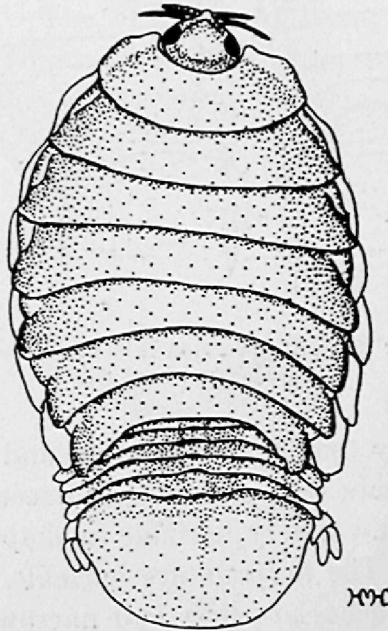


FIG. 259.—*Livoneca raynaudii*, egg-bearing female (x $1\frac{2}{3}$).

apex; the eyes are distinct but rather small. The coxal plates do not reach beyond the hinder angles of their respective segments. The telsonic segment is semi-circular in shape, and the short uropods have both branches suboval and do not reach much beyond the middle of its length.

The male attains to only half the size of the female, and is of more slender build. The telsonic segment is relatively a little longer and more triangular, and the uropods sometimes reach to the level of the hinder margin of the telson. The colour of both sexes is yellow or pale horn. Length of adult female: 38 mm., or $1\frac{1}{2}$ in. (S.A.M.)

A more widely distributed species than the last, ranging from South Africa to Japan, Australia, and New Zealand. As shown by the figures, in this and our remaining species of the family the hinder margin of the head is not trisinate as in the preceding form.

IRONA (Schioedte and Meinert).

Garfish-louse. *Irona melanosticta* (Schioedte and Meinert). (with black dots).

The body of the female is wide, somewhat oval in shape, and usually decidedly twisted to one side or the other. The head is partly immersed in the first thoracic segment, and the eyes are distinct. The coxal plates are wide, rather thin, and nearly flat; the hinder and lateral parts of each

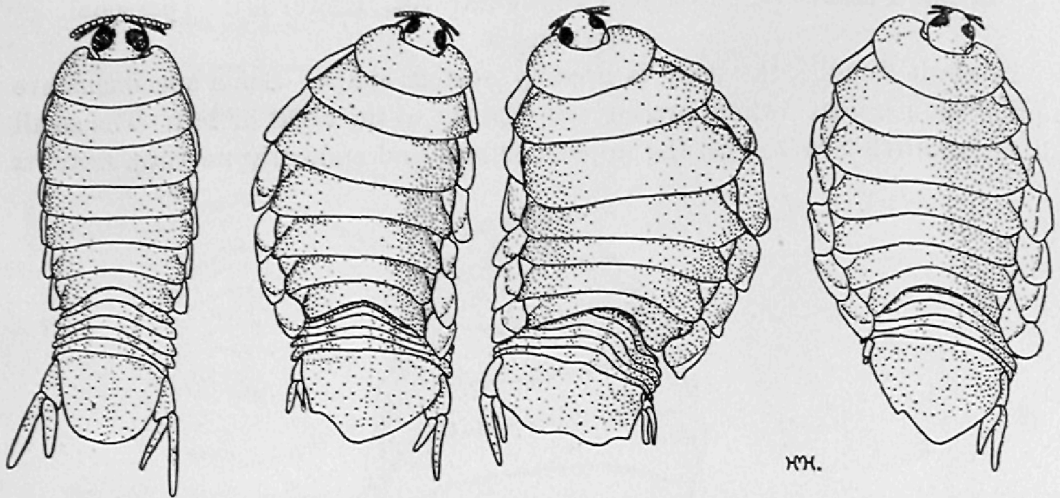


FIG. 260.—*Irona melanosticta*; the left specimen is a male, the other three are egg-bearing females (x about 4).

are softer and more fleshy than the remainder, and in dried specimens this portion shrinks and becomes thin and membranaceous. The hinder part of the telson is also fleshy, and is very variable in shape, but the stronger basal portion is semi-circular. The uropods are variable, and usually the pair is not symmetrical; the branches are thin and narrow.

In the male the body is more slender and more symmetrical, and the head is relatively longer than in the female. The sexes are often taken together on the same fish. The colour of both is white, or pale brown. Length of adult female: 18 mm., or $1\frac{1}{16}$ in. (S.A.M.)

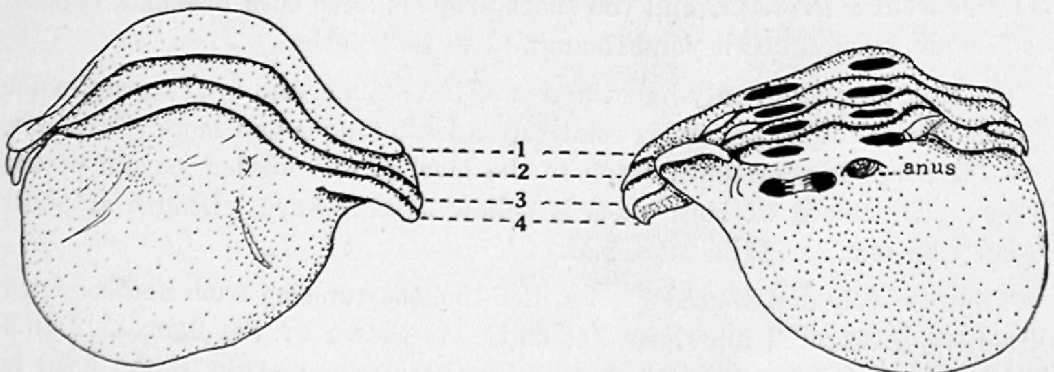


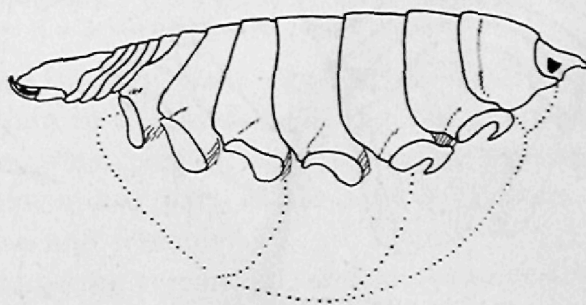
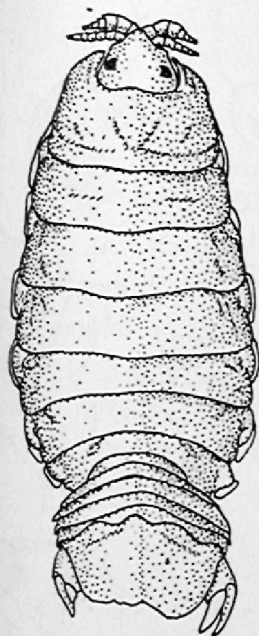
FIG. 261.—Dorsal and ventral views of abnormal abdomen of adult female *Irona melanosticta*; pleopods removed (x 5).

In South Australia this parasite is found beneath the gill-covers of our common Garfish (*Hyporhamphus intermedius*); in Japan and South Africa it parasitizes the related "Long-toms." The distortion of the female is due to the cramped position in the gill-cavity of the host. In some cases the distortion is extreme. In one much-twisted female the fourth and fifth abdominal segments have become fused together, and with the telsonic somite, so that only four separate abdominal segments are present, instead of the normal six. Uropods are wholly absent in this individual (fig. 261). The egg-pouch is of very large size in the species of *Irona* (fig. 255).

CODONOPHILUS (Haswell).

Tongue-biter. *Codonophilus imbricatus* (Fabricius). (scaled).

In adult females the body is usually somewhat distorted, rather elongate, and roughly egg-shaped. The head is subtriangular, with the margins rounded, sinuate or emarginate; the eyes, though small, are usually distinctly defined. The front angles of the first thoracic segment are forwardly



KH.

FIG. 262.—*Codonophilus imbricatus*, dorsal and side view of egg-bearing female (legs not shown); the dotted line indicates the brood-pouch ($\times 1\frac{1}{2}$).

produced and partly embrace the head; the apices of these produced parts may be wide and rounded, or tapering and acute. The branches of the uropods are narrow, scythe-shaped, and subequal in length, but these appendages are often subject to some distortion and abbreviation. Length of adult female: 57 mm., or $2\frac{1}{4}$ in. (S.A.M.)

Egg-bearing females range from $\frac{5}{8}$ in. to over 2 in. in length. This large species occurs in the Indian Ocean, Java, New Zealand, Australia, and South Africa. In our waters it has been taken clinging to the tongue, or lodged under the gill-cover, of the Yellow-tail, Schnapper, Red Gurnard,

Blackfish, Trevally, and Mullet. Doubtless further investigation will show that it occurs on other fishes also; unfortunately, when securing fish-parasites, collectors often fail to record the name of the host. One of the young stages of the Tongue-biter is illustrated in fig. 252.

OUROZEUKTES (M. Edwards).

Leatherjacket-louse. *Ourozeuktes owenii* (M. Edwards). (personal name).

The adult female has a bloated, usually egg-shaped body. The head is rather small, with distinct eyes. The abdominal segments, as mentioned in the generic key, are all fused together, and the outer branches of the first pair of pleopods are curved over the sides of the pleon. The colour is white, sometimes with a smoky median stripe on the body and with the telson black.

The small and symmetrical males are of entirely different form (fig. 265, a), and have all the segments of the body distinctly separated.

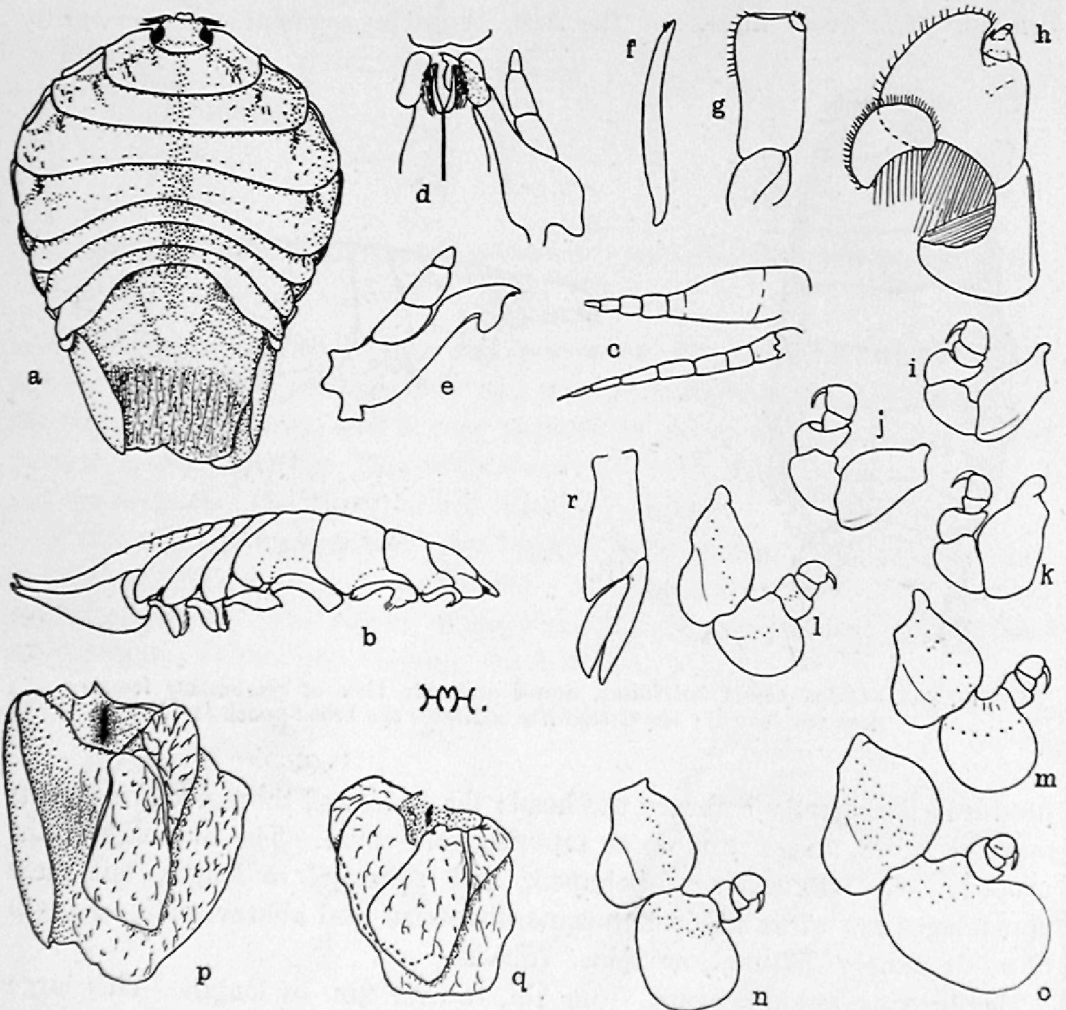


FIG. 263.—*Ourozeuktes owenii*; a and b, dorsal and side views of egg-bearing female ($\times 1\frac{1}{2}$); c, antennae ($\times 8$); d, mandible of left side, labium and margin of labrum ($\times 8$); e, mandible ($\times 8$); f and g, first and second maxillae ($\times 8$); h, maxilliped ($\times 7$); i to o, first to seventh legs ($\times 2$); p and q, ventral view of first and third pleopods ($\times 2$); r, uropod ($\times 3\frac{1}{2}$).