

AN ABSTRACT OF THE THESIS OF

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COTTIDS

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The host fish for this study were collected from January through June of 1965. Tidepools were selected at Bar View, Cape Arago, Neptune State Park, Seal Rock, and Yaquina Head. Of the 187 fish examined, 132 were infected. The following host fishes yielded the following parasites. New Host records are indicated with an asterisk. Clinocottus acuticeps (Gilbert) contained *Lecithaster salmonis Yamaguti, 1934; C. embryum (Jordan and Starks) contained Lecithaster salmonis Yamaguti, 1934; C. globiceps (Girard) contained *Genolinea laticauda Manter, 1925, *Lecithaster salmonis Yamaguti, 1934, *Podocotyle atomon (Rudolphi, 1802), P. blennicottusi Park, 1937, P. pacifica Park, 1937 *P. reflexa (Creplin, 1825), and *Zoogonoides viviparus (Olsson, 1868); Oligocottus snyderi Girard contained *Lecithaster salmonis Yamaguti, 1934, *Podocotyle californica Park, 1937, and

*Zoogonoides viviparus (Olsson, 1868); O. maculosus Girard contained *Genolinea laticauda Manter, 1925, *Lecithaster salmonis Yamaguti, 1934, *Podocotyle californica Park, 1937, and P. pedunculata Park, 1937.

The following species of digenetic trematodes are described in detail: Genolinea laticauda Manter, 1925, Lecithaster salmonis Yamaguti, 1934, Podocotyle blennicottusi Park, 1937, P. californica Park, 1937, P. pacifica Park, 1937, P. pedunculata Park, 1937, and Zoogonoides viviparus (Olsson, 1868).

Variations from the original descriptions are discussed in the following species: Genolinea laticauda Manter, 1925, Lecithaster salmonis Yamaguti, 1934, Podocotyle blennicottusi Park, 1937, P. californica Park, 1937, P. pacifica Park, 1937, and Zoogonoides viviparus (Olsson, 1868).

Host lists are compiled for each species of trematode found in the study.

Species lists are compiled for each genus of trematode reported.

Some Digenetic Trematodes of Oregon's
Tidepool Cottids

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SOME DIGENETIC TREMATODES OF OREGON'S TIDEPPOOL COTTIDS

INTRODUCTION

This project is limited to the collection and study of digenetic trematodes found in five species of tide pool cottids. These species of fish are: Clinocottus acuticeps (Gilbert), C. embryum (Jordan and Starks), C. globiceps (Girard), Oligocottus maculosus Girard, and O. snyderi Greeley. These fish occupy tidepools isolated by low tides and are abundant and easy to collect, thus this project provides the groundwork for possible life cycle and ecological studies of the parasites of tidepool residents.

Of the following list of surveys of the trematode fauna of marine fishes of the West Coast of North America, only three works (Park, 1936, 1937, and Johnson, 1949) were based on tidepool residents.

Stafford (1904) described 18 new genera and 14 new species of trematodes from Canadian fishes. His work lacked illustrations and the descriptions were incomplete so that Miller (1941) studied and redescribed Stafford's slide collection and placed many of the species in synonymy.

Sleggs (1927) reported two species of trematodes from marine fishes of Southern California.

Lloyd and Guberlet (1932) described a new genus and species, Telolecithus pugetensis, from the intestine of the common viviparous perch Cymatogaster aggregatus Gibbons from several localities in Puget Sound waters. DeMartini and Pratt (1964) worked out the life cycle.

A new trematode was described from a toadfish taken from southeastern Alaskan waters by Ward and Fillingham (1934). They also reported collecting other trematodes.

Lloyd and Guberlet (1936) redescribed a distome from the gills of Oncorhynchus gorbuscha and O. nerka from the Puget Sound region.

McFarlane (1936) described 15 species of endoparasitic trematodes of marine fishes of Departure Bay, B. C., of which eight were new species.

Park (1936) collected intertidal fishes from Dillon's Beach, California, and described two new hemiurids, Sterrhurus magnatestis and Tubulovesicula californica. Park (1937) described eight new species of Podocotyle, all except one of which he recovered from tidepool cottids. The species of Podocotyle he described were: P. enophrysi, P. apodichthysi, P. blennicottusi, P. californica, P. kofoidi, P. elongata, P. pedunculata, and P. pacifica. The three species of cottids he collected were Enophrys bison Girard, Blennicottus globiceps (= Clinocottus globiceps), and

Oligocottus maculosus. The latter two fish were the most common cottids collected along the Oregon coast in my survey. Park included a revision of the genus Podocotyle and developed a key to 19 species of Podocotyle based on what he considered to be the least variable morphological characters of these trematodes.

Lloyd (1938) reported finding 13 species of trematodes from Puget Sound fish. Four of these 13 were described as new, but one was later reduced to a synonym by Manter (1954).

Manter (1940) described a few trematode specimens from marine fish along the Mexican Coast.

Acena (1941) reported a new genus Dideutosaccus radifistuli, a trematode with two yolk reservoirs, from Sebastes elongatus Ayres and also described Lecithochirium medius taken from the stomach of Sebastes ruberrimus Cramer. The hosts were collected at Friday Harbor, Washington in the summer of 1938.

Annereaux (1943) described a new species, Opecoelina pharynmagna from Sebastes nebulosus from near Fort Ross, California.

Intuscirrus aspicotti, a new genus as well as species, Lepidapedon pugetensis and Lepidapedon calli were described by Acena (1947) from fishes of Puget Sound.

Annereaux (1947) described three new species of trematodes from marine fishes of California. These were Genolinea

montereyensis from Clinocottus analis (Girard) at Monterey, Asymphyrodora atherinopsidis from Atherinopsis californiensis at Stinson's Beach, and Deretrema pooli from Sebastodes sp. at Santa Cruz.

Kay (1947) reported a new species Otodistomum plicatum from the pyloric stomach of Hexanchus griseus caught at Friday Harbor, Washington in the summer of 1942.

Johnson (1949) found a new species, Podocotyle gibbonsia from two tide pool fishes, Gibbonsia elegans and Caularchus meandricus, at Monterey Bay, California.

Manter and Van Cleave (1951) examined approximately 200 species of fish from off La Jolla, California, and found 17 species of digenetic trematodes, eight of which were new.

Gregoire and Pratt (1952) reported finding 174 trematodes of the species Lecithochirium exodicum (McFarlane) in the stomachs of 213 petrale sole, Eopsetta jordani (Lockington).

McCauley (1954), in his Ph.D. thesis, examined 156 fish of Oregon marine waters and reported eight species of hemiurid trematodes. This work was published (McCauley, 1960).

Margolis and Adams (1956) described a new species, Genolinea oncorhynchi, taken from Oncorhynchus gorbuscha in British Columbia marine waters and compared it with other members of the same genus.

Thirteen digenea, including nine new species and two new genera were reported from the Pacific coast of Mexico by Bravo-Hollis and Manter (1957).

Montgomery (1957) examined 957 fish representing 55 species and found 40 species of digenetic trematodes. He described five new genera plus six new species and 13 new host records.

A new species, Lecithophyllum anteroporum was described by Margolis (1958) from the hake and two species of salmon from off the mouth of the Frazer River in British Columbia.

Aldrich (1960) examined 193 fish from the San Juan Archipelago and found 150 fish belonging to 32 species to be infected with digenetic trematodes. He identified ten species of trematodes, two of which were described as new (Aldrich, 1961).

Ching (1960a) examined 21 species of fish from the Friday Harbor, Washington waters, and collected 24 species of digenetic trematodes. She described three new species and reported 38 new host records for 16 species of Digenea. In another paper, Ching (1960b) reported cercariae from Thais emarginata (Deshayes), T. canaliculata (Duclos), T. lamellosa (Gmelin), and Dentalium dalli Pilsby and Sharp, at Friday Harbor.

MATERIALS AND METHODS

During the period of January through June of 1965, cottid fishes were collected from tide pools along the Oregon coast. All of the pools selected were isolated by any tide lower than plus three feet. Collecting trips to the five selected areas were as follows: January 26 to Neptune State Park, February 19 to Yaquina Head, April 13 to Yaquina Head, April 21 to Neptune State Park, April 27 to Yaquina Head, May 5 to Neptune State Park and Seal Rock, May 19 to Seal Rock and Neptune State Park, May 25 to Bar View (north of Garibaldi), and June 19 to Cape Arago.

Hand dip nets were used to scoop the fish from these pools and the fish were then placed in 2.5 gallon capacity plastic buckets for transport back to the zoology cold room at Oregon State University. Each bucket was suitable, when half full of seawater, for transporting two dozen fish for periods up to three hours with little or no mortality. In the cold room the fish were kept in the same buckets of sea water and were supplied with aerators. The cannibalism of these fish became apparent when large fish were kept in the same buckets with very small fish, so fish of markedly different sizes were kept separate from one another. Those fish that were found in another fish's stomach were not posted or recorded since they were usually digested beyond species recognition. All of the species of

fish collected usually remained alive and active for several weeks.

Species, size, and sex (when possible) was determined for each fish and these data were recorded. Fish were identified with the use of Clemens and Wilby (1949) and the cottid reference collection of the Department of Fisheries and Wildlife, Oregon State University.

In the genus Clinocottus only the largest specimen could be sexed because there is no external sexual dimorphism and the gonads were not mature enough to identify. The fish were slit from oral to anal opening and the gut was removed for examination. The trematodes were removed from the gut and were placed in fish saline in Syracuse dishes. Worms from the stomach were kept separate from the intestinal ones. The trematodes usually were not fixed immediately, but were placed in the refrigerator for overnight storage. They were fixed in AFA under slight coverslip pressure and were stored in 70% ethyl alcohol. The worms were stained with Delafield's hematoxylin, cleared in clove oil, and mounted in piccolyte. Each trematode slide was labeled with data indicating the host fish, size and sex of fish, and the locality and date of collection. Drawings were made with the aid of a micro-projector. Measurements were made in mm.

COLLECTION DATA

One hundred and eighty-seven fish from tidepools above the plus three foot mark were examined for digenetic trematodes. Of the 187 fish, 132 were infected.

The following material indicates the number of fish of each species examined, the number infected, the total number of trematodes of each species found, the number of fish infected with that species of trematode, and the range of the number of trematodes per fish. Asterisks indicate new host records.

Clinocottus acuticeps (Gilbert). One examined.

*One Lecithaster salmonis Yamaguti, 1934.

C. embryum (Jordan and Starks). Three examined, two infected.

Four Lecithaster salmonis Yamaguti, 1934. Two per fish.

C. globiceps (Girard). Sixty-eight examined, 44 infected.

*Genolinea laticauda Manter, 1925. Sixteen in 13 fish.

One to two per fish.

*Lecithaster salmonis Yamaguti, 1934. Fifty-seven in 33 fish. One to six per fish.

*Podocotyle atomon (Rudolphi, 1802). One in one fish.

P. blennicottusi Park, 1937. Two in one fish.

P. pacifica Park, 1937. Three in three fish.

*P. reflexa (Creplin, 1825). Three in three fish.

*Zoogonoides viviparus (Olsson, 1868). Four in three fish.

Oligocottus snyderi Girard. Twenty-nine examined, 13 infected.

*Lecithaster salmonis Yamaguti, 1934. Eight in two fish.
Four each.

*Podocotyle californica Park, 1937. Three on one fish.

*Zoogonoides viviparus (Olsson, 1868). Thirty-six in ten fish. One to seven per fish.

O. maculosus Girard. Eight-six examined, 63 infected.

*Genolinea laticauda Manter, 1925. Sixty-three in 31 fish.
One to six per fish.

*Lecithaster salmonis Yamaguti, 1934. Fifty-four in 25 fish. One to ten per fish.

*Podocotyle californica Park, 1937. Forty-nine in 22 fish. One to four per fish.

P. pedunculata Park, 1937. Two in one fish.

FAMILY HEMIURIDAE

Genus Genolinea Manter

This genus was established by Manter in 1925 with Genolinea laticauda as the type species. The following is his description of the genus:

Small, to medium-sized forms, with flattened body, tapering slightly and broadly pointed anteriorly, but broadly rounded posteriorly. Body almost uniformly wide. Cuticula smooth. Tail appendage lacking. Oral sucker embedded in body, overlapped dorsally by fleshy lip. Ventral sucker about 1-1/2 times the size of oral sucker, located about at end of first body third. No pre-pharynx, pharynx broad, esophagus very short, ceca wide, extending to posterior tip of body. Excretory system as in other Hemiuridae, branches uniting dorsal to pharynx. Genital pore ventral, median, at about the level of the forking of the intestine. Testes globular, obliquely behind one another some distance behind ventral sucker. Ovary large, globular, behind testes. Vitellaria behind one another posterior to ovary. Uterus sends two lateral coils posterior to vitellaria to near body tip. Between the ovary and ventral sucker the uterus is in large, transverse coils. Genital sinus short, sinus sack present, pars prostatica short, seminal vesicle much coiled, just anterior or slightly overlapping the ventral sucker. Eggs 28 to 31 by 12 to 15 μ (Manter, 1925 p. 15).

Fourteen species of Genolinea have been described. One species has been placed in synonymy and the name of one has been changed. A third species is considered to be incertae sedis. The species are: G. aburame Yamaguti, 1934; G. ampladena Manter

and Pritchard, 1960; G. bowersi (Leiper and Atkinson, 1914); G. dactylopagri Manter, 1954; G. lobata Manter and Pritchard, 1960; G. laticauda Manter, 1925; G. manteri Lloyd, 1938; G. montereyensis Annereaux, 1947; G. oncorhynchi Margolis and Adams, 1956; G. tanyopa Montgomery, 1957.

Brachyphallus anurus Layman, 1930 was transferred to Genolinea by Yamaguti (1934) and became G. anura. Yamaguti also considered the genus Parasterrhurus Manter, 1934 to be synonymous with Genolinea, so he proposed that Parasterrhurus anurus become G. argentea Yamaguti, 1954, since the species anurus had already been used in this genus. Genolinea robusta Lloyd, 1938 was considered a synonym for G. laticauda Manter, 1925 by Manter (1954). McCauley (1960) considered Genolinea lintoni (Skrjabin and Guschanskaja, 1954) to be incertae sedis.

Only Genolinea laticauda was found in this survey.

Genolinea laticauda Manter, 1925

See Figure 1.

Synonym: Genolinea robusta Lloyd, 1938

The following description is based on 79 specimens of this species taken from the stomachs of 44 cottids. Sixty-three worms were recovered from 31 Oligocottus maculosus Girard and 16 were recovered from 13 Clinocottus globiceps (Girard). They were

collected at Yaquina Head (O. maculosus and C. globiceps), Neptune State Park (O. maculosus and C. globiceps), Seal Rock (C. globiceps), Bar View (O. maculosus), and Cape Arago (O. maculosus). Five of the specimens were used for the measurements.

External Features

The body is 1.2 to 1.45 long and 0.20 to 0.39 wide at the level of the acetabulum. Anterior to the acetabulum the body tapers slightly to a broadly pointed fleshy lip overhanging the oral sucker. Just posterior to the ventral sucker the body narrows and continues at a nearly uniform width to the posterior end of the body where it is broadly rounded. The oral sucker is 0.078 to 0.095 by 0.06 to 0.12. The ventral sucker is round, measuring 0.175 to 0.191 by 0.185 to 0.225. The genital pore is situated on the mid-ventral surface at the level of the esophagus. The excretory pore is terminal. There is a smooth unarmed cuticle. There is no ecsoma.

Digestive System

The oral opening is on the anteroventral surface of the oral sucker. The digestive system passes from the oral sucker into the muscular pharynx, 0.055 to 0.063 by 0.063 to 0.08. The esophagus is very short and the wide ceca extend to the posterior

end of the body.

Genital Systems

The posterior testis lies obliquely behind the anterior testis in the middle one-third of the body. Both testes are smooth and globular. The anterior testis measures 0.077 to 0.113 by 0.077 to 0.123, the posterior, 0.078 to 0.128 by 0.10 to 0.135. The seminal vesicle is long and coiled. It extends to the anterior part of the ventral sucker or in some to the posterior edge of the ventral sucker. The seminal vesicle enters a short pars prostatica which is surrounded by many prostatic cells. The pars prostatica is joined to the metraterm and they enter the sinus sac as one duct, the hermaphroditic duct. The cirrus is coiled within the sinus sac or partly everted.

The ovary is situated behind the posterior testis and is separated from it by the seminal receptacle which is not always visible. The ovary is large and globular measuring 0.08 to 0.118 by 0.11 to 0.125. The seminal receptacle is about the size of the ovary or larger and is situated anterior to it. The two vitellaria are posterior to the ovary in tandem or oblique juxtaposition with one another. The anterior vitellarium measures 0.075 to 0.10 by 0.078 to 0.12, the posterior, 0.07 to 0.10 by 0.07 to 0.11. The uterus, full of eggs, lies in coils extending from the vitellaria

forward to the level of the testes. The uterus leads forward to the anterior border of the acetabulum where it joins the weak metratrerm. The metratrerm and the pars prostatica become a common tube which enters the sinus sac as the hermaphroditic duct. The genital opening is mid-ventral at the level of the esophagus. The ova measure 0.029 to 0.038 by 0.013 to 0.017.

Excretory System

The excretory bladder is as in other hemiurids. It extends anteriorly to the posterior level of the acetabulum where it bifurcates sending two branches lateral to the intestinal ceca. These branches unite dorsal to the pharynx.

Host List

In addition to the hosts reported in this paper, Genolinea laticauda has been found in Blepsias cirrohosis (Pallas) (McCauley, 1960), Enophrys bison (Girard) (McCauley, 1960), Hippoglossus hippoglossus (Linnaeus) (Manter, 1925), Leptocottus armatus Girard (McCauley, 1960), Ophiodon elongatus Girard (Lloyd, 1938), and Scorpaenichthys marmoratus (Ayres) (McFarlane, 1936). This brings the total number of hosts for this trematode to eight species.

Genus *Lecithaster* Lühe, 1901

Synonyms:

Dichadena Linton, 1910

Leptosoma Stafford, 1904

Mordvilковиaster Pigulewsky, 1938

This genus was established in 1901 by Lühe. The genotype is *Lecithaster confusus* Odhner, 1905. The genus is composed of small or fusiform smooth tailless worms. The oral sucker is sub-terminal, the pharynx well developed, the esophagus short, and the ceca do not quite reach the posterior end. The acetabulum is larger than the oral sucker and is positioned one third of the body length from the anterior end. The testes lie transversally close behind the acetabulum. The seminal vesicle is saccular. The hermaphroditic duct is enclosed in a pouch. The genital pore is ventral to the pharynx or intestinal bifurcation. The ovary is four- or five-lobed. The vitellarium is seven-lobed. The uterus may or may not reach the posterior end. The ova are small. The excretory arms do not unite anteriorly. These worms are parasitic in large or small intestines of marine fishes (Yamaguti, 1958).

The following species have been named in the genus: *L. acutus* Linton, 1910; *L. confusus* Odhner, 1905; *L. extralobus* Srivastava, 1935; *L. gibbosus* (Rudolphi, 1802); *L. galeatus* Looss,

1907; L. indicus Srivastava, 1935; L. intermedius Szidat, 1954; L. salmonis Yamaguti, 1934; L. sayori Yamaguti, 1938; L. stellatus Looss, 1907; L. tauricus Pigulewsky, 1938.

Lecithaster sayori Yamaguti, 1938 was reduced to a synonym of L. stellatus Looss, 1907 by Manter in 1960 thus leaving 11 valid species in this genus.

Only L. salmonis was found in this study.

Lecithaster salmonis Yamaguti, 1934

See Figure 2.

The following description is based on 124 specimens taken from the intestines of all five species of fish examined. Lecithaster salmonis were found in two Clinocottus embryum (Jordan and Starks), 33 Clinocottus globiceps, (Girard), one Clinocottus acuticeps (Gilbert), 25 Oligocottus maculosus Girard, and two Oligocottus snyderi Greeley. Host fish were collected at Neptune State Park (C. embryum, C. globiceps, and O. maculosus), Seal Rock (O. maculosus, O. snyderi, C. globiceps and C. acuticeps), Yaquina Head (O. maculosus and C. globiceps), and Bar View (O. maculosus). The measurements were taken from six well preserved specimens that best represent the size range. The smallest specimen of the six had well developed testes and ovary but had not begun to produce eggs.

External Features

Trematodes with short spindle-shaped bodies and gently pointed ends. The bodies measure from 0.86 to 2.4 in length and 0.31 to 0.73 in width at the level of the acetabulum. The cuticle is delicate and unarmed. The oral sucker is round and measures 0.078 to 0.16 by 0.093 to 0.19. The round ventral sucker lies at the posterior part of the anterior third of the body and measures 0.16 to 0.33 by 0.17 to 0.36. The preoral lip is 0.025 to 0.045 in length. The genital pore opens on the mid-ventral side at the level of the pharyngo-esophageal juncture. The excretory pore lies at the posterior end of the body.

Digestive System

The oral opening is located at the antero-ventral surface of the oral sucker. The digestive tract leads from the oral opening through the oral sucker into the muscular pharynx which measures 0.078 to 0.123 by 0.055 to 0.10. The esophagus is very short and bifurcates immediately into the two ceca which extend backward to the level of the vitellaria or beyond. The most anterior part of each ceca is devoid of epithelium.

Genital Systems

The testes are round with smooth edges and lie transversely behind the acetabulum. The right testis measures 0.088 to 0.158 by 0.032 to 0.163, the left 0.065 to 0.163 by 0.07 to 0.15. The seminal vesicle is on the right posterodorsal side of the acetabulum and measures 0.083 to 0.295 by 0.043 to 0.195. The pars prostatica is long and surrounded by numerous prostatic cells. The hermaphroditic pouch lies ventral to the cecal bifurcation, and the genital opening is ventral to the posterior end of the pharynx. The ovary is four-lobed, measuring 0.138 to 0.42 by 0.098 to 0.34 from the tip of one lobe to the tip of the opposite lobe. It lies just anterior to the vitellarium. The lobes of the ovary are roundish to slightly elongate. The seminal receptacle is large and lies anterodorsal to the ovary. The vitelline gland is composed of seven elongate lobes situated in the anterior part of the posterior one-third of the body. The uterine coils, containing eggs, occupy much of the available space posterior to the acetabulum. The ova are oval measuring 0.0162 to 0.025 by 0.01 to 0.0138.

Excretory System

The excretory pore is terminal and the excretory vesicle widens just before the opening. The vesicle continues forward

passing dorsal to the vitellarium and the ovary, ventral to the seminal receptacle, and bifurcates at the posterior end of the seminal vesicle, sending a branch along each side of the acetabulum.

Host List

Of the five hosts harboring L. salmonis in this study, only Clinocottus embryum had been reported as a host previously. The hosts reported by others are: Clinocottus embryum (Jordan and Starks) (Ching, 1960a); Cymatogaster aggregatus Gibbons (Ching, 1960a); Gasterosteus aculeatus (Linnaeus) (Ching, 1960a); Leiognathus argentea Lacepede (Yamaguti, 1940); Leptocottus armatus Girard (Ching, 1960a); Oncorhynchus kisutch (Walbaum) (Ching, 1960a); O. tshchawytscha (Walbaum) (Lloyd, 1938); Plotosus anguillaris Lacepede (Yamaguti, 1940); Porichthys notatus Girard (Ching, 1960a); Salmo keta (= Oncorhynchus keta (Walbaum)) (Yamaguti, 1934); Sebastes maliger (Jordan and Gilbert) (Ching, 1960a); Sebastes melanops (Girard) (Ching, 1960a); Trachurus trachurus Linné (Yamaguti, 1940). This study brings the number of hosts for Lecithaster salmonis to 17.

FAMILY ZOOGONIDAE

Genus Zoogonoides Odhner, 1902

Synonym: Zoogenus Nicoll, 1912 (Yamaguti, 1958)

The genus Zoogonoides was established by Odhner in 1902 with Z. viviparus (Olsson, 1868) Odhner, 1902 as the type species.

Olsson's description was based on two specimens which he believed came from the stomach of the host. Odhner corrected this mistake and pointed out that the terminal portion of the intestine is the habitat of Z. viviparus. The genus is characterized by having the acetabulum larger than the oral sucker, the body small and covered with spines, the oral sucker subterminal, prepharynx present, pharynx small with the esophagus of moderate length, ceca extending to the level of the acetabulum or a little further in front or behind, testes one on each side of the acetabulum, preacetabular cirrus sac spined or not, genital pore at the level of the intestinal bifurcation, ovary postacetabular, median or submedian, receptaculum seminis and Laurer's canal present, vitellaria compact and single near the ovary, uterine coils occupying most of the hindbody, and a sacular excretory vesicle.

Zoogenus Nicoll, 1912 was said to resemble Zoogonoides and to differ from it in having an unarmed cirrus, a strongly muscular metraterm, and smaller egg capsules. Skrjabin (1964) recognized

the genus Zoogenus. Yamaguti in 1958 reduced Zoogenus to a synonym of Zoogonoides.

Six species of Zoogonoides have been described: Z. acanthogobii Yamaguti, 1938; Z. laevis Linton, 1940; Z. pyriformis Pritchard, 1963; Z. subaequiporus Odhner, 1911; Z. vividus (Nicoll, 1912), and Z. viviparus (Olsson, 1868).

Z. subaequiporus Odhner, 1911 has been relegated to synonymy with Z. viviparus (Olsson, 1868) by Dawes (1946) because he felt that the size relation of the suckers did not justify the erection of a species. This leaves five valid species of Zoogonoides.

Only Zoogonoides viviparus was found in this study.

Zoogonoides viviparus (Olsson, 1868) Odhner, 1902

See Figure 3.

Synonyms:

Distoma viviparum Olsson, 1868

Zoogonus viviparus (Olsson) of Looss, 1901

Zoogonoides subaequiporus Odhner, 1911

The following description is based on five well preserved specimens. A total of 40 specimens were recovered from the lower intestines of two species of fish at Yaquina Head. Thirty-six were taken from ten Oligocottus snyderi Greeley and four specimens were taken from three Clinocottus globiceps (Girard).

External Features

Small trematodes with spindle-shaped bodies. They measure 0.66 to 1.23 in length and 0.29 to 0.39 in width at the level of the acetabulum. The body tapers anteriorly from the centrally located acetabulum to a rounded anterior end and tapers posteriorly to a broadly pointed posterior end. The round oral sucker measures 0.12 to 0.14 by 0.13 to 0.14 and the ventral sucker measures 0.16 to 0.17 by 0.16 to 0.20. The cuticle is spinous with the spines being scarce to dense in the front half of the body and becoming fewer posteriorly. In the hind body the spines are scarce to lacking. The genital opening is on a small papilla midway between the ventral sucker and the oral sucker on the left side of the body. The excretory pore is terminal posteriorly.

Digestive System

The oral opening is subterminal opening into the oral sucker, passing through a short prepharynx, and then into the muscular pharynx. The pharynx measures 0.03 to 0.05 by 0.05. The esophagus is longer than the pharynx and bifurcates midway between the oral and ventral suckers into two sac-like intestinal crura. The ceca extend posteriorly to the mid-level of the body lateral to the acetabulum.

Genital Systems

The testes lie near the midline of the body lateral to the ventral sucker. The left measures 0.06 to 0.09 by 0.04 to 0.08 and the right measures 0.05 to 0.11 by 0.03 to 0.08. The cirrus sac curves inward and posteriorly from the genital pore to the anterior border of the acetabulum. The seminal vesicle is composed of two tandem lobes in the posterior one third of the cirrus sac. The cirrus is slender with its anterior portion bearing small posteriorly directed spines. The round ovary is posterodorsal and slightly to the left of the ventral sucker and measures 0.04 to 0.14 by 0.05 to 0.13. The vitellarium is a globular body posterior and adjacent to the ovary. Its size varies from about one half to nearly equal the size of the ovary. A vitelline reservoir is posterior to the vitellarium. Posterior to the gonads the area is filled by uterine coils. The thin shelled ova in the uterus contain miracidia and measure 0.05 to 0.07 by 0.02 to 0.04. The uterus runs along the left side of the cirrus sac and opens at the genital pore on a small papilla.

Excretory System

The posteroterminal excretory pore opens into a roundish excretory bladder.

Host List

I have collected this species of trematode from Clinocottus globiceps and Oligocottus snyderi. They have also been collected from the following hosts: Anarrhichus lupus Linnaeus (Nicoll, 1915); Blennius gattorugine (Nicoll, 1915); Blennius ocellaris Linnaeus (Nicoll, 1915); Bothus maximus (Nicoll, 1915); Callionymus lyra Linnaeus (Odhner, 1902); Hippoglossoides platessoides (Fabricius) (Odhner, 1902); Microstomus pacificus (Lockington) (Ching, 1960a); Pleuronectes flesus (Odhner, 1902); P. limanda (Linnaeus (Odhner, 1902); P. microcephalus Donovan (Odhner, 1902); P. platessa Linnaeus (Odhner, 1902); Reinhardtius hippoglossoides (Walbaum) (= Pleuronectes cynoglossus Fabricius) (Nicoll, 1915); Rhombus maximus (Nicoll, 1907); Solea vulgaris (Nicoll, 1915); Solea variegata (Nicoll, 1915); Steringophorus furciger (Dawes, 1946); and Zeus faber (Nicoll, 1915). This increases the host number from 17 to 19.

FAMILY OPECOELIDAE

Genus Podocotyle (Dujardin, 1845) Odhner, 1905

Synonym: Sinistroporus Stafford, 1904

The genus Podocotyle was erected by Dujardin in 1845 and was redescribed by Odhner in 1905. The type species is P. atomon (Rudolphi, 1802) Odhner, 1905. The trematodes of this genus are unarmed, with more or less elongate bodies. The acetabulum is in the anterior half of the body and is pedunculated or not. The oral sucker and the pharynx are well developed. The esophagus is short to comparatively long. The ceca terminate at or near the posterior end of the body. The tandem testes are in the middle of the hind-body and close together or separated by some distance. The cirrus pouch is long, slender or claviform, and may or may not extend posterior to the ventral sucker. No external seminal vesicle is present. The genital pore is near the level of the esophagus and to the left of the midline or is median. The ovary is usually three lobed but sometimes 4-lobed or nearly rounded. It is at the midline or to the right and is pretesticular. A seminal receptacle and Laurer's canal are present. The vitellaria range from the level of the anterior border of the acetabulum to the posterior end of the hind body and may be either in bands or confluent posterior to the testes. The uterus is in coils between the ovary and the acetabulum and

passes uncoiled from there to the genital pore. The excretory vesicle usually runs forward to the level of the ovary (Aldrich, 1960).

Yamaguti (1958) listed 36 species of Podocotyle. In 1960 Aldrich in a Ph.D. thesis made a detailed and thorough study of the literature of Podocotyle and found 48 species had been described. He considered 38 of these to be valid species. Since the work of Aldrich three new species have been described. These are: P. bongosi (Nagaty and Aal, 1962), P. plectropomi (Manter, 1963), and P. sinusacca (Ching, 1960a). This brings the total number of species to 41.

Podocotyle atomon (Rudolphi, 1802) Odhner, 1905

Synonyms:

Fasciola atomon Rudolphi, 1802

Distoma atomon Rudolphi, 1809

Distoma angulatum Dujardin, 1845

Allocreadium atomon (Rudolphi, 1802) Odhner, 1901

Sinistroporus simplex Stafford, 1904

Psilostomum redactum Nicoll, 1906

Distomum vitellosum Johnstone, 1907

Fasciola aeglefini Muller, 1776

One specimen of P. atomon was recovered from the intestine of a Clinocottus globiceps at Neptune State Park. The specimen

fitted the description of the species as given by Odhner, 1905 and Aldrich, 1960 without variation.

The life cycle of P. atomon was worked out by Hunninen and Cable (1943) who showed the cercariae is cotylomicrocercous and develops as sporocysts in Littorina rudis. The cercariae penetrate and encyst in the marine amphipods Gammarus sp., Carinogammarus mucronatus, and Amphithoe longimana.

Host List

Aldrich (1960) reported 48 hosts for Podocotyle atomon. Other known hosts are: Anguilla anguilla (Bykhovskaya-Pavlovskaya et al., 1964), A. rostrata (Hunninen and Cable, 1943), Apeltes quadracus (Hunninen and Cable, 1943), Cyclogaster montagui (Nicoll, 1915), Leuciscus brandti (Bykhovskaya-Pavlovskaya et al., 1964), Motella mustela (Nicoll, 1907), Myoxocephalus quadricornis (Bykhovskaya-Pavlovskaya et al., 1964), and Clinocottus globiceps found in this survey. This brings the host number to 56.

Podocotyle blennicottusi Park, 1937

See Figure 4.

Two specimens of this species were taken from the intestine of one Clinocottus globiceps collected at Neptune State Park.

External Features

Worms with bodies 2.36 to 2.5 by 0.675 to 0.875 tapering

slightly and rounded at both ends. The oral sucker is subterminal and round, 0.20 to 0.205 by 0.20 to 0.218. The ovate ventral sucker measures 0.255 to 0.31 by 0.30 to 0.355 and has its anterior border 0.395 to 0.445 from the anterior end. The genital pore is at the level of the pharynx and opens ventrally halfway between the pharynx and the lateral edge of the body. There is an excretory pore at the posterior terminus of the body. The cuticle is thick with longitudinal ridges visible anterior and lateral to the acetabulum. The rudimentary spines in the region of the ventral sucker which were reported by Park were not found.

Digestive System

The digestive system begins at the subterminal oral opening which leads into the oral sucker. Park reported that the prepharynx is visible in section only. The pharynx leads into a short esophagus which bifurcates into two slender ceca extending nearly to the posterior end of the body. The pharynx measures 0.105 to 0.11 by 0.11. The esophagus is 0.05 to 0.08 in length.

Genital Systems

The two testes lie in tandem, very close or touching each other in the posterior half of the body. Both testes are large, extending laterally nearly to the ceca. They have irregular edges

with deep clefts forming lobes. The anterior testis touches or partially overlaps the ovary and measures 0.238 to 0.26 by 0.395 to 0.455. The posterior testis nearly touches the anterior one at the midline and is separated from it anterolaterally by vitellaria. The posterior testis measures 0.295 to 0.325 by 0.39 to 0.46. The pear shaped seminal receptacle measures 0.15 to 0.25 by 0.095 to 0.123. Its posterior end is rounded and lies dorsally over the ovary. The pointed anterior end curves to the left. Laurer's canal was not observed. The cirrus sac extends posterior to the acetabulum midway between it and the ovary. The seminal vesicle within the cirrus sac is composed of an anteriorly directed large posterior part, next a posteriorly directed small loop, and an anteriorly directed front portion. The ejaculatory duct passes forward crossing the intestinal ceca ventrally and opens at the common genital pore. The cirrus was not external.

The ovary has four unequal lobes, three directed posteriorly and one anteriorly. It measures 0.16 to 0.163 by 0.31 to 0.365 across opposite lobes. A small vitelline reservoir lies anterodorsally to the ovary. The vitelline follicles are in two lateral bands anterior to the anterior testis and in four bands, two lateral and two medial, posterior to the anterior testis. The vitellaria are slightly interrupted at the levels of the testes. The bands extend anterior to the middle level of the acetabulum and posterior to the

end of the body. Large vitelline ducts from the bands anterior to the ovary run posterior and toward the middle of the body and join the ducts that run anterior from the vitellaria posterior to the ovary. The uterus coils are ventral to the cirrus sac in the inter-cecal area between the ovary and the posterior border of the acetabulum. The metraterm extends posterior to the mid-level of the ventral sucker and opens at the sinistral genital pore. The ova are 0.070 to 0.08 by 0.030 to 0.040.

Excretory System

The excretory pore is terminal posteriorly.

Podocotyle blennicottusi is characterized by the large closely tandem testes, four-lobed ovary, and the long sinuous seminal vesicle.

Host List

This trematode has been reported from the following hosts: Clinocottus globiceps (Girard) (Park, 1937), Liparis dennyi Jordan and Starks (Aldrich, 1960), and L. fucensis Gilbert (Aldrich, 1960).

Podocotyle californica Park, 1937

See Figure 5.

The following description is based on 52 specimens taken from the intestines of two species of fish. Forty-nine specimens were found in 22 Oligocottus maculosus Girard taken from Bar View (north of Garibaldi) and Cape Arago. Three were found in one O. snyderi Greeley taken at Cape Arago.

External Features

Trematodes with bodies 1.56 to 2.08 in length and 0.35 to 0.54 in width at the level of the ovary. The body tapers anteriorly from the acetabulum to a rounded anterior end and is broadly pointed posteriorly. The cuticle is thick with heavy transverse ridges. The round oral sucker is subterminal and measures 0.145 to 0.175 by 0.145 to 0.175. The ovate ventral sucker lies in the anterior one-third of the body and measures 0.21 to 0.33 by 0.25 to 0.34. The genital pore lies midway between the pharynx and the left edge of the body and opens ventrally. The excretory pore is posteroterminal.

Digestive System

The oral opening leads through the oral sucker to a very short

prepharynx. The muscular pharynx is 0.09 to 0.113 by 0.083 to 0.095 and leads into an esophagus that is 0.035 to 0.063 in length. The thin intestinal ceca extend nearly to the end of the body.

Genital Systems

The testes are in tandem behind the ovary in the posterior half of the body. The testes are mildly to strongly lobed and are separated by 0.02 to 0.115 medially and by vitellaria laterally. The anterior testis measures 0.12 to 0.19 by 0.17 to 0.225 and the posterior testis measures 0.15 to 0.198 by 0.163 to 0.233. The pear shaped seminal receptacle is anterior and to the left of the ovary. It measures 0.175 to 0.188 by 0.098 to 0.10. Laurer's canal emerges from the pointed anterior end of the seminal receptacle and coils laterally to the region of the left intestinal cecum. A large vitelline reservoir is anterior to the ovary. The cirrus sac extends posterior to the level of the acetabulum, overlapping it. The seminal vesicle is straight and constricted slightly into a large posterior part and a small anterior part. The genital pore is at the level of the pharynx midway between it and the left edge of the body.

The ovary is closely anterior to the anterior testis and is composed of four unequal lobes. It measures 0.068 to 0.13 by 0.13 to 0.25 across opposite lobes. The uterus coils in the intercecal area between the posterior border of the acetabulum and the ovary.

Its non-coiled portion passes anterior to the left of the seminal vesicle. The metraterm is as long as the cirrus sac and opens at the common genital pore. The vitellaria are well developed and lie in two lateral bands extending from the mid-level of the acetabulum to the posterior end of the body. There are four rows posterior to the posterior testis. The ova measure 0.0613 to 0.0688 by 0.0313 to 0.0375.

Excretory System

The excretory pore is posteroterminal. The excretory bladder extends anteriorly to the level of the ovary.

Host List

These trematodes have been found previously in Clinocottus globiceps (Girard) (Park, 1937). This study increases the host number to three.

Podocotyle pacifica Park, 1937

See Figure 6.

Three specimens of this worm were collected from the intestines of three Clinocottus globiceps (Girard). Two were found at Neptune State Park and one at Seal Rock. The measurements are taken from the two best preserved specimens.

External Features

Trematodes with elongate bodies that are slightly tapered and rounded at both ends. The worms are 2.0 to 2.1 in length and 0.585 to 0.65 in width at the level of the ovary. The oblong oral sucker measures 0.205 to 0.225 by 0.198. The acetabulum is ovate and is 0.27 by 0.30 to 0.335. It is situated in the anterior one fourth of the body, its anterior border being 0.325 from the anterior end. The cuticle is smooth and unarmed. The genital pore is ventral and to the left of the pharynx midway between it and the lateral edge of the body. The excretory pore is terminal posteriorly.

Digestive System

The oral opening is subterminal and leads through the oral sucker and a very short prepharynx. The pharynx is 0.11 to 0.113 by 0.09 and opens into a short slender esophagus measuring 0.05 in length. The slender intestinal ceca extend to the posterior end of the body.

Genital Systems

The testes are smooth and circular or with slight lobes and are located in tandem posterior to the ovary. The anterior testis is 0.14 to 0.15 by 0.105 to 0.168, the posterior, 0.153 to 0.188 by

0.158 to 0.178. The seminal receptacle was not visible, nor was Laurer's canal. The cirrus sac is clavate and extends posteriorly beyond the acetabulum. The seminal vesicle is sinuous consisting of a large posterior part, a thin loop, a recurved middle portion and the anteriorly directed muscular ejaculatory seminal vesicle. The ejaculatory duct leads to the genital opening through which projects a long cirrus.

The ovary is composed of one anteriorly and three posteriorly directed lobes. It measures 0.153 to 0.165 by 0.20 to 0.238 across opposite lobes. The vitelline reservoir is anterior to the ovary. The vitellaria are small globular structures running in two wide lateral bands from the level of the anterior border of the acetabulum to the posterior end of the body. These bands are interrupted at the levels of both testes and tend to form four rows posteriorly to the posterior testis. The loops of the uterus are contained in the intercecal area between the posterior border of the acetabulum and the ovary. The uterus leads along the left side of the cirrus sac to the genital opening. The ova measure 0.070 to 0.0838 by 0.035 to 0.038.

Excretory System

The excretory pore is terminal. The clavate excretory bladder extends anteriorly to the level of the ovary.

Host List

This trematode has been reported previously in seven hosts:

Clinocottus globiceps (Girard) (Park, 1937), Dasycottus setiger Bean (Aldrich, 1960), Gasterosteus aculeatus Linnaeus (Ching, 1960a), Icelinus borealis Gilbert (Ching, 1960a), Leptocottus armatus Girard (Ching, 1960a), Liparis fucensis Gilbert (Ching, 1960a), L. pulchellus Ayres (Ching, 1960a), and Lycodopsis pacificus (Collett) (Ching, 1960a).

Podocotyle pedunculata Park, 1937

See Figure 7.

The following description is based on two specimens taken from the intestine of one Oligocottus maculosus Girard from Neptune State Park.

External Features

The body is elongate, tapering from the ventral sucker to a broadly rounded anterior end. Posterior to the ventral sucker the body is of uniform width and is rounded posteriorly. The worm is 2.01 in length and 0.27 in width at the level of the ovary. The terminal oral sucker measures 0.12 by 0.13. The acetabulum is strongly pedunculated; its anterior border is 0.40 from the anterior

end. It measures 0.185 by 0.238. The genital pore is at the level of the esophagus midway between it and the left side of the body. There is a terminal excretory pore. The cuticle is smooth and unarmed.

Digestive System

The oral opening is subterminal. There is a short prepharynx and a muscular pharynx which measures 0.078 by 0.085. Cervical glands are present. The slender esophagus is 0.103 in length. The intestinal ceca extend to the posterior end of the body.

Genital Systems

The two intercecal testes are in tandem behind the ovary. The anterior testis, 0.125 by 0.128, just touches the posterior border of the ovary. The posterior testis, 0.138 by 0.143, is separated from the anterior testis by 0.133 with vitellaria in the space. Both testes are round and smooth, having no more than minor indentations in their outlines. The seminal vesicle is clavate and extends back to the region of the acetabulum.

The ovary is located in the center of the body in front of the testes. The ovary, 0.078 by 0.133, is three-lobed with the lobes directed posteriorly. A small vitelline reservoir is situated anterodorsal to the ovary and posteroventral to the seminal

receptacle. The pear-shaped seminal receptacle is 0.075 long and 0.095 wide. From its pointed anterior end, Laurer's canal coils to the left side where it opens dorsally at the region of the left ceca. The vitellaria extend from the posterior tip of the body to the posterior border of the acetabulum. They are composed of grape-like clusters running in two lateral bands along the lateral edges of the ceca. Posterior to the anterior testis there are two more bands of vitellaria that run along the medial borders of the ceca. The four bands posterior to the anterior testis are interrupted at the level of the posterior testis. The two lateral bands are interrupted at the level of the anterior testis. The loops of the uterus are confined to the intercecal region posterior to the acetabulum and anterior to the seminal receptacle. The ova are shaped like orange segments (perhaps an artifact due to shrinkage) and measure 0.061 to 0.062 by 0.032 to 0.034.

Excretory System

The excretory pore is terminal. The intercecal excretory bladder is elongate extending to the level of the ovary.

Host List

This trematode has been found previously in Leptocottus armatus Girard (Ching, 1960a) and Oligocottus maculosus Girard (Park, 1937).

Podocotyle reflexa (Creplin, 1825) Odhner, 1905

Synonyms:

Distoma relflexum Creplin, 1825

Sinistroporus productus Stafford, 1904

Sinistroporus simplex (Rudolphi, 1809) Stafford, 1904

Podocotyle producta (Stafford, 1904) Yamaguti, 1953

Three worms were taken from Clinocottus globiceps, two of which were captured at Yaquina Head and one from Neptune State Park.

These specimens, although smaller than the one specimen described by Miller (1941) from Stafford's collection (1904), fall within the size range and fit all morphological characteristics as given by Aldrich (1960) in his description based on 45 specimens.

Host List

Besides being taken from Clinocottus globiceps (Girard), this trematode has been taken from: Agonus acipenserinus Tilesius (Aldrich, 1960), Asterotheca alascana (Gilbert) (Aldrich, 1960), Cyclopterus lumpus Linnaeus (Odhner, 1905), Gasterosteus aculeatus Linnaeus (Aldrich, 1960), Gaidropsarus mustela (Linnaeus) (Nicoll, 1915), Hemitripteris americanus (Gmelin) (Stafford, 1904), Leptocottus armatus Girard (McFarlane, 1936), Microgadus tomcod

(Walbaum) (Heller, 1949), Osmerus eperlanus (Bykhovskaya-Pavlovskaya, 1964), Salmo salar Linnaeus (Nicoll, 1915), Spinachia spinachia (Linnaeus) (Odhner, 1905), Sygnathus griseolineatus Ayres (McFarlane, 1936), Trigla gurnardus Linnaeus (Odhner, 1905), and Urophycis chus (Walbaum) (Stafford, 1904). This study increases the host number to 15.

DISCUSSION

Examination of only five species of fish yielded 12 new host records illustrating the lack of work on the parasites of tidepool residents.

Some of my specimens of Lecithaster salmonis Yamaguti, 1934 are larger than any of those previously reported. The upper limit in length is increased from 1.26 (Yamaguti, 1934) to 2.4, the oral sucker size from 0.11 by 0.115 to 0.16 by 0.19, the ventral sucker size from 0.18 by 0.18 to 0.33 by 0.36, and all other body parts with the exception of the eggs are proportionally larger. In my preserved specimens the eggs measure less than that given by Yamaguti (1934) for live specimens. Both Ching (1960a) and Lloyd (1938) found the eggs to be smaller in their preserved Puget Sound specimens than those Yamaguti had described. Several of my specimens had longer ceca than Yamaguti described and Ching (1960a) found two specimens with shorter ceca than those of Yamaguti. In view of the other characters these differences are considered to be individual variations.

Clinocottus globiceps (Girard) consistently yielded the largest Lecithaster salmonis Yamaguti, 1934 specimens. Of the 57 specimens recovered from C. globiceps (Girard) the size ranged from 0.71 to 2.4. Of 54 recovered from Oligocottus maculosus (Girard)

the size range was 0.61 to 1.07.

Genolinea laticauda Manter, 1925 closely resembles G. manteri Lloyd, 1938 differing only in minute details. The differences are egg size, extent of seminal vesicle, and body and organ sizes which measure slightly larger in G. manteri Lloyd, 1938. The seminal vesicle of G. laticauda Manter, 1925 is described as anterior to or slightly overlapping the ventral sucker (although one of Manter's drawings (1925, Figure 4) shows it extending nearly to the middle of the acetabulum), whereas in G. manteri Lloyd, 1938 it extends to the middle of the ventral sucker. According to Skrjabin (1964) this is the taxonomic character to separate the two species. My specimens do not follow Skrjabin's key characters since some of those that most closely fit G. laticauda Manter, 1925 in other respects have the seminal vesicle extending to and beyond the middle of the ventral sucker. Since Manter described the species and genus from only two specimens and in view of the other constant characters, I consider the extent of the seminal vesicle to be variable within the species.

Odhner (1905) described Zoogonoides viviparus (Olsson, 1868) as having a sucker ratio of 1:2. Ching (1960a) reported a sucker ratio of 1:1.5. My specimens have a sucker ratio of 1:1.3.

My two specimens of Podocotyle blennicottusi Park, 1937 are slightly larger than the four specimens Park described from

the same species of fish. They are also larger than those described by Aldrich (1960). Other characters such as morphology and location of the seminal vesicle, gonads, and vitellaria agree closely with Park's type specimen.

Podocotyle californica Park, 1937 has not been reported since the original description based on five specimens (Park, 1937). All of my worms are smaller and some have less lobing of the testes than those described by Park.

My specimens of Podocotyle pacifica Park, 1937 were considerably smaller than the one specimen from which Park described the species. Aldrich (1960) also found his specimens from the San Juan Archipelago to be smaller. Variation in the extent of the vitellaria were observed. In one specimen the vitellaria extended anteriorly only to the posterior border of the acetabulum and in another met at the midline and did not tend to form four rows posterior to the second testis.

SUMMARY

The following host fishes yielded the following parasites. New host records are indicated with an asterisk.

Clinocottus acuticeps (Gilbert)

*Lecithaster salmonis Yamaguti, 1934

C. embryum (Jordan and Starks)

Lecithaster salmonis Yamaguti, 1934

C. globiceps (Girard)

*Genolinea laticauda Manter, 1925

*Lecithaster salmonis Yamaguti, 1934

*Podocotyle atomon (Rudolphi, 1802)

P. blennicottusi Park, 1937

P. pacifica Park, 1937

*P. reflexa (Creplin, 1825)

*Zoogonoides viviparus (Olsson, 1868)

Oligocottus snyderi Girard

*Lecithaster salmonis Yamaguti, 1934

*Podocotyle californica Park, 1937

*Zoogonoides viviparus (Olsson, 1868)

O. maculosus Girard

*Genolinea laticauda Manter, 1925

*Lecithaster salmonis Yamaguti, 1934

*Podocotyle californica Park, 1937

P. pedunculata Park, 1937

The following species of digenetic trematodes are described in detail: Genolinea laticauda Manter, 1925, Lecithaster salmonis Yamaguti, 1934, Podocotyle blennicottusi Park, 1937, P. californica Park, 1937, P. pacifica Park, 1937, P. pedunculata Park, 1937 and Zoogonoides viviparus (Olsson, 1868).

Variations from the original descriptions are discussed in the following species: Genolinea laticauda Manter, 1925, Lecithaster salmonis Yamaguti, 1934, Podocotyle blennicottusi Park, 1937, P. californica Park, 1937, P. pacifica Park, 1937, and Zoogonoides viviparus (Olsson, 1868).

Host lists are compiled for each species of trematode found in the study.

Species lists are compiled for each genus of trematode reported.

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- Figure 1. Genolinea laticauda Manter, 1925.
Whole mount; ventral view.
- Figure 2. Lecithaster salmonis Yamaguti, 1934.
Whole mount; ventral view.
- Figure 3. Zoogonoides viviparus (Olsson, 1868).
Whole mount; ventral view.
- Figure 4. Podocotyle blennicottusi Park, 1937.
Whole mount; ventral view.

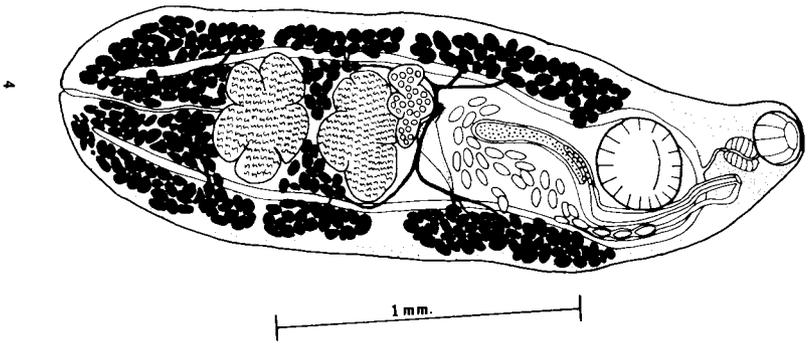
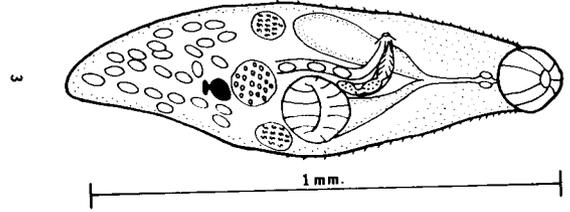
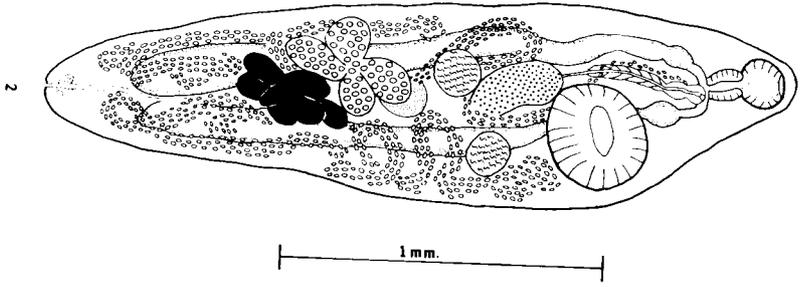
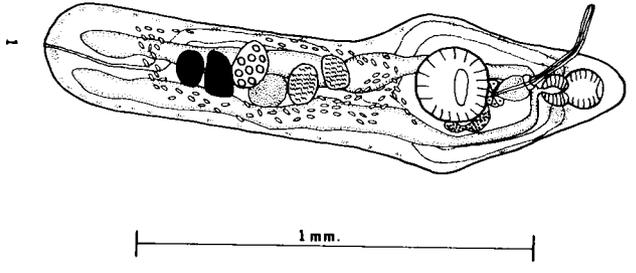


Figure 5. Podocotyle californica Park, 1937.
Whole mount; ventral view.

Figure 6. Podocotyle pacifica Park, 1937.
Whole mount; ventral view.

Figure 7. Podocotyle pedunculata Park, 1937.
Whole mount; ventral view.

