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INTRODUCTION

The parasitic fauna of ocean depths is practically unknown. Although an extensive fish population occurs at all depths, very little study has yet been made on the helminths of these fish. During the summers of 1930, 1931 and 1932 excellent opportunity was offered for the collection of parasites from fish trawled from depths varying from 40 to 582 fathoms at Tortugas, Florida. A considerable number of systematic hauls by the staff and crew of the Tortugas Biological Laboratory of the Carnegie Institution of Washington yielded an abundance and considerable variety of fish, some of rare forms, many of which were examined for parasites. Most of these hauls were made about 20 miles south of Loggerhead Key.

Fish taken from these depths were commonly parasitized by helminths and especially by trematodes. Preliminary notes already published (Manter, 1930, 1931b, 1932) indicate the richness of this new field. In spite of some circumstances making collection more difficult, it was found that the trematode fauna of the deep-water fish is practically as abundant and as varied as is the rich trematode fauna of the reef fish.

von Linstow (1888) reporting on the entozoa collected by the *Challenger* expedition does not record any trematodes from deep-water fish and even assumes their absence. He explains "the trematodes are, as free-swimming larvæ, too delicate to withstand the pressure of a deep-sea life, and are restricted to quiet fresh-water basins or to sheltered littoral regions." This conclusion is, of course, fallacious as is also his observation that ova (of parasites of marine fish) "are too widely scattered in the infinite mass of water to have much chance of reaching their proper intermediate hosts." Actually, parasites meet such handicaps in various ways.

Although 582 fathoms is no great depth in comparison with that over a large part of the ocean floor, the fact that several kinds of trematodes were collected at that level and that many fish from 300 fathoms show them in undiminished number seems to indicate that trematodes can and do live in the abyss. The negative findings of the *Challenger* expedition are perhaps due to lack of facilities for immediate examination and preservation of these parasites. In fact, in an appendix to his report, von Linstow notes the occurrence of two trematodes in the *Challenger* collection, both occurring as immature forms in invertebrates. These immature forms are *Distomum filiferum* Sars from the abdominal cavity of *Nematoscelis megalops* Sars and *Thysanaëssa gregaria* Sars and *Distomum glauci* Bergh from

the nudibranchs *Glaucus glacialis* Bergh and *Glaucus longicirrus* Rhdt. The latter trematode is a ringed hemiurid related to *Hemiurus*, and both forms are without doubt parasites as adults in fish.

A few adult trematodes have been described from deep-water fish. Bell (1887) has described *Distomum halosauri* from the ureters of *Halosaurus macrochir* collected by the *Challenger* expedition from a depth of 1090 fathoms. This trematode from over a mile depth is the deepest-water adult trematode known at present. Its description is insufficient to identify its modern genus, but it evidently belongs in the family Gorgoderidæ near the genus *Phyllodistomum*. The deepest-water (582 fathoms) trematodes in the present collection belong in the family Fellodistomidæ. Odhner 1911*a* names *Proctophantastes abyssorum* from *Macrurus rupestris* and *Gadus æglefinus*, but does not state any depth. Linton (1898, 517) has named *Distomum læve* from *Macrurus bairdii* which is normally a deep-water fish. One of the deepest-water parasites known is an Acanthocephalan, *Echinorhynchus abyssicola* Dollfus, 1931, from *Pachycara obesa* Zugmayer taken from 4783 meters. Dollfus (1931, 187) expresses regret that the helminth parasites of abyssal animals are yet a "*terra incognita*."

There are certain difficulties in connection with the collection of parasites from deep-water hosts. The fish are often dead when they reach the surface and are susceptible to very rapid disintegration, especially in the tropics. It is necessary to collect the trematodes as soon as possible. Many of the fish were examined on board boat immediately after the trawl. Here, the use of a microscope was impossible, but most trematodes could be detected by aid of a hand lens. Fish which could not be examined immediately were placed on ice for later examination, and some of these remained in fairly satisfactory condition for nearly 24 hours.

No new or unusual methods of technique were employed. The different parts of the digestive tube of the fish were scraped in flat glass dishes containing sea-water or diluted sea-water, the lighter débris decanted or pipetted off and the sediment examined against a dark background. Trematodes were almost always killed in formol-alcohol-acetic solution (formalin 6½ parts, 50 per cent alcohol 100 parts, glacial acetic acid 2½ parts) individually under a cover-glass. During this process just enough pressure was applied to the cover-glass to flatten the specimen. This method has seemed advisable especially when only a few specimens are collected, since it insures flattened forms. Its disadvantage lies in the possible displacement of some organs by the pressure. It should be understood that the descriptions in this paper are based on specimens killed in this manner. However, practically no pressure was applied to thin-bodied forms and never more than seemed necessary to bring about ordinary body extension. When material was abundant, some specimens were killed by the shaking method. The killing solution was removed usually after some hours and specimens preserved in 70 per cent alcohol. Trematodes stored in 70

per cent alcohol over a period of time often become dark colored or even completely black. The most successful of numerous treatments tried was one suggested by Dr. O. L. Williams. Immersion in a freshly prepared solution of chlorine gas in 70 per cent alcohol immediately removes the dark color. The trematodes can be removed at once, washed and stained as usual. Specimens were almost always stained with Delafield's hemotoxylin, then cleared in oil of wintergreen and mounted in balsam. Serial sections were made of most species.

The present paper deals only with the digenetic trematodes of deep-water fish. The word deep-water is meant to apply to fish collected by trawling at depths from 40 fathoms down. Few Monogenea were collected from these deep-water hosts, but they probably occur not uncommonly. Not all hosts were examined for gill trematodes. Trematodes in this location are much more likely to be injured or to escape in the process of trawling. Preliminary observation of the Monogenea indicates that 6 kinds were collected, 3 from 50 to 60 fathoms, 3 from 100 to 250 fathoms. The deepest specimen (in or near the genus *Diplectanum*) was from the stomach (none being found from the gills) of *Helicolenus dactylopterus* from 190 to 280 fathoms. A *Microcotyle* species was collected from the gills of this same host species from 197 fathoms. A later report on the Monogenea is intended.

Other helminths seemed to be less common than trematodes. Cestodes and nematodes were more common in larval or immature stages. The general prevalence of these helminths is indicated in table 1, but since the collector was seeking especially the trematodes, other helminths might have been overlooked in some instances.

Trematodes of fish are usually not numerous within a single host, often only one or two being present. In a collection of this kind, therefore, some species are sure to be represented by only one or a very few specimens. Such forms are described in this paper whenever the material was favorable enough to show important details. The limitations of such descriptions are fully realized, yet in some instances most unique and interesting forms occur in small numbers, and it did not seem best to omit descriptions of them. Whenever species are based on small numbers of individuals, that fact is noted in the description. Practically every specimen collected is accounted for in the following report. Immature forms could not, of course, be specifically identified. In only two cases (*Lecithochirium* sp. and *Hemiurus* sp.), because of limited material and uncertain specific criteria within the genera, did it seem impossible to make specific diagnosis of mature specimens. In these cases the probabilities of relationship are discussed.

Any taxonomic study serves primarily as a foundation for later work on physiology, ecology, life history, host-parasite relationships and other studies. The present collection is of especial interest in furnishing data on depth distribution as well as host distribution of certain trematodes. It reveals not only a fairly long list of the trematodes of a new region, but

gives for several species some conception of upper or lower depth limits. Most interesting is a comparison of the deep-water trematode fauna with trematodes of the shallow waters of Tortugas and with trematodes of northern or of distant waters. An extensive study of the trematode parasites of the shallow-water fish of Tortugas is nearing completion. Notes have already been published in regard to it (Manter 1930, 1931b, 1932), and a few forms described (Manter 1933a, 1933b). The trematode fauna of deep-water hosts is surprisingly distinct from that of shore fish, slight overlapping occurring at 50 to 60 fathoms, but only a very few species occurring generally in both regions. The deep-water fauna shows a distinct tendency to resemble northern and far distant forms.

The description of species below is usually given in the form of a diagnosis followed by a comparison with related forms. Measurements are in millimeters unless microns are indicated. The width of the trematode is considered as its greatest width. The forebody is that portion of the body anterior to the ventral sucker, and forebody measurement is the distance from the anterior end of the body to the anterior edge of the ventral sucker. The hindbody is considered as the region from the ventral sucker to the posterior end. All measurements are taken from balsam mounts unless otherwise stated.

As has already been indicated, the collection and preliminary study of specimens was made at the Biological Laboratory of the Carnegie Institution of Washington, at Tortugas, Florida. Dr. O. L. Williams aided in collection work during the summer of 1932. The remainder of the work has been done in the Zoological Laboratory of the University of Nebraska. The author is deeply indebted to Dr. W. H. Longley, in charge of the laboratory at Tortugas, not only for the careful identification of fish hosts, but also for many kindnesses during the development of the work.

Types of all the new species described in this paper are deposited in the United States National Museum, Washington, D. C.

HOSTS, SHOWING GENERAL PREVALENCE OF TREMATODES

Table 1 gives a list of hosts examined, showing approximate depths, number examined and kind of helminths present. 80 per cent of the different host species examined were in one instance or another infected with trematodes. About 35 per cent of the individuals examined were infected with trematodes. Cestodes, usually as larvæ, were the next most numerous, while Acanthocephala were uncommon.

DESCRIPTIONS OF TREMATODES COLLECTED

As stated in the Introduction, practically all trematodes collected were identified or described. In the case of several immature forms, identification beyond the genus was not possible, and one species of *Hemiurus* and one species of *Lecithochirium* were not given specific names because of the

need of additional material. Of 48 species of digenetic trematodes collected, only 9 were recognized as having been previously described. One new subfamily and 10 new genera are named.

A list of trematodes from each host will follow the descriptions of species.

TABLE 1

Host	Depth in fathoms	Number examined	Number with trematodes	Number with cestodes	Number with nematodes	Number with acanthocephala
Aleposomus sp.	.....	2	1	..	2	..
Diplacanthopoma brachysoma Günther	250-300	4	4	..	..	..
Ancylopsetta dilectum (Goode & Bean)	60-125	7	7	4	5	..
Antennarius radiosus Garman	60	3	3	3	1	..
Argentina striata Goode & Bean	96-168	5	4	..	1	..
Bathypterois quadrifilis Günther	300	1	..	..	..	..
Bellator militaris (Goode & Bean)						
Bembrops gobioides (Goode), "if distinct from East Indian species"	200-250	20	4	5	1	..
Benthodesmus atlanticus Goode & Bean	300	1	1	1	..	..
Brotula barbata (Bloch & Schneider)	79-140	1	1	1	..	..
Callionymus agassizii Goode & Bean	60-90	34	1	11	10	..
Centropristis ocyurus (Jordan & Evermann)	40-60	6	4	..	2	1
Chaunax nuttingi Garman, "if distinct from *C. pictus* Lowe"	200-390	9	5	1	..	..
Chloropthalmus chalybæus (Goode)	140-249	14	1	4	3	..
Chloropthalmus truculentus Goode & Bean	200	4	1	3	..	1
Chromis enchrysurus Jordan & Gilbert	40	2	..	..	..	..
Citharichthys cornutus (Günther)	55-100	28	2	4	10	..
Cœlorhynchus carminatus (Goode)	200-390	35	16	..	..	..
Cyclopsetta fimbriata (Goode & Bean)	50	8	8	2	1	..
Decodon puellaris (Poey)	40-50	2	2	..	..	..
Dibranchus atlanticus Peters	300-430	13	2	..	..	..
Diplectrum bivittatum (Cuv. & Val.)	40	4	..	4	..	..
Engyophrys sentus	40	6	1	3	1	..
Epigonus occidentalis Goode & Bean	250-300	7	1	..	..	..
Epinephelus niveatus (Cuv. & Val.)	139-159	3	2	..	..	..
Gymnachirus fasciatus Günther	50	1	..	1	1	..
Halieutichthys aculeatus (Mitchill)	50-60	21	11	13	2	..
Helicolenus dactylopterus (de la Roche)	200-315	21	12	4	4	..
Hollardia hollardi Poey	60	7	1	1	..	..
Hypoclydonia bella Goode & Bean	140-250	17	6	3	..	..
Kathetostoma albigutta Bean	60-66	3	2	..	..	..
Kathetostoma sp.	139-156	1	..	..	..	..
Læmonema barbatulum Goode & Bean	140-197	19	6	1	2	..
Lophius piscatorius Linn. (?)	55	1	1	1	1	..
Lutianus vivanus (Cuv. & Val.)	40	1	1	..	..	1
Macrouridæ, *Cœlorhynchus carminatus* (Goode) or *Chalinura occidentalis* (Goode & Bean)	200	5	2	..	..	1
Merluccius sp.	140-315	23	8	21	13	2
Monolene antillarum Norman	90-168	49	5	3	3	1
Neoscopelus macrolepidotus Johnson	249	4	1	1	..	..
Paralichthys oblongus (Mitchill)	140-250	7	7	4	5	..
Paralichthys sp.	40	1	1	1	1	1
Peristedion imberbe Poey	100	16	7	5	..	..

TABLE 1—Continued

Host	Depth in fathoms	Number examined	Number with trematodes	Number with cestodes	Number with nematodes	Number with acanthocephala
Peristedion longispathum (Goode & Bean)	139-200	32	3	..	1	..
Peristedion miniatum Goode	138-150	11	6	..	1	..
Peristedion platycephalum (Goode & Bean)	150	14	6	2	1	..
Peristedion sp.	140-197	2	1	..	..	..
Pœcilopsetta beanii (Goode)	150	2	..	..	..	..
Polymixia lowei Günther	140-197	1	1	..	..	..
Pontinus beanorum Evermann & Marsh (?)	....	1	1	..	..	..
Pontinus longispinus Goode & Bean	60-149	23	13	..	2	..
Prionodes phœbe (Poey)	40	7	6	5	..	..
Prionodes sp., undescribed	50	15	7	6	5	..
Prionodes sp., undescribed	50	29	4	3	2	..
Prionotus alatus Goode & Bean	60	4	4	1	..	..
Prionotus stearnsi Jordan & Swain	50	3	1	2	1	..
Pristipomoides macrophthalamus (Müller & Trosch.)	50	16	..	9	3	..
Pronotogrammus sp.	139-156	14	5	8	1	2
Pteroplatea maclura (leSueur)	60	1	1	1	..	..
Raia ornata Garman	300	3	..	..	..	..
Saurida sp.	50-60	6	6	4	..	..
Scorpœna agassizii Goode & Bean	60	6	5	..	..	..
Scorpœna cristulata Goode & Bean	250	2	1	..	1	..
Setarches parmatus Goode	250	2	2	..	..	..
Symphurus sp.	....	17	..	2	4	..
Syacium papillosum (Linn.)	50-60	20	11	8	12	2
Synodontid, "large size, may reach 370 mm."	90	7	4	4	3	..
Synodontid	100	1	1	1	1	..
Synodus intermedius (Agassiz)	40	9	1	5	6	1
Synodus sp.	60-195	4	4	3	..	..
Trichopsetta ventralis (Goode & Bean)	50	16	3	5	6	..
Upeneus parvus Poey	50	2	1	1	1	..
Urophycis chesteri (Goode & Bean)	250-315	6	3	1	3	..
	168	..	..	..	1	..
Urophycis cirratus (Goode & Bean)	60-125	8	7	5	4	..
Urophycis regius (Walbaum)	60-125	8	8	..	..	..
Yarrella blackfordi Goode & Bean	300-367	7	..	2	..	..
Unidentified (lizard fish)	582	1	1	..	1	..
Unidentified (small lizard fish)	582	1	1	..	..	..
Unidentified (sole)	249	1	1	..	..	..
Unidentified (blind fish)	295-315	1	1	..	..	..
Unidentified (eel)	300	2	2	..	..	..
		731	265	187	129	13
		–10	–1	–4	–2	
		721	264	183	127	

ORDER GASTEROSTOMATA

Family Bucephalidæ

Prosorhynchus ozakii n. sp.

(Fig. 1)

Host—Epinephelus niveatus (Cuv. & Val.)
Frequency—Present in 1 of 3 hosts examined.
Position—Intestine.
Depth—90 fathoms.

Specific Diagnosis

Body flattened, elongate, length 1.293 mm., width 0.361 mm. Rhynchus somewhat extended transversely, muscles weakly developed, 0.154 mm. in transverse diameter. Mouth a short distance posterior to midbody, ventral to right testis; intestine extending forward a short distance anterior to midbody. Testes large, slightly longer than wide, diagonal, more or less lateral, slightly overlapping, the left testis more anterior. Cirrus sac elongate, nearly half-body length, 0.504 mm. in length, extending from genital atrium beyond the right testis, anterior to mouth, to posterior edge of left testis. Genital pore a short distance anterior to posterior end; genital atrium spacious. Ovary round, partly anterior to and partly overlapping dorsally the right testis, lateral to left testis or slightly posterior. Vitelline follicles in two widely separated groups, 13 to 15 follicles on each side, extending from level of ovary to near anterior end. Uterus not extending anterior to vitellaria. Eggs without processes, 25 to 29 by 15 to 17 μ.

Comparisons

This species will key to *Prosorhynchus aculeatus* in Eckmann's key (1932). Issaitschikow (1928) would establish the genus *Skrjabiniella* for *P. aculeatus* on the basis of the position of testes on opposite sides of the body, mouth in posterior half of body, and uterus not extending beyond the vitellaria. These characters do not seem to me to be generic, and *Skrjabiniella* is considered a synonym of *Prosorhynchus*. The present species was considered at first as *P. aculeatus* but a study of vanBeneden's (1870) figure reveals that the present form differs in being more elongate, in more anterior extent of the intestine, in much longer cirrus sac, more anterior genital pore and, above all, in the widely separated rows of vitellaria which in *P. aculeatus* form an arch across the body. In other species of *Prosorhynchus* the ovary is anterior to both testes and all of these organs are more or less in a row. The description of this species (*P. ozakii*) is based on two specimens (one immature) and more material is needed to confirm the constancy of characters. Even in the immature, less elongate specimen, however, the ovary is far lateral, overlapping the right testis and slightly posterior to the left testis. This arrangement is very different from that in all other species except *P. aculeatus*. *P. aculeatus* has been reported several times from northern waters, but its structure has not been well described.

This species is named in honor of Y. Ozaki, Japanese parasitologist, who has described numerous species of trematodes from fish.

Rhipidocotyle longleyi n. sp.

(Figs. 2-5)

Host—Hypoclydonia bella Goode & Bean.
Position—Intestine.
Frequency—Present in 5 of 17 hosts examined.
Depths—140 to 197 fath., 150 fath., 249 fath., 250 fath.

Specific Diagnosis

Length 1.71 to 3.7 mm., width 0.344 to 0.680 mm. Body not much flattened, widest at midbody or somewhat posterior to midbody, covered with spines. Anterior sucker subterminal, surmounted by a flattened cephalic disc ("hood") bearing seven lobes, one group of three dorsal, and two lateral pairs; lobes inconspicuous when retracted (fig. 5), but blunt, finger-like processes with transparent narrowed tips when extended (fig. 4). Mouth ventral at midbody; pharynx almost spherical; intestine extending both anterior and posterior to mouth, mostly posterior. Testes large, tandem or diagonal, near one side, in posterior half of body. Cirrus sac large, extending from anterior border of posterior testis to posterior end of body; seminal vesicle a simple sac, pars prostatica sinuous but not coiled; prostate gland well developed; genital atrium large, with large glandular lobe (genital tongue); genital pore usually subterminal and

Measurements

Length	Width	Sucker diameter	Disc diameter	Mouth to anterior end	Genital pore to posterior end	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	mm.	μ
2.755	0.680	0.156	0.204	1.33	0.098		21 by 11
							24 12
2.18	.546	.137	.196	1.13	.050		22 12
3.705	.562	.168		1.90	.098	0.101 by .107	22 11
1.71	.344	.117	.176	0.966		.078 by .064	20 12
2.47	.562	.129	.176	1.209		.080 wide	20 12

ventral, sometimes terminal; a small transparent papilla immediately posterior to genital pore. Ovary rounded or somewhat extended transversely, immediately anterior to anterior testis; uterus coils anteriorly beyond the vitellaria to about 1/5 body length from anterior end. Eggs 20 to 24 by 11 to 12 μ. Vitellaria in two lateral rows extending from level of ovary about halfway to anterior end, approximately 15 vitelline follicles on each side.

This parasite sometimes occurs in large numbers. It is named in honor of Dr. W. H. Longley, Executive Officer of the Biological Laboratory of the Carnegie Institution at Tortugas, Florida.

One specimen was recovered by washing the cœlom of *Chlorophthalmus chalybæus*. Since this collection was made the same day as those from *Hypoclydonia bella* there is a probability of accidental contamination from a previous examination. Although two different species of fish were examined between the two hosts in question, the *Hypoclydonia*, examined shortly before the *Chlorophthalmus*, was heavily infected. *Chlorophthalmus chalybæus* should be considered a questionable host for this parasite.

Comparisons

Eckmann (1932) recognizes five species of *Rhipidocotyle*. *R. longleyi* differs from all of them primarily in the number of lobes (or papillæ) of the

cephalic disc. Five is the usual number, although none are present in *R. baculum* (Linton) and there are 15 in *R. papillosum* (Woodhead). *R. longleyi* is larger and more elongate than *R. galeatum* (Rud.), but at the same time has smaller eggs. It is much larger than *R. baculum* and has a more anterior extent of the uterus. It differs from *R. pentagonum* (Ozaki) in that the uterus extends to near the posterior end. Ozaki (1928, 54) describes 40 to 80 vitelline follicles on each side for *R. pentagonum*, but his figure (p. 55, fig. 24) shows 15 on each side. The transparent papilla posterior to the genital pore of *R. longleyi* is not described for any of the other species. *R. longleyi* differs from *Gasterostomum* sp. of Linton (1910) from *Mycteroperca bonaci*, in anterior extent of the uterus and in having much smaller eggs.

The 7-lobed character of the disc of *R. longleyi* is probably a modification of the typical number of 5. It could not be decided, however, whether the increased number has arisen by a doubling of lateral papillæ or the double splitting of a median dorsal papilla. Figure 4 shows that the three dorsal papillæ or lobes are closely associated and the four lateral lobes appear to be two pairs.

Eckmann (1932, 99-100) follows Nicoll in accepting *Gasterostomum minimum* Diesing as type of the genus *Rhipidocotyle* Diesing, 1858, but finds that *G. minimum* Wagener is a synonym of *G. galeatum* Rud., which thus becomes *Rhipidocotyle galeatum* (Rud.), the type of the genus. Eckmann defines the genus as follows: "Bucephalidæ at the anterior end of which occurs a sucker and a structure usually provided with papilla-like processes. Ovary at the level of anterior testis or in advance of this level. Intestine sac-like." She considers *Nannœnterum* Ozaki as a synonym and lists the following species: *R. galeatum* (Rud.), *R. baculum* (Linton), *R. papillosum* (Woodhead), *R. pentagonum* (Ozaki), and (?) *Gasterostomum* sp. Linton, 1910, p. 79.

The term cephalic disc as used above is suggested for the flap-like structure surmounting the anterior sucker.

Rhipidocotyle kathetostomæ n. sp.

(Figs. 6-9)

Host—*Kathetostoma albigutta* Bean.
Position—Intestine.
Frequency—Present in 2 of 3 hosts examined.
Depth—60 fathoms.

Specific Diagnosis

Length 0.688 to 1.434 mm., greatest width in anterior half of body, 0.277 to 0.386 mm. Body tapering toward posterior end from about midbody, posterior end pointed, anterior end truncated and much broader than posterior end. Body only slightly flattened, covered with spines. Anterior sucker slightly longer than wide, with subterminal, ventral opening; muscular wall of sucker with two, internal, submedian, inconspicuous humps or elevations at posterior end of its cavity. A cephalic disc or hood is lacking, but papillæ occur on edge of anterior sucker, the latero-ventral pair of papillæ bifid or bilobed. Dorsal edge of the anterior end usually approximately smooth, sometimes with 3 minute elevations. Thus, traces of 5 papillæ can be detected. Dorsal wall of anterior sucker with 5 longitudinal

regions of diagonal muscles separated by 4 regions of longitudinal muscles (fig. 7). Mouth ventral, approximately at midbody; pharynx ovoid, longer than wide; esophagus directed forward, about same length as pharynx; intestine sac-shaped, not extending posteriorly as far as level of mouth. Testes tandem, median, just posterior to midbody, posterior to mouth, usually extended transversely, sometimes rounded. Cirrus sac slender, much elongated, thick-walled; genital atrium very large, spacious, elongate, more than half the length of the remaining cirrus sac; length of cirrus sac with genital atrium usually half body length, sometimes much longer; base of cirrus sac at least anterior to posterior testis. Seminal vesicle sac-shaped. Genital cone well developed. Uterus enters atrium from dorsal side near genital cone. Muscular, ovoid sucker around the common sex duct near the genital pore (fig. 8). Genital pore ventral a short distance in front of posterior end. Ovary ovoid, approximately in midbody, near mouth, pre-

Measurements

Length	Width	Sucker diameter	Mouth from anterior end	Pharynx	Cirrus sac length	Genital pore from post. end	Eggs
mm.	mm.	mm.	mm.	μ	mm.	mm.	μ
1.159	0.386	0.186	0.588	70 by 51	0.571	0.049	20 by 9-10
1.36	.277	.158	.529		.537	.084	20 9-10
0.688	.336	.147	.378	58 μ	.420	.045	20 11
1.327	.336	.205	.630	78 by 49	.613	.039	20 10
1.428	.285	.176			.705	.058	20 10
1.434	.285	.176	.672	68 53	.714	.088	18 10

testicular. Vitellaria in 2 lateral groups, extending from shortly behind anterior sucker almost to level of ovary; number of follicles from 13 to 17 on each side. Uterus extending anteriorly between the rows of follicles partly or entirely to their anterior limit. Eggs 18 to 20 by 10 to 11 μ, often with irregularly shaped cap at anopercular pole (fig. 9). Excretory pore at extreme posterior tip; excretory vesicle a simple tube extending far forward to base of anterior sucker.

Comparisons

This species is peculiar in its carrot-shaped body, tapering to a point posteriorly and widest in anterior half. It is unlike all other species except *R. longleyi* in the fact that the lateral head papillæ are the most strongly developed. The dorsal papillæ are more weakly developed than in any other species. The cirrus sac is longer in proportion to body length and to its own width than in any other species. The genital sucker or pharynx-like sphincter near the pore is not described for any other species. Descriptions of the excretory vesicle in other species indicate a termination in the testicular region, whereas in *R. kathetostomæ* the organ extends far forward. The peculiar cap common at the anopercular pole of the egg is unique, although a definite process or filament is described by Eckmann (1932) for *Prosorhynchus crucibulus*. This cap was not detected in some specimens.

Rhipidocotyle kathetostomæ is to be considered a seventh species of the genus. Among its most interesting features is the peculiar but apparently inconstant development at the anopercular egg tip. This semitransparent

cap or process is very suggestive of similar structures on the eggs of Fellodistomidæ (figs. 16, 18, 21, 23). The similarity is even more interesting in view of the comparison already made by Odhner (1905, 301-303, 307-308) between the genital cone, genital atrium, and spermatophores in the two groups. If the terminal genital apparatus is sufficient to indicate possible relationship, the similarity of the eggs is of added significance. Woodhead (1929, 1930, 1931) has described the peculiar miracidia of certain gasterostomes. It will be interesting to learn the type of miracidia of the Fellodistomidæ.

Dolichœnterum sp.

(Fig. 10)

Host—Citharichthys cornutus (Günther).

Position—Intestine.

Frequency—Present in 1 of 28 hosts examined.

Depth—100 fathoms.

This immature gasterostome, of which only one specimen was collected, is referred to the genus *Dolichœnteron* Ozaki, 1924, on the basis of the anterior sucker provided with papillæ, the extent of the intestine throughout the greater length of the body and the position of the ovary between the testes. *Prosorhynchoides* Dollfus, 1929, also has a long intestine, but the sucker is simple and the ovary is anterior to the testes. In the present form, the mouth is more posterior than in *Dolichœnterum longissimum,* the only described species of the genus.

ORDER PROSOSTOMATA

Family FELLODISTOMIDÆ Nicoll

Synonym: Steringophoridæ Odhner

The adoption of the name Fellodistomidæ in preference to Steringophoridæ becomes well established by the opinion of Dr. Ch. W. Stiles in Stunkard and Nigrelli 1930, 342.

Stunkard lists the following genera in the subfamily Fellodistominæ: *Fellodistomum* Stafford, 1904; *Steringophorus* Odhner, 1905; *Pycnadena* Linton, 1911; *Rhodotrema* Odhner, 1911; *Steringotrema* Odhner, 1911; *Bacciger* Nicoll, 1914 and *Lintonium* Stunkard & Nigrelli, 1930. This subfamily is richly represented among deep-water trematodes of Tortugas, 8 species of mature forms being collected together with 2 additional immature forms. The deepest-water trematode collected is classified here as are also several other interesting genera. A key to genera of the subfamily will follow a description of species collected.

Subfamily Fellodistominæ

Steringophorus magnus n.sp.

(Figs. 11-12)

Host—Unidentified eel-like fish.

Position—Intestine.

Frequency—Present in both of 2 hosts examined.

Depth—300 fathoms.

Odhner (1905, 309) gives essentially the following diagnosis for the genus *Steringophorus*:

Medium-sized distomes with plump, rather thick bodies. Suckers near together, rather strong. Cuticula very thick and unspined. Digestive

system with pharynx, esophagus and half-length ceca. Genital pore about at level of intestinal bifurcation, median or to the left. Cirrus sac present, nearly spherical, enclosing bipartite seminal vesicle, well-developed pars prostatica and a short, wide cirrus. Ovary to the right, immediately behind the ventral sucker, lobed. Seminal receptacle lacking, Laurer's canal present. Vitellaria little developed, lateral, in middle of body. Uterus coils between testes, mostly filling the hindbody. Eggs numerous, about 45 to 65 μ in length. Excretory vesicle very large, Y-shaped, its stem forking between the testes and the crura ending beside the pharynx. In the intestine of marine fish.

Type species—S. furciger (Olss.)

The present species agrees with this generic description almost completely.

Specific Diagnosis

Body large, elongate, thick anteriorly, somewhat flattened posteriorly, 6. to 7. mm. in length; 1.9 to 2.6 mm. in width; greatest width posterior to ventral sucker; flesh color when alive. Body tapering toward each end,

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Eggs
mm.	mm.	mm.	mm.	mm.	μ
6.08	2.66	0.498	0.962	1.23	30-31 by 14-15
7.22	1.90	.423	.923	1.29	30-32 15-17

posterior end may be either truncated or somewhat pointed. Ventral sucker about 1/4 to 1/5 body length from anterior end, about twice the size of oral sucker, somewhat wider than long, occupying about ½ body width, with transverse aperture. No prepharynx; esophagus about same length as pharynx; intestinal bifurcation halfway between suckers; ceca narrow, extending posterior to testes but usually not halfway between testes and posterior end. Genital pore median or slightly to the left, at level of intestinal bifurcation. Testes globular, with only slightly irregular outline; symmetrical or diagonal, chiefly intercecal, separated by the uterus, a short distance posterior to ventral sucker, left testis usually slightly in advance. Cirrus sac large, slightly longer than wide, lying diagonally between ventral sucker and genital pore. Seminal vesicle tubular, bipartite, in basal half of cirrus sac. Prostate gland well developed; prostate duct with thick walls. Short, wide cirrus with folded muscular walls, continuous with genital atrium which is also broad with muscular walls and at least partly enclosed in cirrus sac. Genital atrium with lip-like, muscular lobe (genital or copulatory lobe). Ovary multilobed, slightly to the right, immediately posterior to ventral sucker. Uterus coiling backward to near posterior end, then forward, passing between testes; coils not reaching sides of body by some distance. Vitelline follicles small, in two rather wide, short, lateral groups, mostly extracecal, in midbody region, from posterior border of ovary to posterior edge of testes. In each of three specimens the left group was more or less divided near the middle (fig. 11). Eggs 30 to 32 by 14 to 17 μ. Excretory vesicle Y-shaped median stem long, forking a short distance posterior to testes, branches extending to pharynx region.

Comparisons

This species differs from *S. furciger*, the only other species in the genus, in its much larger size, relatively more anterior ventral sucker, more diagonal testes, vitellaria somewhat posterior to ventral sucker, stem of excretory vesicle forking behind the testes and much smaller eggs. *Steringophorus furciger* is a species of northern waters being reported from Swedish, Greenland, Arctic and Canadian waters by Olsson, Levinsen, Odhner and Stafford.

The species name *magnus* refers to the large size of the trematode.

Steringophorus profundus n.sp.

(Fig. 13)

Host—*Argentina striata* Goode & Bean.
Position—Intestine.
Frequency—Present in 2 of 5 hosts examined.
Depth—140 fathoms.

Specific Diagnosis

Body plump, smooth, tapering somewhat anterior to ventral sucker, broadly rounded posteriorly, length 1.71 to 2.05 mm., width from 1/2 to 1/3

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Cirrus sac	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.052	0.763	0.204	0.330	0.456	0.364 by 0.180	31-34 by 16
1.71	.83	.220	.373	.290	.332 .232	30-34 16

length. Oral sucker terminal; ventral sucker about 1/3 from anterior end, about 1 1/2 times the diameter of oral sucker, occupying about 1/2 body width, with transverse aperture. Prepharynx lacking; esophagus short; intestinal bifurcation nearer oral than ventral sucker; the narrow ceca, more or less distant from the sides of the body, extending to a level about halfway between testes and posterior end. Genital pore median or submedian, opposite the intestinal bifurcation or immediately posterior, about halfway between the suckers. Testes smooth or only slightly lobed, symmetrical, lateral and far apart, about 1/3 the distance between ventral sucker and posterior end. Cirrus sac large, robust, filling the entire intercecal, preacetabular area and overlapping at least one cecum, extending posteriorly to mid-sucker level, containing a bipartite seminal vesicle, well-developed prostate gland, rather long prostate duct, short cirrus with heavy, folded walls and, near the genital pore, a broad genital atrium. Ovary multilobed, partly overlapping the ventral sucker dorsally, median or to the right. Seminal receptacle lacking. Follicles of the vitellaria forming two, short, lateral clusters in midbody between the posterior edge of ventral sucker and posterior ends of the testes, chiefly extracecal. Uterus completely filling the hindbody posterior to testes, the ascending portion coiling between the testes, crossing the ovary ventrally and extending along the left edge of the ventral sucker. Eggs yellow, 30 to 34 by 16 μ.

Comparisons

This species differs from the generic diagnosis in possessing a very short esophagus. In view of the Y-shaped excretory vesicle, the median genital pore, the symmetrical testes, and the distribution of the vitellaria, it is considered in the genus *Steringophorus* in spite of the short esophagus. It differs from *S. furciger* in its short esophagus, more rounded posterior end and somewhat longer ceca. It differs from *S. magnus* in its much smaller size, shorter esophagus, more anterior position of the vitellaria, smaller eggs and in that the uterus extends to the sides of the body.

The species name, *profundus*, indicates its occurrence in a deep-water host.

Steringophorus (?) sp.

(Fig. 33)

Host—Small, lizard fish, unidentified.
Position—Uncertain.
Frequency—Present in 1 of 1 host examined.
Depth—582 fath.

This single, immature specimen of fellodistomid has the following measurements: length 1.915 mm., width 0.973 mm., oral sucker 0.252 mm., ventral sucker 0.205 mm., forebody 0.604 mm. The esophagus is very short or lacking, the ceca rather long. Other characters, in brief are: Genital pore submedian at level of intestinal bifurcation; cirrus sac thick and robust; testes spherical and diagonal; ovary lobed; excretory vesicle Y-shaped. These characters agree with those of *Steringophorus* except that a longer esophagus should be present. It can not be the same species as either of those described above. The small size of the ventral sucker is not usual in *Steringophorus*. This trematode may belong in the genus *Fellodistomum* but the genital pore is rather far forward for that genus.

Steringophorus (?) sp.

(Fig. 34)

Host—*Aleposomus* sp.
Position—Intestine.
Frequency—Present in 1 of 2 hosts examined.
Depth—300 fath.

This form is another immature fellodistomid provisionally referred to the genus *Steringophorus*, but unlike others collected.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Esophagus
mm.	mm.	mm.	mm.	mm.	mm.
2.185	0.88	0.336	0.277	0.638	0.166
1.889	.912	.285	.277	.588	.127
1.50	.95	.294	.302	.520	.088

The ceca do not reach the posterior end by some distance; the genital pore is to the left and postbifurcal; the excretory vesicle is Y-shaped. This form also differs from most species of *Steringophorus* in its small ventral sucker.

Megenteron crassum n.gen., n.sp.

(Figs. 14-16)

Host—*Diplacanthopoma brachysoma* Günther.
Frequency—Present in all of 4 hosts examined.
Position—Intestine.
Depth—249 to 300 fathoms.

Specific Diagnosis

Body smooth, thick, slightly flattened, about 3 times longer than wide, tapering slightly anteriorly, abruptly truncated posteriorly in mature specimens, anterior end rounded, length 2.43 to 4.67 mm., width 0.608 to 1.824 mm., hindbody almost equally wide. Oral sucker large, at anterior end, slightly wider than long; ventral sucker about 1/3 from anterior end (more posterior in young forms), slightly larger than oral sucker in mature forms, slightly smaller in young individuals. Prepharynx very short; pharynx large, pyriform, widest near anterior end, esophagus usually about half the

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
4.674	1.824	0.539	0.581	1.33	0.373 by 0.299	28-30 by 14-16
3.85	1.38	.373	.439	1.07	.279 .207	30 16
3.268	1.04	.410	.415	0.95	.240 .232	30 14-16
4.75	1.52	.483	.514	1.42	.336 .249	28-30 16-18
2.43	0.608	.307	.249	0.83	.232 .166	
6.498	2.603	.622	.805	1.615	.456 .315	28 16
2.166	0.76	.415	.315	0.95	.249 .183	

length of pharynx; ceca large, conspicuous, filled with black contents (blood of host), slanting backward from esophagus, extending to near posterior end of body. Conspicuous gland cells in forebody, one group lateral and dorsal to pharynx, another surrounding esophagus. Genital pore slightly to the left, a short distance anterior to ventral sucker, about at level of intestinal bifurcation. Cirrus sac claviform, about twice as long as wide, extending from genital pore medianly and posteriorly across the median line, ending at anterior border of ventral sucker, filling the preacetabular, intercecal area. Seminal vesicle in base of cirrus sac, divided into a small, posterior, broadly tubular region and a larger, spherical, anterior portion which fills nearly half the cirrus sac; prostate gland fairly well developed. Short genital atrium at least partially enclosed by cirrus sac; copulatory or genital lobe (fig. 15) poorly developed. Testes more or less lobed, diagonal, approximately in midbody, far apart laterally, separated by uterus, partially overlapping ceca ventrally, left testis slightly more anterior. Ovary multilobed, to right of midline, partly overlapping the right cecum ventrally, shortly in front of right testis. Mehlis' gland to the left and anterior to ovary, very well developed, receiving the two yolk ducts; seminal receptacle lacking, early coils of uterus containing masses of sperm cells. Laurer's canal well developed, containing sperm cells. Vitellaria of small-sized follicles in two lateral groups, extending from midacetabular level to the anterior testis, overlapping the ceca

ventrally, extending medianly beyond ceca but not meeting. Uterus coiling anteriorly to posterior edge of ventral sucker, then backward to near posterior end of body, then forward to genital atrium, largely intercecal. Eggs yellow, with moderately thick shells, 28 by 16 μ, shell extended at one end to form a short process 4 to 6 μ long. Excretory vesicle large, V-shaped.

Generic Diagnosis

Thick bodied, somewhat elongate fellodistomids. Ventral sucker entirely anterior to midbody, only slightly larger than oral sucker. Short prepharynx; esophagus of moderate length; ceca very large, extending to posterior end. Excretory vesicle V-shaped. Testes lobed, diagonal. Seminal vesicle bipartite. Genital pore to the left, near intestinal bifurcation. Genital or copulatory lobe poorly developed. Ovary multilobed, to the right. Vitellaria follicular, in two lateral groups, chiefly between ovary and ventral sucker. Laurer's canal present. Eggs with short, rather stout, unipolar processes. Parasites in the intestine of marine fishes. So far as known from rather deep waters.

Type species—Megenteron crassum.

The genus name is from *mega*, large, and *enteron*, gut, and refers to the large intestinal ceca. The species name is from *crassum*, thick.

Comparisons

Megenteron differs from all described genera of the family in the possession of a polar process on the egg and the almost equal size of the suckers. The elongate form of the body, the truncated posterior end and the very large intestinal ceca are unusual. The genus differs from *Steringophorus* in its V-shaped excretory vesicle, more elongate cirrus sac, more anterior ventral sucker and in lobed testes. It differs from *Fellodistomum* in presence of esophagus, V-shaped excretory vesicle and in distribution of vitellaria. It differs from *Rhodotrema* in longer ceca, V-shaped excretory vesicle and distribution of vitellaria.

These large trematodes must be rather injurious to their hosts, since they feed on blood. The gland cells of the forebody may be developed in connection with this food habit. Gland cells around the pharynx stain heavily with eosin, while those around the esophagus stain heavily with Delafield's hematoxylin. Growth occurs more rapidly posterior to the ventral sucker as in most trematodes, but in this species, unlike some others such as *Otodistomum cestoides*, the ventral sucker shares slightly in this differential growth. This sucker is slightly smaller than the oral sucker in the smallest specimens, about the same size in young forms and slightly larger in fully mature individuals.

Lomaphorus wardi n.gen., n.sp.

(Figs. 17-19)

Host	Frequency in hosts examined	Depth
Cœlorhynchus carminatus (Goode)	3 of 33	250 fath.
Urophycis regius (Walbaum)	1 13	140-197

Position—Intestine.

Specific Diagnosis

Body elongate, thick, more tapering anteriorly, widest at about midbody, hindbody almost equally wide, posterior end broadly rounded, length 1.4 to 3.7 mm., width 0.564 to 1.463 mm. Ventro-marginal folds with 7 pairs of outer lobes and sometimes an eighth pair at extreme posterior end of body. Oral sucker large, terminal, mouth round, ventral; ventral sucker somewhat larger than oral sucker, usually wider than long, about 1/3 body length from anterior end, its aperture subcircular, its outer rim embedded in body. Prepharynx very short; esophagus about one and one-half to twice the length of pharynx; intestinal bifurcation midway between suckers; ceca very narrow, ending a short distance in front of posterior end. Genital pore shortly postbifurcal, some distance anterior to ventral sucker, slightly to the left. Cirrus sac large, about same size as ventral sucker, very broad, filling intercecal, preacetabular area, base often abruptly narrowed and pointed. Seminal vesicle bipartite, the two sac-like portions approximately equal in size; prostate gland well developed, prostatic duct or vesicle thick-walled. Cirrus very short, the walls of the prostatic duct continuous with two conspicuous, muscular lobes, the larger one anterior, the smaller

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Cirrus sac		Eggs	
mm.	mm.	mm.	mm.	mm.	mm.		μ	
3.7	1.178	0.416	0.456	1.235	0.456 by 0.332		28 by 14	
2.09	0.76	.298	.323	0.68	.332	.190	26	15
3.515	1.463	.398	.481	1.007	.498	.332	27-28	14-16
1.9	0.817	.273	.332	0.614	.332	.249	28-31	14-16
1.69	.725	.257	.315	.515	.365	.207	30	15
1.71	.622	.249	.265	.531	.398	.200	28	14
1.419	.564	.249	.265	.456	.249	.160	28	16
1.862	.725	.265	.270	.597	.398	.200	28	14

posterior, projecting into genital atrium (fig. 19). These copulatory lobes may be protruded from the genital pore. They evidently represent the same structures described by Odhner (1911*b*:107) for the genus *Proctæces*. Genital atrium spacious, with folded, muscular walls, mostly enclosed in cirrus sac. Testes slightly lobed, diagonal, in equatorial region, separated by uterus, ventral to ceca, left testis more anterior. Ovary very large, multilobed, directly in front of right testis, overlapping right cecum ventrally. Seminal receptacle lacking. Uterus fills entire hindbody, covering the ceca ventrally. Follicles of vitellaria extending in two lateral, extracecal fields in middle third of body. Eggs dark yellow, thick-shelled, slightly wider at anopercular pole, 26 to 31 by 14 to 16 μ. At the anopercular pole is an inconspicuous, more or less colorless, short (about 2 or 3 μ long) polar process. Excretory pore dorsal, median, subterminal; excretory vesicle V-shaped, with swollen, closely convoluted branches reaching to the esophagus level.

In the above table the first three specimens are from *Cœlorhynchus carminatus*, the last five from *Urophycis regius*.

Comparisons

Lomaphorus wardi differs from the two following species in more truncated posterior end, wider cirrus sac, and especially in the smaller eggs. It is named in honor of Dr. H. B. Ward.

Generic Diagnosis

Fellodistomids with fairly elongate, plump, flesh-colored bodies tapering anteriorly but broadly rounded posteriorly, with two longitudinal ventrolateral folds thrown into lobes. These convolutions are muscular and usually conspicuous. Oral sucker large, ventral sucker slightly larger, preequatorial. Prepharynx very short, esophagus longer than pharynx, ceca narrow, not reaching the posterior end, intestinal bifurcation about halfway between suckers. Genital pore slightly to the left, postbifurcal, preacetabular. Testes in equatorial zone, diagonal, lobed, the left testis slightly more anterior. Cirrus sac strongly developed, intercecal, extending to anterior border of ventral sucker, with bipartite seminal vesicle, well-developed prostate gland, prostatic duct with very thick walls, genital atrium spacious with well-developed muscular, genital lobe. Ovary multilobed, immediately anterior to right testis. Seminal receptacle lacking. Uterine coils filling hind body. Vitelline glands in two, lateral, extracecal rows in middle third of body length. Egg with polar process either rudimentary or clearly evident. Excretory vesicle V-shaped. Parasites of the intestine of marine fishes.

Type species—Lomaphorus wardi.

The name *Lomaphorus* is from *loma*, fringe and *phorus*, to bear, and refers to the characteristic longitudinal folds of the body wall.

Lomaphorus monolenei n.sp.

(Figs. 20-21)

Host—Monolene antillarum Norman.

Position—Intestine.

Frequency—Present in 5 of 49 hosts examined. Usually 1, sometimes 2 or 3 in a host.

Depths—100 fath.; 79 to 140 fath.; 135 to 156 fath.; 82 to 93 fath.

Specific Diagnosis

Color, when alive, reddish orange. Length 2.85 to 3.15 mm.; greatest width 1.23 to 1.34 mm. Body tapering anteriorly to a narrow diameter, broadly rounded and plump posteriorly; greatest diameter near posterior end. Body wall thrown into definite muscular folds along the ventrolateral border, 7 lobe-like, lateral, outer expansions on each side; 6 medianly directed lobes. Oral sucker terminal, large, with ventral, circular aperture; ventral sucker preequatorial, slightly larger than oral sucker, occupying about half the body diameter at that level. Very short prepharynx; well-developed pharynx; narrow esophagus a little longer than pharynx, forking about halfway between suckers; narrow ceca ending a short distance in front of posterior end. Conspicuous gland cells surround the esophagus and pharynx. Genital pore postbifurcal, shortly anterior to ventral sucker, slightly to the left. Cirrus sac extending diagonally backward, filling most of intercecal, preacetabular area, widest about in the middle, its posterior end tapering almost to a point, barely overlapping the anterior border of ventral sucker. Bipartite seminal vesicle in base of cirrus sac, prostatic duct large, thick-walled, prostate gland fairly well developed although not to such a degree as in *L. wardi*. A conspicuous, muscular, genital lobe projects into the spacious genital atrium. The smaller posterior lobe found in *L. wardi* seems to be lacking. Two testes somewhat lobed, diagonal,

separated by uterus, the left testis in equatorial region, slightly in advance of the right testis. Ovary multilobed, immediately in front of right testis. Seminal receptacle lacking. Uterus extends to the left and a short distance anteriorly before coiling backward to posterior end of body. Uterine coils fill the intercecal, postacetabular area. Vitellaria of small follicles, in two lateral, cecal and extracecal fields from posterior level of ventral sucker halfway to posterior end of body. Eggs large, dark yellow when mature, ovoid, only very slightly wider at posterior end, without polar process. In young eggs there is a distinct thickening of the egg shell at the posterior end, but this thickening is absent or barely noticeable in mature eggs. Seminal vesicle V-shaped with crura reaching into the pharyngeal region.

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Cirrus sac	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.850	1.230	0.365	0.473	0.913	0.348 by 0.180	40 by 22
3.154	1.273	.431	.498	.913	.416 .203	40 19-20
3.145	1.340	.416	.464	.697	.381 .160	40 19
						36 18

Comparisons

This species differs from *Lomaphorus wardi* in body shape (the greatest diameter being near the posterior end); cirrus sac not as wide; a single genital lobe; and especially in the constantly larger egg size and the lack of evident polar process on the egg.

Lomaphorus gracilis n.sp.

(Figs. 22-23)

Host—*Peristedion miniatum* Goode.
Position—Intestine.
Frequency—One specimen in 1 of 7 hosts examined.
Depth—138 to 140 fathoms.

Specific Diagnosis

Body elongate, relatively rather slender, tapering anteriorly, broadly rounded posteriorly, widest near posterior end, length 2.5 mm., width 0.87 mm. Ventro-marginal lobes inconspicuous, traces of 4 on the right side of body, only 3 on the left. Oral sucker terminal, 0.282 mm. in diameter; ventral sucker about 1/3 from anterior end, approximately same size as oral sucker, 0.290 mm. in diameter, occupying about 1/3 body width. Very short prepharynx; rather small pharynx; long esophagus, nearly 3 times length of pharynx; narrow ceca not reaching posterior end by some distance. Genital pore at level of intestinal bifurcation, slightly to the left. Cirrus sac extending diagonally to anterior edge of ventral sucker, 0.215 by 0.124 mm., more slender than in other species. Only the anterior genital or copulatory lobe present in the genital atrium (as in *L. monolenei*). Testes slightly lobed, diagonal, intercecal, approximately in midbody. Ovary multilobed, immediately anterior to right testis. Seminal receptacle lacking. Uterus filling most of hindbody. Vitellaria extending from ventral

sucker 2/3 the distance to posterior end, extracecal. Eggs narrowed at anterior end, almost triangular in general appearance, much wider at posterior end, 40 to 42 by 21 μ. At the broad end of the egg occurs a colorless, transparent, cap-like structure which narrows abruptly to a point (fig. 23). The entire egg in outline is shaped much like an acorn. Excretory system not observed. It doubtless has the same form as in the two preceding species.

Comparisons

In body form this species is somewhat like *L. monolenei*, except more slender. The ventro-marginal lobes seem to be reduced, the esophagus longer, the ventral sucker smaller. The cirrus sac is slender, especially as compared with *L. wardi*. The eggs of *L. gracilis* are characteristic. In size they resemble those of *L. monolenei* and differ from *L. wardi*. In shape they are distinct from both in the much broader posterior end and in the transparent, cap-like, polar process.

The above description is based on a single specimen. The name *gracilis* refers to the slender form of the body.

Lissoloma brotulæ n.gen., n.sp.

(Figs. 24-26)

Host—Brotula barbata (Bloch & Schneider).
Position—Intestine.
Frequency—Present in a single host examined.
Depth—79 to 140 fathoms.

Specific Diagnosis

Color, when alive, pink or flesh-color. Length 2.14 mm., width 0.988 mm. Edges of body curving inward, especially at each end, body boat-shaped with edges somewhat flattened in middle region. In addition to longitudinal muscles which are especially well developed in the anterior half of the body, radiating bands lead backward or outward and dorsally from the incurved body edge (fig. 24). These suggest the musculature of the body folds of *Lomaphorus*. The ventral surface posterior to the ventral sucker is free of body muscles except for 5 rather inconspicuous, transverse bands. Short, longitudinal muscle fibers cross the transverse bands at right angles (fig. 24). Oral sucker subterminal, 0.282 mm. in diameter, its opening round; ventral sucker, 1/3 from anterior end, also measures 0.282 mm. in diameter. A prepharynx seems to be lacking (although the angle of the oral sucker would make this structure difficult to observe in this specimen); pharynx 0.120 mm. in length, 0.100 mm. wide; short esophagus, forking approximately halfway between the suckers; ceca extending to near the posterior end. Genital pore slightly to the left, immediately posterior to intestinal bifurcation. Muscular genital atrium containing anterio-dorsally a lip-like, muscular, genital lobe; posterior lobe not evident. Cirrus sac 0.224 by 0.150 mm., extending diagonally between ventral sucker and genital pore. Seminal vesicle sac-like, bipartite; a somewhat coiled, tubular portion of seminal vesicle lying outside the base of cirrus sac proper but enclosed by a membrane forming a tapering sac attached to the dorsal, posterior portion of the cirrus sac proper. Thick-walled pars prostatica occupying at least 2/3 the length of cirrus sac. Testes lobed, diagonal, in midbody region,

lateral, intercecal, separated by uterus, left testis slightly in advance. Ovary multilobed, immediately anterior to right testis. Seminal receptacle lacking. Uterus a very narrow, thin-walled, inconspicuous, coiled tube, leading at first to the left and anteriorly nearly to ventral sucker, then posteriorly to level of cecal tips, then anteriorly to genital atrium, becoming almost straight at about midacetabular level, entering genital atrium dorsally and posteriorly. Coils of uterus occasionally extending into the extracecal area posterior to the vitellaria. Vitellaria, composed of irregularly shaped, often coalescing follicles, forming two lateral groups in middle third of body, partly extracecal and partly ventral to the ceca. Eggs colorless, transparent, thin-shelled, pyriform, tapering to a rounded point at one end and more or less truncated at the other, broad end, 38 to 44 by 18 to 20 μ. Extending from the middle of the broad end of the egg is a filament about the same length of the egg or a little shorter. It is often more or less coiled or at least bent, but is thicker and stiffer at its base. Excretory vesicle V-shaped with swollen branches. The excretory pore could not be seen at the posterior tip and is probably a short distance in front of this point. Branches of excretory vesicle at first intercecal, crossing the ceca ventrally at the level of the ventral sucker and extending to anterior end of body.

The genus name *Lissoloma* is from *lisso*, smooth, and *loma*, fringe, referring to the smooth body fold. The species name *brotulæ* is for the host, *Brotula*.

Generic Diagnosis

Medium-sized fellodistomids, body smooth, rounded at both ends; body edges incurved ventrally, especially at both ends, making the body shape like that of an elongate-oval, shallow boat; body edges not frilled or lobed. Suckers about the same size, ventral sucker about 1/3 from anterior end. Ceca extending to near posterior end. Genital pore slightly to the left, immediately posterior to intestinal bifurcation, approximately halfway between the suckers; genital atrium with anterior copulatory lobe. Cirrus sac ovoid except for narrowed, pointed, posterior region, intercecal, extending to ventral sucker. Testes slightly lobed, diagonal, far apart, approximately in midbody. Ovary multilobed, close in front of right (posterior) testis. Uterus very narrow, thin-walled, inconspicuous, extending posteriorly to level of cecal tips, coils chiefly intercecal but also, especially posterior to vitellaria, extracecal. Vitellaria of small, irregularly shaped follicles, lateral, ventral, cecal and extracecal, in middle third of body, not extending anterior to ventral sucker. Eggs colorless, thin-shelled, pear-shaped, truncated at broad end, with filament nearly as long as egg, egg about 40 μ in length. Excretory vesicle V-shaped, branches wide, folded, crossing ceca at level of ventral sucker.

Type species—Lissoloma brotulæ.

Comparisons

Although based on a single specimen, this genus seems very distinct. Its nearest relative is *Lomaphorus* with which it agrees in development of a ventro-lateral expansion of the body wall. This fold, however, in *Lissoloma* is entirely smooth. The genus is like *Lomaphorus* in excretory system, distribution of vitellaria, and shape of cirrus sac. Additional differences are:

Lissoloma has a distinctly different body shape, filamented, colorless egg, and more slender uterus. It is interesting to note that the egg filament is suggested in some species of *Lomaphorus* (figs. 21, 23) and in *Megenteron* (fig. 16). *Lissoloma* differs from *Megenteron* in body shape, ventro-lateral fold, shape of pharynx, shape of cirrus sac, extent of vitellaria, egg color and shape. It differs from *Steringophorus* in shape of excretory vesicle and shape of body. It differs from *Steringotrema* in shape of body, extent of vitellaria and shape of eggs.

Benthotrema plenum n.gen., n.sp.

(Figs. 27-28)

Host—Unidentified lizard fish.
Position—Body cavity (?).
Frequency—1 specimen in 1 host examined.
Depth—582 fathoms.

SPECIFIC DIAGNOSIS

Body large, plump, robust, not flattened, unspined, length 4.7 mm., width 2.3 mm. Greatest width posterior to midbody, both ends broadly rounded. Oral sucker at anterior end, 0.48 mm. in diameter; mouth ventral, round. Ventral sucker about 1/3 from anterior end (forebody 1.276 mm.), same size as oral sucker (diameter 0.48 mm.), occupying less than 1/3 body width at that level, its aperture small and round. No prepharynx; pharynx relatively small (0.151 mm. long, 0.168 mm. wide); esophagus short, broad; ceca at first broad, becoming narrow, extending to posterior edge of testes but probably not far beyond. Genital pore a short distance in front of ventral sucker and slightly to the left, ventral to left cecum, surrounded by radial muscles which form a sucker-like structure. Cirrus sac well developed, wide, extending inwardly and posteriorly from the genital pore, its posterior border overlapping the anterior edge of ventral sucker. Seminal vesicle a coiled tube, not evidently bipartite, in posterior half of cirrus sac; prostate gland well developed; cirrus of moderate length. Genital atrium apparently a fairly spacious chamber but without muscular genital lobes. Testes smooth, ovoid, longer than wide, symmetrical, a short distance posterior to ventral sucker. Ovary large, about same size as ventral sucker, smooth, globular, immediately in front of right testis, to the posterio-right of the ventral sucker. Seminal receptacle lacking, sperm cells in uterus. Uterus highly coiled, filling completely the entire hindbody, coiling between testes; metraterm not observed. Vitellaria of numerous, large, somewhat irregular follicles, extending from intestinal bifurcation to anterior edge of testes, covering ceca ventrally, meeting medianly anterior to cirrus sac, sparsely colored with black pigment. Eggs ovoid, with thick, brown shells, shells provided with many spine-like protuberances (fig. 28), 49 by 34 μ. Excretory vesicle with branches extending to level of oral sucker, otherwise not observed.

From the above description a generic diagnosis of *Benthotrema* might be given as follows:

Fellodistominæ of plump, thick body form, medium to large sized, without body folds; suckers approximately equal in size; esophagus short and broad; genital pore to the left, with radiating muscles; cirrus sac ovoid; seminal vesicle coiled, not bipartite; genital atrium without genital lobes; testes smooth, symmetrical; ovary unlobed, anterior to testes; vitellaria of numer-

ous pigmented follicles and entirely anterior to midbody; eggs dark brown, with spiny shells.

Type species—Benthotrema plenum. Position, body cavity (?) of marine fish.

The genus name is from *benthos*, depth of the sea, and *trema*, referring to trematode. The species name *plenum*, full, refers to the crowded appearance of the plump body.

Comparisons

This genus differs from all other genera in the subfamily in its small ventral sucker and spiny eggs. *Steringotrema* and *Bacciger* are the only other genera with unlobed ovary. The wide extent of the vitellaria in the forebody is distinctive. It differs from *Bacciger* also in the sinistral genital pore, lateral ovary and short esophagus.

Deretrema fusillus Linton, 1910

(Fig. 29)

Hosts	Frequency in hosts	Depth
Abudefduf marginatus (Bloch)	1 of 14	
Decodon puellaris (Poey)	1 2	50 fath.
Upeneus parvus Poey	1 2	50

Position—Intestine, except once in gall bladder.

Linton collected this trematode from *Abudefduf marginatus* (synonym: *Abudefduf saxatilis*), *Hæmulon macrostomum* and *Ocyurus chrysurus*.

My material indicates that the seminal receptacle described by Linton is a portion of the uterus filled with sperm cells. In view, also, of slight additions to Linton's description, the following specific diagnosis is suggested.

Body thick, plump, smooth, widest at level of ventral sucker, tapering gradually and rounded anteriorly, pointed posteriorly, length 1.68 to 2.03 mm., width 0.64 to 1.125 mm. Oral sucker terminal, extended transversely; ventral sucker in middle of body, a little less than twice diameter of oral sucker. No prepharynx; esophagus long, thick-walled, about 3 times the length of pharynx; intestinal bifurcation about midway between the suckers; ceca extend to middle of testes and end dorsal to testes. Genital pore on left edge of body, varying from level of intestinal bifurcation to level of middle of esophagus. Cirrus sac claviform, slender, extending medianly and somewhat posteriorly to near the median line; seminal vesicle simple, pars prostatica about ½ length of cirrus sac, prostate gland very weakly developed. Testes large, lateral, symmetrical, immediately posterior to ventral sucker. Ovary submedian, extended transversely, unlobed. Seminal receptacle lacking. Laurer's canal present. Vitelline follicles large, lateral, chiefly extracecal, 6 to 8 on each side in middle of body. Uterus filling hindbody and also much of forebody with loose coils. Eggs yellow-brown, 33 to 49 by 19 to 24 μ, usually about 40 by 20 μ. Excretory vesicle Y-shaped with long median stem.

Deretrema fusillus is classified in the Fellodistomidæ with some uncertainty. Its plump, smooth body, shortened ceca, symmetrical testes, lack of seminal receptacle, course of uterus, reduced vitellaria and its excretory system, suggest the Fellodistomidæ. The weak development of the cirrus sac,

the lateral position of the genital pore, the weak prostate gland and undivided seminal vesicle are unlike typical fellodistomids. The Lecithostaphylinæ (family Zoogonidæ) is suggested by some characters (position of the genital pore and character of the cirrus sac) but the species seems to be excluded from that family by the lack of body spines, absence of seminal receptacle and shape of excretory vesicle. The Plagiorchidæ should be considered as a possibility, but unspined trematodes are rare in that family and the plump body and the lateral genital pore would be unusual. The genus is here included in the Fellodistomidæ provisionally.

Key to Genera of Fellodistomidæ

1. (8) Vitellaria not extending anterior to ventral sucker 2
2. (3) Excretory vesicle Y-shaped ..... *Steringophorus*
3. (2) Excretory vesicle V-shaped 4
4. (5) Eggs with polar filament ..... *Lissoloma*
5. (4) Eggs without polar filament 6
6. (7) Body with paired, ventro-lateral lobes ..... *Lomaphorus*
7. (6) Body without lobes ..... *Lintonium*
8. (1) Vitellaria extending anterior to ventral sucker 9
9. (10) Ventral sucker same size as oral sucker, eggs spiny ..... *Bathytrema*
10. (9) Ventral sucker larger than oral sucker, eggs not spiny 11
11. (12) Genital pore lateral ..... *Deretrema*
12. (11) Genital pore on ventral surface 13
13. (16) Ceca not extending posterior to testes 14
14. (15) Genital pore median, ovary unlobed ..... *Bacciger*
15. (14) Genital pore to the left, ovary lobed ..... *Rhodotrema*
16. (13) Ceca extending posterior to testes 17
17. (18) Genital pore median ..... *Pycnadena*
18. (17) Genital pore to the left 19
19. (20) Esophagus absent, excretory vesicle Y-shaped ..... *Fellodistomum*
20. (19) Esophagus present, excretory vesicle V-shaped ..... *Steringotrema*[1]

Family ZOOGONIDÆ

Subfamily Lecithostaphylinæ

Brachyenteron peristedioni n.gen., n.sp.

(Figs. 30-32)

Host—Peristedion platycephalum (Goode & Bean).
Position—Intestine.
Frequency—Present in 1 of 14 hosts examined.
Depth—135 to 156 fathoms.
10 specimens were collected.

Specific Diagnosis

Body flattened, elongate, tapering almost to a point at each end, widest at level of ventral sucker; length 1.22 to 1.51 mm.; width 0.42 to 0.51 mm., scale-like spines becoming fine and easily lost posterior to testes. Ventral sucker slightly larger than oral sucker, occupying about 1/4 body diameter, about 1/3 body length from anterior end. Prepharynx short; pharynx small, about same length as prepharynx; esophagus long, 0.110 to 0.130 mm. in length; intestinal bifurcation midway between suckers or a little nearer the ventral sucker; ceca short, sac-like, about same length as esophagus, divergent, extending to region of ventral sucker, entirely anterior to genital organs. Genital pore lateral, on left edge of body, about 2/3 the distance

[1] The *Steringotrema pulchrum* of Layman, 1930, seems to belong more appropriately in the genus *Lintonium* Stunkard & Nigrelli, 1930.

from oral to ventral sucker. Cirrus sac (fig. 32) well developed, chiefly preacetabular, ventral to ceca, protrusible cirrus (sometimes inserted in metraterm of same individual). Seminal vesicle bipartite, the two parts of about equal size, occupying only the posterior fourth of cirrus sac. Testes unlobed, subspherical, symmetrical, either opposite or closely posterior to ventral sucker. Ovary spherical, large, about same size as ventral sucker, overlapping ventral sucker, slightly to the right, often intertesticular. Seminal receptacle fairly large, postovarian. Laurer's canal opening on dorsal surface between ovary and seminal receptacle. Uterus may reach to posterior end (fig. 30) or terminate a short distance in front of posterior end (fig. 31). Metraterm with conspicuous, bulb-like, muscular thickening near genital pore, entering genital atrium anteriorly. Eggs yellow, thick-shelled, 26 to 30 by 14 to 19 μ. Vitellaria at level of ventral sucker, consisting of two lateral groups of 7 to 9 follicles, sometimes meeting medianly dorsal to ventral sucker. Excretory vesicle elongated, sac-like, unbranched, extending forward to posterior edge of ovary.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Pharynx	Esophagus	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	mm.	μ
1.51	0.456	0.100	0.120	0.430	40 by 36	0.190	26 by 14
1.226	.420	.094	.134	.340	50 48	.110	28 14
							30 16
1.51	.428	.090	.121		40 30	.120	28 18
1.285	.490	.090	.140	.400		.120	28 16
1.370	.510	.104	.130	.458	50 32	.130	28 16
							30 19

Generic Diagnosis

Fairly small, flattened, elongate, spined Lecithostaphylinæ, tapering at each end, widest at level of ventral sucker. Suckers small; oral sucker terminal; ventral sucker about 1/3 from anterior end, slightly larger than oral sucker. Prepharynx present; pharynx small; esophagus long, thick-walled; ceca short, sac-like, divergent, extending to or almost to anterior edge of ventral sucker. Genital pore on left body edge, preacetabular. Cirrus sac clavate, extending diagonally to anterior edge of ventral sucker; seminal vesicle bipartite. Testes subspherical, smooth, symmetrical or slightly diagonal, closely posterior or slightly overlapping ventral sucker. Ovary slightly to the right, overlapping ventral sucker, often intertesticular. Laurer's canal present. Seminal receptacle postovarian. Uterus filling all or large part of hindbody. Vitellaria forming two more or less separate groups of large follicles at or near the level of ventral sucker. Metraterm highly muscular, somewhat shorter than cirrus sac. Eggs fairly large. Excretory vesicle a large, swollen tube, extending to ovary.

Type species—Brachyenteron peristedioni.

Comparisons

This genus differs from all other genera of the Lecithostaphylinæ (*Proctophantastes* Odhner, *Lecithostaphylus* Odhner, *Lepidophyllum* Odhner, *Steganoderma* Stafford [1]) in its very short, divergent ceca limited to the

[1] The genus *Nordosttrema* Issaitschikow, 1928 must be considered a synonym of *Steganoderma* Stafford, 1904. Issaitschikow's species, *N. mcssjatzevi*, is only slightly different from *Steganoderma formosum* and occurs in a related host.

forebody. It differs from *Proctophantastes* in its more elongate body, much smaller, more anterior ventral sucker, shorter esophagus and in the distribution of the vitellaria. It differs from *Lecithostaphylus* in its more tapering ends, longer esophagus, smaller pharynx, more anterior position of the testes and in the distribution of the vitellaria. It differs from *Steganoderma* in more tapering ends, distribution of the vitellaria and more anterior position of the testes. It differs from *Lepidophyllum* in its more elongate body, lateral genital pore, much greater extent of the uterus and of the vitellaria, and in its muscular metraterm.

The name *Brachyenteron* is from *brachy*, short and *enteron*, gut, and refers to the very short ceca.

Family ACANTHOCOLPIDÆ

Stephanostomum lineatum n.sp.

(Figs. 35-37)

Hosts	Frequency in host	Depth
Læmonema barbatulum (Goode & Bean)	1 of 13	140 to 197 fath.
Urophycis cirratus (Goode & Bean)	5 8	60 125
Urophycis regius (Walbaum)	4 8	60 200

Position—Ceca and intestine.

The degree of infection is usually light, but one specimen of *Urophycis regius* contained hundreds of the trematodes, one of the heaviest trematode infections of any kind found during the present work.

The genus *Stephanostomum* Looss, 1899, was renamed *Stephanochasmus* by Looss in 1900. According to the rules of nomenclature the genus *Stephanostoma* Danielsen, 1880 does not invalidate *Stephanostomum* Looss, 1899, and *Stephanochasmus* must be considered a synonym of *Stephanostomum*. Unfortunately, the genus has become well known as *Stephanochasmus*.

Specific Diagnosis

Body elongated, very narrow, filiform, little flattened, almost cylindrical, length 2. to about 7. mm., width 0.126 to 0.37 mm. Ventral sucker far forward, about 1/8 to 1/10 body length from anterior end, always slightly larger than oral sucker. Oral sucker with crown of more or less rhombic spines arranged in three more or less distinct rows (fig. 36). Third (posterior) row of spines better developed in some specimens than in others, sometimes very incomplete, total number of spines 50 to 52. A bare area forming a naked ring around the body immediately posterior to the oral crown. Body spines conspicuous, variable in shape, often pointed needle-like sometimes almost rhombic in shape. Pigment flecks dorsally on forebody. Prepharynx long, usually much longer than pharynx, in contraction only a little longer than pharynx; medium-sized pharynx; distinct but short esophagus; narrow ceca extending to posterior end. Genital pore median, immediately in front of ventral sucker. Genital atrium tubular, spined, extending a short distance posterior to ventral sucker. Cirrus sac long, narrow, sinuous, swollen at base, containing a bipartite seminal vesicle, extending posteriorly almost halfway between ventral sucker and ovary. Cirrus spined. Testes median, tandem, in middle of posterior half of body, elongate-oval to almost round, diameter nearly filling body diameter, separated by vitelline follicles, posterior testis usually larger. Posttesticu-

lar space very long, always longer than forebody, 1/4 to 1/5 total body length. Ovary globular, median, about in midbody, separated from anterior testis by vitelline follicles. Uterus preovarian; metraterm spined, sinuous, not quite as long as cirrus sac. Vitelline follicles extending from base of cirrus sac to posterior end of body, interrupted opposite testes and ovary, confluent between these organs, filling posttesticular space. Eggs thin-shelled, light yellow, 62 to 66 by 34 to 45 μ.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Posttesticular area	Prepharynx	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	mm.	μ
5.55	0.36	0.11	0.14	0.637	1.32	0.315	64-66 by 40-45
4.72	.37	.112	.16	.52	1.128	.28	64-66 40-45
5.85	.21	.112	.154	.72	1.27	.42	64-66 40-45
6.91	.31	.105	.147	.637	1.45	.322	64-66 40-45
5.46	.126	.105	.14	.455	1.09	.28	64-66 40-45
5.42	.315	.105	.147	.45	1.34	.28	64-66 40-45
4.55	.28	.091	.135	.291	0.855	.14	64-66 40-45
2.36	.24	.084	.114	.38	0.57		

Comparisons

This species is to be compared with *Stephanostomum rhombispinosum* (Lebour) (Synonym: *Stephanochasmus rhombispinosus* Lebour) which is the only species it closely resembles. These two species are alike in their thread-like, elongate, body form, rhombic oral spines, extent and distribution of the vitellaria, extent of the cirrus sac and position of the testes and ovary. *S. rhombispinosum* is from the whiting, *Gadus merlangus*, from European waters. The hosts are therefore related. *S. lineatum* must be considered as distinct, however, because of the following differences: a more or less complete third row of spines, ventral sucker distinctly larger than oral sucker, a constantly much longer posttesticular space and a considerably smaller egg. None of the species of *Stephanostomum* from shallow-water fish of Tortugas shows nearly as close relationship as does *S. rhombispinosum* from distant but cooler waters.

Stephanostomum microstephanum n.sp.

(Figs. 38-41)

Host—Epinephelus niveatus (Cuv. & Val.).
Position—Intestine.
Frequency—Two specimens in 1 of 3 hosts examined.
Depth—90 fathoms.

Specific Diagnosis

Length of mature specimen 2.09 mm., greatest width 0.520 mm. (about at midbody). Body flattened, rounded at ends. Oral sucker fairly large, terminal, directed forward. Ventral sucker just in front of midbody, smaller than oral sucker (ratio about 3:4). Oral sucker with a crown of three rows of oral spines much reduced in size, somewhat irregular in shape, not sharply pointed, easily lost, total number at least 150, maximum size 10 by 6 μ (fig. 39). Behind the oral crown there is a short space free of spines,

followed by the spined region of the body. Body spines either scale-like and easily shed, or sharply pointed, extending to near the posterior end. Pigment flecks (or, in young, distinct eye spots) dorsally, shortly behind oral sucker. Prepharynx long, somewhat expanded posteriorly, pharynx pyriform, widest posteriorly, only slightly shorter than prepharynx; very short esophagus, intestinal bifurcation about 2/3 the distance between oral and ventral suckers; broad ceca extending to posterior end of body. Genital pore median, immediately anterior to ventral sucker. Genital sinus very short, cirrus sac elongate-oval, extending a short distance posterior to ventral sucker, containing a bipartite seminal vesicle in its posterior third, a fairly well-developed prostate gland and long cirrus with long, narrow spines (fig. 40). Testes large, median, tandem, rounded, in posterior third of body, not far apart, separated by a few vitelline follicles especially dorsally, posttesticular space short, about the length of testis diameter.

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Pre-pharynx	Pharynx	Cirrus sac	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	μ
2.090	0.520	0.230	0.190	0.814	0.172	0.168	0.213	70 by 43
								62 41
1.440	.395	.226	.154	.588	.156	.147		

Ovary ovoid, smooth, transversely extended, immediately in front of anterior testis, not far posterior to midbody. Uterus preovarian, intercecal, metraterm not conspicuous, a little shorter than cirrus sac. Eggs fairly large, thin-shelled, 62 to 70 by 41 to 43 μ. Vitellaria extending from immediately behind the intestinal bifurcation to the posterior end of the body, largely cecal, dorsal and ventral, confluent anterior to ventral sucker, dorsally between the testes and behind the testes. Excretory vesicle forking between the testes, two narrow crura extending into anterior end. In the postacetabular area these crura are intercecal.

Comparisons

There is no other species of *Stephanostomum* very similar to this form. One of the most characteristic features, the three rows of oral spines, as well as the rhomboid shape of these spines is shared by *S. lineatum*, another species from deep-water fish. These spines in *S. lineatum*, however, are much larger and much fewer in number. Furthermore, *S. lineatum* is conspicuously different in body proportions, length of posttesticular space, length of esophagus, distribution of vitellaria and length of genital sinus. No other species of *Stephanostomum* possesses nearly as many oral spines, 56 in *S. baccatus* is the nearest—a number about 1/3 the number present in *S. microstephanum*. In no other species of *Stephanostomum* do the vitellaria extend anterior to the ventral sucker and become confluent there. The very short genital sinus or atrium is not characteristic for the genus. In fact, these differences might well be sufficient to identify a new genus. At present the species is referred to *Stephanostomum*, with its nearest (yet distant) relative *S. lineatum*.

The fact that the oral spines are so much reduced and so easily lost suggests a comparison with related genera lacking the oral crown. The body form and vitellaria are somewhat like *Acanthopsolus* but this genus possesses

a sac-shaped excretory vesicle (at least, supposedly), diagonal testes, much larger eggs and smaller oral sucker (as well as lacking oral spines). Poche (1926) named the genus *Tormopsolus* for the *Distomum osculatum* of Looss (1901). This species seems to be so much like *Stephanostomum* (especially *S. caducus* Looss, 1901) that it seems probable that its oral spines had become accidentally lost. It is entirely unlike the present species in body form, sucker position and ratio, extent of vitellaria, and in other characters.

Family ALLOCREADIIDÆ

Subfamily Allocreadiinæ

Helicometra fasciata (Rud.)

Hosts	Frequency in host	Depth
Prionotus alatus Goode & Bean	3 of 4	60 fath.
Prionodes sp.	1 1	50
Bellator militaris (Goode & Bean)	3 9	50

Position—Intestine.

The occurrence of this species at Tortugas has already been described (Manter, 1933*a*). It is a common species of Europe, but does not seem to occur in shallow-water fish of Tortugas, nor was it collected from fish below 60 fathoms. Yet it is common enough to be readily obtainable at the depths mentioned above.

Helicometrina nimia Linton, 1910

This species was collected once from 1 of 6 specimens of *Scorpæna agassizii* Goode & Bean at 60 fathoms. The parasite has been recently discussed by the author (Manter, 1933*a*). It occurs commonly in reef fish and is known from 14 host species. The above record is the only instance reported of its occurrence in other than shallow-water fish.

Podocotyle pearsei n.sp.

(Fig. 61)

Host—Urophycis chesteri (Goode & Bean).
Position—Intestine.
Frequency—Present in 2 of 6 hosts examined.
Depth—250 to 367 fathoms.

Specific Diagnosis

Body smooth, not especially elongate, length 1.46 to 1.84 mm., width 0.655 to 0.722 mm., tapering in front of ventral sucker, hindbody more or less equally broad and rounded posteriorly. Oral sucker terminal, round; mouth subterminal; ventral sucker preequatorial, about twice the diameter of oral sucker, its aperture transverse or almost round; forebody a little less than ¼ body length. Very short prepharynx; unusually large, ovoid pharynx; long esophagus, about twice the length of the pharynx; intestinal bifurcation at anterior border of ventral sucker; ceca broad, extending to posterior end. Genital pore to the left, halfway to body edge, opposite anterior edge of intestinal bifurcation, a short distance anterior to ventral sucker. Testes tandem (in one instance diagonal), in contact, smooth or

slightly lobed, immediately postequatorial, occupying the intercecal area, posterior testis more or less triangular, both transversely extended. Post-testicular area less than ¼ body length and usually slightly less than fore-body length. Cirrus sac claviform, extending to middle of ventral sucker or slightly beyond; prostate gland lacking. Ovary transversely extended, median, equatorial, immediately anterior to testes, with anterior border more or less distinctly 3-lobed. Seminal receptacle tubular and inconspicuous. Vitelline follicles from posterior edge of ventral sucker to posterior end of body, chiefly ventral to ceca but to some extent dorsal, continuous, filling the posttesticular area. Uterus short, between ovary and ventral sucker. Eggs large and rather elongate, 96 to 105 by 39 to 45 μ. Excretory vesicle extending as a simple tube from the terminal excretory pore to the posterior edge of ovary.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Post-testicular area	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
1.84	0.670	0.235	0.386	0.504	0.395	98 by 45
1.69	.655	.235	.487	.418	.428	103 43
1.46	.688	.218	.412	.404	.336	103 45
1.61	.714	.218	.428	.386	.395	105 43
1.52	.722	.235	.487	.404	.344	96 39

Comparisons

Although the lobing of the ovary is indistinct in some specimens, this species is referred to the genus *Podocotyle* because of the position of the genital pore, the extent of the cirrus sac and the extent of the vitellaria. Since the three lobes of the ovary are directed forward, the species is most like *Podocotyle levinseni* Issaitschikow and *Podocotyle odhneri* Issaitschikow from the Russian Arctic. It is, in fact, very similar to *Podocotyle levinseni*, agreeing in body form, shape and position of reproductive organs, as well as in the large pharynx and rather long esophagus. The eggs of *Podocotyle pearsei*, however, are longer and at the same time more narrow (96 to 105 by 39 to 45 μ as compared with 80 to 95 by 40 to 58 μ) and the vitellaria in all my 11 specimens end abruptly at the posterior edge of the ventral sucker, whereas they reach to the middle of this sucker in *P. levinseni*.

This species represents another deep-water form with closest relationship to Arctic species rather than to any member of adjacent waters.

The species is named in honor of Dr. A. S. Pearse, American zoologist.

Eurycreadium vitellosum n.gen., n.sp.

(Fig. 64)

Host—*Læmonema barbatulum* Goode & Bean.
Position—Intestine.
Frequency—Present in 1 of 19 hosts examined.
Depth—249+ fathoms.

Specific Diagnosis

Body unspined, rather broad and thick, tapering toward each end, widest and thickest about at midbody, more pointed posteriorly, length 1.7 to 2.18

mm., width about 1/2 body length or a little more, depending on degree of contraction. Forebody mobile, capable of considerable extension. Oral sucker terminal; mouth terminal or subterminal; ventral sucker about 1/3 from anterior end, not very powerful, 1 1/2 to 2 times the diameter of oral sucker, its aperture longitudinal. Very short prepharynx, apparently absent when forebody is contracted; ovoid pharynx; muscular esophagus longer than pharynx; intestinal bifurcation at anterior border of ventral sucker; ceca curving around the ventral sucker and ending at the anterior borders of the testes, thus scarcely extending beyond midbody, usually somewhat enlarged terminally. Genital pore prebifurcal, slightly to the left. In one specimen (fig. 64) it was opposite the pharynx, in another (with extended forebody) it was opposite anterior portion of esophagus. Cirrus sac elongate-clavate in shape, gradually enlarging toward its base which is dorsal to the middle of ventral sucker; most of cirrus sac filled with the undivided, sac-shaped seminal vesicle; prostate gland very weakly developed. Testes large, symmetrical or slightly diagonal, smooth or slightly lobed, directly posterior to the tips of the ceca, somewhat wider

Measurements

Length	Width	Oral sucker	Ventral sucker	Fore-body	Cirrus sac	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ	μ
1.729	1.064	0.199	0.357	0.365	0.448	104 by 48	68-78 by 31-36
2.185	1.045	.175	.273	.539	.380	100 72	82-84 36-40

than long, occupying the greater part of the body diameter. Ovary 3- or 4-lobed, to the right, a short distance anterior to right testis; uterus coiling to the left then forward along the right border of, or dorsal to, the ventral sucker, not extending posterior to testes; early coils of uterus narrow and muscular, a terminal metraterm also muscular. True seminal receptacle lacking, sperm cells in early coils of uterus may accumulate adjacent to Mehlis' gland. Laurer's canal long, coiled, opening dorsally anterior to the ovary. Vitelline follicles fairly large and well distributed through the body dorsally, anteriorly extending to the pharynx and posteriorly to a point shortly behind the testes, not limited to a lateral position but overlapping all the organs including the ventral sucker. They also occur to some extent ventral to the ceca. Yolk ducts crossing body at about the level of the ovary; yolk reservoir dorsal to ovary. Eggs large, few in number, with thin, yellow shells, star-shaped in cross-section, size variable, the largest being 82 to 84 by 36 to 40 μ but some young, apparently normal, eggs only 68 by 31 μ. Excretory pore terminal, excretory vesicle at first narrow, then widening into a lobed, sac-like form, unbranched, terminating abruptly, immediately posterior to ovary.

Comparisons

The similarities of this trematode to the Fellodistomidæ including the short ceca, lobed ovary and the symmetrical testes are superficial and misleading. There can be little doubt of its position in the Allocreadiidæ as indicated by its short uterus anterior to testes, large and few eggs, character of the cirrus sac, extent of the vitellaria, and the sac-shaped excretory vesicle. The possible symmetrical position of the testes is unusual for allocreadids but occurs also in the genus *Microcreadium* Simer, 1929

(which is, however, not a close relative). What seem to be the most closely related forms yet described are two species described by Issaitschikow (1928) from the Russian Arctic. These were described and figured as "*Rhodotrema skrjabini* and *Rhodotrema problematicum*." *Rhodotrema* is a genus of the Fellodistomidæ. Yet Issaitschikow's species differ radically from *Rhodotrema* in that the uterus does not extend behind the testes, the cirrus sac does not show the characters of *Rhodotrema*, the eggs are large, and the excretory vesicle is not V-shaped but a simple, undivided sac. On the other hand, these two species agree with the present form in many characters such as short ceca terminating immediately anterior to testes; diagonal or symmetrical, large testes; 3-lobed ovary; widened body; longitudinal aperture of the ventral sucker; the dorsal, extensive vitellaria; and the excretory vesicle. Both of Issaitschikow's species differ from the present form in more posterior genital pore, shorter esophagus, and in that the vitellaria do not extend posterior to the testes. It is proposed to unite them with the above species in the genus *Eurycreadium*. Their names thus become *Eurycreadium skrjabini* (Issaitschikow, 1928) n. comb. and *Eurycreadium problematicum* (Issaitschikow, 1928) n. comb.

The genus *Eurycreadium* evidently should be referred to the Allocreadiinæ and the following diagnosis is suggested.

Generic Diagnosis

Allocreadiinæ with bodies more or less broadened; ventral sucker larger than oral sucker, with longitudinal aperture. Very short prepharynx; esophagus moderately long, ceca short, not extending behind testes. Genital pore preacetabular, to the left. Cirrus sac with large, undivided seminal vesicle, weak prostate gland and narrow cirrus. Testes symmetrical or diagonal. Ovary 3- or 4-lobed, to the right or submedian, postacetabular, pretesticular. Uterus entirely pretesticular; eggs few, large, thin-shelled. True seminal receptacle absent; Laurer's canal present. Vitelline follicles extensively developed, mostly dorsal, extending into forebody. Excretory vesicle simple, unbranched, sac-like.

Type species—Eurycreadium vitellosum.

Eurycreadium differs from all other genera in the family in the position of the testes posterior to the ends of the short ceca. The lack of a seminal receptacle and the extensive distribution of the vitellaria are unusual features.

The name *Eurycreadium* is from *eury*, broad, and *creadium*, referring to a broad, Creadium-like trematode. The name *vitellosum* refers to the extensive development of the vitellaria.

Genus CYMBEPHALLUS Linton, in press

Two species of trematodes in the present collection seem to show many resemblances to the *Dist. vitellosum* of Linton. Linton has now in press a paper soon to appear in the Journal of the Washington Academy of Science in which *Dist. vitellosum* is referred to a new genus *Cymbephallus*. Dr. Linton has very kindly forwarded to me an advance copy of his description of the genus *Cymbephallus* and of its two species to which he allots his former *Dist. vitellosum*. It is believed that the two following species can be referred to this genus, although both seem to lack the scalloped or papillated border of the ventral sucker. The following diagnosis is based chiefly on my two species, but includes the characters noted by Linton.

Cymbephallus: Allocreadiinæ. Unspined, usually elongate. Ventral sucker more or less embedded in the body or protruded, surmounted or encircled by folds of the body wall, with or without lobes or papillæ. Anus lacking.[1] Genital pore to the left, well anterior to ventral sucker. Testes smooth or lobed, tandem, postovarian, median. Cirrus short and thick, sucker-like. Cirrus sac reduced, enclosing only the short cirrus and the pars prostatica. Prostate gland lacking. Seminal vesicle tubular, entirely outside cirrus sac, extending posterior to ventral sucker. Uterus rather short, eggs medium-sized to large. Uterine seminal receptacle. Vitelline follicles from region of ventral sucker to posterior end.

The outstanding characteristic of the genus is the structure of the terminal genital ducts. These are strongly suggestive of the Opecœlidæ of Ozaki (1928), in particular *Opecœlus elongatus* Ozaki, 1928b. An anus, however, does not occur in *Cymbephallus*.

Cymbephallus vulgaris n.sp.

(Figs. 42-47)

Hosts	Frequency in hosts	Depth
Ancylopsetta dilecta (Goode & Bean)	4 of 8	60-125 fath.
Bellator militaris (Goode & Bean)	1 23	50
Bembrops gobioides (Goode)	3 28	200-250
Benthodesmus atlanticus Goode & Bean	1 1	300
Brotula barbata (Bloch & Schneider)	1 1	79-140
Helicolenus dactylopterus (de la Roche)	8 18	200-315
Læmonema barbatulum Goode & Bean	3 6	249-316
Peristedion imberbe Poey	6 17	100
Peristedion miniatum Goode	3 8	138-150
Peristedion platycephalum (Goode & Bean)	8 12	150
Pontinus longispinus Goode & Bean	9 18	60-149
Prionotus alatus Goode & Bean	3 4	60
Prionotus stearnsi Jordan & Swain	1 3	50
Pronotogrammus sp.	3 14	139-156
Scorpæna cristulata Goode & Bean	1 2	100
Unidentified	1 1	

Position—Intestine, rarely in the stomach.

Specific Diagnosis

Length 1.3 to 4.18 mm., width 0.32 to 0.95 mm. Body usually tapering posteriorly, hindbody flattened, body usually indented opposite testes. Ventral sucker from 2 to 3 times the diameter of oral sucker, somewhat extended transversely, with transverse aperture, from 1/4 to 1/6 body length from anterior end. Body folds, especially in the form of a lip-like anterior fold, developed in connection with ventral sucker, but no finger-like processes or papillæ. Prepharynx very short; esophagus long, usually about twice the length of pharynx, forking a short distance anterior to ventral sucker. Genital pore to the left opposite the posterior half of pharynx. Testes lobed, the posterior testis often bilobed, close together in posterior half of body. Posttesticular space variable but almost always longer than forebody. Cirrus short and wide; pars prostatica short; prostate gland lacking; seminal vesicle entirely external, tubular, extending posteriorly to a point about halfway between ventral sucker and ovary. Ovary lobed, 3

[1] Linton does not mention the presence or absence of ani which are presumably lacking.

lobes directed posteriorly; uterine seminal receptacle; eggs variable in size but always relatively large, 90 to 127 by 50 to 76 μ. In very young individuals eggs may be as small as 78 by 40 μ but whenever eggs of 78 to 80 μ in length occur, the specimen can be recognized as young. Vitellaria from region of ventral sucker to posterior end, sometimes slightly interrupted opposite testes. Excretory vesicle simple, extending to about the level of ovary.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Post-testicular space	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.39	0.67	0.136	0.326	...	...	97-100 by 52-55
1.318	.47	.112	.302	0.361	0.26	101 58
3.23	.95	.176	.428	.478	.89	94 62
1.57	.46	.112	.310	.327	.45	95 53
2.318	.60	.151	.352	.412	.59	98 57
3.33	.67	.218	.453	.613	1.01	93 52-58
4.18	.68	.215	.478	.504	1.58	101 66
2.52	.588	.151	.361	.462	0.72	121 68
1.86	.462	.124	.327	.420	.54	98 53-58
3.51	1.045	.201	.495	.646	1.121	105 55
2.29	0.672	.143	.336	.445	0.714	102 66
1.99	.76	.164	.378	.386	.596	94 59
2.24	.546	.117	.302	.462	.756	100-103 49-55
1.9	.478	.126	.285	.412	.537	98 50
1.39	.327	.105	.226	.252	.404	78 40
2.5	.504	.142	.319	.336	.73	123-127 70-72

Discussion

Considerable variation in structure makes this species somewhat confusing. The vitellaria, usually extending to the middle of the ventral sucker, may extend to the anterior border of the sucker, or may reach only the posterior border. All of 13 specimens from *Ancylopsetta dilecta* were alike in that the vitellaria extended to the extreme anterior border of the ventral sucker. Specimens from *Peristedion imberbe* were more variable in this character, the vitellaria barely reaching the sucker, extending to midsucker, or to the anterior border. 4 specimens from *Læmonema barbatulum* from 300 fathoms differed in that the vitelline follicles were more dense (*i.e.* close together), impinging to some degree between the testes and ending abruptly at the posterior border of the ventral sucker. It hardly seems, however, that these characters (which vary so much in other specimens) could identify the form as a different species. It is, therefore, included as an example of *C. vulgaris*.

The specimens collected from *Pontinus longispinus* tended to be smaller in size, noticeably attenuated posteriorly, with ventral sucker occupying practically the entire diameter of the body and with the vitellaria ending at the posterior edge of the ventral sucker. Here, again, a separate species can not be safely indicated, because of the variation these same structures exhibit in specimens from other hosts. The tendency for such variations to be constant in individuals from a certain host species illustrates one of the problems of classification. The parasite seems to show a rather wide spread of variation in a host like *Peristedion imberbe*, but to attain a greater uniformity in some hosts like *Ancylopsetta dilecta, Pontinus longispinus*

and *Læmonema barbatulum*. The possibility that several different species are involved is greatly lessened by the variations found within certain other hosts. The forms are therefore all included under one species. There may be some ground for the recognition of several varieties.

After considerable observation of these trematodes, the species was eventually recognized chiefly by the position of the genital pore, the size of the eggs and the shape of the testes. Papillæ of the ventral sucker are clearly absent. The eggs are unusually large and distinguish the species from both of Linton's.

The common occurrence of this parasite, especially at depths of about 100 fathoms, renders it a favorable species for a depth distribution study. The species was collected 56 times from a total of 16 different hosts. It has never been collected from shallow-water fish, although hundreds of these have been examined. Related but distinct species do occur in shallow-water fish. The depths of the different collections are shown in table 4. The number of hosts examined being approximately equal at the different depths involved, it can be seen immediately that the parasite is by far most common in depths from 75 to 150 fathoms. It seems fairly certain that the parasite does not occur in shallow water (to 10 fathoms). The depths from 10 to 50 fathoms have not been sampled in any representative degree, but judging from the few collections of the parasite at 50 fathoms, it can not be expected to occur other than rarely at these depths. The occurrence of the trematode in depths below 300 fathoms is also unknown. There seems to be an upper limit of distribution at or near 50 fathoms, whereas a lower limit seems less definite.

Cymbephallus fimbriatus Linton, in press

(Fig. 48)

Host—Cœlorhynchus carminatus (Goode) or *Chalinura occidentalis* (Goode & Bean).

Position—Intestine.

Frequency—1 specimen in 1 of 5 hosts examined.

Depth—200 fathoms.

Description

Body flattened, elongate, tapering anteriorly, more or less rounded posteriorly; length 2.935 mm.; width 0.672 mm., unspined. Oral sucker terminal, 0.156 mm. in diameter; ventral sucker slightly extended transversely, with transverse aperture, 0.252 mm. in diameter; encircled by a fold of the body wall, probably protrusible. Forebody 0.520 mm. Short prepharynx; large elongate pharynx; esophagus about same length as pharynx or a little longer; intestinal bifurcation shortly in front of ventral sucker; ceca extending to near the posterior end, without ani. Genital pore somewhat to the left, approximately at midesophagus level; short, sucker-like cirrus and short prostate vesicle; no prostate gland; cirrus sac not evident; coiled, tubular seminal vesicle extending not quite halfway from ventral sucker to ovary. Testes large, slightly indented, median, immediately posterior to midbody, close together; posttesticular space about 1/3 body length (1.035 mm.). Ovary smooth, globular, immediately anterior to testes; vitelline glands chiefly lateral, but largely filling posttesticular area, not reaching ventral sucker anteriorly confluent around ends of ceca. Eggs almost colorless, thin-shelled, 57 to 66 by 39 to 44 μ.

Discussion

Linton places in this species *Dist. vitellosum* of Linton, 1905, 388,390; figs. 176-178. The present specimen is referred to this species in spite of the fact that definite papillæ could not be discerned on the raised border of the ventral sucker. Linton has already mentioned that their appearance varies greatly from time to time and it is possible that more material would show their presence in the present form. Such papillæ are rather clearly absent in *C. vulgaris*, but possibly present here. The trematode is identified as *C. fimbriatus* for the following reasons: similar shape of the body, especially the rounded posterior end; similar shape of the testes and ovary; the anterior extent of the vitellaria is approximatly the same and differs from that of other species; similar egg size; similar esophagus length. Definite sucker measurements are not at present available for *C. fimbriatus*, but Linton's figure 176 (1905) shows sizes very much like those found in the present form.

Linton reports *C. fimbriatus* from *Menticirrhus saxatilis* at Woods Hole, Massachusetts, and from *Bairdiella chrysurus* and *Sciænops ocellatus* at Beaufort, North Carolina.

Another single, similar trematode from *Peristedion longispathum* could not be certainly identified as belonging to this species. It agreed in many respects, but the testes were separated by vitellaria and the ceca seemed to open to the outside.

Subfamily Lepocreadiinæ

Lepidapedon rachion (Cobbold)

(Fig. 49)

Host—*Cœlorhynchus carminatus* (Goode).

Position—Intestine.

Frequency—Present in 7 of 35 hosts examined.

Depths—200 to 315 fathoms.

These specimens agree with specimens of the same species collected from the Maine coast in short esophagus, long prepharynx, sucker ratio, position of intestinal bifurcation and extent and distribution of vitellaria which are partly ventral but not dorsal to the ceca. The only difference which could be detected was a slightly smaller egg size (59 μ as compared with 65 μ) and in that the testes were slightly lobed rather than round. These differences can not be safely accepted as specific, especially since one specimen possessed round, unlobed testes.

The species was not collected from a depth of less than 200 fathoms.

Lepidapedon elongatum (Lebour)

(Fig. 50)

Hosts	Frequency in host	Depth
Cœlorhynchus carminatus (Goode)	1 of 35	200 fath.
Læmonema barbatulum Goode & Bean	1 13	140-197
Urophycis chesteri (Goode & Bean).....	1 6	367
Epigonus occidentalis Goode & Bean.....	1 7	250

Position—Intestine.

This species differs from *L. rachion* chiefly in that the esophagus is longer, the pharynx not quite so large, and in that the vitellaria do not reach the

ventral sucker. The genital pore is somewhat closer to the ventral sucker. In all my Tortugas material except that from *Epigonus occidentalis* the vitelline follicles are lateral and ventral to the ceca but not dorsal. The eggs in both *L. rachion* and *L. elongatum* are from 59 to 68 μ in length.

Issaitschikow (1928) names *L. rachiœa* subsp. *gymnacanthi* differing from *L. rachion* in that the vitellaria begin between the ventral sucker and ovary, in shorter prepharynx and fairly well-developed esophagus, and eggs 90 by 36 μ. He does not figure this subspecies but most of its characters suggest *L. elongatum* rather than *L. rachion*. The eggs are large for either species.

The anterior ends of the specimens from *Epigonus occidentalis* were digested. The specimens otherwise seemed to be like *L. elongatum*, except that the testes were close together. The vitellaria occurred both dorsal and ventral to the ceca.

Lepidapedon nicolli n.s.

(Figs. 51-53)

Host—*Epinephelus niveatus* (Cuv. & Val.).
Position—Intestine.
Frequency—Three specimens in 1 of 3 hosts examined.
Depth—90 fathoms.

Specific Diagnosis

Body flattened, elongate, 1.71 to 2.35 mm. by 0.46 to 0.68 mm., widest at level of ventral sucker or anterior to ventral sucker, spined. Pigment granules on dorsal surface just posterior to pharynx. Oral sucker terminal, larger than ventral sucker, ratio usually about 4:3; prepharynx very short; pharynx elongate; esophagus muscular, usually a little longer than the pharynx; intestinal bifurcation about midway between ventral sucker and pharynx; ceca narrow, some distance from sides of body, extending to within a short distance of posterior end. Genital pore slightly to the left at level of anterior border of ventral sucker or slightly posterior to this level. Testes smooth, almost spherical, tandem, close together, median, intercecal, posterior to midbody. Posttesticular distance from 1/5 to 1/8 body length. Cirrus sac elongate, pyriform, only slightly curved, extending about halfway (slightly more or less) between ventral sucker and ovary. Sac-like seminal vesicle occupying basal fourth of cirrus sac; wide pars prostatica, occupying approximately the middle third of cirrus sac; distal region of cirrus sac occupied by slightly coiled ejaculatory duct which expands distally to form an oval, thick-walled structure (the cirrus) near the genital pore. Genital atrium very short. External seminal vesicle a large tube, bent once or twice, nearly as long as cirrus sac, surrounded by gland cells enclosed by a thin membrane. Ovary smooth, oval, median, intercecal, shortly in front of anterior testis. Yolk reservoir overlapping the dorsal posterior edge of ovary. Vitelline follicles chiefly lateral, from region of ventral sucker to posterior end of body, overlapping ceca both dorsally and ventrally, not extending between gonads, but confluent posterior to testes. Seminal receptacle small, inconspicuous, near yolk reservoir. Uterus preovarian. Metraterm short, thick-set, surrounded by gland cells. Eggs thin-shelled, 60 to 64 by 38 to 44 μ. Excretory vesicle a long tube extending forward a short distance in front of ventral sucker.

There is some variation in this species in the anterior extent of the vitellaria. In one of the smaller specimens (fig. 51) they extend to the level of the middle of the ventral sucker, whereas in both of the others the vitellaria fail to reach the ventral sucker by a short distance. The

Measurements

Length	Width	Forebody	Oral sucker	Ventral sucker	Pharynx	Esophagus	Eggs
mm.	mm.	mm.	mm.	mm.	μ	μ	μ
1.71	0.630	0.457	0.160	0.122	100 by 60	110	60-64 by 40-44
1.89	.462	.437	.162	.134	84 56	120	60 38
2.35	.688	.392	.176	.162	98 54	90	60 40

glandular mass around the external seminal vesicle, characteristic for the genus *Lepidapedon*, seems to be lacking in the large specimen. The possibility of this specimen representing another species is not great because of its general similarity to the other two specimens. The reduction of the gland cells may be an abnormality or it may be that these cells tend to disappear in older individuals.

Comparisons

This species of *Lepidapedon* differs from *L. rachion* and *L. elongatum* in its very short prepharynx. In this respect it resembles the genus *Lepocreadium* and also *Lepidapedon garrardi* (Leiper and Atkinson). It differs from *L. rachion* but resembles *L. elongatum* in position of genital pore close to the ventral sucker and distribution of the vitellaria on both sides of the ceca. The body tends to be broader anteriorly than in either of these species. The testes are not separated by vitellaria as in *L. elongatum*. The conspicuous presence of gland cells surrounding the external seminal vesicle places the species in the genus *Lepidapedon*, but the great reduction of these glands in the larger specimen together with the short prepharynx indicates close relationship to *Lepocreadium*.

Immature Forms

Immature or juvenile forms (fig. 53) which seem to belong to *L. nicolli* occur very widely and very commonly in the intestine of many different kinds of fish at 40 to 60 fathoms depth. This metacercaria occurred in ten different host species. It was found in seven of eight species in one day's collection made at 55 fathoms. It also occurs at 40 fathoms, but has not been secured from a depth greater than 60 fathoms. It is most common in *Prionodes* spp. (two species). It also occurs in *Upeneus parvus, Bellator militaris, Lophius* sp., *Centropristis ocyurus, Engyophrys sentus* and *Halieutichthys aculeatus*.

This metacercaria or juvenile distome (fig. 53) agrees in all its recognizable characters with the above species. The body is spined, with pigment spots just behind the pharynx; the oral sucker is slightly larger than the ventral sucker; the prepharynx is very short, the pharynx elongate, the esophagus long, the ceca narrow. The excretory bladder extends forward anteriorly to the same level as in *L. nicolli*. Although the metacercariæ are free in the intestine, its hosts probably serve as at least facultative intermediate hosts.

Lepidapedon lebouri n.sp.

(Fig. 54)

Host—Macrouridæ.
Position—Intestine.
Frequency—One specimen in 1 of 5 hosts examined.
Depth—205-285 fathoms.

Specific Diagnosis

Length 4.35 mm.; width 0.684 mm. Body spined, tapering anteriorly, broadly rounded posteriorly. Oral sucker terminal, 0.154 mm. in diameter. Ventral sucker 1/3 body length from anterior end, much smaller, 0.101 mm. in diameter. Forebody 1.452 mm. Prepharynx long, 0.395 mm., pharynx 0.141 mm. in length; esophagus 0.176 mm. Ceca rather distant from body sides, extending to posterior end. Intestinal bifurcation 2/3 from anterior end to ventral sucker. Genital pore slightly to the left, somewhat anterior to ventral sucker, postbifurcal. Cirrus sac ending dorsal to the ventral sucker, internal seminal vesicle reduced or absent; glandular, external seminal vesicle well developed, enclosed by membrane. Testes rounded, tandem, not far apart, separated by vitelline follicles, postequatorial. Post-testicular space 1.134 mm. (more than 1/4 body length). Ovary round, pretesticular, just behind midbody. Uterus preovarian, intercecal. Eggs 70 to 72 by 37 to 39 μ. Vitelline follicles filling sides of body from anterior border of ventral sucker to posterior end, ventral but not dorsal to ceca, extra- and intercecal, confluent behind the testes, almost meeting between testes. Excretory vesicle extending to posterior testis.

Comparisons

This species is very similar to *L. elongatum*, especially in body form and digestive system. It differs in being much larger, with relatively longer post-testicular space, in that the vitellaria extend to the ventral sucker and in that the ventral sucker is considerably smaller than the oral sucker. The genital pore is somewhat more distant from the ventral sucker than in my specimens of *L. elongatum* and somewhat nearer the intestinal bifurcation than in Miss Lebour's figure (Lebour, 1908).

Myzoxenus vitellosus n.gen., n.sp.

(Figs. 62-63)

Hosts	Frequency in host	Depth
Calamus calamus (Cuv. & Val.)	2 of 14	....
Decodon puellaris (Poey)	2 2	50-60 fath.

Position—Intestine.

Specific Diagnosis

Posterior half of body much flattened, anterior half somewhat thicker, spined in region of oral sucker, slightly tapering anteriorly, anterior end rounded, greatest width about in middle of body, posterior end variable, truncated or somewhat pointed, length 2.18 to 2.43 mm., width 0.772 to 1.05 mm. Oral sucker subterminal, tending to be slightly longer than wide;

ventral sucker immediately anterior to midbody, about 1 1/2 times diameter of oral sucker, with characteristic, narrow, longitudinal aperture, widened slightly in its middle; provided with conspicuous, curved semicircular bands of muscles on each side of aperture, 4 or 5 on each side, separated at anterior and posterior poles. Short prepharynx, medium-sized pharynx; narrow esophagus about same length as pharynx; intestinal bifurcation midway between suckers; ceca bowing outward, then extending posteriorly to near the end of body. Genital pore somewhat to the left, median to left cecum, about halfway between intestinal bifurcation and ventral sucker. Testes median, tandem, intercecal, posterior to midbody, near together but not in contact, extended transversely, slightly lobed; posttesticular space a little less than forebody length. Cirrus sac slender, with chiefly circular muscles, extending medianly and posteriorly, cylindrical except for narrowed,

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Post-testicular space	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.43	0.966	0.285	0.420	0.730	0.646	50-54 by 25-27
2.18	.772	.243	.395	.638	.588	52 30
2.36	1.05	.285	.428	.736	.621	50 26

posterior, non-muscular region (fig. 63); prostate gland weakly developed; internal seminal vesicle tubular, sinuous but not coiled; external seminal vesicle tubular, curving posteriorly close to left border of ventral sucker and extending slightly posterior to the sucker. Ovary ovoid, median or submedian, extended transversely, immediately anterior to anterior testis. Seminal receptacle present. Laurer's canal present. Uterus entirely pretesticular. Vitelline follicles filling sides of body from region of oral sucker to posterior end, usually confluent in region of intestinal bifurcation and filling posttesticular area, overlapping the ceca ventrally but only slightly dorsally. Excretory vesicle a simple tube from posterior end to region of testes.

Generic Diagnosis

Lepocreadiinæ with flattened hindbody, more thickened forebody; spines limited to cephalic region; ventral sucker larger than oral sucker, with longitudinal aperture bounded laterally by definite, semicircular bands of muscles; prepharynx present; pharynx of moderate size; esophagus present; testes tandem, close together; internal seminal vesicle tubular, external seminal vesicle extending posterior to ventral sucker; cirrus sac anterior to ventral sucker; eggs of moderate size, thin-shelled.

Type species—Myzoxenus vitellosus.

Comparisons

This genus is distinguished from other genera in the subfamily by its peculiar ventral sucker. Except for this character it resembles *Lepocreadium* very much, differing in larger ventral sucker, more limited body spines and cirrus sac entirely anterior to ventral sucker. It differs from *Lepidauchen* in smaller oral sucker and pharynx, larger ventral sucker,

presence of esophagus and lobed testes. It differs widely from *Lepidapedon* in many characters such as sucker ratio, length of prepharynx and absence of gland cells around the external seminal vesicle.

Travassos (1924) describes *Dolichosaccus amplicava* as a member of the Plagiorchidæ. His figure shows a modification of the ventral sucker very suggestive of that found in the present species. Since Travassos did not observe the excretory system, his species may deserve further comparison with the Allocreadiidæ. It is, however, probably not an allocreadid, since the host is an amphibian. It does not seem to have an external seminal vesicle and the uterus extends somewhat posterior to the ovary.

Another species of *Myzoxenus*, or a very closely related genus, has been collected from *Lachnolaimus maximus* at Tortugas and will be described in a later paper.

The name *Myzoxenus* is from *myzo*, sucker, and *xenus*, strange, and refers to the curious ventral sucker.

Subfamily Opecœlinæ

Opecœlina scorpænæ n.sp.

(Figs. 55-58)

Host—*Scorpæna cristulata* Goode & Bean.
Position—Ceca and intestine.
Frequency—Present in both of 2 hosts examined.
Depth—250 fathoms.

Specific Diagnosis

Body smooth, elongate, more or less flattened, 1.67 to 2.2 mm. in length; width about ¼ length, tapering slightly anterior to ventral sucker, approximately equally wide posterior to ventral sucker, posterior end broadly rounded. Oral sucker subterminal; ventral sucker about 1/4 from anterior end, wider than long, with transverse aperture, almost exactly twice the diameter of oral sucker, seemingly not protuberant but more or less embedded in the body and surmounted anteriorly by a broad fold of the body wall, perhaps capable of being protruded; no evidence of marginal papillæ or processes on ventral sucker or its fold. Prepharynx lacking or very short; muscular esophagus almost as wide as pharynx and twice as long; intestinal bifurcation at anterior edge of ventral sucker; ceca extending to near the posterior end where they unite forming a short rectum and open to the outside through an anus. Anus dorsal and posterior to the excretory pore. Both pores open into a depression of the body wall. Genital pore to the left, about halfway between the midline and the body edge, at mid-esophagus level. Testes median, tandem, usually somewhat lobed but sometimes almost smooth, close together or not far apart, immediately posterior to midbody, not separated by vitellaria.[1] Cirrus sac long, straight, slender, not very strongly developed, leading diagonally backward from genital pore to posterior edge of ventral sucker, gradually increasing to a greatest diameter near its base, containing a tubular, internal, seminal vesicle, only slightly coiled, and an evident, but poorly developed, prostate gland. Cirrus often inserted into the metraterm of the same individual. External seminal vesicle conspicuous, sac-shaped or slightly curved, ex-

[1] Three abnormal specimens were collected from one host. In one, the anterior testis was absent (fig. 55); in another the posterior testis was absent (fig. 56) and in a third the vitellaria in midbody region were greatly hypertrophied.

tending almost directly backward almost halfway to the ovary, dorsal to the uterus, connected with cirrus sac by a tubular, narrow region. Ovary large, usually 3-lobed, although the lobes are indistinct in some cases, extended transversely, immediately in front of anterior testis. Seminal receptacle and yolk reservoir dorsal to ovary. Laurer's canal opening dorsally to the left of median line. Vitelline follicles large, extending in the sides of body from posterior edge of ventral sucker to posterior end of body, dorsal and ventral to ceca, confluent behind testes but not impinging between the gonads, usually continuous but may be slightly interrupted opposite the testes. Uterus coiling between ovary and ventral sucker. Eggs 70 to 78 by 39 to 47 μ, with thin shells which become yellow in color. Excretory pore

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Post-testicular area	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
1.99	0.498	0.158	0.320	0.348	...	70 by 40
2.2	.412	.137	.285	.428	0.546	76 39
1.93	.504	.153	.295	.520	.404	72 39
1.67	.445	.127	.260	.352	.412	76 43
1.74	.420	.133	.268	.361	.386	72 43
1.74	.588	.127	.294	.428	.310	78 47

dorsal, subterminal, immediately anterior to anus; excretory vesicle extending to ovary.

Generic Diagnosis

Opecœlinæ with elongate, more or less flattened bodies. Ventral sucker preequatorial. Prepharynx short or absent; long esophagus; intestinal bifurcation at anterior border of ventral sucker; ceca uniting near posterior end; single, median, dorsal, subterminal anus. Genital pore to the left, anterior to intestinal bifurcation. Cirrus sac elongate, straight, slender, delicate, claviform, containing tubular, internal seminal vesicle and prostate gland. External seminal vesicle present, separated from cirrus sac by a narrow tube. Testes tandem, posterior to midbody. Ovary lobed or smooth, immediately anterior to testes. Seminal receptacle present. Laurer's canal present. Vitellaria from ventral sucker to posterior end. Eggs about 70 μ in length, thin-shelled. Excretory pore anterior to anus, dorsal. Excretory vesicle extending to ovary. Intestinal parasites of marine fish.

Type species—Opecœlina scorpænae.

Comparisons

This genus is most closely related to those included by Ozaki (1928b) in the Opecœlidæ, agreeing in general arrangement of reproductive organs, united ceca and single anus. It differs in possessing a seminal receptacle, in that the anus is dorsal and posterior to the excretory pore rather than ventral and anterior, and in that the cirrus sac is much better developed, inclosing a much larger portion of the seminal vesicle. In addition, it differs from *Opecœleus* in lacking marginal papillæ of the ventral sucker. The vitellaria do not extend so far forward as in *Opegaster*.

Opecœlina helicoleni n.sp.

(Figs. 59-60)

Host—*Helicolenus dactylopterus* (de la Roche).
Position—Intestine.
Frequency—Present in 1 of 21 hosts examined.
Depth—197 fathoms.

Specific Diagnosis

Body elongate, narrow, 2.58 to 3.59 mm. in length; 0.504 to 0.592 mm. in width; slight, lateral indentations just posterior to ventral sucker and opposite testes. Oral sucker terminal, round; mouth ventral, subterminal; ventral sucker about 1/5 from anterior end, a little over twice the diameter of oral sucker, wider than long, embedded in the body, with a muscular, liplike fold of the body wall at anterior border. Short prepharynx; esophagus a little over twice the length of pharynx; narrow ceca uniting near the posterior end. A narrow, median, subterminal, dorsal depression indicates that the relation of the anus and excretory pore are as in *O. scorpænæ*. Genital pore to the left, slightly in advance of intestinal bifurcation, opposite posterior part of esophagus, nearer the ventral than the oral sucker. Testes rounded, smooth, tandem, median, separated by a short distance, the anterior testis about in midbody; posttesticular portion of body over three times the length of posterior testis, much longer than forebody. Cirrus sac extending to posterior border of ventral sucker. External seminal vesicle may extend 1/3 the distance to ovary (fig. 59), or may lie almost horizontally near the ventral sucker (fig. 60); internal seminal vesicle tubular, slightly coiled, prostate gland fairly well developed, cirrus long and slender. Ovary distinctly 4-lobed, the anterior lobe being the portion of more mature ova. Yolk reservoir and sac-shaped seminal receptacle at dorsal, anterior border of ovary. Laurer's canal present, opening dorsally to the left of median line. Uterus between ovary and ventral sucker. Vitelline follicles large, rounded, in the sides of body from posterior edge of ventral sucker to extreme posterior tip of body, dorsal and ventral to ceca, interrupted opposite testes, almost meeting medianly between testes, more or less filling hindbody posterior to testes. Eggs thin-shelled, light yellow, 72 to 74 by 41 to 42 μ. Excretory vesicle extends to ovary.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Post-testicular area	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.584	0.592	0.151	0.361	0.310	0.950	72 by 41
3.59	.504	.147	.344	.550	1.292	74 41-42

Comparisons

It seemed almost possible at first to include this form as elongate specimens of *Opecœlina scorpænæ* with which it agrees in many details. The following differences, however, taken together serve to separate the species from *O. scorpænæ*. The body is more elongate and narrow; the ventral sucker is more anterior; the genital pore is more posterior; the posttesticular portion is much longer; the testes show no indication of lobing

and are somewhat separated by vitellaria; the external seminal vesicle does not extend so far posteriorly; and the prostate gland is better developed.

The description of *O. helicoleni* is based on a study of two specimens.

Both of the above species of *Opecœlina* are named for their hosts. They serve as two more examples of deep-water trematodes whose nearest relatives, so far as are described, occur in distant waters.

Family HEMIURIDÆ

Subfamily Hemiurinæ

Hemiurus sp.

(Fig. 67)

Host—Peristedion imberbe Poey.
Position—Stomach.
Frequency—One specimen in 1 of 16 hosts examined.
Depth—100 fathoms.

Description

Length of body 1.1 mm., width 0.3 mm.; length of tail about 0.4 mm. Oral sucker 0.075 mm.; ventral sucker 0.203 mm. Forebody 0.026 mm. Body rings extend, at least along the sides of the body, to the posterior level of the vitellaria. Their dorsal extent could not be determined. Esophagus short; ceca not entering tail appendage. Genital pore opposite base of oral sucker; sinus sac long and slender, its length over half the diameter of ventral sucker; pars prostatica moderately developed, dorsal to ventral sucker, not extending appreciably posterior to ventral sucker; seminal vesicle elongate pyriform, between testes and ventral sucker, not evidently divided into two parts, thin-walled. Testes oblique, about in midbody. Ovary rounded, obliquely behind posterior testis; vitellaria large, elongated, with short broad lobes. Uterus not entering tail. Eggs 18 by 9 to 10 μ.

Discussion

This species differs from *H. levinseni* in sucker ratio. It is like *H. communis* in its long sinus sac, size of ventral sucker in relation to body size and moderate length of pars prostatica, but differs in that the ventral sucker is somewhat larger in proportion to the oral sucker, more lobed vitellaria, shorter forebody, slightly smaller eggs. Since the specimen does not offer a lateral view it is not possible to determine the dorsal extent of the body rings. The sinus sac is shorter than in *H. rugosus*, the prostate gland much shorter. It differs from *H. appendiculatus* in shorter prostate gland, smaller oral sucker and more lobed vitellaria. *H. merus*, described by Linton (1910) from Tortugas, seems to be distinct from the present form in posterior extent of prostate gland and less elongate more muscular seminal vesicle. These differences may be due to contraction, but Linton's figure seems to represent a well-extended specimen.

The character of the seminal vesicle is of especial interest in that it seems to be undivided. This is also the case of *H. merus*. Vaz and Pereira (1930), however, distinguish their genus *Parahemiurus* from *Hemiurus* on the basis of an undivided seminal vesicle. A study of more material may lead to the inclusion of *H. merus* and the present form in the genus *Parahemiurus*, or it may show that the seminal vesicle is actually inconspicuously divided into two regions. The description of *Parahemiurus parahemiurus* Vaz & Pereira is very suggestive of *Hemiurus merus*. There is some doubt as to whether the genus *Parahemiurus* should be considered as distinct from *Hemiurus*.

Subfamily Sterrhurinæ

Sterrhurus floridensis n.sp.

(Figs. 68-71)

Synonym: *Sterrhurus læve* (Linton) of Manter, 1931b.

This trematode was collected from a large number of both shallow- and deep-water fish at Tortugas as shown in the following below.

Hosts	Frequency in host	Depth
Ancylopsetta dilecta (Goode & Bean)	3 of 8	55-100 fath.
Antennarius radiosus Garman	2 2	....
Antennarius scaber (Cuv.)	2 2	....
Bathystoma rimator (Jordan & Swain)	1 14	....
Bembrops gobioides (Goode)	1 20	100
Brotula barbata (Bloch & Schneider)	1 1	79-140
Calamus bajanado (Bloch & Schneider)	1 9	....
Caranx latus Agassiz	2 6	....
Centropristis ocyurus (Jordan & Evermann)	4 5	40-60
Chaunax nuttingi Garman	2 9	200-300
Coryphæna hippurus Linn.	1 6	....
Cyclopsetta fimbriata (Goode & Bean)	8 8	50
Diplectrum bivittatum (Cuv. & Val.)	1 3	....
Diplectrum formosum (Linn.)	10 21	....
Echeneis naucrates Linn.	3 3	....
Epinephelus striatus (Bloch)	1 6	....
Eques lanceolatus (Linn.)	1 7	....
Euthynnus alleteratus (Raf.)	3 3	....
Hæmulon album Cuv. & Val.	1 2	....
Hæmulon flavolineatum (Desmarest)	1 11	....
Hæmulon plumieri (Lacépède)	1 24	....
Hæmulon sciurus (Shaw)	2 33	....
Halieutichthys aculeatus (Mitchill)	12 22	40-60
Holocentrus ascensionis (Osbeck)	2 2	....
Ioglossus calliurus Bean	1 1	....
Lonchopisthus micrognathus (Poey)	1 1	....
Lophius piscatorius Linn.	1 1	55
Lutianus apodus (Walbaum)	1 19	....
Lutianus griseus (Linn.)	3 28	....
Lutianus synagris (Linn.)	1 8	....
Lutianus vivanus (Cuv. & Val.)	1 1	40
Ocyurus chrysurus (Bloch)	8 48	....
Ogcocephalus cubifrons (Richardson)	2 5	....
Paralichthys sp.	1 1	40
Peristedion imberbe Poey	1 17	100
Polymixia lowei Günther	1 1	140-197
Pontinus longispinus Goode & Bean	1 18	90
Priacanthus arenatus Cuv. & Val.	2 3	....
Priacanthus cruentatus (Lacépède)	2 3	....
Prionodes sp.	2 15	50
Prionotus stearnsi Jordan & Swain	1 3	50
Prionotus sp.	2 11	....
Scorpæna agassizii Goode & Bean	1 6	60
Scorpæna brasiliensis Cuv. & Val.	1 4	....
Scorpæna plumieri Bloch	1 3	....
Syacium micrurum Ranzani	9 14	....
Syacium papillosum (Linn.)	10 20	....
Synodus fœtens (Linn.)	7 7	....
Synodus poeyi Jordan	1 1	....
Trachurops crumenophthalma (Bloch)	2 5	....
Trichopsetta ventralis (Goode & Bean)	1 16	79-140
Trisotropis microlepis Goode & Bean	1 1	....
Tylosurus raphidoma (Ranzani)	1 10	....
Upeneus maculatus (Bloch)	2 20	....
Urophycis cirratus (Goode & Bean)	5 8	60-125

Position—Stomach.

Specific Diagnosis

Body little flattened, length 0.8 to 2.28 mm.; width 0.126 to 0.630 mm. Length of tail appendage highly variable according to contraction, usually 1/3 to 1/5 body length but sometimes more than half the body length. Forebody also variable, typically about 1/4 body length. Forebody usually hollowed out, lacking groove. Ventral sucker between 2 and 3 times (usually about twice or slightly more than twice) the diameter of oral sucker. Pharynx immediately following oral sucker; very short esophagus; ceca extending to end of body, sometimes but not usually entering tail appendage. Genital pore median or sub-median, ventral to pharynx, varying from near the anterior to near the posterior portion of pharynx. Sinus sac (fig. 70) clavate, ending posteriorly a short distance behind intestinal bifurcation, containing in its base a spherical prostate vesicle. The metraterm enters

Measurements

Body length	Tail length	Width	Oral sucker	Ventral sucker	Fore-body	Sinus sac	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	mm.	μ
1.615	0.210	0.478	0.100	0.210	0.320	0.137	12-13 by 9-10
1.52	.655	.546	.126	.252	.462	....	16 10
1.387	.430	.462	.129	.268	.336	....	13-14 9-10
1.38	.546	.512	.124	.252	.395	.107	13-14 9-10
1.102	.092	.378	.112	.214	.327	.095	15 9-10
1.140	1.235	.361	.075	.168	.369	....	13-14 9-10
1.058	0.126	.210	.096	.160	.319	.120	13-14 9-10
2.242	.840	.529	.109	.226	.420	.139	15-16 10
1.285	.235	.386	.109	.218	.378	.110	13-14 9
1.09	.201	.369	.100	.216	.176	....	15-16 9-10
0.882	.201	.252	.084	.168	.252	....	12 9
1.805	.646	.588	.117	.255	.420	.123	13-14 9-10
1.42	.646	.336	.109	.226	.404	.121	12 9
1.310	.218	.453	.109	.210	.352	.092	16 9-10
0.966	.252	.336	.092	.210	.252	.068	16 9-10
1.577	.974	.630	.109	.226	.336	.098	15-16 9-10
1.634	1.004	.638	.145	.297	.504	.141	14-15 9-10

the sinus sac and joins the male tube immediately in front of this prostate vesicle, forming a sinuous ductus hermaphroditicus occupying the anterior 2/3 or 3/4 of the sinus sac. Prostate gland short, immediately posterior to sinus sac; seminal vesicle a sac-like tube, divided into two parts, the posterior of which is much larger and overlaps the ventral sucker slightly. Testes subglobular, smooth, diagonal, chiefly intercecal, immediately behind ventral sucker. Ovary globular, often extended transversely, smooth, near or slightly behind midbody, slightly to the right. Lobes of vitellaria (fig. 71) short and thick, not much longer than wide and sometimes inconspicuous. Uterus with coils to near the end of body, sometimes entering tail appendage, then forward, straightening between testes. Eggs 12 to 16 by 9 to 10 μ. Branches of excretory system unite dorsal to pharynx.

Comparisons

This species is very similar to *Sterrhurus musculus* Looss, 1907, agreeing in size of body, sucker ratio, shape of vitellaria, position and division of the seminal vesicle. It differs only in egg size. Looss gives an egg measurement for *S. musculus* of 19 to 21 by 11 to 13 μ. Although my measurements have

been taken from balsam mounts, large eggs have been selected. The maximum length was 16 μ (in one instance 17 μ) and the greatest width about 10 μ. It will be seen in the table of measurements above that most of the eggs are 13 to 15 μ in length. Thus they seem to be considerably below the minimum measurements of Looss. The widely different locality and hosts favor the existence of two species, especially in view of the fact that *S. floridensis* does not seem to extend its range to northern United States waters. On the other hand, the occurrence of the species in deeper-water fish indicates a possible means of wide dispersal. It should be understood that the species is named as distinct from *S. musculus* only on the basis of smaller egg size. Wider egg variation in either *S. floridensis* or *S. musculus* might easily prove them identical. The Florida species although similar to other species of *Sterrhurus* in that region can be recognized by the sucker ratio, the character of the seminal vesicle, the short, stubby lobes of the vitellaria and the egg size. Of these characters the shape of the vitellaria is the most useful.

Sterrhurus floridensis is most remarkable in its wide occurrence at Tortugas. No other trematode there has been found in nearly as many different hosts. It seems to have the capacity to infect at least in small numbers almost any kind of teleost fish. It is, however, much more at home in certain hosts, especially *Cyclopsetta fimbriata* where it occurs in very large numbers (sometimes 100 or more). Numerous specimens sometimes occur in *Synodus fœtens* but in most of the hosts named above only one or a few individuals occurred. The parasite is not limited to shallow water fish, nor to shore fish, but occurs in open sea hosts and in fish from all depths down to about 200 fathoms at least.

Considering this unusual range, it is somewhat surprising that the species does not seem to have been reported from Beaufort, North Carolina, nor from Woods Hole, Massachusetts. Linton's *Distomum monticellii* (Linton 1907, 104-105) from *Synodus saurus* and *Mycteroperca apua* at Bermuda is almost certainly *Sterrhurus floridensis*, judging from sucker ratio, vitellaria and other measurements. Linton does give an egg measurement of 18 by 12 μ which brings the egg size closer to Looss's figures for *S. musculus*. Linton's original description of *Dist. monticellii* (1898, 518) differs in larger size and larger ventral sucker and longer lobes of vitellaria.

Sterrhurus floridensis often occurs simultaneously with other species of *Sterrhurus*. *Synodus fœtens* has been found to contain *Sterrhurus floridensis, S. monticellii* and *Lecithochirium* sp. simultaneously.

Sterrhurus lævis (Linton) n.comb.

(Figs. 72-73)

Synonyms: *Distomum lœve* Linton, 1898.
Hemiurus lœve (Linton) Looss, 1898.
nec Sterrhurus lœve (Linton) of Manter, 1931.

Hosts	Frequency in host	Depth
Helicolenus dactylopterus (de la Roche)	1 of 21	197 fath.
Peristedion longispathum (Goode & Bean)	1 32	200
Peristedion miniatum Goode	2 11	138-140
Peristedion platycephalum (Goode & Bean)	4 14	168

Specific Diagnosis

Length of body 1.55 to 2.09 mm.; length of tail 0.336 to 0.97 mm., greatest body width 0.56 mm. near the posterior end; body tapering gradually to anterior end. Ventral sucker about 1/3 body length from anterior end, not filling entire body diameter; about twice the diameter of oral sucker. Preoral lobe single, simple, muscular. Cross-fold of forebody usually present. Short esophagus; ceca may or may not enter tail appendage. Genital pore median, opposite posterior half of pharynx. Genital atrium short, broad; cirrus or sinus sac (which surrounds the short atrium and the prostatic vesicle) short and very broad (fig. 73), thick-walled, mostly filled by the tall cells of the prostate vesicle; prostate gland short and broad, more or less butterfly-shaped, free, between seminal vesicle and cirrus sac; seminal vesicle conspicuously divided into two parts separated by a narrow duct, one part usually lying partly anterior to ventral sucker,

Measurements

Body length	Tail length	Body width	Oral sucker	Ventral sucker	Fore-body	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.000	0.800	0.550	0.145	0.302	0.504	23 by 10
1.900	.779	.613	.159	.302	.378	23 9
2.090	.684	.655	.148	.319	.404	25 9
1.710	.741	.546	.134	.260	.462	25 10
1.630	.336	.520	.122	.268	.369	25 9
1.550	.588	.478	.126	.235	.336	21 10

the other usually partly posterior to ventral sucker. Testes large, oblique, intercecal, immediately postacetabular, the right usually anterior. Ovary entire or smooth, median, postequatorial, extended transversely. Vitellaria almost smooth, only slightly indented to suggest lobes, immediately behind ovary; no seminal receptacle; sperm cells in uterus; uterus may or may not enter tail appendage; eggs 21 to 25 by 9 to 10 μ.

Comparisons and Discussion

This species is distinct from most others in the genus in the slight lobing of the vitellaria and the sharply separated parts of the seminal vesicle. The cirrus sac is unusually short and broad and the genital atrium very short.

Linton (1898, 517-518) described *Distomum lævе* from *Macrourus bairdi* at Woods Hole. His descrpition is slightly confused in regard to the seminal vesicle. What is called "the posterior seminal vesicle" must be the uterine seminal receptacle. The portion of his figure 1, plate XLIV, labeled "*vd*" is evidently the anterior portion of the seminal vesicle. In only slight details does Linton's description differ from above. Thus, he gives 26 by 12 μ as egg measurements, whereas my measurements (from balsam mounts) are approximately 25 by 10 μ. This is an insignificant difference. Linton describes the ventral sucker as about 2½ times the oral sucker in diameter, whereas in my material this size was only slightly over twice the oral sucker.

This trematode has been collected seven times from Tortugas, but never from a depth less than 138 fathoms. Linton does not give the depth from which his host was taken, but *Macrourus bairdi* is a deep-sea species, only occasionally ranging into shallow water.

Sterrhurus præclarus n.sp.

(Fig. 74)

Host—*Merluccius* sp.
Position—Stomach.
Frequency—1 specimen from 23 hosts examined.
Depth—390 fathoms.

Specific Diagnosis

Body robust and plump, not much flattened, smooth, length 3.5 mm., width 1.116 mm., almost equally wide behind ventral sucker, tail appendage little developed. Oral sucker round or slightly extended transversely, diameter 0.34 mm.; ventral sucker round with circular aperture, 1/3 body length from anterior end, diameter 0.664 mm. Prepharynx lacking, pharynx medium-sized, short esophagus, ceca sinuous, extending to posterior end of body, not entering tail appendage. Genital pore median, at level of intestinal bifurcation. Testes rounded, smooth, symmetrical, separated by uterus, immediately posterior to ventral sucker. Seminal vesicle an elongate sac with base opposite anterior border of ventral sucker, narrowing anteriorly, indistinctly divided into two portions, the anterior, narrow portion composing about 1/3 the total length. Pars prostatica free, well developed, intercecal, approximately same length as seminal vesicle. Sinus sac much reduced, directed chiefly dorsally from the genital pore. Metraterm joins the ductus hermaphroditicus at anterior end of pars prostatica near genital pore. Ovary rounded, unlobed, directly posterior to right testis. Uterus extending backward in short transverse coils to a level ¼ body length from posterior end, then coiling anteriorly in short transverse coils near left side of body; metraterm from near genital pore to base of seminal vesicle. Vitellaria with seven distinct, long, club-shaped lobes. Each lobe narrows abruptly to form a narrow, stem-like basal portion. The narrow basal stems, which may curve more or less, unite at the posterior edge of the ovary. Length of thickened portion of the lobe is from 0.332 to 0.373 mm., the narrowed stem from 0.090 to 0.180 mm. Eggs yellowish, with moderately thick shell 30 by 19 to 20 μ. Median stem of excretory vesicle forks immediately posterior to ventral sucker, the two lateral branches uniting dorsal to pharynx.

Comparisons

This species is clearly and easily separated from all others in the genus by the very short genital sinus or ductus hermaphroditicus, which does not extend appreciably posterior to the genital pore. The symmetrical rather than oblique position of the testes also seems to be a peculiarity. The tail appendage is more poorly developed than in other described species of *Sterrhurus*. The distinctly separate and elongate lobes of the vitellaria differentiate the species from all others except *S. fusiformis*, but even this latter species does not show the stem-like bases of the lobes.

The name *præclarus* is intended to suggest the beautiful appearance of the type specimen which reveals all organs with unusual clearness.

Sterrhurus robustus n.sp.

(Figs. 75-78)

Hosts	Frequency in host	Depth
Chaunax nuttingi Garman	4 of 9	200 fath.
Chlorophthalmus truculentus Goode & Bean	1 4	200
Merluccius sp.	3 23	190-280
Paralichthys oblongus (Mitchill)	3 7	150-250
Urophycis chesteri (Goode & Bean)	1 6	300
Urophycis regius (Walbaum)	3 8	139-220

Specific Diagnosis

Body thick, robust, cylindrical, tapering only slightly at the ends, smooth, with retractile tail appendage which, when extended, may reach 1/2 the length of body proper. Body 1.8 to 3.7 mm. by 0.63 to 1.42 mm. Oral sucker subterminal, surmounted by a fleshy lobe; ventral sucker about 1/3 from anterior end, more than twice the diameter of oral sucker, ratio about 2:5. No prepharynx; ovoid pharynx; short esophagus; broad ceca which may but do not usually enter tail appendage. Intestinal bifurcation slightly nearer the oral than the ventral sucker. Genital pore median or very slightly to the left at posterior edge of oral sucker or opposite pharynx. Genital sinus fairly long, tubular; uterus joins this sinus terminally, the prostatic duct joins the sinus from one side; prostate gland free, well-developed, surrounding prostate vesicle, broad, extending from intestinal bifurcation to anterior edge of ventral sucker and filling most of the intercecal, preacetabular area. Seminal vesicle large, bipartite, the anterior portion overlapping the right edge of ventral sucker often to midsucker level, separated by a constriction from the posterior part which runs transversely along the posterior part of the ventral sucker. Seminal vesicle separated from pars prostatica by a narrow duct. Testes oblique (left testis usually more anterior), immediately postacetabular. Ovary smooth, transversely extended, to the left, immediately behind midbody. Vitellaria close behind ovary, one with three, the other with four broad lobes. Seminal receptacle rudimentary, enclosed in Mehlis' gland, most sperm cells accumulating in the early coils of uterus. Uterus coils to near end of body then anteriorly, sometimes but not usually entering tail appendage. Eggs thin-shelled, elongate and bowed, 22 to 25 by 8 to 11 μ. Excretory vesicle forking between testes, branches uniting dorsal to oral sucker. Very large vesicle-like cells in parenchyma of tail appendage and in the posterior part of body.

Measurements

Body length	Body width	Tail length	Oral sucker	Ventral sucker	Fore-body	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
2.394	0.89	....	0.209	0.489	0.470	20 by 10
1.805	.672	1.235	.168	.420	.420	22 10
1.805	.672	0.798	.170	.420	.336	22 9
1.8	.630	.336	.176	.378	.436	22 9
2.24	.9	.804	.193	.454	.504	22 11
3.705	1.42	1.805	.243	.663	.672	22 9
2.812	1.102	1.52	.201	.537	.596	25 8

Comparisons

This species is unlike all others in the genus *Sterrhurus* in the character of the male genital ducts. The usual sac-like structure more or less enclosing the vesicle of the prostate and the genital sinus is lacking, the prostate gland lying free around the prostate vesicle, while the ejaculatory duct and genital atrium are simply tubular in form. Another characteristic feature is the far posterior position of the seminal vesicle and its division into two more or less equal parts extending in different directions, almost at right angles. A conspicuous division of the seminal vesicle into two parts is seen in *Sterrhurus lævis*, but here the prostate gland is distinct from the prostate vesicle as in other species in the genus. The large, elongate, vesicle-like cells in the tail and body (fig. 77) of *Sterrhurus robustus* are especially conspicuous. The preoral extension of the body does not bear conspicuous papillæ, but in a few specimens a median lobe and two small submedian dorsal lobes could be made out. *Sterrhurus lævis* is probably the most nearly related species, agreeing not only in the form of the seminal vesicle but also in the presence of large vesicle-like cells in the tail appendage and in the shape of vitellaria.

Sterrhurus profundus n.sp.

(Figs. 82-85)

Hosts	Frequency in host	Depth
Aleposomus sp.	1 of 2	300 fath.
Pronotogrammus sp.	2 14	135-156

Position—Stomach.

Specific Diagnosis

Body elongate, cylindrical, smooth, widest at level of ventral sucker, 2.24 to 3.43 mm. by 0.398 to 0.665 mm. Tail appendage telescope-like, not sharply differentiated from body, very long, the most anterior fold of the tail being usually anterior to both ovary and vitellaria and at least anterior to a portion of the vitellaria. Oral sucker at anterior end of body, preoral lobe absent or slightly developed, mouth directed more or less anteriorly, numerous papillæ dorsal and anterior to oral sucker. Ventral sucker far forward (forebody being 1/5 to 1/7 total length of body and tail), about three times the diameter of oral sucker, its aperture circular. No prepharynx; pharynx large; very short esophagus; narrow ceca extending to extreme posterior tip of tail. Genital pore median, far forward, immediately posterior to mouth, ventral to oral sucker. Genital atrium very short; ejaculatory duct long, narrow, straight or slightly sinuous, widening opposite the pharynx to form a thick-walled prostate vesicle. Seminal vesicle undivided, sac-shaped, thick-walled, intercecal, overlapping ventral sucker sometimes as far as midsucker, connected with the prostate vesicle by a narrow tube. Prostate gland lacking or very weakly developed (in one immature specimen). Testes oblique, postacetabular, smooth, longer than wide. Ovary median, large, smooth, immediately posterior to hind (left) testis. Vitellaria two, large, unlobed, elongate, immediately posterior to ovary, partly or wholly within the tail appendage. Early coils of the uterus filled with

sperm cells; seminal receptacle rudimentary; uterus coils to posterior end of tail, soon becoming much swollen, extending anteriorly as a swollen, almost straight tube; normal eggs thin-shelled, almost colorless, about 22 to 26 by 16 to 19 μ. Excretory vesicle forks at level of ventral sucker, branches seemingly do not unite, but end opposite oral sucker.

Measurements

Total length	Length of tail	Width	Oral sucker	Ventral sucker	Fore-body	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ
3.249	1.368	0.665	0.16	0.41	0.664	21-22 by 17-19
3.43	1.425	.665	.132	.398	.498	20-26 13-18
2.57	1.079	.614	.117	.224	.34	22 16
2.24	1.06	.398	.149	.287	.34	22 14-16

Comparisons

This species shows so many peculiarities that it possibly deserves a new genus. Looss (1907a, 600-602) named the genus *Sterrhurus* and included four species. Later (1907b, 136) he referred to the probability that American waters (as suggested by Linton's work) would yield numerous species of Sterrhurinæ. This prediction is well confirmed by a study of Tortugas trematodes, both of shallow-water and deep-water fish. Several species of *Sterrhurus* have been named above. There arises a question as to whether the genus should be limited to species with sinus sac and terminal genital ducts as in *Sterrhurus musculus* Looss (the type species) and *Sterrhurus floridensis* (figs. 69, 70) or whether it should include also such forms as *Sterrhurus robustus, Sterrhurus præclarus* and *Sterrhurus profundus*. During the early development of any genus, it is difficult to arrive at a logical generic limitation. As more species of *Sterrhurus* are named, the genus will undoubtedly be divided. At present, it seems best to allow the genus to grow, based on the fundamental characters of smooth body provided with a tail appendage rather than to erect several genera of single species.

The present form differs from all others in the genus in the extreme development of the tail, the undivided seminal vesicle, the far forward position of the genital pore, the lack of prostate gland, the straight ascending limb of the uterus and the apparently un-united branches of the excretory vesicle. Its unlobed vitellaria are unusual as is also the extreme posterior extent of the uterus and ceca.

Two specimens for some reason lacked skill in egg formation and there were many abnormal eggs. Probably less than half the eggs in the sparsely filled uterus were normal. The abnormal eggs (fig. 85) varied greatly in size and shape, but agreed in their very thick shells. The shell material was often irregularly arranged so that one end of the egg might be covered by only a thin membrane, the remainder possessing a very thick shell. Others were almost masses of shell with a very small cavity in the center. Others were elongated with narrow slit-like cavities. All of these abnormal eggs seemed to be empty. The normal eggs are thin-shelled, almost colorless, only a little longer than wide, about 22 to 26 by 16 to 19 μ.

Lecithochirium sp.

(Figs. 86-87)

Host—Urophycis regius (Walbaum).
Position—Stomach.
Frequency—2 specimens in 1 of 8 hosts examined.
Depth—200 to 220 fathoms.

DESCRIPTION

This trematode occurred together with *Sterrhurus floridensis* from which it may be distinguished by the presence of an inconspicuous cervical pit, more elongate lobes of the vitellaria, division of the seminal vesicle into three parts and very slightly larger ventral sucker. Body measurements on the two specimens are 1.58 by 0.386 mm. and 1.8 by 0.345 mm. The forebody is about 1/5 body length. The uterus was filled with eggs in the 1.58 mm. specimen, but contained only a few abnormal eggs in the 1.8 mm. specimen (fig. 86). The oral sucker is subterminal without internal elevations. The ventral sucker is somewhat more than twice the size of the oral sucker (0.109 by 0.248 mm., and 0.109 by 0.260 mm., respective diameters) and occupies most of the body diameter. The cervical pit is inconspicuous a short distance in front of the ventral sucker. The tail appendage is short and deeply retracted into the body. The intestinal bifurcation follows a very short esophagus near the oral sucker; the ceca do not enter the tail appendage. The genital pore is opposite the base of the oral sucker; sinus sac pyriform; prostate gland short; seminal vesicle indistinctly tripartite, overlapping the ventral sucker slightly. The testes and ovary are typical in form and position. In one specimen (fig. 86) one vitelline gland was 5-lobed, the other 4-lobed; but the other specimen showed the typical 4- and 3-lobed condition. The excretory system is typical. Egg measure 20 to 22 by 10 to 12 μ.

Because of the small amount of the material and because neither specimen is entirely favorable for study, specific identification of this form is not attempted. However, it is probably a new species, as the following comparison shows.

It differs clearly from *L. synodi* Manter in larger eggs, absence of conspicuous gland cells around the cervical pit, slightly more anterior genital pore and, in spite of the larger egg size, the body size is smaller than most specimens of *L. synodi*. The sucker ratio is very different from that of *L. rufoviride* (Rud.). It is most similar to *L. gravidum* Looss, but seems to differ in lacking the elevations within the oral sucker. The ventral sucker is relatively larger in comparison with the oral sucker, although it occupies less of the body diameter than it seems to in *L. gravidum*.

Dinosoma rubrum n.gen., n.sp.

(Figs. 79-81)

Hosts	Frequency in host	Depth
Synodontid	9 of 7	60 to 125 fath.
Urophycis regius (Walbaum)	1 8	200 220

Position—Stomach.

Specific Diagnosis

Color when alive, red. Length of body 2.5 to 5.12 mm., length of tail 0.76 to 2.66 mm., width of body 0.613 to 1.42 mm. Body covered with transverse rows of scales except extreme anterior tip, preoral lobe with single, median, somewhat ventral papilla and two sublateral, more dorsal papillæ. Forebody about 1/7 body length; ventral sucker a little less than twice the diameter of oral sucker. Esophagus very short; ceca may or may not enter tail appendage. Genital pore median, opposite pharynx. Genital sinus long, tubular, muscular. A small sac-like structure at base of sinus receives uterus terminally and male duct laterally (fig. 81). It is proposed to name this modification of the ductus hermaphroditicus the prostate receptacle. Prostate vesicle large, bipartite (fig. 81). Testes diagonal, ventral, a short distance posterior to ventral sucker. Ovary entire, about halfway between testes and posterior end of body (soma). Vitellaria directly behind ovary, the right 4-lobed, the left 3-lobed; lobes short and thick. Seminal receptacle rudimentary, sperm cells in uterus; uterus may or may not enter tail appendage. Eggs 23 to 27 by 13 to 14 μ.

Measurements

Body length	Tail length	Body width	Oral sucker	Ventral sucker	Fore-body	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	mm.	μ	μ
4.75	2.66	1.14	0.300	0.546	0.789	123 by 124	24 by 13
2.66	0.76	0.714	.208	.344	.495	98 98	25 14
2.565	1.102	.613	.170	.285	.487		
4.21	1.55	.950	.260	.445	.613	137 121	23 13
4.08	2.47	.874	.285	.495	.882		25 13
5.12	2.49	1.42	.327	.588	.756	147 147	25 13

Generic Diagnosis

Fairly large-sized, tailed hemiurids; body cylindrical, covered with transverse rows of scales, ventral scales of forebody often large and irregular in shape. Preoral lobe with pointed median, terminal, nipple-like projection and two dorsal submedian elevations. Suckers not far apart. Genital pore median, opposite pharynx or oral sucker; genital sinus tubular, rather long, muscular; prostate vesicle large, ovoid, surrounded by free prostate gland cells filling intercecal preacetabular area. Seminal vesicle partly dorsal to ventral sucker, conspicuously bipartite, posterior portion at angle to anterior. Testes diagonal, postacetabular. Ovary ovoid, smooth, median, in posterior half of body. Vitellaria with broad, short lobes.

Type species—Dinosoma rubrum.

Habitat—Stomach of marine fish.

The name Dinosoma is from *dino*, terrible, and *soma*, body, and refers to the striking, lizard-like armature of the body. The name *rubrum*, red, refers to the color of the living animal.

Comparisons

This genus is much like *Sterrhurus robustus* except for the body scales. The irregular shape of the scales of the ventral surface of the forebody suggests the irregular cuticular prolongations of *Dinurus barbatus*. But *Dinosoma* differs from *Dinurus* in shape of vitellaria, short prostate gland

and presence of scales. The elevations on the pre-oral lobe suggest the high development of these structures in *Ceratosoma* Jones, 1933, but this latter genus is smooth, possesses a ventral groove and has a different arrangement of terminal genital ducts. The structure of the terminal ducts of *Dinosoma* shows that *Sterrhurus robustus* is probably the nearest relative. Thus, the shape of the seminal vesicle, structure of the prostate vesicle and the prostate gland are identical in the two forms. In both forms, the uterus joins the male duct close to the prostate vesicle, and the muscular tube leading to the pore is a common duct, the genital sinus or ductus hermaphroditicus. This tube is somewhat more muscular in *Dinosoma*. The vitellaria have the same form in both species. The body armature of *Dinosoma*, however, is a conspicuous difference and the presence of a ringed cuticula has been a fundamental subfamily character among the Hemiuridæ. The smooth body and lobed vitellaria of *Sterrhurus robustus* place it in the subfamily Sterrhurinæ. *Dinosoma* can not be placed in a subfamily different from that of *St. robustus*, because of its almost identical internal organization. It seems to form a genus of the Sterrhurinæ detached from all others in the presence of scales. The body rings of *Dinurus* tend to split into scales and the armature of *Dinosoma* is suggestive of the Dinurinæ. It is not considered in that subfamily, however, because of the lobed rather than tubular vitellaria. Other differences shown by *Dinurus* include well-developed genital atrium, very powerful genital sinus, tripartite seminal vesicle and much smaller eggs.

The true nature of the branches of the excretory vesicle of *Dinosoma rubrum* is somewhat in doubt. Sections of one specimen and most of the toto-mounts seem to reveal the branches as not uniting. One fine specimen, however, showed a very distinct union of these branches dorsal to the lower portion of the oral sucker. Such variation is most unusual in the excretory system.

Dinosoma rubrum is a common parasite of Synodontids from 60 to 125 fathoms, but was not found at all even in related hosts from shallow water. It often occurs in large numbers in the stomach, where its bright red color makes it very conspicuous.

Parasterrhurus anurus n.gen., n.sp.

(Figs. 93-95)

Host—Argentina striata Goode & Bean.
Position—Stomach.
Frequency—Four specimens in 3 of 5 hosts examined.
Depth—98 to 168 fathoms.

Specific Diagnosis

Body more or less elongated, tapering anteriorly from ventral sucker, abruptly truncated posteriorly, widest near posterior end; length 1.12 mm., width 0.398 mm. Cuticula smooth, no tail appendage. Oral sucker subterminal, 0.110 mm. in diameter; ventral sucker about 1/3 from anterior end, 0.156 mm. in diameter. No prepharynx, rather small globular pharynx, no esophagus, intestinal ceca broad, thrown more or less into sac-like folds and reaching to posterior end of body. Genital pore median or slightly to the left, opposite the intestinal bifurcation, not far posterior to oral sucker. Testes smooth, globular, oblique, close together, intercecal or partly overlapping ceca ventrally, right testis in advance a short distance posterior to

ventral sucker. Seminal vesicle tubular rather than sac-shaped, its posterior end close to the anterior border of ventral sucker. Thence, it coils forward in several, chiefly lateral, diminishing coils to the pars prostatica. Prostate gland free, pars prostatica bowed, partly dorsal to base of sinus sac, total length (straightened) about equal to length of sinus sac. Sinus sac (fig. 95) pyriform, about 0.1 mm. long, broad at its base (0.06 mm.) but narrowing anteriorly, bending ventrally toward the genital pore. Genital sinus a muscular tube coiling slightly within the sac and forming a small sac-like enlargement in the base. Ovary large, smooth, globular, overlapping ventrally the left cecum, a short distance posterior to the left testis. Seminal receptacle immediately to the right of ovary. Two compact vitelline glands, close together, one diagonally behind the other, to the right and partly posterior to the ovary. Uterus extending posterior to ovary and vitellaria, but not reaching posterior end of body by some distance, coiling forward ventral to the ceca and dorsal to the testes. Eggs oval, 28 to 30 by 14 to 18 μ, yellowish in color, with moderately thin shells. Excretory pore conspicuous, ventral, median, near the posterior end, surrounded by muscles. The stem of the excretory vesicle conspicuously stained posterior to the uterus, exact level of its forking undetermined, two lateral stems uniting dorsal to pharynx.

Generic Diagnosis

Small to medium-sized hemiurids with smooth cuticula and without tail appendage, truncated posteriorly. Genital pore opposite intestinal bifurcation. Sinus sac pyriform. Pars prostatica not longer than sinus sac. Seminal vesicle tubular, coiled, anterior to ventral sucker. Ovary large, globular, posterior to left testis. Vitellaria in form of two diagonal, unlobed masses. Uterus chiefly postacetabular, extending posterior to ovary. Eggs medium-sized, without filaments.

Habitat—Stomach of marine fish.

Type species—Parasterrhurus anurus.

Relationships

This hemiurid is of great interest in its combination of characters of several genera. It seems to be like *Sterrhurus* without a tail appendage and with a tubular, coiled seminal vesicle. The smooth cuticle and lack of tail appendage would seem to relate it to the Lecithasterinæ but the undivided character of the vitellaria as well as the tubular seminal vesicle make it unlike any genus in that subfamily. The truncated body form is unusual. It differs from *Derogenes* in lacking a genital cone and in that the uterus is not well developed anterior to the ventral sucker. The smooth cuticle, the genital sinus, the testes, ovary and vitellaria are like *Sterrhurus*. Some species of *Sterrhurus* from shallow-water fish at Tortugas have a greatly reduced tail appendage, and in view of these gradations the genus is classified in the Sterrhurinæ. The character of the vitellaria is considered as excluding it from the Lecithasterinæ. The conspicuous muscles of the excretory pore and the cellular prominence of the posterior part of the excretory vesicle indicate that the origin of the tail appendage pertains to the excretory system.

The above description is based on one entire specimen and all but the posterior end of another from another host. Two specimens were lost because of a defective vial.

Subfamily Lecithasterinæ

Aponurus intermedius n.sp.

(Fig. 88)

Hosts	Frequency in host	Depth
Chaunax nuttingi Garman	2 of 9	200-300 fath.
eel—unidentified	1 1	300
sole—unidentified	1 1	249

Position—Stomach.

Specific Diagnosis

Small to medium-sized hemiurids, more or less cylindrical, with smooth cuticula, without tail appendage, 1.1 to 2.075 mm. by 0.28 to 0.589 mm. Body tapers toward both ends from region of ventral sucker, both ends more or less pointed, the body being, therefore, more or less spindle-shaped. Oral sucker subterminal; ventral sucker immediately anterior to midbody, occupying about 2/3 body width, approximately twice or slightly less than twice the diameter of oral sucker. No prepharynx; globular pharynx; definite but short esophagus; slightly sinuous ceca which do not reach posterior end by a short distance. Genital pore median, opposite esophagus. Testes symmetrical or slightly diagonal, immediately posterior to ventral sucker. Seminal vesicle small, thin-walled, undivided, gourd-shaped, immediately anterior to ventral sucker. Pars prostatica well developed, prostate gland conspicuous, extending anteriorly in a dorsally directed bow from the narrowed anterior end of the seminal vesicle. Sinus sac inconspicuous, very short and wide, much shorter than pars prostatica. Ovary oval, smooth, immediately posterior to left testis; seminal receptacle very large and conspicuous, immediately posterior to right testis, at about same level as ovary. Vitellaria in the form of seven distinct rounded masses, usually clearly separated and forming a cluster of four facing ventrally and a cluster of three facing partly to one side. Uterus extending to near posterior end of body then anteriorly to the genital pore. Eggs yellow, elongate-oval, 36 to 38 by 14 to 20 μ. Branches of excretory vesicle uniting dorsal to pharynx.

Measurements

Length	Width	Oral sucker	Ventral sucker	Eggs
mm.	mm.	mm.	mm.	μ
1.1	0.28		0.219	36 by 14
1.15	.32	0.136	.200	37 16
1.45	.472	.160	.304	36-37 16-17
1.79	.589	.180	.390	36-38 19-20
2.075	.539	.180	.355	36 20

Comparisons

This species differs from *Aponurus laguncula* Looss, 1907, in its larger egg size (36 to 38 by 14 to 20 μ as compared with 27 by 16 μ) and the much shorter, more rounded form of the sinus sac. It differs from *Aponurus*

sphærolecithus Manter, 1926, in much smaller egg size, much shorter sinus sac, especially as compared with the length of the prostate gland, and much shorter seminal vesicle. It differs from both and from the usual generic diagnosis by being somewhat pointed posteriorly rather than broadly rounded.

Odhner (1927, 6) expresses the belief that *Aponurus sphærolecithus* belongs in the genus *Lecithophyllum*, because of the large size of the eggs. Yet the genital atrium is not as well developed as in *Lecithophyllum*. The intermediate size of the eggs in *Aponurus intermedius* indicates that this character is not entirely satisfactory for separation of genera, and it may prove necessary to consider these two genera identical. Thus, most of the characters summarized by Manter, 1926, as separating the genera are not of generic value.

Aponurus vitellograndis Layman, 1930, possesses a tail appendage described and figured as weakly developed. The subfamily Lecithasterinæ is characterized as lacking a tail appendage, hence this species should not be considered as belonging in the genus *Aponurus*. Since the cuticula is smooth, it seems to be a species of *Sterrhurus*, and the name *Sterrhurus vitellograndis* (Layman) n. comb. is proposed.

Subfamily Derogenetinæ

Derogenes varicus (Muller)

(Fig. 89)

Hosts	Frequency in hosts	Depth
Helicolenus dactylopterus (de la Roche)	2 of 18	296-315 fath.
Merluccius sp.	2 23	190-280
Scorpæna cristulata Goode & Bean	1 2	367
Setarches parmatus Goode	1 2	250
Urophycis regius (Walbaum)	1 8	250—

Position—Stomach.

This widely distributed trematode has been reported from over 50 species of marine fish. Nicoll (1915) records 44 different hosts from British waters; Issaitschikow (1928) lists 5 hosts from the Russian Arctic; Manter (1926) records 6 hosts from Maine. The above 5 hosts from deep waters of the Gulf of Mexico are new host records and extend the distribution of the species into southern waters. It does not seem to occur, however, in shallow-water fish of Tortugas, nor has it been reported from Beaufort, North Carolina. Circumstantial evidence indicates a certain temperature limiting factor necessary for the parasite or its life history.

Derogenes crassus n.sp.

(Fig. 90)

Host—Callionymus agassizii Goode & Bean.
Position—Digestive system, probably stomach.
Frequency—Rare. One specimen from 39 hosts examined.
Depth—90 fathoms.

Specific Diagnosis

Body thick, more or less cylindrical, unspined, unringed, orange-red in color when alive. Size (killed under some pressure) 2.268 by 0.882 mm.

Broadly rounded posteriorly, somewhat more tapering anteriorly. Oral sucker 0.285 mm. in diameter, surmounted by a fleshy lobe. Ventral sucker mostly postequatorial, 0.697 mm. in diameter or almost three times the size of oral sucker. Pharynx contiguous with oral sucker; esophagus very short or lacking; ceca extending at first forward beside the oral sucker, then backward, with broad, close folds to near the posterior end of body. Genital pore median, opposite pharynx, near oral sucker. Cone-shaped genital papilla conspicuous. Prostate gland free, extending posteriorly halfway to ventral sucker; seminal vesicle a swollen tube, bent near its middle, not reaching the ventral sucker by a short distance. Testes transversely extended, symmetrical, far apart, ventral to ceca, a short distance posterior to ventral sucker; right testis crowded forward by ovary immediately behind it. Ovary ovoid, somewhat extended transversely, closely posterior to right testis. Two large, compact, unlobed vitelline glands, symmetrical, extended transversely, one immediately behind the ovary, the other behind the left testis, almost meeting medianly. Uterus filling most of body, although not appreciably overlapping gonads; anterior to ventral sucker it occasionally over-reaches the ceca to extend to body edge. Eggs large, thick-shelled, dark, golden yellow in color, 64 by 36 μ.

Comparisons

Although but a single specimen of this species was found, it seems to possess enough definite characters to make it distinct. The body form is more thick-set and muscular than *Derogenes varicus*, a character which makes the live worm seem quite different from the latter species. Other characteristic features are the broadly rounded, rather than pointed, posterior end; the much broader, more convoluted ceca; the larger vitellaria extended transversly rather than longitudinally; and, perhaps most important of all, the much larger egg size which distinguishes the species from *Derogenes varicus* and *D. affinis*. It differs from *D. minor* in its larger ventral sucker, more anterior genital pore, broader posterior end and shape of vitellaria. It differs from *D. ruber* in sucker ratio and in shape of vitellaria. *Derogenes fuhrmanni* Mola, 1912, has a different sucker ratio, longer, narrower egg and, if correctly described, a more posterior genital pore.

Derogenes kobayashi Layman, 1930, differs from all other species in that genus in that the testes are posterior rather than anterior to the ovary and the uterus is entirely preovarian. These two characters place the species in the genus *Gonocerca* Manter, 1926, and the corrected name becomes *Gonocerca kobayashi* (Layman) new combination. It occurs in the stomach of *Myoxcephalus raninus* in Peter the Great Bay.

Genus GONOCERA Manter, 1925

Generic Diagnosis

Medium-sized, cylindrical, smooth, tailless hemiurids. Ventral sucker large, chiefly posterior to midbody. Ceca do not unite posteriorly. Genital sinus short; prostate gland free; seminal vesicle undivided; testes rounded, unlobed, tandem or diagonal, postovarian, in extreme posterior part of body. Ovary rounded, unlobed, not far behind ventral sucker; vitellaria compact, unlobed, immediately posterior to ovary, pretesticular. Seminal receptacle lacking, sperm cells in uterus; uterus entirely anterior to ovary, chiefly preacetabular. Eggs without filaments. Excretory vesicle branching posterior to ovary, branches uniting dorsal to oral sucker. Parasites of gills, mouth, and stomach of marine fishes.

Type species—Gonocerca phycidis Manter, 1925.

Gonocerca is to be classified in the Derogenetinæ as a smooth-bodied, tailless hemiurid. Other genera considered in this subfamily are *Derogenes* Lühe, *Progonus* Looss (Synonym, *Genarches* Looss), *Bunocotyle* Odhner, *Genarchopsis* Ozaki, *Liopyge* Looss (synonym, *Liocerca* Looss) *Hemipera* Nicoll, *Derogenoides* Nicoll, *Genolinea* Manter, *Halipegus* Looss (synonym, *Genarchella* Trav., Artigas, & Pereira),[1] and *Vitellotrema* Guberlet. Of these genera, only *Liopyge, Gonocerca* and *Hemipera* possess testes posterior to the ovary. *Hemipera* is easily recognized by its filamented eggs. *Liopyge* differs from *Gonocerca* chiefly in the extent of the uterus posterior to the ovary and testes, also in the more posterior position of the genital pore, longer prostate gland and more anterior ventral sucker.

Gonocerca phycidis Manter, 1925

(Fig. 91)

Hosts	Frequency in host	Depth
Cœlorhynchus carminatus (Goode)	1 of 35	300 fath.
Merluccius sp.	3 27	197-367
Urophycis regius (Walbaum)	1 8	139-156

Specific Diagnosis

Body cylindrical, slender, not robust, length 1.4 to 2.3 by 0.25 to 0.42 mm. Numerous eggs in 1.4 mm. specimen. Ventral sucker round, with elongate aperture, located behind midbody, a little less than twice diameter of oral sucker (ratio about 3:2). No prepharynx, very short esophagus, rather narrow ceca, usually not extending posterior to testes. Genital pore median, opposite posterior half of oral sucker, genital cone or papilla weakly developed; prostate gland short, opposite pharynx; seminal vesicle tubular, bent sharply near anterior end, never extending more than halfway to ventral sucker. Testes large, tandem or almost tandem, in extreme posterior end. Ovary globular, behind ventral sucker, pretesticular; vitellaria compact, slightly longer than wide, slightly broader posteriorly, therefore very roughly triangular in outline, on each side of ovary, extending partly posterior to ovary; uterus entirely preovarian, mostly preacetabular; lateral coils usually overlap ceca and extending to body edges. Seminal receptacle lacking. Eggs 45 to 55 by 20 to 23 μ. Branches of excretory vesicle uniting dorsal to oral sucker.

Measurements

Length	Width	Forebody	Oral sucker	Ventral sucker	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	μ	μ
1.634	0.336	0.756	0.210	0.370	62 by 64	45 by 21
1.480	.395	.705	.235	.369		45 23
1.800	.420	.924	.268	.436	78 78	49 24
1.425	.378	.714	.210	.361	74 74	47 23
2.300	.344	1.344	.294	.462	68 98	44 20
1.400	.294	0.798	.170	.310	59 68	55 22
1.420	.252	.722				43 20

[1] Travassos, Artigas, & Pereira named the genus *Genarchella* in 1928. Its characters do not seem to differ from those of *Halipegus* and it is here considered a synonym.

Discussion

This species differs from *G. crassa* in its smaller size; more slender, less muscular body; more tandem testes; and uterine coils tending to extend to edges of body. The genital pore tends to be slightly more anterior, the genital cone less well developed, and the vitellaria tend to have a slightly different shape.

A comparison of the table of measurements given above with that given for *Gonocerca phycidis* from Maine (Manter, 1926, 103) shows remarkable agreement. The apparent difference of the more anterior position of the genital pore in the original description led to a study of paratype material from Maine. It was discovered that the far anterior position of the genital pore and the elongate form of the oral sucker was not constant in all specimens (although true for several) and probably is due to a retraction of the oral sucker into the body. Specimens were found with the pore at the posterior edge of the oral sucker and with the prostate gland opposite the pharynx. In the Maine material, one or both of the ceca extend beyond the testes. In only one of the specimens from Florida did one cecum reach back so far. In the specimens from Maine, the uterus did not extend completely to the body edges. Considering the identity in other features, these minor characters can not be sufficient to separate the forms which are therefore considered to represent the same species. Among my Maine trematodes, I find examples of this same species collected from the stomach of *Hippoglossus hippoglossus*, a host not listed in my report (Manter, 1926).

The above specific diagnosis is to be considered as replacing the former description with which, however, it agrees except in position of genital pore and prostate gland.

There are, thus, two American species in the genus *Gonocerca*. All of the Florida hosts for *G. phycidis* also serve as hosts for *G. crassa*. In two of the five collections, it occurred together with *G. crassa*. *G. crassa* has not been described from Maine.

The occurrence of this Maine species at Tortugas at depths from 150 to 300 fathoms is of great interest in view of the fact that it is one of several species with such distribution, occurring in shore fish of cold North Atlantic and deeper (cold) water of South Atlantic. In this connection it may be of significance that *G. crassa*, possibly a southern species only, was collected from much shallower water (40 fathoms).

Gonocerca phycidis is now known to have the following hosts, all of which except the first are new records: *Urophycis chuss, Hippoglossus hippoglossus, Merluccius* sp., *Urophycis regius, Cœlorhynchus* sp.

Gonocerca crassa n.sp.
(Fig. 92)

Hosts	Frequency in hosts	Depth
Ancylopsetta dilecta (Goode & Bean)	1 of 8	100 fath.
Brotula barbata (Bloch & Schneider)	1 1	79-140
Cœlorhynchus carminatus (Goode)	3 35	300
Lophius piscatorius Linn.	1 1	55
Merluccius sp.	4 23	168-250
Paralichthys oblongus (Mitchill)	1 7	168
Paralichthys sp.	1 1	40
Setarches parmatus Goode	1 2	249
Synodus intermedius (Agassiz)	1 9	40
Saurida sp.	1 6	60
Synodontid	1 7	92
Urophycis cirratus (Goode & Bean)	2 8	90
Urophycis regius (Walbaum)	3 8	168-220

Position—Stomach.

Specific Diagnosis

Body cylindrical, robust, thick, ventral sucker large, posterior to midbody. Length 2.24 to 3.57 mm., width 0.798 to 0.42 mm. A specimen 2.03 mm. in length is immature. Preoral lobe well developed, oral sucker circular or slightly wider than long, with round or transverse opening; ventral sucker a little less than twice the diameter of oral sucker, embedded in body, opening rather small, longitudinal. No prepharynx, very short esophagus, broad ceca extending past testes to posterior end. Genital pore median, close behind oral sucker, opposite pharynx or base of oral sucker. Genital atrium short, wide, genital cone extending into atrium, capable of extrusion; genital sinus short, opening at tip of genital cone; prostate gland fairly short, free, at base of genital cone, opposite intestinal bifurcation; seminal vesicle small, tubular, undivided, sometimes somewhat curved, never extending posteriorly

Measurements

Length	Width	Forebody	Oral sucker	Ventral sucker	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	μ	μ
2.547	0.840	1.59	0.327	0.588		52 by 20
3.53	1.26	2.03	.420	.730	147 by 156	49 22
3.57	1.00	1.90	.361	.688	127 127	45 22
3.70	0.84	1.93	.420	.596		45 20
2.47	.798	1.60	.436	.596	131 127	41 20
2.489	.88	1.17	.336	.630	137 117	49 20
3.23	1.01	1.9	.386	.596	127 119	50 20
3.23	0.84	1.65	.369	.604	117 117	45 25
3.42	.84	1.85	.420	.750	92 143	41 20
2.24	.80	1.14	.319	.504	90 111	45 21
2.03	.714	1.045	.268	.487	84 109	

more than halfway between the suckers. Testes globular, large, diagonal, postovarian, near the extreme posterior tip of body. Ovary median, globular, immediately behind the ventral sucker, pretesticular. Vitellaria compact, unlobed, large, one on each side and partly posterior to ovary. Seminal receptacle lacking, Laurer's canal lacking, sperm cells in uterus. Uterus entirely preovarian, almost wholly preacetabular, with short lateral coils chiefly intracecal. Eggs large, without filament, yellow, 41 to 52 by 20 to 22 μ. Branches of excretory vesicle uniting dorsal to oral sucker.

Comparisons

This species differs from *Gonocerca phycidis* in its larger size; shape of oral sucker; more posterior position of genital pore, prostate gland, and seminal vesicle; as well as in host and locality.

Discussion

The depth distribution of collections is from 40 to 300 fathoms. Of 21 collections, 2 were from 40 fathoms, 1 from 55 fathoms, 1 from 60 fathoms, 2 from about 90 fathoms and the remaining 15 from depths of 100 fathoms or over. Although the parasite has a relatively large number of hosts, it was not found in any of the shallow-water fish at Tortugas.

The specimen from *Lophius* differed from all others in that the gonads were not so closely crowded together. It agreed in almost all other respects.

Hemiperina nicolli n.gen., n.sp.

(Figs. 96-98)

Hosts	Frequency in hosts	Depth
Chaunax nuttingi Garman	1 of 9	300 fath.
Diplacanthopoma brachysoma Günther	4 4	249-300
Dibranchus atlanticus Peters	1 8	300

Position—Stomach.

Specific Diagnosis

Body cylindrical, smooth, tapering at both ends, more pointed posteriorly; no tail appendage; length 2.07 to 3.135 mm., width 0.72 to 0.87 mm., greatest width near ventral sucker. Oral sucker subterminal, preoral lobe present; ventral sucker posterior to midbody, less than twice diameter of oral sucker (ratio 2:3 or 3:4), with circular aperture. No prepharynx; pharynx short; esophagus very short; ceca wide, extending to near posterior end but not posterior to testes. Genital pore median, opposite base of pharynx. Cirrus sac or sinus sac lacking, weakly muscular region surrounding genital atrium; genital atrium very short; prostate gland free, short, about same length as seminal vesicle; seminal vesicle sac-shaped, thick-walled, extending a short distance posterior to intestinal bifurcation. Testes in extreme posterior end of body, postovarian, diagonal, smooth, rounded. Ovary small, smooth, globular, anterior to testes. Vitellaria two, smooth, unlobed, symmetrical, between ovary and testes, somewhat separated laterally. Seminal receptacle lacking, sperm cells in uterus; uterus in spiral coils, entirely preovarian, coils occurring, even in young specimens, posterior as well as anterior to ventral sucker, spirals rather narrow, chiefly intercecal. Eggs 44 to 52 by 16 to 20 μ, each egg with long filament at an opercular pole. This filament may be 20 times or more the length of the egg. Excretory vesicle forking posterior to ovary, branches uniting dorsal to pharynx.

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Eggs
mm.	mm.	mm.	mm.	mm.	μ
3.135	0.874	0.398	0.589	1.615	52 by 20
2.28	.78	.332	.498	1.12	44-50 16-20
2.03	.722	.323	.456	1.12	50-52 18-19
2.07	.788	.332	.498	0.874	.....

Generic Diagnosis

Cylindrical Derogenetinæ, with smooth elongate body tapering toward each end. Ventral sucker postequatorial. Genital pore median, opposite pharynx. Very short genital atrium, no cirrus sac; short prostate gland; short sac-shaped seminal vesicle far anterior to ventral sucker. Testes postovarian in posterior end of body. Vitellaria compact between ovary and testes; seminal receptacle lacking; uterus entirely preovarian; eggs medium-sized, with long unipolar filaments.

Type species—Hemiperina nicolli.

Comparisons

This trematode is a close relative of *Hemipera*. Other relatives which, however, lack filamented eggs are *Gonocerca* and *Liocerca*. Filamented eggs are developed in a number of Hemiurid genera (*Halipegus, Vitellotrema, Hemipera, Genarchopsis*), but in all of these except *Hemipera* the testes are anterior to the ovary. The present species is not included in the genus *Hemipera* because of the evident lack of a cirrus sac (fig. 98), absence of seminal receptacle, better developed prostate gland and much smaller eggs. The genus *Hemipera* contains two species, *H. ovocaudata* and *H. sharpei*, both from British waters. In *H. ovocaudata* the prostate gland and ejaculatory duct are enclosed in a "cirrus sac." In *H. sharpei*, the cirrus sac is described as "short and muscular," but a prostate gland is not described or figured. In *H. ovocaudata*, the uterus is short and not in spirals. In *H. sharpei*, the coils of the uterus are entirely anterior to the ventral sucker. In both species, the eggs are 100 μ in length. Nicoll gives the length of the filament for *H. ovocaudata* as 200 μ while the filament of the egg of *H. sharpei* is figured as about 11 times the length of the egg. In the present species the egg filament is much longer. One filament was measured for 1.176 mm. and its complete length was somewhat beyond this figure. Thus, the filament is at least 20 times the length of the egg.

Hemiperina nicolli seems to be strictly limited to rather considerable depths, being collected often from 300 fathoms, once from 249 fathoms, but never in shallower water. It is of interest to note that its nearest relatives occur in distant and more northern waters rather than in nearby shallow waters.

The name *Hemiperina* is given to suggest the genus *Hemipera*. The species is named in honor of Dr. Wm. Nicoll, English parasitologist.

Family AZYGIIDÆ

Otodistomum (?) sp.

(Fig. 99)

Host—*Cœlorhynchus carminatus* (Goode).
Position—Stomach, intestine, possibly cœlom.
Frequency—Present in 2 of 35 examined.
Depth—300 to 390 fathoms.

These forms are all (5 specimens) immature and their positive identification is not possible. The body form, suckers, digestive system, excretory system and the rudiments of the cirrus sac and gonads all suggest *Otodistomum*. If the trematodes belong in this genus, the final host is doubtless some selachian and the parasites would not advance beyond a juvenile stage in *Cœlorhynchus*.

Family HETEROPHYIDÆ

Mueller and vanCleave (1932) have recently shown that the Heterophyidæ occur in fish as well as in birds and mammals, and refer several species of fresh-water fish trematodes hitherto of uncertain classification to this family. The genus *Siphodera* Linton, 1910, for which Linton named the family Siphoderidæ, has been a trematode of perplexing relationships for some time. A related genus from deeper waters is described below. The scaled cuticula, the absence of cirrus sac and cirrus, the large seminal receptacle and finally the muscular development in connection with the

genital pore and ventral sucker, all suggest the family Heterophyidæ. Since the genera do not agree with any described subfamily, a new subfamily is suggested with the following characteristics.

Siphoderinæ n. subfamily

Body medium-sized to large and thick; spiny or scaly cuticula; anterior portion of body not dilated; oral sucker large, subterminal; ventral sucker small, deeply embedded in the body wall, encircled by a muscular region of the body forming a pseudosucker; forebody with gland cells; genital pore immediately anterior to ventral sucker, within the pseudosucker; digestive system with pharynx; ceca extending to posterior end of body; excretory vesicle Y-shaped; two testes, lateral and lobed or numerous testes in two lateral rows; seminal vesicle broadly tubular; cirrus and cirrus sac lacking; ovary multilobed, median, ventral; uterus with descending and ascending coils; short genital atrium, seminal receptacle large; Laurer's canal present. Intestinal parasites of marine fishes.

Type genus—*Siphodera* Linton, 1910.

This subfamily differs from other Heterophyidæ in the large body size, the modification of the gonotyl to form a pseudosucker enclosing the ventral sucker, the shape or number of testes and the development of forebody gland cells. Its further relationships will be discussed below.

Siphoderina brotulæ n.gen., n.sp.

(Figs. 65-66)

Hosts	Frequency	Depth
Brotula barbata (Bloch & Schneider).....	1 host	79-140 fath.
Lophius piscatorius Linn.		55

Position—Intestine.

Specific Diagnosis

Rather thick-bodied distomes, 2.66 to 2.85 by 1.558 to 1.805 mm., broadest near anterior end, posterior end truncated. Cuticula armed, at least as far back as midbody, with fine scales bearing pointed spines in anterior region of body but becoming smooth posteriorly. Oral sucker large, terminal, mouth subterminal, ventral; ventral sucker much smaller than oral sucker, ¼ from anterior end, embedded within encircling fold of the body wall. This body fold provided with radial muscles and forming what might be called a pseudosucker,[1] without definite outer rim and without definite bands of radial muscles. Genital pore in anterior part of pseudosucker, slightly anterior and ventral to anterior edge of ventral sucker. A lip-like, muscular lobe, broadly conical in shape extends backward into the cavity of the pseudosucker from its anterior wall (fig. 66). In one individual there seemed to be another muscular lobe extending anteriorly, giving

[1] The posterior rim of this pseudosucker is clear-cut, but anteriorly, in at least one specimen, the border spreads out and merges with the body surface. In such an instance, the depression is deeper posteriorly and more shallow anteriorly. In another specimen, the anterior border is fairly definite. The entire structure is probably mobile and variable. The radiating muscle fibers give the pseudosucker a sucker-like appearance along the inner margin, but they are not definitely limited at the outer margin where they seem to merge with body musculature. There are no definite bands of radiating muscles as in *Siphodera* and the rim of the pseudosucker is less circular and less definite.

the appearance of two lips or lobes. Prepharynx lacking; pharynx broader than long; esophagus lacking; ceca slanting posteriorly toward the sides of the body, then extending backward to extreme posterior end where they come very close to the body surface. Testes large, diagonal, rather far apart laterally, each near the body edge, separated by the uterus, dorsal to the ceca, partly extracecal, lobed on their median surfaces where two or three bud-like processes occur, right testis slightly more anterior, left testis slightly posterior to midbody. Character of terminal genital ducts essentially as in *Siphodera*. Seminal vesicle a swollen tube, extending from a short distance posterior to ventral sucker around the right border of the sucker, anteriorly to the intestinal bifurcation where it bends sharply back and becomes the pars prostatica. Pars prostatica tubular, not as broad as in *Siphodera*. No prostate gland cells evident outside the transparent cells of the pars prostatica. Cirrus and cirrus sac lacking. Genital atrium or sinus very short. Ovary large, multilobed, median, approximately in midbody. Seminal receptacle large, spherical, dorsal to ovary. Laurer's canal present. Vitelline follicles usually tapered at one end, in two lateral groups extending almost to median line, dorsal to ceca, from about the level of

Measurements

Length	Width	Oral sucker	Ventral sucker	Forebody	Pharynx	Eggs
mm.	mm.	mm.	mm.	mm.	μ	μ
2.85	1.558	0.503	0.114	0.74	80 by 200	20-22 by 8
2.66	1.805	.58	.170	.7	140 200	22 8

posterior edge of pharynx to anterior border of the anterior testis. Uterus coiling irregularly backward on the right side to a level some distance from the posterior end, then irregularly forward in the left half of the body. Anterior to the ovary the uterus proceeds to the right side then returns to the median line immediately posterior to ventral sucker. Uterus chiefly ventral to all other organs. Eggs at first colorless, become yellow, then brown as they mature, size 20 to 22 by 8 μ. Excretory vesicle Y-shaped, the large median stem branching dorsal to the posterior part of the ovary, the two large branches extending forward to near the anterior end of the body where each ends blindly. The lateral excretory branches are ventral to the ceca and to the vitellaria.

Comparisons and Discussion

This species is the first clear relative of *Siphodera* to be described. It is like *Siphodera* in body form, body spines, small ventral sucker, pseudosucker, multilobed ovary, dorsal position and character of the vitellaria, large seminal receptacle, and still more significantly in the course of the uterus, shape of eggs, absence of cirrus sac and prostate gland, and in the conspicuous glands of the forebody. The excretory system, also, is the same in both. It differs from *Siphodera* in possessing 2 testes rather than 9, in the less definite nature of the pseudosucker, which is not provided with radial bands of muscles, in the more anterior extent of the seminal vesicle, shape of the pars prostatica, lack of prepharynx and esophagus, more anterior extent of vitellaria and slightly narrower eggs.

The relationships of *Siphodera* have been problematical and the genus has been listed as one of uncertain taxonomic position. Linton's family

Siphoderidæ has been criticised by several writers and considered invalid. The genera *Stegopa, Metadena, Prodistomum* and *Genolopa* which Linton (1910, 74-79) seemed to include in the Siphoderidæ are not all related to *Siphodera.*

The fairly large-sized, thick bodies of *Siphodera* and *Siphoderina* suggest the family Fellodistomidæ. The lobed ovary, course of the uterus, shape of the excretory vesicle and gland cells of the forebody indicate fellodistomid relationships. The two genera are excluded from the Fellodistomidæ, however, by their lack of cirrus sac and prostate gland (both of which are strongly developed in the Fellodistomidæ), presence of body spines and the presence of a large seminal receptacle. As has been indicated above, the only other group at all similar is the family Heterophyidæ. With this family, the two genera agree in absence of cirrus sac, in spiny cuticula, large seminal receptacle, the course of the uterus and in a muscular development associated with the genital pore. It is proposed here that this sucker-like formation, sometimes containing a lobe-like expansion near the genital pore, represents a modification of that typical heterophyid structure, the gonotyl. The large size, thick bodies and expansion of the muscular, genital sucker to involve the entire ventral sucker are characters entirely different from those found in any subfamily of the Heterophyidæ, and the subfamily Siphoderinæ is proposed above. The resemblances to the Fellodistomidæ, especially in consideration of the muscular, copulatory lobes there developed, suggest a relationship between the Fellosdistomidæ and the Heterophyidæ.

A very brief diagnosis of the genera *Siphodera* and *Siphoderina* follows.

Siphodera—Siphoderinæ with short prepharynx, short esophagus; pseudosucker a well-defined ring with definite radial bands of muscles; testes nine; seminal vesicle not extending anterior to ventral sucker; vitellaria not extending anterior to ventral sucker.

Type species—Siphodera vinaledwardsi (Linton).

Siphoderina—Siphoderinæ with prepharynx and esophagus lacking; pseudosucker not clearly defined, no definite, radial bands of muscles; testes two; both seminal vesicle and vitellaria extending anterior to ventral sucker.

Type species—Siphoderina brotulæ.

The two specimens from *Lophius* agree with the above description of *S. brotulæ* except that the ventral sucker is somewhat smaller (the sucker measurements being 260:100 μ and 300:112 μ) and in that a few rows of spines at the border of the oral sucker were slightly larger than the other body spines, suggesting a tendency toward special oral spines such as occur in some other heterophyids.

A second, undescribed species of *Siphoderina* has been collected from *Lutianus analis* at Tortugas.

UNCLASSIFIED

Distomum fenestratum Linton

Position—Usually digestive system, often gills, sometimes blood and tissues.

This trematode is a juvenile or immature form. In addition to the above 11 hosts from deep-water, it has been collected from 11 different shallow-water fish. It will be considered more completely in the report on parasites of these fish. Its unusual distribution has already been noted (Manter 1931b, 1932). The trematode evidently might be found in almost any fish of almost any depth in almost any organ. Found usually in very small

numbers, it may occur in some selachians (*Ginglymostoma cirratum, Pteroplatea maclura*) in very large numbers. It seems to be less common below 100 fathoms. It does not seem to be found consistently in any single host species. The suggestions have been made that the adult of this trematode is either a blood fluke or a member of the Didymozoonidæ (Manter 1931b, 1932). The final host must be a wide rover such as mackerels or turtles and occurs both near the reef and in the open sea, or there may be several different final hosts covering these regions. Cercaria L of Miller 1925 (Carnegie Inst. Wash. Year Book No. 24, p. 238) from *Crepidula aculeata* resembles *Dist. fenestratum* very strongly.

Deep-water hosts	Frequency in hosts	Depth
Antennarius radiosus Garman	1 of 3	60 fath.
Centropristis ocyurus (Jordan & Evermann)	1 6	40
Cyclopsetta fimbriata (Goode & Bean)	1 8	50
Hypoclydonia bella Goode & Bean	1 17	140-197
Lophius piscatorius Linn.	1 1	55
Merluccius sp.	1 23	168
Paralichthys oblongus (Mitchill)	1 7	50
Pontinas longispinus Goode & Bean	1 23	90
Pronotogrammus sp.	1 14	135-156
Pteroplatea maclura (le Sueur)	1 1	60
Synodontid	1 7	90

BATHYMETRIC DISTRIBUTION OF DEEP-WATER TREMATODES

In the preceding pages there has been included with each trematode description a record of the depths from which the trematode was collected. Since an approximately equal number of examinations was made from depths down to 200 fathoms and enough examinations made from 200 to 300 fathoms to furnish representative samples, the depth records furnish considerable data on bathymetric limits of distribution. The 721 fish examined are not only fairly equally distributed over different depths (except that there are fewer examples below 200 fathoms) but deliberately extended to include as many different hosts as possible. The data, therefore, represent a broad survey of the region. The shallow-water fish have been even more thoroughly surveyed, approximately 1500 fish of this region being examined and most species of fish known from that region included. Therefore, while there may be much uncertainty as to the lower limit of distribution, the absence of a trematode species from shallow water can be fairly well demonstrated. Linton, Pratt and others also have contributed to knowledge of shallow-water trematodes of Tortugas.

The depths from which 22 species of trematodes were collected are graphically shown in tables 2 to 8. These 22 species are those collected at least 3 times from deep-water fish. The tables or charts are most impressive in cases where the trematode has been collected numerous times from certain depths and not at all from other, equally well-sampled, depths. Some of the cases are only suggestive, others show certain distribution limits very clearly.

In these charts or tables, the name of the trematode occurs at the top of a column, beneath it is indicated the number of different kinds of fish from which it was collected, while the column proper is marked by horizontal lines indicating depths of 50, 100, 150, 200, 250 and 300 fathoms. In this column each collection of the parasite is indicated by an asterisk (*). The vertical position of the asterisk indicates the depth of the collection. The horizontal arrangement of the asterisks is more or less at random and has no special significance. The number of collections, although small in many cases, is of added significance because no special attempt was made to increase it in any instance. For example, *Hemiperina nicolli* is common in an anacanthid from about 300 fathoms and many more could have been collected, thus increasing the number of asterisks in that position. The chief purpose of the study, however, was to diversify both hosts and depths as much as possible. The charts represent, then, the broadest possible survey of the species involved.

A single haul often varies a number of fathoms between start and finish. When a fish host was collected between two depths, the asterisk is placed approximately midway between these levels. The asterisks, therefore, are to be interpreted as representing approximate depths. The fish are, of course, in every case essentially bottom dwelling.

The most interesting cases for the present are those trematodes of restricted distribution but with a variety of hosts, indicating a certain amount of non-specificity on the part of the parasite. Trematodes with only one host (such as those shown in table 2) may be limited by a host specificity rather than any depth factor. These cases need to be studied in more detail in connection with the depth distribution of the particular host involved. *Megenteron crassum*, for example, is a species restricted to deeper waters than most others, all of my collections of it being near 250 fathoms. But it is found only in an anacanthid host. *Lomaphorus monolenei*, never occurring, apparently, in shallow water, can be easily found in depths of about 100 fathoms or 150 fathoms, but it has not been found at 200 fathoms or below. But this species also is limited to a single host species.

Stephanostomum lineatum (table 3) is able to live in 3 kinds of fish, yet has an upper limit of distribution of about 60 fathoms and was not collected below 140 to 197 fathoms.

Helicometra fasciata (table 3) shows the peculiar condition of being relatively common in 3 different species of fish at about 50 fathoms, but never collected from depths either much above or below that region. Other species of the same genus occur in reef fish. *H. fasciata* is a common European species.

Lepidapedon elongatum (table 3) is not common, but has been collected at different depths from approximately 160 to 350 fathoms.

The most interesting species in this connection is *Cymbephallus vulgaris*. It is the most common trematode collected from deep-water fish and occurs

in 15 different host species. It is so common in some hosts (for example, *Pontinus* and *Peristedion*) that it can be collected readily at any time. Yet it has not been recognized from hundreds of examinations of shallow-water fish. Related species have been found in shallow-water hosts, but *C. vulgaris* has not been collected from less than 40 fathoms. A glance at table 4 shows that this trematode is most prevalent in depths from 75 to 175 fathoms, but does occur at lower depths. Its upper limit of distribution is fairly definite, its lower limit indefinite.

Derogenes varicus (table 5) is interesting as the most widely distributed and most non-specific fish trematode known. It has been reported from many northern fish but has never been found in shallow-water fish at Tortugas, nor has it been reported from Beaufort, North Carolina. It was collected once, in the present work, at only 125 fathoms, but 6 times from below 200 fathoms. It exhibits its cosmopolitan nature by occurring in 5 different fish at these depths.

Sterrhurus floridensis (table 6) has already been discussed as the most nearly ubiquitous trematode so far as the Tortugas region is concerned. It has been collected 137 different times. Its distribution chart shows it is predominantly a shallow-water species although it has extended its range fairly well into deep water. In interpreting table 6, it should be remembered that approximately 3 times more examinations were made from shallow water than from deep water. *S. floridensis* was identified once as occurring at 250 fathoms and is not uncommon at 100 fathoms. It is the only sexually mature form found to occur generally in both shallow-water and deep-water regions.

Sterrhurus robustus collections (table 8) from 6 different hosts cluster around the 200-fathom line, although the parasite may be found much deeper (300 fathoms). Its upper limit seems to be fairly definite at about 150 fathoms, its lower limit less definite and unknown.

Dinosoma rubrum (table 8) is readily secured from about 100 fathoms, but not elsewhere.

Gonocerca crassa (table 8) has one of the most extensive ranges. Although capable of parasitizing 14 kinds of fishes, it does not seem able to extend its range to surface hosts. My collections of this parasite are rather uniformly distributed between 40 and 300 fathoms. Why should the species not occur among some of the scores of fish species of shallow water?

The distribution of *Gonocerca phycidis* (table 8) is of particular interest in comparison with that of *Derogenes varicus* (table 5). The vertical positions of collections are markedly similar, the variety of hosts approximately the same, and both species have been collected by the author from marine fishes of Maine (Manter, 1925).

Distomum fenestratum is always immature and the final host is not known. Its remarkable distribution has been noted (p. 327). It is the only

other trematode in addition to *Sterrhurus floridensis* found both in surface waters and at considerable depth. Although its distribution seems to end at about 175 fathoms, it occurs so rarely in some hosts and often in such small numbers that it might be expected at lower depths. The unknown source of the eggs, however, may be entirely from the surface.

It is recognized that the collection records presented here offer somewhat fragmentary evidence of bathymetric distribution. They are, I believe, the first to be assembled in this form. It is hoped that the suggestions they present will eventually lead to further understanding of ecological relationships between host, parasite and environment. It should be emphasized, as deserving further consideration, that a gradient of changing environment is reflected not only in the free-living animal population but also in their parasites.

A comparison of deep-water trematodes with trematodes of other regions of the earth will be considered in the following section.

TABLE 2

Trematode	RHIPIDOCOTYLE LONGLEYI	MEGENTERON CRASSUM	LOMAPHORUS WARDI	LOMAPHORUS MONOLENE
Number of different host species	1	1	1	1
Depth in fathoms				
50				
100				* * *
150	*			* *
200	* *		*	
250	* *	*	* * *	
300		* * *		

TABLE 3

Trematode	STEPHANOSTOMUM LINEATUM	HELICOMETRA FASCIATA	LEPIDAPEDON RACHION	LEPIDAPEDON ELONGATUM
Number of different host species	3	3	1	4
Depth in fathoms				
50		**** *		
100	* * * *	* * *		
150	* * * *			
200	*		* *	* *
250				*
300			* *	
			* * *	*

TABLE 4

Trematode	CYMBEPHALLUS VULGARIS
Number of different host species	15
Depth in fathoms	
50	
100	
150	
200	
250	
300	

TABLE 5

Trematode	MYZOXENUS VITELLOSUS	PARASTERRHURUS ANURUS	APONURUS INTERMEDIUS	DEROGENES VARICUS
Number of different host species	2	1	3	5
Depth in fathoms				
50	**			
100	* *	* * *		
150				*
200				
250			* *	* * *
300				* *
				*

TABLE 6

Trematode	STERRHURUS FLORIDENSIS
Number of different host species	52
Depth in fathoms	
50	
100	
150	
200	
250	
300	

TABLE 7

Trematode	STERRHURUS LAEVIS	STERRHURUS ROBUSTUS	STERRHURUS PROFUNDUS	DINOSOMA RUBRUM
Number of different host species	4	6	2	2
Depth in fathoms				
50				
100				
150				
200				
250				
300				

TABLE 8

Trematode	GONOCERCA PHYCIDIS	GONOCERCA CRASSA	HEMIPERINA NICOLLI	DISTOMUM FENESTRATUM
Number of different host species	3	14	3	22
Depth in fathoms				
50				
100				
150				
200				
250				
300				

LIST OF HOSTS WITH TREMATODE PARASITES OF EACH

In the following list, trematodes without the name of the author are described in this paper.

Aleposomus sp.
- *Steringotrema sp.*
- *Sterrhurus profundus*

Diplacanthopoma brachysoma
- *Hemiperina nicolli*
- *Megenteron crassum*
- Immature distome

Ancyclopsetta dilecta (Goode & Bean)
- *Cymbephallus vulgaris*
- *Gonocerca crassa*
- *Sterrhurus floridensis*

Antennarius radiosus Garman
- *Distomum fenestratum* Linton
- *Sterrhurus floridensis*

Argentina striata Goode & Bean
- *Parasterrhurus anurus*
- *Steringophorus profundus*

Bathypterois quadrifilis Günther
- No trematodes

Bellator militaris (Goode & Bean)
- *Cymbephallus vulgaris*
- *Helicometra fasciata* (Rud.)
- Metacercariæ, probably of *Lepidapedon nicolli*

Bembrops gobioides (Goode)
- *Cymbephallus vulgaris*
- *Sterrhurus floridensis*

Benthodesmus atlanticus Goode & Bean
- *Cymbephallus vulgaris*

Brotula barbata (Bloch & Schneider)
- *Cymbephallus vulgaris*
- *Gonocerca crassa*
- *Lissoloma brotulæ*
- *Siphoderina brotulæ*
- *Sterrhurus floridensis*

Callionymus agassizii Goode & Bean
- *Derogenes crassus*

Centropristis ocyurus (Jordon & Evermann)
- *Distomum fenestratum* Linton
- *Sterrhurus floridensis*

Chaunax nuttingi Garman
- *Aponurus intermedius*
- *Hemiperina nicolli*
- *Sterrhurus floridensis*
- *Sterrhurus robustus*

Chloropthalmus chalybæus (Goode)
- (?) *Rhipidocotyle longleyi*

Chloropthalmus truculentus Goode & Bean
- *Sterrhurus robustus*

Chromis enchrysurus Jordan & Gilbert
- No trematodes

Citharichthys cornutus (Günther)
- *Dolichœnterum sp.*

Cœlorhynchus carminatus (Goode)
- *Lepidapedon elongatum* (Lebour)
- *Lepidapedon rachion* (Cobbold)

Cyclopsetta fimbriata (Goode & Bean)
- *Distomum fenestratum* Linton
- *Sterrhurus floridensis*

Decodon puellaris (Poey)
- *Deretrema fusillus* Linton
- *Myzoxenus vitellosus*

Dibranchus atlanticus Peters
- *Derogenes varicus* (Müller)
- *Hemiperina nicolli*

Diplectrum bivittatum (Cuv. & Val.)
- No trematodes

Engyophrys sentus
- Metacercariæ, probably of *Lepidapedon nicolli*

Epigonus occidentalis Goode & Bean
- *Lepidapedon elongatum* (Lebour)

Epinephelus niveatus (Cuv. & Val.)
- *Lepidapedon nicolli*
- Monogenea
- *Prosorhynchus ozakii*
- *Stephanostomum microstephanum*

Gymnachirus fasciatus Günther
- No trematodes

Halieutichthys aculeatus (Mitchill)
- *Sterrhurus floridensis*

Helicolenus dactylopterus (de la Roche)
- *Cymbephallus vulgaris*
- *Derogenes varicus* (Müller)

Helicolenus dactylopterus (Cont.)
Opecœlina helicoleni
Sterrhurus lævis (Linton)
Monogenea
Monogenea
Hollardia hollardi Poey
Immature distome
Hypoclydonia bella Goode & Bean
Distomum fenestratum Linton
Rhipidocotyle longleyi
Kathetostoma albigutta Bean
Rhipidocotyle kathetostomae
Kathetostoma sp.
No trematodes
Læmonema barbatulum Goode & Bean
Cymbephallus vulgaris
Eurycreadium vitellosum
Lepidapedon elongatum (Lebour)
Stephanostomum lineatum
Lophius piscatorius Linn. (?)
Distomum fenestratum Linton
Gonocerca crassa
Siphoderina brotulæ
Sterrhurus floridensis
Metacercariæ, unidentified
Lutianus vivanus (Cuv. & Val.)
Sterrhurus floridensis
Macrouridæ
Cymbephallus fimbriatus Linton
Merluccius sp.
Derogenes varicus (Müller)
Distomum fenestratum Linton
Gonocerca crassa
Gonocerca phycidis Manter
Sterrhurus robustus
Monolene antillarum Norman
Lomaphorus monolenei
Neoscopelus macrolepidotus Johnson
Unidentified specimen (lost), probably *Cymbephallus vulgaris*
Paralichthys oblongus (Mitchill)
Distomum fenestratum Linton
Gonocerca crassa
Sterrhurus robustus
Immature distomes
Paralichthys sp.
Gonocerca crassa
Sterrhurus floridensis
Peristedion imberbe Poey
Cymbephallus vulgaris
Hemiurus sp.
Sterrhurus floridensis
Peristedion longispathum (Goode & Bean)
Sterrhurus lævis (Linton)
Peristedion miniatum Goode
Sterrhurus lævis (Linton)
Cymbephallus vulgaris
Lomaphorus gracilis
Peristedion platycephalum (Goode & Bean)
Brachyenteron peristedioni
Cymbephallus vulgaris
Sterrhurus lævis (Linton)
Peristedion sp.
No trematodes
Poecilopsetta beanii (Goode)
No trematodes
Polymixia lowei Günther
Sterrhurus floridensis
Pontinus beanorum Evermann & Marsh (?)
Sterrhurus floridensis
Pontinus longispinus Goode & Bean
Cymbephallus vulgaris
Distomum fenestratum
Sterrhurus floridensis
Monogenea
Prionodes phœbe (Poey)
Metacercariæ, probably of *Lepidapedon nicolli*
Prionodes sp., undescribed
Sterrhurus floridensis
Metacercariæ, like above
Prionodes sp., undescribed
Helicometra fasciata (Rud.)
Prionotus alatus Goode & Bean
Cymbephallus vulgaris
Helicometra fasciata (Rud.)
Prionotus stearnsi Jordan & Swain
Cymbephallus vulgaris
Pristipomoides macrophthalamus (Müller & Trosch.)
No trematodes
Pronotogrammus sp.
Cymbephallus vulgaris
Distomum fenestratum Linton
Sterrhurus profundus
Pteroplatea maclura (leSueur)
Distomum fenestratum Linton
Monogenea

Raia ornata Garman
No trematodes
Saurida sp.
Dinosoma rubrum
Gonocerca crassa
Letithochirium sp.
Scorpæna agassizii Goode & Bean
Helicometrina nimia Linton
Sterrhurus floridensis
Scorpæna cristulata Goode & Bean
Cymbephallus vulgaris
Derogenes varicus (Müller)
Opecœlina scorpaenae
Setarches parmatus Goode
Derogenes varicus
Gonocerca crassa
Syacium papillosum (Linn.)
Sterrhurus floridensis
Symphurus sp.
Synodontid
Dinosoma rubrum
Distomum fenestratum Linton
Synodus intermedius (Agassiz)
Gonocerca crassa
Synodus sp.
Dinosoma rubrum
Sterrhurus floridensis
Trichopsetta ventralis (Goode & Bean)
Sterrhurus floridensis
Upeneus parvus Poey
Deretrema fusillus Linton
Metacercaria, probably of *Lepidapedon nicolli*
Urophycis chesteri (Goode & Bean)
Lepidapedon elongatum (Lebour)
Podocotyle pearsei
Urophycis cirratus (Goode & Bean)
Gonocerca crassa
Stephanostomum lineatum
Sterrhurus floridensis
Urophycis regius (Walbaum)
Derogenes varicus (Muller)
Dinosoma rubrum
Gonocerca crassa
Gonocerca phycidis
Lomaphorus wardi
Stephanostomum lineatum
Sterrhurus robustus
Yarrella blackfordi Goode & Bean
No trematodes
Unidentified (lizard fish)
Benthotrema plenum
Unidentified (small lizard fish)
Steringophorus sp.
Unidentified (sole)
Aponurus intermedius
Unidentified (blind fish)
Cymbephallus vulgaris
Unidentified (eel)
Aponurus intermedius
Steringophorus magnus

DISCUSSION

Forty-nine species of trematodes have been described above. The distribution of most of these is seen to be limited to deep water. Only a very few species (*Sterrhurus floridensis* and *Distomum fenestratum*, an immature form) occur in reef fish and also from 100 fathoms or below. *Deretrema fusillus*, *Myzoxenus vitellosus* and *Helicometrina nimia* of shallow-water hosts occur at depths of 50 or 60 fathoms but not below. This distinctness of the trematode population of deep waters perhaps is to be expected since different species of fish, snails, crustacea, and other animals are found there. On the other hand, a few highly cosmopolitan trematodes have definite upper limits to their distribution.

An interesting aspect of this study is the similarity of the deep-water trematodes with other forms described from northern and far distant waters. This similarity has been suggested from time to time in the preceding pages and may be reviewed here.

Seven species of trematodes, from deep water only at Tortugas, are identical with forms well known from northern regions. These seven are: *Derogenes varicus, Lepidapedon rachion, L. elongatum, Helicometra fasciata, Cymbephallus fimbriatus, Gonocerca phycidis* and *Sterrhurus lævis.* Although more thoroughly studied than the deep-water species, those from shallow water at Tortugas show practically no similarity to northern forms. In composition the deep-water trematode fauna is more like the surface fauna of Maine, Great Britain or Norway than like the shallow-water fauna at Tortugas, only a few miles away.

Furthermore, many deep-water species of trematodes collected find their nearest relatives in distant (surface) waters rather than in nearby surface waters. Thus, *Steringophorus magnus, S. profundus, Dolichœterum sp., Stephanostomum lineatum, Podocotyle pearsei, Eurycreadium vitellosum, Gonocerca crassa, Hemiperina nicolli, Otodistomum* sp., as well as two immature fellodistomids, are to be compared with forms from far distant waters rather than with species from Tortugas.

This tendency to resemble surface trematodes of cold-water regions suggests that temperature is an important factor in the distribution of marine fish trematodes. *Derogenes varicus* in particular would seem to be excluded from all shallow-water Tortugas fish, directly or indirectly, because of temperature. It might even be found eventually that some species of trematodes have a continuous distribution from Arctic to Antarctic through deep-water hosts although their shallow-water hosts might appear only in distant regions. Trematodes of the Antarctic are practically unknown and their comparison with deep-water forms of the tropics would be most interesting.

SUMMARY

1. A description is given of 49 species of trematodes collected from approximately 90 species of fish from depths of 40 to 582 fathoms. 721 individual fish were examined.
2. Approximately 80 per cent of the host species were infected with trematodes, a percentage comparable with the degree of infection found in fish of shallow water. About 30 per cent of the individuals examined were infected with trematodes. There was no indication that trematodes became more scarce as depth increased.
3. One new subfamily (of the family Heterophyidæ), 11 new genera and 33 new species are described.
4. Families are represented by the following number of species: Hemiuridæ, 15; Allocreadiidæ, 13; Fellodistomidæ, 11; Bucephalidæ, 4; Acanthocolpidæ, 2; Zoogonidæ, 1; Azygiidæ, 1; Heterophyidæ, 1; unclassified, 1.
5. These trematodes are markedly distinct from nearby, shallow water, only 2 species collected from below 100 fathoms occurring also in shallow-water hosts. These 2 species are *Distomum fenestratum* and

Sterrhurus floridensis. At about 50 fathoms, *Deretrema fusillus* *Myzoxenus vitellosus* and *Helicometrina nimia*, also found in shallow-water fish, occurred.

6. Seven species of trematodes known from fish hosts of northern waters were found in deep-water hosts at Tortugas. The deep-water trematode fauna, therefore, is more similar to that of distant, cooler water than it is to the trematode fauna of warm, surface waters of Tortugas. Also, more species of northern trematodes are to be found in deep water than in shallow water at Tortugas.
7. The depths from which collections were made are indicated in chart form to demonstrate the definite bathymetric distribution of some species of trematodes. This study emphasizes the fact that a gradient of changing environment (such as depth) is reflected not only in the free-living population of a region but also in their parasites.

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EXPLANATION OF PLATES

All figures were drawn with the aid of a camera lucida except the diagrams (figs. 8, 46, 81).

The value of the projected scale is indicated in each figure. The following abbreviations are used:

a.....anus
bf.....body fold
bm.....body muscles
bs.....body scale
cc.....intestinal cecum
cir.....cirrus
cs.....cirrus sac
cv.....cervical groove
ej.....ejaculatory duct
ep.....excretory pore
esv.....external seminal vesicle
ex.....excretory vesicle
ga.....genital atrium
gl.....genital lobe
glc.....gland cells
gp.....genital pore
gs.....genital sinus
gsv.....glandular seminal vesicle
i.....intestine
lm.....longitudinal muscles
m.....mouth
mg.....Mehlis' gland
mt.....metraterm
ov.....ovary
os.....oral sucker
p.....papilla
pcs.....posterior portion of cirrus sac
pg.....prostate gland
ph.....pharynx
pp.....pars prostatica
prr.....prostate receptacle
ps.....pseudo-sucker
pv.....prostate vesicle
s.....sucker
sr.....seminal receptacle
ss.....sinus sac
sv.....seminal vesicle
t.....testis
tf.....tail fold
ut.....uterus
utsv.....uterine seminal vesicle
vll.....ventro-lateral lobe
vs.....ventral sucker
vt.....vitellaria

Plate 1

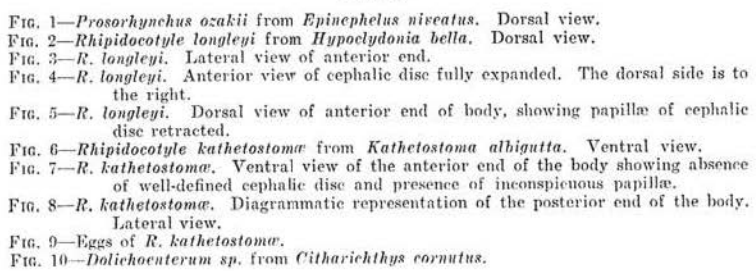

Fig. 1—*Prosorhynchus ozakii* from *Epinephelus niveatus*. Dorsal view.
Fig. 2—*Rhipidocotyle longleyi* from *Hypoclydonia bella*. Dorsal view.
Fig. 3—*R. longleyi*. Lateral view of anterior end.
Fig. 4—*R. longleyi*. Anterior view of cephalic disc fully expanded. The dorsal side is to the right.
Fig. 5—*R. longleyi*. Dorsal view of anterior end of body, showing papillæ of cephalic disc retracted.
Fig. 6—*Rhipidocotyle kathetostomæ* from *Kathetostoma albigutta*. Ventral view.
Fig. 7—*R. kathetostomæ*. Ventral view of the anterior end of the body showing absence of well-defined cephalic disc and presence of inconspicuous papillæ.
Fig. 8—*R. kathetostomæ*. Diagrammatic representation of the posterior end of the body. Lateral view.
Fig. 9—Eggs of *R. kathetostomæ*.
Fig. 10—*Dolichocenterum sp.* from *Citharichthys cornutus*.

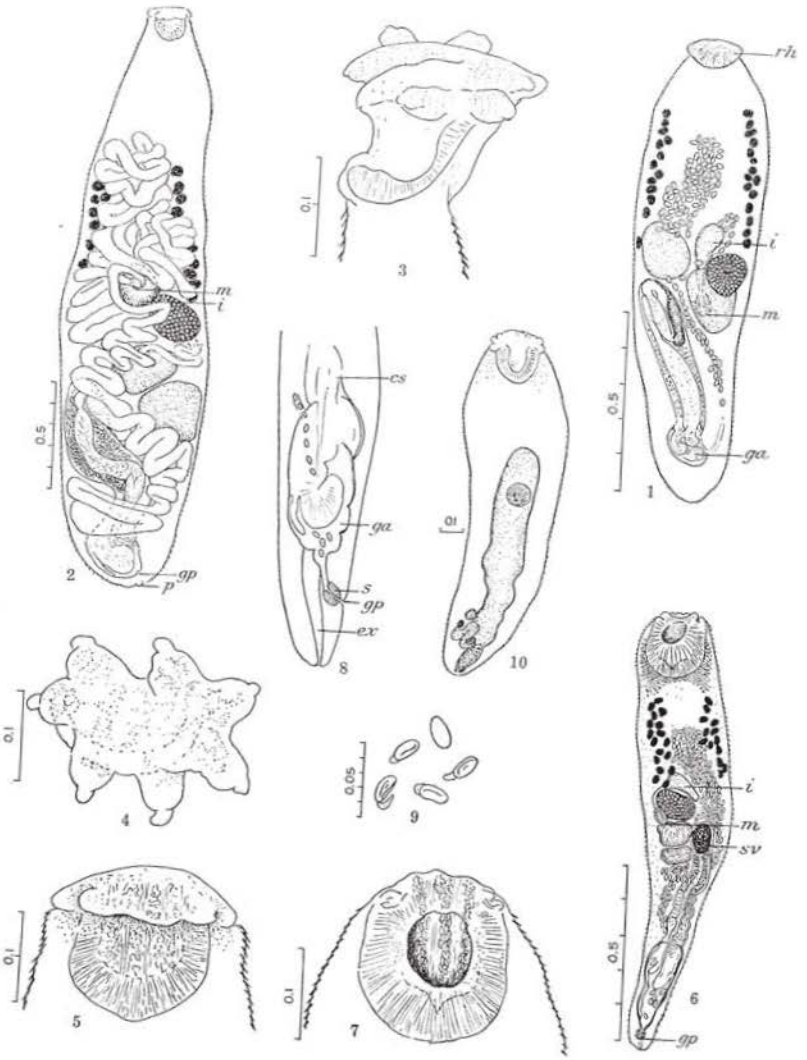
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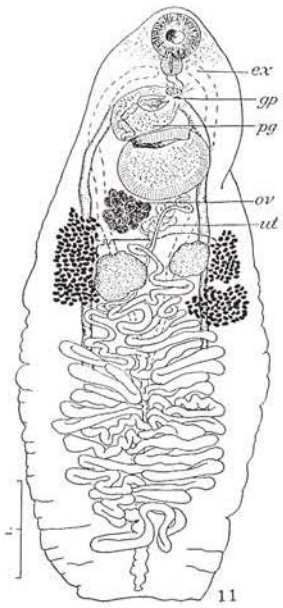
PLATE 2

FIG. 11—*Steringophorus magnus* from unidentified, eel-like fish.
FIG. 12—Eggs of *S. magnus*.
FIG. 13—*Steringophorus profundus* from *Argentina striata*. Ventral view.
FIG. 14—*Megenteron crassum* from Anacanthid. Ventral view.
FIG. 15—*M. crassum*. Sagittal section through the genital pore and a portion of the cirrus sac.
FIG. 16—Eggs of *M. crassum*.



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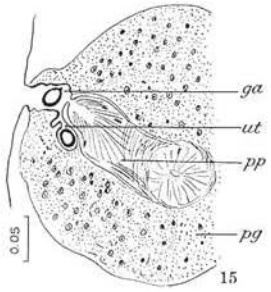

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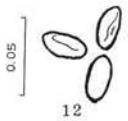

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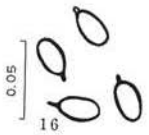

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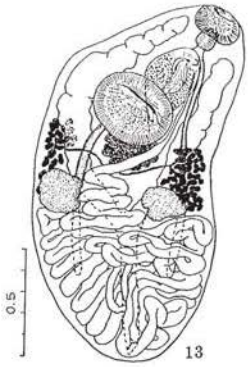

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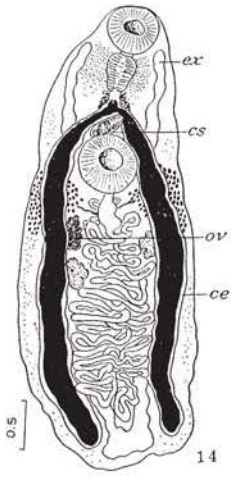
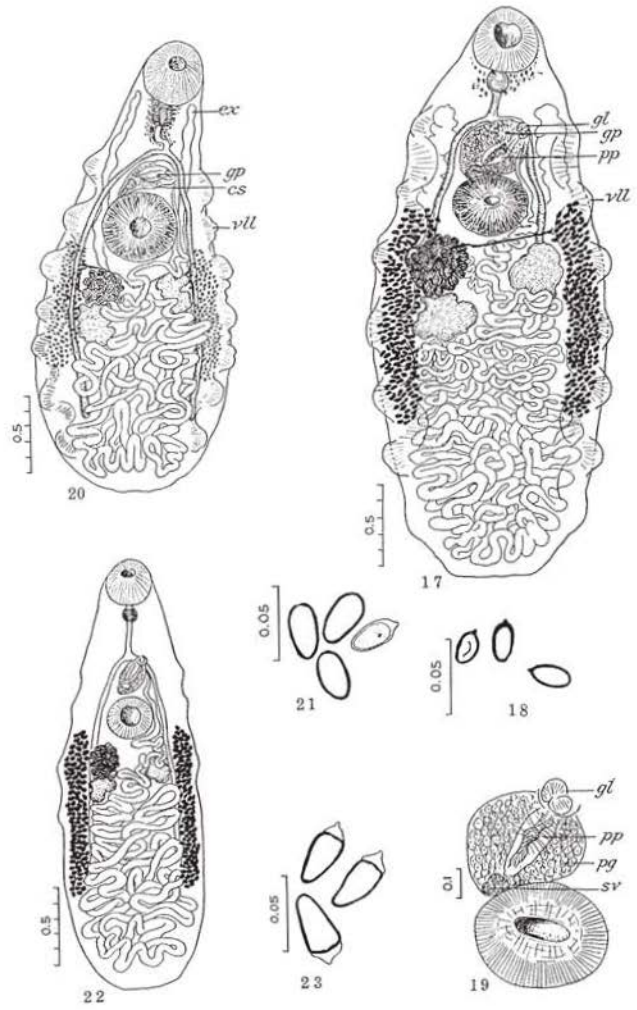


14

PLATE 3

FIG. 17—*Lomaphorus wardi* from *Carlorhynchus carminatus*. Ventral view.
FIG. 18—Eggs of *L. wardi*.
FIG. 19—*L. wardi*. Ventral view of the cirrus sac and the ventral sucker.
FIG. 20—*Lomaphorus monolenei* from *Monolene antillarum*. Ventral view.
FIG. 21—Eggs of *L. monolenei*.
FIG. 22—*Lomaphorus gracilis* from *Peristedion miniatum*. Ventral view.
FIG. 23—Eggs of *L. gracilis*.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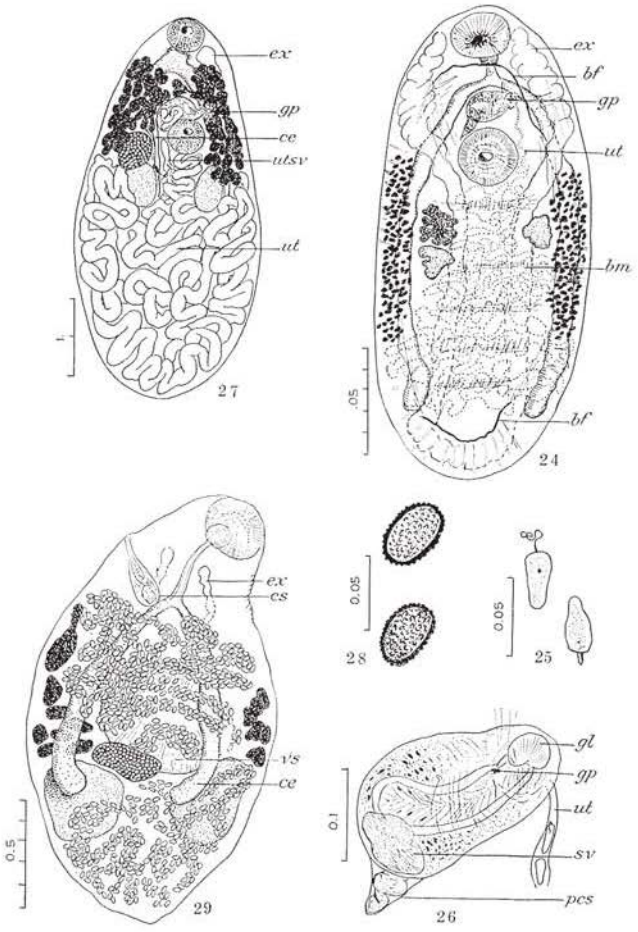
19

PLATE 4

FIG. 24—*Lissoloma brotulæ* from *Brotula barbata*. Ventral view.
FIG. 25—Eggs of *L. brotulæ*.
FIG. 26—Ventral view of cirrus sac of *L. brotulæ*.
FIG. 27—*Benthotrema plenum* from unidentified fish. Ventral view.
FIG. 28—Eggs of *B. plenum*.
FIG. 29—*Deretrema fusillus* from *Upeneus parvus*. Dorsal view.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ut
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pcs
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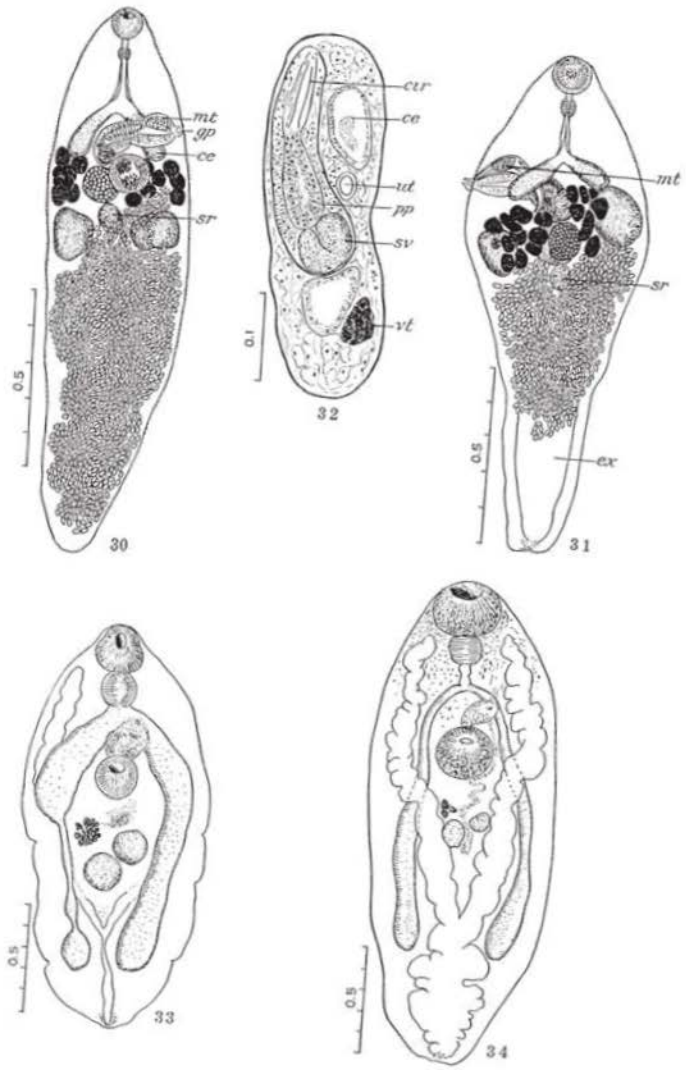
26

PLATE 5

FIG. 30—*Brachyenteron peristedioni* from *Peristedion platycephalum*. Ventral view.
FIG. 31—*B. peristedioni*. Dorsal view.
FIG. 32—*B. peristedioni*. Cross-section through the body at the level of the cirrus sac.
FIG. 33—*Steringophorus (?)* sp. from unidentified host. Ventral view.
FIG. 34—*Steringophorus (?)* sp. from *Alepocomus* sp. Ventral view.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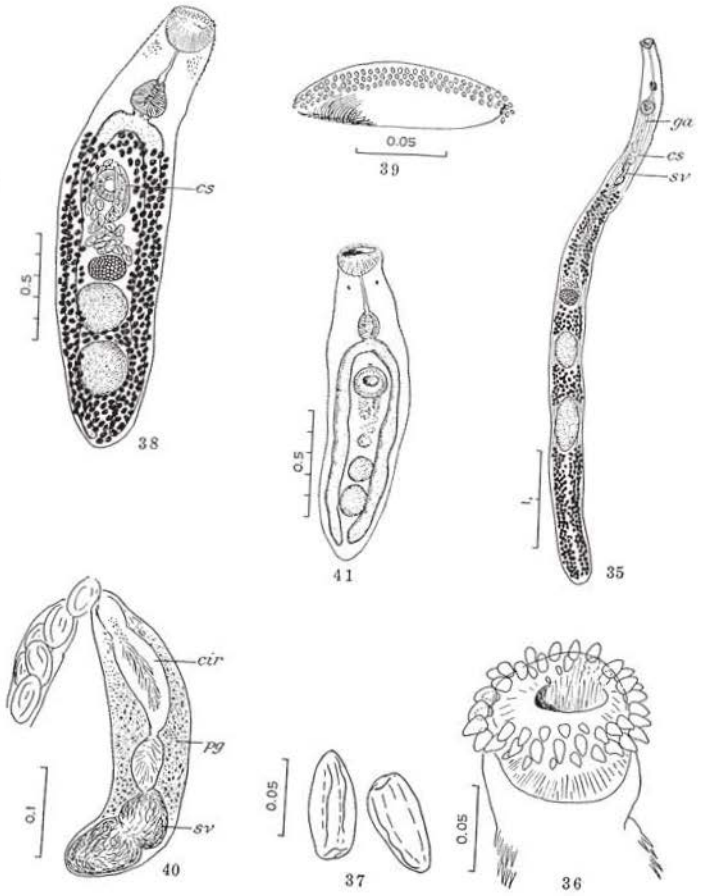
34

PLATE 6

FIG. 35—*Stephanostomum lineatum* from *Urophycis regius*. Ventral view.
FIG. 36—*S. lineatum*. Ventral view of anterior end.
FIG. 37—Eggs of *S. lineatum*.
FIG. 38—*Stephanostomum microstephanum* from *Epinephelus niveatus*. Ventral view.
FIG. 39—*S. microstephanum*. Ventral view of tip of the oral sucker showing oral spines of dorsal side.
FIG. 40—*S. microstephanum*. Ventral view of cirrus sac and metraterm.
FIG. 41—Young specimen of *S. microstephanum*. Ventral view.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36

PLATE 7

FIG. 42—*Cymbephallus vulgaris* from *Bembrops gobioides*. Ventral view.
FIG. 43—*C. vulgaris* from Macrouridæ. Ventral view of a young specimen.
FIG. 44—*C. vulgaris* from *Peristedion imberbe*. Ventral view.
FIG. 45—*C. vulgaris*. Ventral view of a portion of the hindbody showing variation in shape of the testes.
FIG. 46—*C. vulgaris*. Diagram to show structure of the terminal genital ducts.
FIG. 47—*C. vulgaris*. Portion of a cross-section through the pars prostatica and uterus.
FIG. 48—*Cymbephallus fimbriatus* from Macrouridæ. Ventral view.

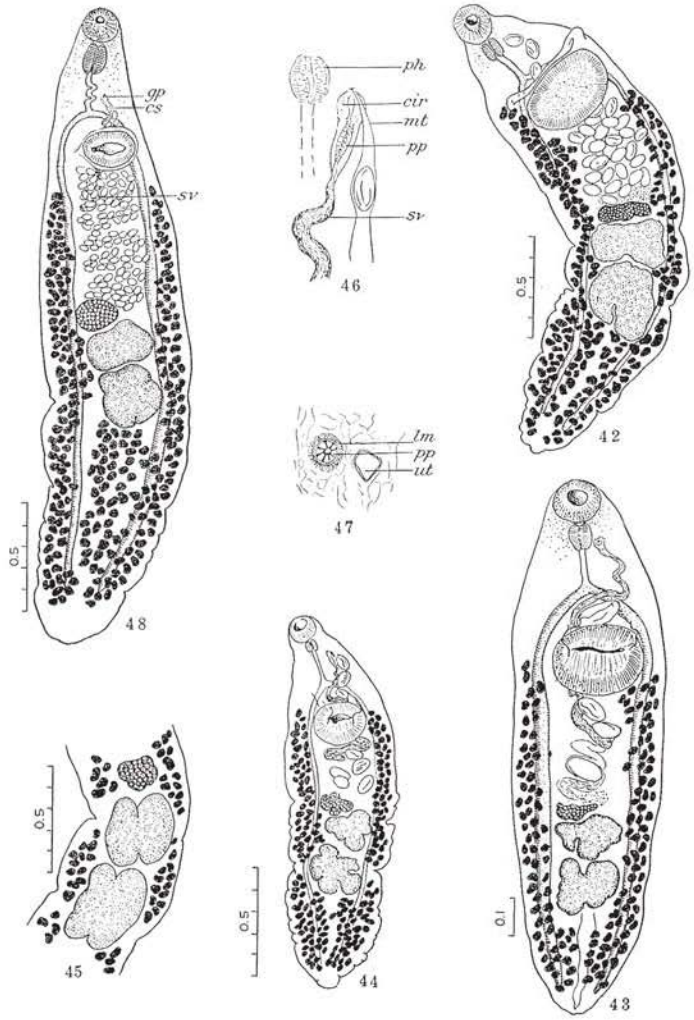
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PLATE 8

FIG. 49—*Lepidapedon rachion* from *Coelorhynchus carminatus*. Ventral view.
FIG. 50—*Lepidapedon elongatum* from *Coelorhynchus carminatus*. Ventral view.
FIG. 51—*Lepidapedon nicolli* from *Epinephelus niveatus*. Ventral view.
FIG. 52—*L. nicolli*. Ventral view of the genital ducts and ventral sucker.
FIG. 53—Metacercaria, probably of *L. nicolli* from *Upeneus parvus*. Ventral view.
FIG. 54—*Lepidapedon lebouri* from Macrouridae. Ventral view.

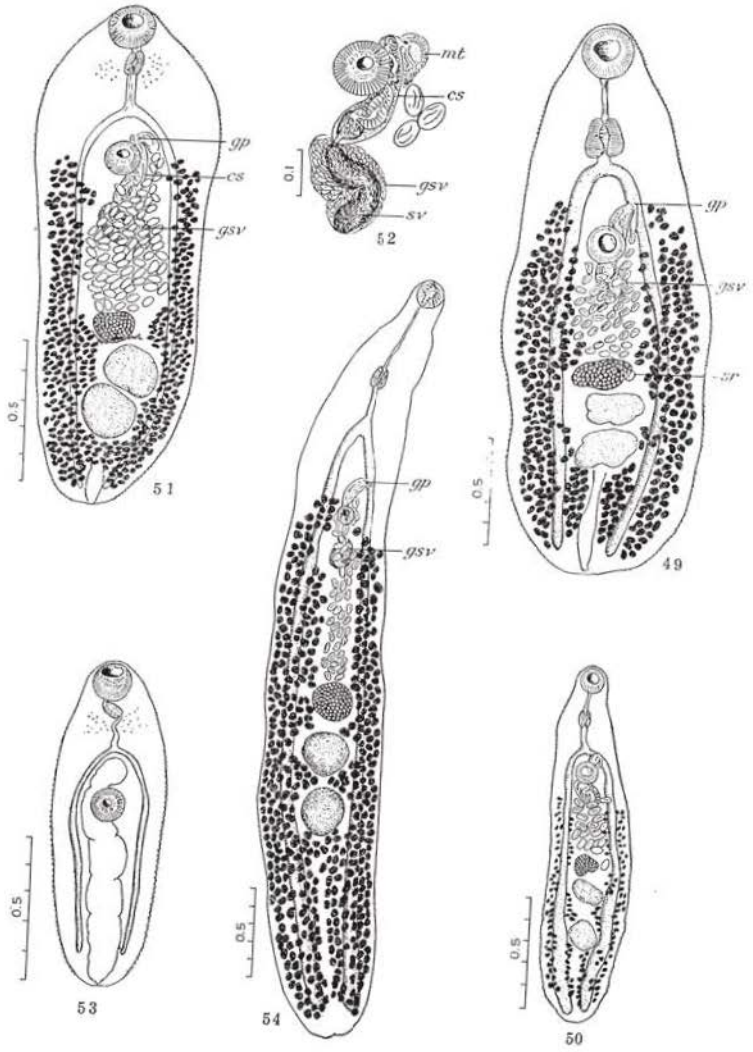
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PLATE 9

FIG. 55—*Opecœlina scorpænæ* from *Scorpæna cristulata*. Dorsal view. The anterior testis is degenerate.
FIG. 56—*O. scorpænæ*. Dorsal view the posterior testis is degenerate.
FIG. 57—*O. scorpænæ*. Ventral view.
FIG. 58—*O. scorpænæ*. Dorsal view of the posterior end showing relationship of excretory pore and anus.
FIG. 59—*Opecœlina helicolenæ* from *Helicolenus dactylopterus*. Ventral view.
FIG. 60—*O. helicolenæ*. Dorsal view of terminal male ducts.
FIG. 61—*Podocotyle pearsei* from *Urophycis chesteri*. Ventral view.

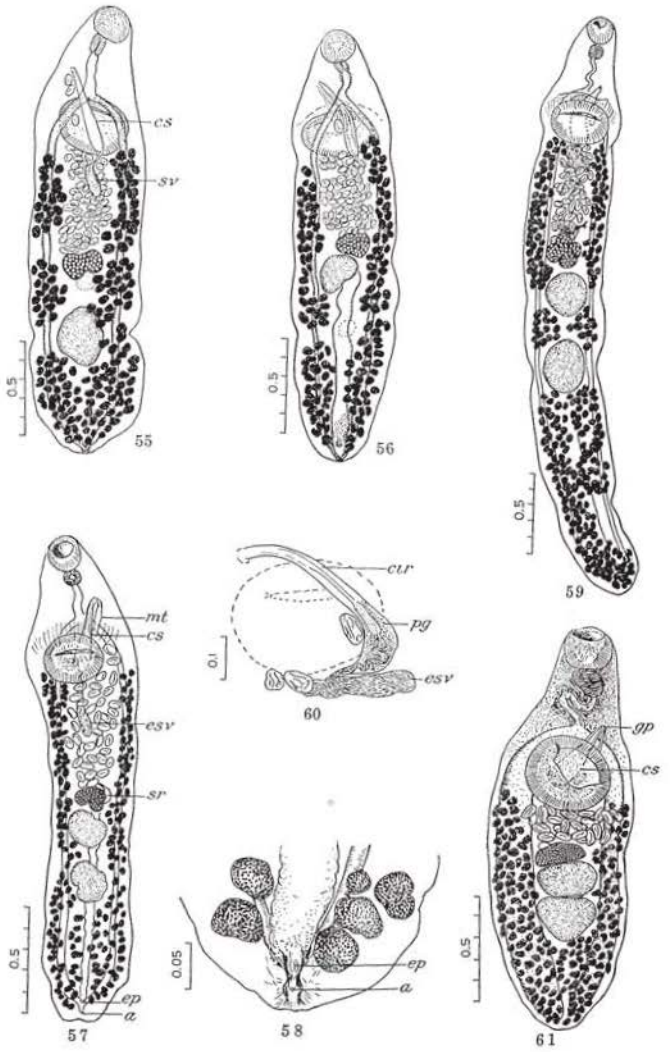
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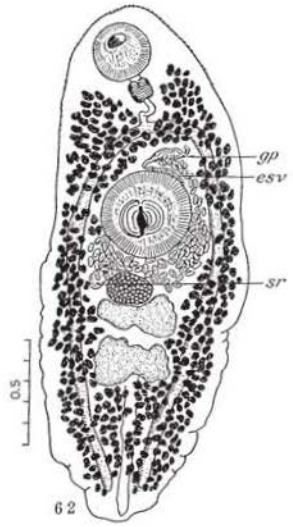
PLATE 10

FIG. 62—*Myzoxenus vitellosus* from *Decodon puellaris*. Ventral view.
FIG. 63—*Myzoxenus vitellosus*. Ventral view of terminal genital ducts.
FIG. 64—*Eurycreadium vitellosum* from *Lamonema barbatulum*. Ventral view.
FIG. 65—*Siphoderina brotulæ* from *Brotula barbata*. Ventral view.
FIG. 66—*S. brotulæ*. Enlarged view of the region of the ventral sucker. Ventral view.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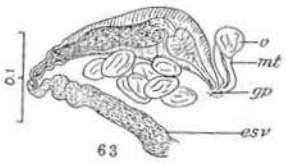
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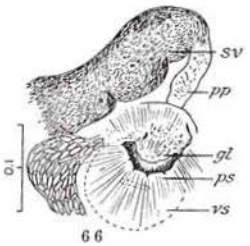
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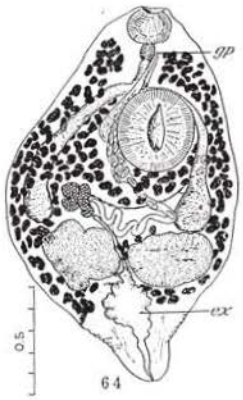
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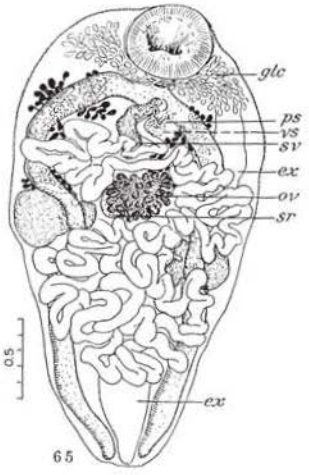
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