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SOME DIGENETIC TREMATODES, INCLUDING EIGHT  
NEW SPECIES, FROM MARINE FISHES OF  
LA JOLLA, CALIF.<sup>1</sup>

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IN April and May, 1940, one of us (Van Cleave) carried on a preliminary investigation of the worm parasites of marine fishes of southern California. The Scripps Institution of Oceanography, through its director, Dr. H. U. Sverdrup, very generously provided facilities, and Dr. Denis Fox extended privileges of his laboratory, while Percy Barnhart aided in the collection and identification of the fishes. In the vicinity of La Jolla approximately 200 individual fishes were examined, representing 34 species. Two papers have been published previously on the Acanthocephala encountered (Van Cleave, 1940, 1945), and another is in preparation. The present report is based wholly upon the digenetic trematodes recovered from 16 species of fishes, but in some instances the trematodes were either immature or so few as to render identification impossible. Several of the hosts from which no trematodes were taken were represented by one or a very few autopsies; consequently for these hosts the negative records are without significance. More extensive sampling would be needed before a faunal list approaching completeness could be presented.

<sup>1</sup> Studies from the Department of Zoology, University of Nebraska, No. 249; Studies from the Department of Zoology, University of Illinois; and Contributions from the Scripps Institute of Oceanography, new series, No. 482.

The writers are especially indebted to Mrs. Jean A. Ross for staining and mounting the specimens, to Mrs. Katharine Hill Paul for most of the drawings that illustrate this report, and to Dr. Carl L. Hubbs for checking the names of the fish hosts.

All hosts are from the vicinity of La Jolla in southern California unless other localities are cited. All the croakers and corbinas (family Sciaenidae) were taken by line fishing from the Scripps Laboratory pier at La Jolla. Most of the other fishes were collected by seining in shallow waters and tide pools or were obtained from commercial fishermen.

In this study 17 species of digenetic trematodes are recognized from marine fishes, of which 8 are regarded as previously undescribed. In the collections available for study there are unsatisfactory representatives of two additional species, but the material is not adequate to serve as the basis for describing these as new species. One is a species of the genus *Phyllodistomum* (family Gorgoderidae) from *Fundulus parvipinnis parvipinnis* Girard, and the other is an undescribed species of the genus *Lepidapedon* (family Lepocreadiidae) from *Mycteroperca pardalis* Gilbert, from Mazatlán, Gulf of California. The former is represented by a single individual and the latter by two broken specimens, both of which lack the anterior extremity including the oral sucker. We prefer to withhold descriptions of these in the hope that some other worker may discover more adequate material on which to base the species.

For each new species described in this report a holotype has been designated and is deposited in the United States National Museum as a stained whole mount in clarite. All additional specimens of the new species are regarded as paratypes, and as far as available these are deposited in our own collections at Lincoln, Nebr., and Urbana, Ill., respectively, and in the United States National Museum.

A total of nine families of digenetic trematodes are represented in the collection under consideration, of which the family Opecoelidae had the widest representation of genera and species as well as of individual specimens. In the text descriptions are arranged by families of the trematodes. A list of fish hosts, with the trematodes encountered in each, is given on pages 336-337.

Previously there have been few studies of trematodes of fishes from the Pacific coast of this continent. Chief of these are the publications of Lloyd, McFarlane, Noble, Annereaux, and Park, while Manter (1940) has described a few species from the Mexican coast. The trematode fauna of southern California has been but little known. Sleggs (1927) reported *Otodistomum cestoides*

(= *Distomum veliporum* of Sleggs) from *Raja bituberculata*<sup>2</sup> at La Jolla, and a hemiurid, which he called *Distomum appendiculatum*, from *Paralichthys californicus*, presumably also from La Jolla. This latter species is too incompletely described to permit of its identification. In the present study an immature hemiurid from the same host could not be identified as to genus.

## Order GASTEROSTOMATA

### Family BUCEPHALIDAE

#### Genus BUCEPHALOPSIS Baer, 1855

#### BUCEPHALOPSIS LABIATUS, new species

#### PLATE 12, FIGURES 1, 2

*Description* (measurements based on nine specimens).—Small, ovoid gasterostomes, 0.635 to 0.745 mm. long by 0.234 to 0.328 mm. wide, widest near anterior end. Anterior sucker (as) 0.127 to 0.146 mm. in transverse diameter. Mouth posterior to midbody, usually about two-thirds body length from anterior end, with a conspicuous anterior oral lobe or lip (ol). Pharynx (ph) ovoid, wider than long, 0.071 to 0.080 mm. in transverse diameter; esophagus extending anteriorly, gradually widening to become the cecum (ic), which curves backward from near posterior edge of ovary so that the digestive system is inverted U-shaped, ending slightly anterior to level of the mouth. Testes (t) ovoid, diagonal; anterior testis approximately at midbody level and mostly anterior to mouth. Cirrus sac (cs) long and slender, almost uniform in width, extending anterior to mouth to midbody or beyond; 0.314 to 0.360 mm. long by 0.066 to 0.073 mm. wide; seminal vesicle an ovoid sac 0.076 to 0.078 mm. long by 0.046 to 0.070 mm. wide; atrial tube moderately long, 0.060 to 0.087 mm.; genital pore ventral, near posterior end of body. Ovary (ov) globular, immediately anterior to anterior testis; vitelline follicles (v) fused to form two irregular longitudinal masses at ovarian level, meeting near anterior end of ovary, diverging slightly posteriorly, usually seeming to be displaced toward one side of the body; vitelline duct from each mass extends posteriorly to meet near intertestis level and some distance posterior to ovary; uterus (ut) extends anteriorly near right edge of body from near union of yolk ducts, reaching to anterior sucker, extending posteriorly to right of ovary, a short metraterm leads to the genital atrium (ga). Uncollapsed and normal eggs 25 to 31 $\mu$  by 16 to 17 $\mu$ . Excretory pore terminal; excretory vesicle (ex) extending to near base of anterior sucker.

<sup>2</sup> Probably a lapsus calami for *Raja binoculata*.

*Host.*—*Paralichthys californicus* (Ayres), California halibut.

*Location.*—Intestine.

*Types.*—Holotypes and paratypes, U.S.N.M. Helm. Coll. No. 37142.

*Discussion.*—The name *labiatus* is from *labium*, lip, and refers to the preoral lip (ol, pl. 12, figs. 1, 2), which is not present in any other species in the genus. Uncommon features are the posterior location of the mouth, the reduced and contiguous vitellaria, the long excretory vesicle, the curved cecum, and the long cirrus sac. The species most similar to *B. labiatus* seems to be *B. karvei* Bhalerao, 1937, from *Belone* in the Indian Ocean. The two species agree in small body size, mouth posterior to midbody, and cirrus sac reaching anterior to midbody; but differ in that *B. karvei* has vitellaria in two widely separated groups, does not have a recurved cecum, lacks the preoral lip, and has smaller eggs. *B. magnacetabulum* Nagaty, 1937, from *Belone choram*, in the Red Sea, resembles and differs from *B. labiatus* in the same respects except that its cirrus sac is relatively shorter. It may be found that *B. karvei* and *B. magnacetabulum* are a single species.

The occurrence in Belonidae of species of trematodes apparently most similar to a species occurring in sinistral flat fishes (Bothidae) suggests the host distribution of the species of *Steganoderma* (Manter, 1947, p. 312). Neither the ecology nor the phylogeny of these families of fishes indicates any relationship that would be suggested by their trematode parasites.

## Order PROSOSTOMATA

### Family OPECOELIDAE

#### Genus OPECOELUS Ozaki, 1925

##### OPECOELUS ADSPHAERICUS, new species

#### PLATE 12, FIGURES 3-5

*Description* (based on about 60 specimens with measurements on 7 individuals selected for size range).—Body elongate, cylindrical, smooth, 1.336 to 4.004 mm. long by 0.167 to 0.409 mm. in greatest width. Oral sucker 0.084 to 0.146 in diameter; acetabulum 0.112 to 0.255 mm. in diameter. Sucker ratio 1:1.33 to 1.66. Acetabulum protuberant; with three pairs of short, rather inconspicuous, lobelike, simple papillae (ap, pl. 12, fig. 4), barely discernible when retracted. Often only lateral views of the suckers are presented; measurements of depths rather than transverse diameters give similar sucker ratio. Forebody 0.197 to 0.511 mm. or about one-fifth to one-eighth body length. Posttesticular

distance 0.380 to 1.219 mm. or about one-third to one-fourth body length and about twice length of forebody. Prepharynx short; pharynx 0.051 to 0.095 mm. long by 0.051 to 0.102 mm. wide; esophagus 0.119 to 0.153 mm. long or about  $1\frac{1}{2}$  times length of pharynx; intestinal bifurcation near anterior edge of acetabulum; ceca uniting and opening through a ventral anus (a, fig. 3) slightly anterior to posterior end of body.

Genital pore slightly to the left, opposite anterior half of esophagus, varying from near base of pharynx to about midesophageal level. Testes rounded to elongate, smooth, tandem, almost always separated by vitellaria (only one apparent exception); anterior testis about at midbody level. Cirrus sac (cs, fig. 5) elongate pyriform, 0.102 to 0.110 mm. long in medium-sized specimens, mostly anterior to intestinal bifurcation, containing a short cirrus (cir), a tubular prostatic vesicle, and a few inconspicuous gland cells (fig. 5) surrounding male tube immediately outside cirrus sac; seminal vesicle (sv) external, tubular, sinuous, extending a short distance posterior to acetabulum. Ovary indistinctly 3-lobed; seminal receptacle lacking; uterus preovarian; eggs 49 to 59 by 25 to  $38\mu$ ; uncollapsed eggs near ovary 49 to  $59\mu$  by 32 to  $38\mu$ ; collapsed eggs 51 to  $56\mu$  by 25 to  $32\mu$ . Anterior extent of vitelline follicles varying from base of cirrus sac to posterior edge of acetabulum; follicles almost always interrupted opposite one or both testes and usually opposite ovary, almost always confluent between testes and usually between ovary and anterior testis, filling post-testicular space. The vitelline follicles are unusually variable in this species. Excretory pore terminal; excretory vesicle extending to near ovary.

*Hosts.*—*Clinocottus analis australis* Hubbs, tide-pool woolly sculpin; *Girella nigricans* (Ayres), the common opaleye.

*Location.*—Intestine.

*Types.*—Holotype and paratype, U.S.N.M. Helm. Coll. No. 37143.

*Discussion.*—The following 12 species of *Opecoelus* have been named: *elongatus* Ozaki, 1925; *gonistii* Yamaguti, 1938; *inimici* Yamaguti, 1934; *lobatus* Ozaki, 1925; *mexicanus* Manter, 1940; *minor* Yamaguti, 1934; *mutu* Yamaguti, 1940; *ozakii* (Layman, 1930) Yamaguti, 1938; *quadratus* Ozaki, 1928; *sebastodis* Yamaguti, 1934; *sphaericus* Ozaki, 1925 (type species); *xenistii* Manter, 1940.

Of these species, three (*sphaericus*, *minor*, and *sebastodis*) are extremely similar. Yamaguti himself (1934) confused *O. minor* and *O. sebastodis*, finally deciding (1940) that the latter differed from the former only in shorter acetabular papillae and larger

eggs (54 to 65 $\mu$  by 30 to 38 $\mu$  for *minor* as compared with 63 to 75 $\mu$  by 40 to 45 $\mu$  for *sebastodis*). He expressed the view that egg measurements differed considerably between living and preserved specimens, yet most descriptions do not indicate whether measurements are made on living or fixed material. Also, it seems unusual that Yamaguti should claim considerably larger egg sizes for preserved material as compared with living. Actually, his living egg sizes for *O. minor* agree well with measurements on two preserved specimens of *O. minor* sent to one of us (Manter) by Yamaguti several years ago. Thus, *O. minor* can be distinguished from *O. sphaericus* by its longer acetabular papillae and smaller eggs (72 to 81 $\mu$  by 41 to 47 $\mu$  for *sphaericus*). The rather small specimens from a "black eel" reported as "probably" *O. sphaericus* by Yamaguti (1940 p. 73) would seem to be doubtfully that species. Their sucker ratio and egg sizes are much more like *O. minor*.

The corrections by Yamaguti mentioned above make *O. sebastodis* more like *O. sphaericus*. Egg sizes agree as well as body proportions. The only difference discernible from descriptions is one of body size (1.6 to 3.4 mm. length for *sebastodis*, 4.3 to 8.25 mm. for *sphaericus*). Until and unless further constant differences can be found, *O. sebastodis* should be considered a synonym of *O. sphaericus*.

*Opecoelus adsphaericus* differs from *O. minor* only in having short, inconspicuous acetabular papillae and a more anterior genital pore. Even when the acetabulum is greatly extended the papillae are usually very short in *O. adsphaericus*. In only 3 specimens of more than 60 did the papillae seem to be at maximum extension measuring up to 0.036 mm. in length. In two specimens of *O. minor* available for study, each of which was almost exactly the size of the above specimens of *O. adsphaericus*, the papillae measured 0.050 and 0.072 mm., while Yamaguti states they reach 0.118 mm. His figure shows them about as long as the depth of the acetabulum itself, a condition never approached in *O. adsphaericus*. Also, in *O. minor* the papillae have a thick outer layer of cuticula. The two species agree in shape and location of reproductive organs and in egg size. Sucker ratios are difficult to compare, as Yamaguti's original figures indicate a ratio of 1:1.8 for *O. minor* but his fig. 46 (1934), which he later (1940) claimed to be *O. minor* rather than *O. sebastodis* as labeled, shows a ratio of more than 1:2. We do not feel it possible to identify our specimens as *O. sphaericus* (= *O. sebastodis*) because of two differences: *O. adsphaericus* has a genital pore opposite the anterior half of the esophagus and an egg size of 49 to 59 $\mu$  by 26 to 24 $\mu$  (as compared with 72 to 81 $\mu$  by 44 to 47 $\mu$ ). Our specimens are consider-

ably smaller than the sizes originally given for *O. sphaericus* but not smaller than *O. Sebastodis*. Unfortunately, in *O. adsphaericus* the extent of the vitelline follicles is unreliable as a diagnostic aid, since both their anterior extent and their interruption opposite the testes varied in our material. However, in *O. adsphaericus* the follicles are almost always interrupted opposite the testes, whereas Ozaki states (1928, p. 12) that in *O. sphaericus* they are usually continuous but may be discontinuous opposite the gonads.

A series of 11 specimens of *Opecoelus* from the intestine of *Girella nigricans* (Ayres) showed some fairly consistent differences from those taken from *Clinocottus*. In individuals from *Girella* the pharynx was often somewhat larger, with reference to diameter of the oral sucker, than was typical for individuals from *Clinocottus*; likewise the eggs averaged larger, and the oral papillae were in some instances longer and more pointed. However, in some individuals from *Girella*, measurements of these details fell distinctly within the range established for the series from *Clinocottus*. Consequently it seems admissible to identify the specimens from *Girella* as *Opecoelus adsphaericus* and in so doing to recognize considerable individual variability within this species.

The name *adsphaericus* indicates the similarity of the species to *O. sphaericus*.

Related genera occur in the Atlantic, but as yet the genus *Opecoelus* is reported only from Japanese waters and from the American Pacific coast.

#### Genus PSEUDOPECOELUS von Wicklen, 1946

##### PSEUDOPECOELUS GIBBONSAE, new species

##### PLATE 12, FIGURES 6, 7

*Description* (based on two specimens).—Body (pl. 12, fig. 6) rather thick, unspined, 2.262 to 2.558 mm. in length, 0.643 to 0.780 mm. in thickness at acetabular level. Oral sucker (os) 0.179 to 0.195 mm. in length; 0.187 to 0.195 mm. in thickness. Acetabulum (ac) slightly protuberant, without papillae; 0.421 to 0.468 mm. in length; 0.382 to 0.429 mm. in depth. Ratio of sucker lengths, 1:2.35 to 2.4. Acetabulum 0.773 to 0.811 mm. or about one-third body length from anterior end. Prepharynx 0.055 to 0.086 mm. in length. Pharynx (ph) large, 0.163 to 0.179 mm. long by 0.179 to 0.195 mm. thick. Esophagus frequently longer than pharynx, 0.269 mm. long in the 2.558 mm. specimen, in which the pharynx was 0.179 mm. long. Ceca (ic) ending blindly near posterior end of body. Genital pore (gp) ventral, slightly to the left, opposite posterior fourth of pharynx; accessory suckers lacking. Testes (t) smooth, sub-spherical, tandem, contiguous, in midregion of hindbody; post-

testicular space 0.523 to 0.577 mm. Seminal vesicle (sv) a relatively narrow sinuous tube extending from near the genital pore posterior to acetabulum almost to ovary; cirrus very short; cirrus sac lacking; a few gland cells (pl. 12, fig. 7) in region of genital pore. Ovary globular, smooth, immediately pretesticular, slightly to the right; seminal receptacle lacking; sperm cells in uterus; Mehlis' gland very large and conspicuous; vitelline follicles (v) large, extending from a point about midway between pharynx and acetabulum continuously to posterior end of body, surrounding the ceca. Uterus preovarian; metraterm lacking; eggs 90 to  $92\mu$  by 36 to  $47\mu$ , when uncollapsed 90 to  $92\mu$  by 43 to  $47\mu$ . Excretory vesicle extending to posterior edge of ovary.

*Host*.—*Gibbonsia metzi* Hubbs, weed sawfish.

*Location*.—Intestine.

*Holotype*.—U.S.N.M. Helm. Coll. No. 37145.

*Discussion*.—The genus *Pseudopecoelus* contains the following species: *vulgaris* (Manter, 1934) Von Wicklen, 1946; *japonicus* (Yamaguti, 1938) Von Wicklen, 1946; *elongatus* (Yamaguti, 1938) Von Wicklen, 1946; *tortugae* Von Wicklen, 1946; *priacanthi* (MacCallum, 1916) Manter, 1947. *P. gibbonsiae* differs from all these in that its vitellaria extend anterior to the acetabulum. *P. vulgaris* and *P. japonicus* have a lobed ovary. *P. elongatus* has a more posterior genital pore and smaller eggs, and its vitellaria are interrupted opposite the gonads. *P. tortugae* has a more posterior genital pore, much longer hindbody and uterus, and smaller eggs. *P. priacanthi* has a different sucker ratio and much smaller eggs.

PSEUDOPECOELUS UMBRINAE, new species

PLATE 12, FIGURES 8, 9

*Description*.—This species has the generic characters of *Pseudopecoelus*, namely: smooth body; acetabulum without papillae; no accessory sucker; ceca ending blindly; no cirrus sac; short cirrus; and tubular seminal vesicle. Length 1.037 to 2.420 mm.; greatest width (near posterior end or at acetabular region) 0.460 to 0.873 mm. Body tapering from acetabular level to anterior end, broadly rounded posteriorly. Forebody 0.292 to 0.584 mm. in length or approximately one-fourth body length; a little greater or a little less than posttesticular space. Oral sucker 0.124 to 0.190 mm. in transverse diameter; acetabulum 0.219 to 0.365 mm. in transverse diameter, slightly wider than long, with transverse aperture. Sucker ratio 1:1.65 to 2. Acetabulum usually slightly



less than twice the diameter of oral sucker. Prepharynx short; pharynx 0.061 to 0.095 mm. in length by 0.075 to 0.124 mm. in width; length of esophagus one to two times length of pharynx; intestinal bifurcation a short distance anterior to acetabulum; ceca ending blindly a short distance anterior to posterior end of body.

Genital pore (gp, pl. 12, figs. 8, 9) muscular, slightly to left of midline at midpharyngeal level. Testes (t, pl. 12, fig. 8) large, tandem or slightly diagonal, close together, smooth or slightly irregular in outline. Posterior testis usually with a slightly indented outline. Cirrus (cir, fig. 9) very short; prostatic vesicle (pv) small and ovoid; seminal vesicle (sv) sinuous, somewhat more swollen posteriorly, extending dorsal to acetabulum to mid-acetabular level or to near posterior edge of acetabulum; cirrus sac lacking. Ovary 3- or 4-lobed (ov, fig. 8), partly to the right and partly anterior to anterior testis. Uterus beginning to left of ovary, mostly preovarian. Seminal receptacle and metraterm lacking. Vitelline follicles (v, fig. 8) large, extending from posterior end of esophagus to posterior end of body; lateral, dorsal, and ventral to ceca; anterior to acetabulum they are lateral and dorsal but only scantily dorsal to ceca; confluent posterior to testes; almost confluent anterior to acetabulum. Eggs 61 to 71 $\mu$  (rarely to 80 $\mu$ ) by 27 to 49 $\mu$ ; collapsed eggs 61 to 68 $\mu$  by 27 to 32 $\mu$ ; uncollapsed eggs near ovary and probably more nearly representing the size of living eggs, 68 to 71 $\mu$  by 42 to 49 $\mu$ . Excretory vesicle extending forward almost to ovary.

*Host.*—*Umbrina roncador* Jordan and Gilbert, yellowfin croaker.

*Location.*—Intestine.

*Types.*—Holotype and paratype, U.S.N.M. Helm. Coll. No. 37146.

*Discussion.*—*P. umbrinae* differs from all species in the genus, except *P. gibbonsiae*, in that the vitellaria extend anterior to the acetabulum. It is the only species in which the seminal vesicle does not extend posterior to the acetabulum. The acetabulum is relatively larger than in *P. japonicus*, *P. elongatus*, or *P. tortugae*, and relatively smaller than in *P. vulgaris*. It differs from *P. gibbonsiae* in its lobed ovary, smaller pharynx, more flattened body, and much smaller eggs.

#### Genus HELICOMETRINA Linton, 1910

HELICOMETRINA ELONGATA Noble and Park, 1937

#### PLATE 13, FIGURE 10

*Hosts.*—*Clinocottus analis australis* Hubbs,<sup>3</sup> tide-pool woolly sculpin; *Gibbonsia elegans* (Cooper),<sup>3</sup> ocellated sawfish; *Gibbonsia metzi* Hubbs,<sup>3</sup> weed sawfish.

<sup>3</sup> New host record.

*Location.*—Intestine.

*Discussion.*—The previously recorded host for this species is *Sicyogaster maeandrica* (= *Caularchus maeandricus*), Bodega Bay, Calif.

This species is distinguished from *H. nimia* in that the vitelline follicles (v, pl. 13, fig. 10) are interrupted near the acetabulum, the genital pore is anterior to the intestinal bifurcation, and the ovary (ov) has four rather than three lobes. These distinctions held for all of about 37 specimens from *Gibbonsia* and almost all of 20 specimens from *Clinocottus*, although rarely the vitellaria were continuous on one side. Three specimens from *Clinocottus* confuse the picture somewhat. These have continuous vitellaria, a genital pore posterior to the bifurcation, and an ovary either with four lobes or with lobes too indistinct to count. Perhaps these specimens are *H. nimia*, which is already known to have a wide host and geographical distribution and has been reported from the Pacific (Galápagos Islands). However, numerous specimens of *H. nimia* from both Tortugas, Fla., and the Galápagos Islands agree in that the three or four primary lobes of the ovary are secondarily lobed and the testes are not rounded as in *H. elongata* but wider than long and irregular in outline, sometimes almost lobed. For the present it seems best to consider the round testes and the 4-lobed ovary as characters distinguishing *H. elongata* from *H. nimia*. However, a conspicuous interruption of the vitelline follicles and a more anterior genital pore seem to be at least almost always characteristic of *H. elongata* and perhaps never occur in *H. nimia*.

#### Genus GENITOCOTYLE Park, 1937

##### GENITOCOTYLE ACIRRATA Park, 1937

*Hosts.*—*Damalichthys vacca* Girard,<sup>3</sup> pileperch; *Umbrina roncadore* Jordan and Gilbert,<sup>3</sup> yellowfin croaker.

*Location.*—Intestine.

*Number.*—One in a single specimen of each host species.

*Discussion.*—A specimen of *G. acirrata* sent to one of us (Mantel) several years ago was available for comparison. It is believed that Park's so-called "pars prostatica" is actually a thick-walled cirrus with circular muscles especially conspicuous. Thus, the name given to the species is probably inappropriate.

This species is known previously only from *Holconotus rhodoterus* Agassiz, the porgy or surfperch, from Dillons Beach, Calif.

<sup>3</sup> New host record.

Genus *PLAGIOPORUS* Stafford, 1904*PLAGIOPORUS ISAITSCHIKOWI* (Layman, 1930) Yamaguti, 1938*Host*.—*Paralabrax clathratus* (Girard),<sup>3</sup> kelp bass.*Location*.—Intestine.

*Discussion*.—Three specimens, in only fair condition and showing only a lateral view, are identified as this species. They agree with Yamaguti's description in such characteristic details as vitellaria interrupted opposite acetabulum; testes tandem; genital pore opposite pharynx; uterus extending to posterior edge of anterior testis; ceca ending a little beyond posterior testis. However, the cirrus sac extends to a little past midacetabular level (rather than ending close to anterior border) and the largest eggs in utero were 48 by 34 $\mu$  as compared with 57 to 63 $\mu$  by 38 to 40 $\mu$  described for *P. isaitschikowi*. Contraction of the forebody might affect somewhat the posterior extent of the cirrus sac. The difference in egg size is considerable, but Yamaguti does not state whether his measurements were from preserved specimens. The sucker ratio on our specimens could not be determined because of the lateral view. *P. isaitschikowi* has been previously reported from *Sebastiscus albofasciatus*, from Suruga Bay, Japan, and from Peter the Great Bay.

Genus *OPECHONA* Looss, 1907*OPECHONA ORIENTALIS* (Layman, 1930) Ward and Fillingham, 1934

## PLATE 13, FIGURES 11, 12

*Host*.—*Girella nigricans* (Ayres),<sup>3</sup> common opaleye.*Location*.—Intestine.*Number*.—Several specimens, some immature.

*Discussion*.—These trematodes agree well with those reported from *Paranthias furcifer*, a "small mackerel," and *Angelichthys* sp., from the Mexican coast and the Galápagos Islands (Manter, 1940). A young specimen shows that the "branch of the excretory vesicle" on the left side of the body actually is represented on both sides (pl. 13, figs. 11, 12). When swollen, these lateral trunks or tubes (lt) are fairly conspicuous, extending from near the intestinal bifurcation to a short distance posterior to the testes where each seems to have an inconspicuous union with the excretory vesicle (ex, fig. 12). The median trunk of the excretory vesicle (mt) extends forward ventral to the intestinal bifurcation to end just posterior to the pharynx. It often contains round, deeply staining concretions. However, this median tube is separated by a narrow constriction from that portion of the vesicle posterior to

<sup>3</sup> New host record.

the testes (fig. 12), and thus may be homologous to the lateral excretory tubes. The lateral tubes do not occur in *Opechona pharyngodactyla*.

### Family ACANTHOCOLPIDAE

#### Genus STEPHANOSTOMUM Looss, 1899

*Stephanostomum* LOOSS, 1899, p. 576.

*Stephanochasmus* LOOSS, 1900, p. 603.

*Lechradena* LINTON, 1910, p. 46.

*Echinostephanus* YAMAGUTI, 1934, p. 374.

More than 30 species of *Stephanostomum* have been named. Of these, three—*Stephanochasmus hystrix* (Dupardin, 1845, of Olsson) Looss, 1899; *S. robustus* MacCallum, 1917; and *Stephanostomum sobrinum* (Levinsen, 1881) Looss, 1899—are insufficiently described. Since the genus is a large one and widely distributed among marine fishes, a list of species and a key to aid in their identification is presented.

For many years species in this genus were considered in the genus *Stephanochasmus*, which Looss (1900) named for them because he considered *Stephanostomum* invalidated by *Stephanostoma* Danielsen and Koren, 1880. As *Stephanochasmus* species were transferred to *Stephanostomum*, the literature frequently did not clearly indicate the authors of new combinations. Of the species in the following list, Dawes (1946) seems to have first used the combination in one case, while four seem to be new combinations. Synonyms of only the new combinations are listed here.

#### SPECIES OF STEPHANOSTOMUM

*anisotremi* Manter, 1940

*baccatum* (Nicoll, 1907) Manter, 1934

*bicoronatum* (Stossich, 1883) Manter, 1940

*caducum* (Looss, 1901) Manter, 1934

*californicum* (p. 328), new species

*casum* (Linton, 1910) McFarlane, 1936

*cesticillum* (Molin, 1858) Looss, 1899 (type species)

*cloacum* (Srivastava, 1938), new combination; synonym *Echinostephanus*

*cloacum* Srivastava, 1938

*coryphaenae* Manter, 1947

*dentatum* (Linton, 1900) Manter, 1931

*ditrematis* (Yamaguti, 1939) Manter, 1947

*elongatum* (Park, 1939) Hanson, 1950

*fistulariae* (Yamaguti, 1940) new combination; (synonym *Echinostephanus fistulariae* Yamaguti, 1940)

*hispidum* (Yamaguti, 1934) Manter, 1940

*imparispine* (Linton, 1905) Manter, 1940

- japonicum* (Yamaguti, 1934), new combination; (synonym *Stephanochasmus japonicus* Yamaguti, 1934)  
*lineatum* Manter, 1934  
*megacephalum* Manter, 1940  
*microstephanum* Manter, 1934  
*minutum* (Looss, 1901) Manter, 1940  
*multispinosum* Manter, 1940  
*pristis* (Deslongchamps, 1824) Looss, 1899  
*promicropsi* Manter, 1947  
*rhombispinosum* (Lebour, 1908) Manter, 1934  
*sentum* (Linton, 1910) Manter, 1947  
*tenue* (Linton, 1898) Linton, 1940  
*triglae* (Lebour, 1908) Dawes, 1946  
*tristephanum* McFarlane, 1935

## KEY TO SPECIES OF STEPHANOSTOMUM

- |    |  |                              |
|----|--|------------------------------|
| 1  | (6) Three rows of oral spines.....   | 2                            |
| 2  | (5) Spines very numerous (140 or more).....  | 3                            |
| 3  | (4) Vitellaria extending anterior to acetabulum.....                               | <i>microstephanum</i>        |
| 4  | (3) Vitellaria not reaching acetabulum.....  | <i>tristephanum</i>          |
| 5  | (2) Spines 50 to 52.....   | <i>lineatum</i>              |
| 6  | (1) Two rows of oral spines.....   | 7                            |
| 7  | (14) Vitellaria interrupted opposite testes.....                                   | 8                            |
| 8  | (9) Oral spines rhomboid.....  | <i>rhombispinosum</i>        |
| 9  | (8) Oral spines elongate.....  | 10                           |
| 10 | (11) Oral spines 36; vitellaria not reaching cirrus sac.....                       | <i>pristis</i>               |
| 11 | (10) Oral spines at least 48; vitellaria reaching cirrus sac.....                  | 12                           |
| 12 | (13) Sucker ratio 1:1.....   | <i>caducum</i> <sup>4</sup>  |
| 13 | (12) Sucker ratio 1:2.....   | <i>promicropsi</i>           |
| 14 | (7) Vitellaria not interrupted opposite testes.....                                | 15                           |
| 15 | (28) Vitellaria extending to posterior edge of acetabulum.....                     | 16                           |
| 16 | (17) Oral sucker larger than acetabulum.....                                       | <i>fistulariae</i>           |
| 17 | (16) Oral sucker smaller than acetabulum.....                                      | 18                           |
| 18 | (19) Oral spines very numerous (about 80).....                                     | <i>multispinosum</i>         |
| 19 | (26) Oral spines considerably fewer than 80.....                                   | 20                           |
| 20 | (23) Eggs 96 to 126 $\mu$ long.....  | 21                           |
| 21 | (22) Suckers subequal.....   | <i>triglae</i>               |
| 22 | (21) Sucker ratio about 1:1.4 to 1.6.....  | <i>japonicum</i>             |
| 23 | (20) Eggs 56 to 80 $\mu$ long.....   | 24                           |
| 24 | (25) Oral spines 24.....   | <i>elongatum</i>             |
| 25 | (24) Oral spines 36 or more.....   | 26                           |
| 26 | (27) Oral spines 36; prepharynx considerably longer than<br>pharynx.....           | <i>casum</i>                 |
| 27 | (26) Oral spines 48 to 50; prepharynx not considerably longer<br>than pharynx..... | <i>dentatum</i>              |
| 28 | (15) Vitellaria not reaching acetabulum.....                                       | 29                           |
| 29 | (40) Vitellaria reaching only to base of cirrus sac or slightly beyond.....        | 30                           |
| 30 | (31) Oral spines 56; eggs 87 to 101 $\mu$ .....                                    | <i>baccatum</i> <sup>5</sup> |

<sup>4</sup> Lebour's (1907) specimen of *S. caducum* from the whiting did not have interrupted vitellaria. It may represent another species. It is much like *S. ditrematis* except for its equal suckers.

<sup>5</sup> Nicoll's original specimen of *S. baccatum* had vitellaria extending only to base of cirrus sac. He later described a somewhat more anterior extent but not to the acetabulum. Manter's (1926) figure shows the vitellaria to the acetabulum. Thus, there is some uncertainty regarding this character in this species.

31	(30)	Oral spines not over 48; eggs not over 85 $\mu$ .....	32
32	(33)	Suckers subequal; oral spines interrupted ventrally.....	<i>megacephalum</i>
33	(32)	Acetabulum larger than oral sucker; oral spines not interrupted ventrally .....	34
34	(35)	Numerous vitelline follicles between ovary and anterior testis .....	<i>ditrematis</i>
35	(34)	No or very few vitelline follicles between ovary and anterior testis	36
36	(37)	Cirrus sac not reaching halfway to ovary; oral spines 36.....	<i>sentum</i>
37	(36)	Cirrus sac reaching halfway or more to ovary; oral spines not 36	38
38	(39)	Sucker ratio about 1:2; oral spines 38 to 40.....	<i>anisotremi</i>
39	(38)	Sucker ratio about 1:1.26; oral spines 33 to 34.....	<i>imparispine</i>
40	(29)	Vitellaria extending some distance along cirrus sac but not reaching acetabulum .....	41
41	(42)	Length not over 1.9 mm.; eggs about 47 $\mu$ long.....	<i>minutum</i>
42	(41)	Length much over 1.9 mm.; eggs at least 60 $\mu$ long.....	43
43	(44)	Acetabulum about twice size of oral sucker.....	<i>bicoronatum</i>
44	(43)	Acetabulum considerably less than twice size of oral sucker.....	45
45	(48)	Oral spines 40 to 42.....	46
46	(47)	Numerous vitellaria between ovary and anterior testis.....	<i>hispidum</i>
47	(46)	Few or no vitellaria between ovary and anterior testis.....	<i>tenue</i> <sup>6</sup>
48	(45)	Oral spines 30 to 36.....	49
49	(50)	Cirrus sac extending considerably more than halfway to ovary .....	<i>cloacum</i>
50	(49)	Cirrus sac extending only halfway or less to ovary.....	51
51	(52)	Cirrus sac S-shaped, wider in anterior half.....	<i>coryphaenae</i>
52	(51)	Cirrus sac almost straight; wider in posterior half .....	53
53	(54)	Eggs 94 to 109 $\mu$ long.....	<i>californicum</i>
54	(53)	Eggs 80 $\mu$ long.....	<i>cesticillum</i>

## STEPHANOSTOMUM CALIFORNICUM, new species

## PLATE 13, FIGURE 13

*Description* (based on the single specimen collected).—Length 4.786 mm., greatest width 0.482 mm., near posterior end. Oral sucker 0.219 mm., acetabulum 0.321 mm. in transverse diameters; sucker ratio approximately 1:1.47. Oral spines 33, although a space at the middorsal line suggests that a thirty-fourth spine had been lost; spines in anterior row 80 to 90 $\mu$  long; spines in posterior row 61 to 78 $\mu$  long. Forebody length 1.255 mm. or slightly less than one-fourth body length; posttesticular distance 0.606 mm. or approximately one-half length of forebody. Prepharynx 0.547 mm. long; pharynx pyriform, 0.292 mm. long by 0.255 mm. wide; esophagus very short; intestinal bifurcation a short distance preacetabular; ceca extending close to posterior end of body, probably opening into excretory vesicle.

<sup>6</sup> Linton (1940) has reported *S. tenue* from six hosts at Woods Hole, but his figures 32 and 34, with very different extent of the cirrus sac, suggest that he may have dealt with more than one species. Martin (1939) has described the life cycle of this species.

Genital pore median (gp, pl. 13, fig. 13), immediately preacetabular. Testes (t) tandem in posterior third of body, elongated, separated by a few vitelline follicles; cirrus sac slightly sinuous extending 0.511 mm. posterior to acetabulum or approximately one-third distance to ovary. Ovary (ov) elongate, about two-thirds body length from anterior end; separated from anterior testis by a few vitelline follicles. Vitelline follicles (v) extending anteriorly to a point slightly beyond midway between base of cirrus sac and acetabulum although not quite so far on one side; not reaching acetabulum; not interrupted opposite testes; dorsal, ventral, and lateral to ceca; dorsal to testes and ovary but not to the uterus. Uterus preovarian; metraterm not evident; eggs very large, ovoid, 94 to 109 $\mu$  by 43 to 58 $\mu$ .

*Host*.—*Umbrina roncadore* Jordan and Gilbert, yellowfin croaker.

*Location*.—Intestine.

*Holotype*.—U.S.N.M. Helm. Coll. No. 37149.

*Discussion*.—This species differs from most other *Stephanostomum* species in its very large eggs. It seems to be most like *S. cesticillum* (Molin, 1858) Looss, 1899 and *S. bicoronatum* (Stossich, 1883) Manter, 1940, which it resembles in number of oral spines and extent of vitellaria. *S. bicoronatum* differs in that the oral sucker is only one-half the diameter of the acetabulum, the cirrus sac extends halfway to the ovary, a metraterm is well developed, and eggs are about 80 $\mu$  by 50 to 55 $\mu$  (or 63 to 78 $\mu$  by 33 to 45 $\mu$  according to Yamaguti (1938)). *S. cesticillum* has eggs 80 $\mu$  by 50 to 55 $\mu$ , an oral sucker only slightly smaller than the acetabulum, and a cirrus sac extending more than halfway to the ovary, a conspicuous metraterm, and its oral spines are at least usually interrupted ventrally by a spine lacking or by small spines.

*S. imparispine* (Linton, 1905) Manter, 1940, has 33 or 34 oral spines but differs in that the vitellaria do not extend so far anteriorly, do not extend between the gonads, and the eggs are only 70 by 40 $\mu$  in size.

Species that also have large eggs are *S. japonicum* (Yamaguti, 1934), which differs in that the vitellaria extend to the acetabulum and there are 46 oral spines; *S. triglae* (Lebour, 1908), differing from *S. californicum* in these same respects; and *S. baccatum* (Nicoll, 1907), which has 56 oral spines and tapered eggs.

#### STEPHANOSTOMUM DENTATUM (Linton, 1900) Manter, 1931

*Echinostephanus pagrosomi* Yamaguti, 1939, p. 221.

*Stephanostomum pagrosomi* (Yamaguti, 1939) Manter, 1947, p. 308.

*Host*.—*Paralichthys californicus* (Ayres),<sup>†</sup> California halibut.

*Location*.—Intestine.

<sup>†</sup> New host record.

*Discussion.*—The three specimens collected agree with most of the important specific characters of *S. dentatum*, such as: continuous distribution of vitellaria to the acetabulum, 48 to 50 oral spines, and contiguous gonads. The forebody is extended, and the prepharynx is about twice the length of the pharynx or longer than in most specimens of *dentatum*. Sucker ratios are 1:1.33; 1:1.37 and 1:1.625 or slightly above the ratio (1:1.22) described for *dentatum*. Eggs are 61 to 68 $\mu$  by 42 to 50 $\mu$ . These measurements approach or reach those given for *S. pagrosomi* (Yamaguti, 1939), which Manter (1947, p. 308) pointed out was very similar to *S. dentatum*. It is here considered a synonym.

Genus PLEORCHIS Railliet, 1896

PLEORCHIS CALIFORNIENSIS, new species

PLATE 13, FIGURE 14

*Description* (based on two mature and five immature specimens. Measurements given are for the mature specimens).—Length 4.901 to 6.435 mm.; width 1.495 to 2.058 mm.; a specimen 3.536 mm. long is immature. Oral sucker 0.365 to 0.400 mm. in transverse diameter, somewhat wider than long; acetabulum circular, 0.292 mm. in diameter; sucker ratio 1:0.73 to 0.8. Forebody 0.766 to 1.261 mm. or about one-fifth to one-sixth body length. Anterior half of body with large conspicuous spines. A pair of small, rather widely separated eye spots on the dorsal surface at, or slightly posterior to, posterior edge of oral sucker. In the holotype (largest) specimen, the eye spots show signs of being lost and the one on the left has disappeared although very fine black granules occur at its location. Prepharynx 0.043 to 0.243 mm. long, varying with contraction of the forebody; when extended it is almost as long as the pharynx; pharynx 0.215 by 0.241 mm. long by 0.219 to 0.234 mm. wide; esophagus a very short narrow tube only 0.021 to 0.029 mm. long; ceca with anteriorly directed arms 0.343 to 0.438 mm. long (ace, pl. 13, fig. 14), and with short lateral branches (ca) arising from outer (or lateral) edges beginning shortly posterior to acetabulum; ceca ending near posterior end of body. Testes in dorsoventral pairs arranged in two longitudinal rows, usually 26 or 27 pairs in each row to total 104 to 108 testes; smallest number observed was 21 and 25 pairs or 92 testes. Testes wider than long, close together in the rows. Cirrus sac thin walled, containing a large, ovoid seminal vesicle, more or less clearly divided into a narrowing anterior portion curving around the acetabulum and a saclike posterior portion (sv); extending well posterior to acetabulum to near the ovary; prostatic cells few; cirrus tubular, unspined. Ovary lobed with short, thick



lobes all close together; slightly to right of midline; not far posterior to acetabulum. Mehlis' gland anterior to ovary, between ovary and seminal vesicle; seminal receptacle lacking; uterus short, preovarian; eggs few, rather thin shelled, variable in size (owing to abnormal shapes), normal eggs  $59$  to  $67\mu$  by  $40$  to  $45\mu$ . Genital pore (gp) median, immediately preacetabular. Vitelline follicles (v) close together, extending from slightly posterior to acetabulum to posterior end of body, covering most of the ceca; confluent posterior to testes. Excretory pore terminal; excretory vesicle I-shaped extending to posterior end of ovary where it flares out laterally to receive the collecting tubes.

*Host.*—*Cynoscion nobilis* (Ayres), white sea bass.

*Location.*—Intestine.

*Types.*—Holotype and paratype, U.S.N.M. Helm. Coll. No. 37148.

*Discussion.*—The genus *Pleorchis* contains three other species: *P. polyorchis* (Stossich, 1892) Railliet, 1896; *americanus* Lühe, 1906; and *sciaenae* Yamaguti, 1938. Manter (1949) has indicated that *P. mollis* (Leidy, 1856) Stiles, 1896, almost certainly does not belong in the genus. *Pleorchis oligorchis* Johnston, 1914, was transferred to the genus *Schistorchis* by Yamaguti (1942). *P. californiensis* differs from all three species in possessing many more testes (almost twice as many as occur in any of the other species). It has a much shorter esophagus than does *P. americanus*. The vitellaria do not reach to the acetabulum as they do in the other three species. The ovary is more deeply lobed than in *P. sciaenae*.

The family Pleorchidae was named by Poche (1926) to include *Pleorchis* Railliet and *Schistorchis* Lühe, 1906. Cable and Hunninen (1942) pointed out that these two genera seemed unrelated and that *Pleorchis* should be considered in the family Acanthocolpidae. *Schistorchis*, with its unspined body and presence of a seminal receptacle, seems more closely related to *Decemtestis* Yamaguti, 1934. Since *Pleorchis* is the type genus of the Pleorchidae, its transfer to the family Acanthocolpidae forces the family Pleorchidae to become a synonym of Acanthocolpidae. *Pleorchis*, at least superficially, suggests the subfamily Campulinae (family Fasciolidae). Similarities include such characters as large size, body spines, H-shaped ceca, lack of seminal receptacle, I-shaped excretory vesicle, preovarian uterus, and extensive vitellaria. The testes are entirely different and the Campulinae are parasites of marine mammals. Probably an important difference is the presence of very definite eyespots on *Pleorchis*, the cercariae of which must therefore be oculate. Eyespots are lacking in all the known life cycles of Fasciolidae. The H-shaped ceca may have developed independently in *Pleorchis* and in Campulinae as well as in the Accacoeliidae.

## Family ZOOGONIDAE

Genus *DIPLANGUS* Linton, 1910*DIPLANGUS TRIRADIATUS*, new species

PLATE 13, FIGURES 15, 16

*Description* (based on nine mature and eight immature specimens from *Menticirrhus undulatus* and *Roncador stearnsi*).—Length 0.686 to 0.967 mm. One specimen 0.702 mm. in length did not contain eggs although gonads were well developed; another 0.686 mm. in length did contain eggs. Body smooth, cylindrical, greatest width or thickness near acetabular level, 0.195 to 0.273 mm. Forebody tapering but rounded, hindbody tapering and more pointed. Acetabulum protrusible and in all specimens greatly extended so that the acetabular stalk is almost as long as or even longer than the hindbody; in one specimen the distance from the acetabulum edge to dorsal wall of body was practically the same as the total body length. Base of acetabular stalk from one-third to one-half body length from anterior end of body. The lateral position of most specimens prevented transverse measurements of the suckers. Oral sucker length 0.093 to 0.099 mm., thickness 0.081 to 0.093 mm., width (two specimens) 0.083 to 0.092 mm. Acetabulum length 0.135 to 0.172 mm., thickness (one specimen) 0.135 mm., width 0.144 to 0.179 mm. Ratio of lengths of oral sucker and acetabulum 1:0.91 to 2. Genital pore (gp, pl. 13, figs. 15, 16) median or submedian, opposite base of pharynx or slightly posterior to pharynx. Short prepharynx present; pharynx often but not always with a median constriction, 0.054 to 0.063 mm. long, 0.029 to 0.050 mm. wide or thick. Esophagus (e) longer than pharynx, wide and thin walled. Ceca (ic) sinuous and extending to level of middle of anterior testis, some distance from posterior end of body, or rarely to posterior edge of posterior testis. Excretory pore terminal; excretory vesicle I-shaped, extending past the posterior testis, ending dorsal to anterior testis. Testes globular, diagonal, about midway between acetabular stalk and posterior end of body. Genital atrium (ga) a short thin-walled tube. Cirrus (cir) thick-walled, bulblike, becoming thin walled just before joining the atrium; cirrus sac and prostatic vesicle apparently lacking; seminal vesicle tubular, bipartite with a saclike, thin-walled anterior portion (sv<sup>1</sup>) and a swollen S- or V-shaped tube (sv<sup>2</sup>) with cellular walls (fig. 16); vesicle ending near base of acetabular stalk. Ovary globular, slightly anterior to but overlapping the anterior testis, to left of midline. Seminal receptacle (sr) round, well developed, preovarian. Vitellaria (v) in two lateral clumps

of follicles at ovarian level; follicles fairly large, 8 or 9 on each side, often pressed close together. Uterus extending posterior to testes; eggs, more or less collapsed in utero, 27 to  $34\mu$  by 13 to  $18\mu$ , almost always 32 to  $34\mu$  by 13 to  $16\mu$ .

About 10 specimens from a related host, *Umbrina roncador*, differed only in being somewhat larger (to 1.802 mm. in length), suckers somewhat nearer equal in size, and almost always in having a longer space between posterior extent of the uterus and posterior end of body.

*Hosts.*—*Menticirrhus undulatus* (Girard), California corbina; *Roncador stearnsi* (Steindachner), spotfin croaker; *Umbrina roncador* Jordan and Gilbert, yellowfin croaker.

*Location.*—Intestine.

*Types.*—Holotype and paratype, U.S.N.M. Helm. Coll. No. 37147.

*Discussion.*—*D. triradiatus* differs from *D. parvus* Manter, 1947, in its pointed posterior end, longer hindbody, much smaller acetabulum and in lack of a prostatic vesicle. It differs from *D. miolecithus* Manter, 1947, in development of the vitellaria, shorter ceca, diagonal testes, lack of prostatic vesicle, and smaller eggs. It is probably most similar to *D. paxillus* Linton, 1910. Some apparent differences such as the more posterior genital pore and the sinuous ceca might be due to the extreme extension of the acetabulum. However, *D. triradiatus* has diagonal rather than tandem testes, the excretory vesicle extends past the posterior testis, a distinct prostatic vesicle is lacking, and the eggs are almost always distinctly smaller (usually 32 to  $34\mu$  by 13 to  $16\mu$  as compared with 34 to  $45\mu$  by 14 to  $18\mu$ ). Eggs of *D. paxillus* were measured in nine specimens from several host species at Tortugas, Fla., and only in one (from *Balistes vetula*) were eggs found less than  $34\mu$  long.

The name *triradiatus* is suggested by the triradiate appearance given the body by the long acetabular stalk.

## Family HAPLOSPLANCHNIDAE

Genus HAPLOSPLANCHNUS Looss, 1902

HAPLOSPLANCHNUS GIRELLAE, new species

PLATE 13, FIGURES 17, 18

*Description.*—Small, elongate distomes of about equal width and thickness; widest and thickest at acetabular level; rounded anteriorly but narrowing almost to a point posteriorly. The following measurements are based on seven specimens showing a dorsal or ventral view and three specimens showing, as did most of the specimens, a side view (pl. 13, fig. 17). Length 1.073 to 1.569 mm.; width 0.219 to 0.290 mm.; thickness 0.226 to 0.277 mm. Oral

sucker (os) wider than long; 0.153 to 0.204 mm. in transverse diameter; 0.153 to 0.197 mm. in depth (dorsoventral). Dorsal wall of oral sucker much thicker than ventral wall; a small papillalike projection often visible on midventral line. Acetabulum, including aperture, slightly wider than long; 0.157 to 0.219 mm. in transverse diameter or subequal to oral sucker; sucker ratio 1:0.85 to 1.04. Depth of acetabulum, as seen from side view, 0.124 to 0.146 mm. or somewhat less than depth of oral sucker. Forebody 0.299 to 0.431 mm.

Prepharynx very short; pharynx (ph) globular, 0.043 to 0.076 mm. long by 0.048 to 0.068 mm. wide by 0.051 to 0.059 mm. thick. Esophagus (e) not clearly demarked from cecum; cecum (ic) extending to a point one-fourth to two-thirds distance from acetabulum to posterior end of body, usually ending dorsal to testis.

Genital pore median, slightly nearer to oral sucker than to acetabulum, opposite posterior edge of pharynx or slightly posterior to that level. Single testis (t), elongated oval, 0.182 to 0.277 mm. long by 0.116 to 0.138 mm. wide, smooth; located usually somewhat anterior to middle of hindbody; posttesticular space very long, 0.292 to 0.474 mm., in only one specimen was it shorter than the forebody. Cirrus a thick-walled tube extending diagonally backward from genital pore, sometimes appearing spherical from surface view; prostatic vesicle (pv) ovoid to elongate, not apparent in many specimens; seminal vesicle (sv) a slightly sinuous tube ending dorsal to acetabulum; entering ventral side of prostatic vesicle slightly posterior to its middle.

Ovary (ov) spherical or ovoid, immediately posterior to acetabulum or partly dorsal to acetabulum, pretesticular, median or submedian, usually slightly dextral. Seminal receptacle spherical or ovoid, largely dorsal and slightly posterior to ovary. Vitelline glands (v) not in definite follicles but in irregular longitudinal masses, lateral, usually from level of pharynx to well posterior to testis; always interrupted opposite testis. Anterior extent of vitellaria seems to be the anterior border of acetabulum although large cells in the forebody probably are vitelline cells; the posterior extent varies from one-half to four-fifths distance between testis and posterior end of body. Uterus preovarian, short, dorsal to left half of acetabulum. Eggs (fig. 18) large, few (1 to 7), measuring (uncollapsed) 73 to 80 $\mu$  by 48 to 53 $\mu$ . Excretory vesicle forking dorsal to testis.

*Host*.—*Girella nigricans* (Ayres), common opaleye.

*Location*.—Intestine.

*Number*.—Very numerous.

*Types*.—Holotype and paratype, U.S.N.M. Helm. Coll. No. 37144.

*Discussion*.—Of the eight known species of *Haploplanchnus*, *H.*

*girellae* is probably most similar to *H. kyphosi* Manter, 1947, and *H. obtusus* (Linton, 1910) from Tortugas, Fla. It differs from *H. obtusus* in its long posttesticular space, in the spherical shape of the seminal receptacle, in lacking distinct vitelline follicles, in the interruption of the vitellaria opposite the testis, and in shape of the eggs. It differs from *H. kyphosi* in its unlobed ovary, relatively larger acetabulum, elongated testis, interrupted vitellaria, and smaller body size.

### Family MONORCHIDAE

Genus PROCTOTREMA Odhner, 1911

PROCTOTREMA LONGICAECUM Manter, 1940

*Host.*—*Anisotremus davidsonii* (Steindachner),<sup>8</sup> California sargo.

*Location.*—Intestine.

*Number.*—Two.

*Discussion.*—This species is known hitherto from *Anisotremus interruptus* (Gill) from the Galápagos Islands.

### Family HEMIURIDAE

Genus APONURUS Looss, 1907

APONURUS TRACHINOTI Manter, 1940

*Host.*—*Porichthys* sp.<sup>8</sup>

*Location.*—Stomach.

*Discussion.*—A single specimen agrees with the description of *A. trachinoti* except in one respect: the eggs measure 30 to 32 $\mu$  by 13 $\mu$  rather than 25 by 10 $\mu$ . Since our specimen is somewhat larger (1.77 mm. long) and no other differences could be seen, it is felt a new species should not be named. Characteristic features are the shape of the egg (pointed at one end), ceca not reaching the posterior end, and the relatively small acetabulum (slightly less than twice the size of the oral sucker).

Genus BRACHADENA Linton, 1910

BRACHADENA PYRIFORMIS Linton, 1910

*Hosts.*—*Anisotremus davidsonii* (Steindachner),<sup>8</sup> California sargo; *Porichthys* sp.<sup>9</sup>

*Location.*—Stomach.

<sup>8</sup> New host record.

<sup>9</sup> In the field this host was identified as *Porichthys notatus* Girard. Specimens were not saved for later verification, but it seems probable that the hosts were the locally more common *Porichthys myriaster* Hubbs and Schultz, which had been recognized only a short time when this study was in progress.

*Discussion.*—A single specimen was collected from each of the above hosts. Sucker ratio in this species is rather variable. The specimen from *Porichthys* has approximately a 1:2 ratio rather than the more usual 1:2.5 to 3. However, a 1:2 ratio occurs in Atlantic specimens from *Ogecephalus radiatus*, *Micropogon undulatus*, and *Calamus bajonado*. This trematode is very common at Tortugas, Fla., where it has numerous hosts, and it is known also from North Carolina and Massachusetts. This record is the first from the Pacific.

Genus ELYTROPHALLUS Manter, 1940

ELYTROPHALLUS MEXICANUS Manter, 1940

*Host.*—*Paralabrax clathratus* (Girard),<sup>10</sup> kelp bass.

*Location.*—Intestine.

*Number.*—Two.

*Discussion.*—This species was found to be common in a variety of fishes of Socorro and Clarion Islands (Mexico) and less common in the Galápagos Islands (Manter, 1940). The trematode is normally a stomach parasite.

In the following list of fishes the species are arranged by families in the sequence followed in the Jordan, Evermann, and Clark checklist (1930).

## HOST LIST

### CYPRINODONTIDAE: Killifishes

*Fundulus parvipinnis parvipinnis* Girard, southern California killifish:  
*Phyllodistomum* sp.

### BOTHIDAE: Sinistral Flatfishes

*Paralichthys californicus* (Ayres), California halibut:  
*Bucephalopsis labiatus*, new species.  
*Stephanostomum denatum* (Linton, 1900).  
Immature hemiurid.  
Immature *Distomum fenestratum*.

### SERRANIDAE: Sea Basses

*Mycteroperca pardalis* Gilbert:  
*Lepidapedon* sp.  
*Paralabrax clathratus* (Girard), kelp bass:  
*Elytrophallus mexicanus* Manter, 1940.  
*Plagioporus isaitschikowi* (Layman, 1930).

### HAEMULIDAE: Grunts

*Anisotremus davidsonii* (Steindachner), California sargo:  
*Brachadena pyriformis* Linton, 1910  
*Proctotrema longicaecum* Manter, 1940

<sup>10</sup> New host record.

## GIRELLIDAE: Nibblers

*Girella nigricans* (Ayres), common opaleye:

*Haploplanchnus girellae*, new species.

*Opechona orientalis* (Layman, 1930).

*Opecoelus adsphaericus*, new species.

## SCIAENIDAE: Croakers

*Menticirrhus undulatus* (Girard), California corbina:

*Diplangus triradiatus*, new species.

*Roncador stearnsi* (Steindachner), spotfin croaker:

*Diplangus triradiatus*, new species.

*Umbrina roncador* Jordan and Gilbert, yellowfin croaker:

*Diplangus triradiatus*, new species.

*Genitocotyle acirrata* Park, 1937.

*Pseudopecoelus umbrinae*, new species.

*Stephanostomum californicum*, new species.

*Cynoscion nobilis* (Ayres), white sea bass:

*Pleorchis californiensis*, new species.

## COTTIDAE: Sculpins

*Clinocottus analis australis* Hubbs, tide-pool woolly sculpin:

*Helicometrina elongata* Noble and Park, 1937.

*Opecoelus adsphaericus*, new species.

## EMBIOTOCIDAE: Surfperches and Sea perches

*Damalichthys vacca* Girard, pileperch:

*Genitocotyle acirrata* Park, 1937.

## GOBIIDAE: Gobies

*Gillichthys mirabilis* Cooper, mudsucker:

Immature hemiurid.

## CLINIDAE

*Gibbonsia elegans* (Cooper), ocellated sawfish:

*Bucephalus* sp., immature, encysted.

*Helicometrina elongata* Noble and Park, 1937.

*Gibbonsia metzi* Hubbs, weed sawfish:

*Helicometrina elongata* Noble and Park, 1937.

*Pseudopecoelus gibbonsiae*, new species.

## BATRACHOIDIDAE

*Porichthys* sp.:

*Aponurus trachinoti* Manter, 1940.

*Brachadena pyriformis* Linton, 1910.

An examination of the foregoing list reveals a striking degree of fidelity between the digenetic trematodes and their definitive marine fish hosts in southern California. Only 3 of the 17 species of digenetic trematodes identified in this study have been found to transgress family bounds in their definitive hosts. These are *Helicometrina elongata*, *Genitocotyle acirrata*, and *Opecoelus adsphaericus*.

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## EXPLANATION OF PLATES

All drawings were made from stained permanent mounts in clarite, by aid of a camera lucida. Katharine Hill Paul, scientific artist in the department of zoology of the University of Illinois, prepared the drawings and arranged the plates.

### SYMBOLS USED

a, anus	lt, lateral excretory trunk
ac, acetabulum	mt, median excretory trunk
ace, anterior cecum	o, egg
ap, acetabular papilla	ol, oral lip
as, anterior sucker	os, oral sucker
ca, cecal arm	ov, ovary
cir, cirrus	ph, pharynx
cs, cirrus sac	pv, prostatic vesicle
e, esophagus	sr, seminal receptacle
es, eye spots	sv, seminal vesicle
ex, excretory vesicle	t, testis
ga, genital atrium	ut, uterus
gp, genital pore	v, vitellaria
ic, intestinal cecum	yr, yolk reservoir

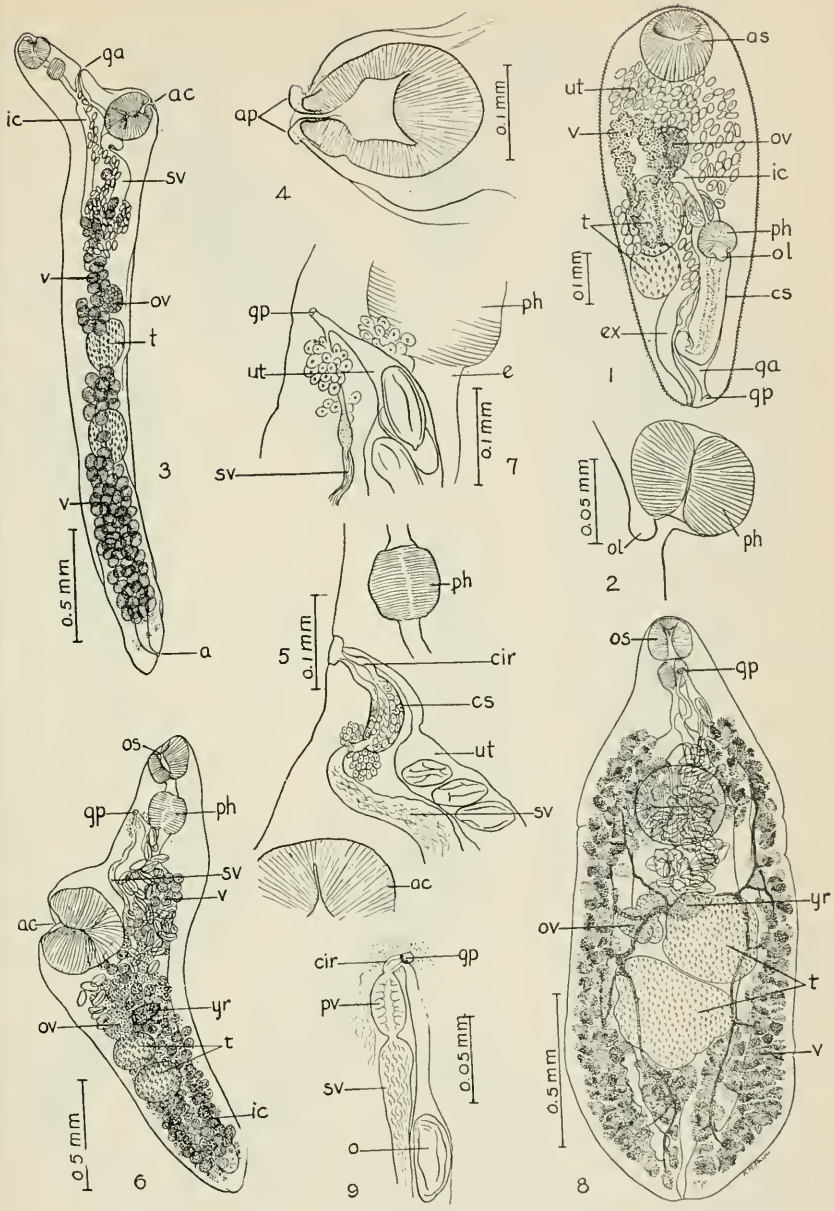
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### PLATE 12

- 1, 2. *Bucephalopsis labiatus*, new species: 1, Holotype as viewed from ventral surface; 2, lateral view of pharynx and oral lip as seen in a paratype individual.
- 3-5. *Opecoelus adphaericus*, new species: 3, Holotype as viewed from right side; 4, acetabulum of a paratype as viewed from lateral surface to show papillae, one pair of the lateral papillae not shown; 5, region of genital atrium showing relations of ducts to other structures.
- 6, 7. *Pseudopecoelus gibbonsiae*, new species: 6, Holotype in side view; 7, detail showing structures associated with the genital atrium.
- 8, 9. *Pseudopecoelus umbrinae*, new species: 8, Holotype as viewed from ventral surface; 9, relations of genital ducts to the genital pore in a paratype individual.

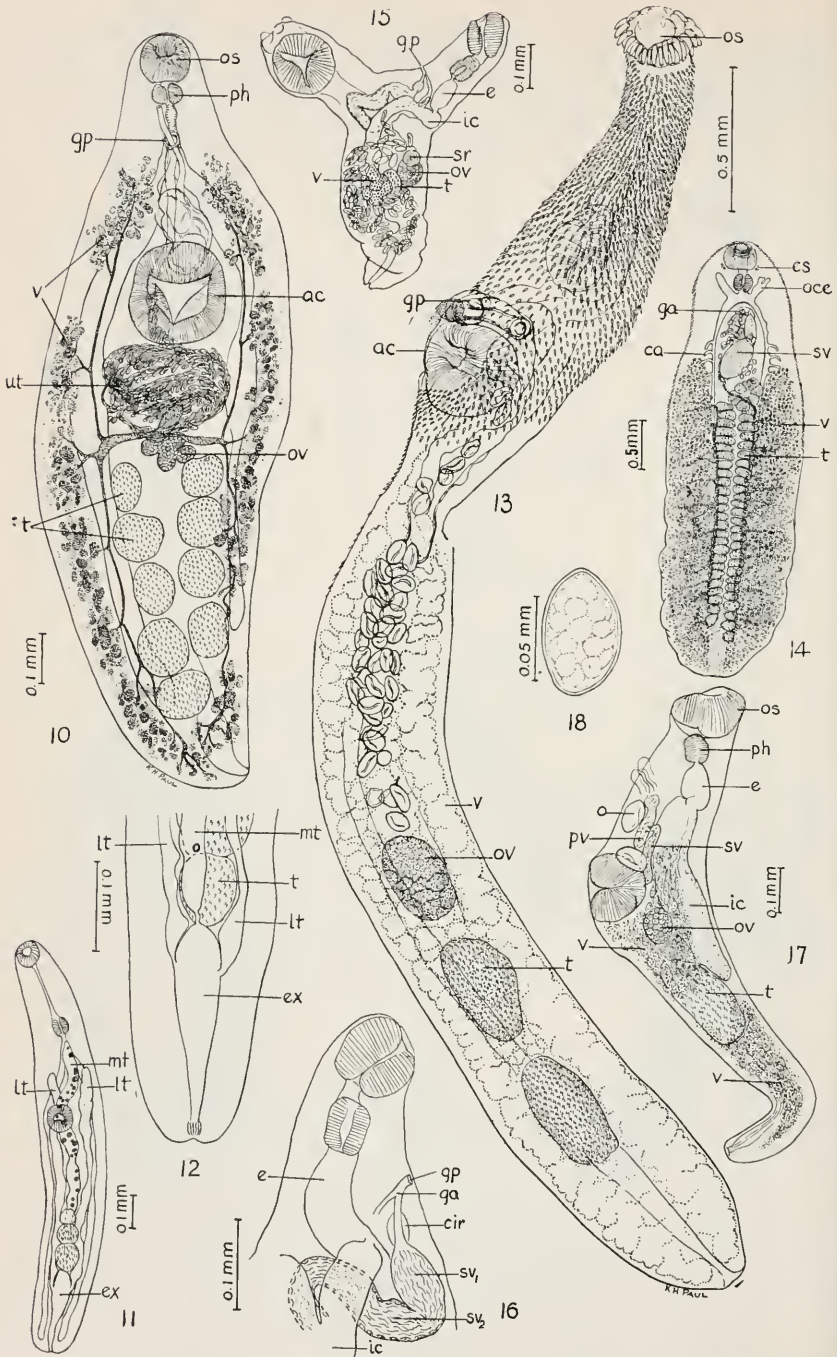
### PLATE 13

10. *Helicometrina elongata* Noble and Park, 1937, viewed from the ventral surface. Specimen from intestine of *Clinocottus analis australis*.
- 11, 12. *Opechona orientalis* (Layman, 1930) Ward and Fillingham, 1934: 11, Entire worm chiefly from ventral view; 12, detail of posterior extremity showing relations of the excretory trunks and vesicle.
13. *Stephanostomum californicum*, new species: Morphology of holotype.
14. *Pleorchis californiensis*, new species: Holotype as viewed from dorsal surface. Only the dorsal series of testes is shown.
- 15, 16. *Diplangus triradiatus*, new species: 15, Holotype in side view; 16, Anterior extremity of a paratype, showing details of structure.
- 17, 18. *Haplospalchnus girellae*, new species: 17, Holotype in lateral view; 18, a single uterine egg.



SPECIES OF BUCEPHALOPSIS, OPECOELUS, AND PSEUDOPECOELUS.

FOR EXPLANATION SEE PAGE 340.



SPECIES OF HELICOMETRINA, OPECHONA, STEPHANOSTOMUM, PLEORCHIS, DIPLANGUS, AND HAPLOSPLACHNUS.



