

**CHAPTER X**  
**PARASITIC WORMS**



## PARASITIC HELMINTHS

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The helminth parasites of the Gulf of Mexico, with the exception of the trematodes, have been studied very little. The bulk of the collecting done so far has been at the former Biological Laboratory of the Carnegie Institution at Dry Tortugas, Florida, at the eastern side of the Gulf. A few desultory investigations or reports of one or a few species have been made at other points on the United States coast and from the north coast of Cuba, but with the exception of one new species of trematode reported from a manatee no studies have yet been made along the extensive Mexican coast where many new helminths will probably be found, particularly in the non-migratory fishes of the shallower waters and bays. Practically all the work done so far has been taxonomic and morphological, dealing either with adult or larval forms. Of more than 200 species of trematodes from Gulf animals only 3 life cycles have been studied, and the life cycles of none of the cestodes, acanthocephalans, or nematodes have been studied at all.

The only parasitic helminths of Gulf animals that have thus far been studied comprehensively are the trematodes of oceanic fishes and these only at Dry Tortugas where the pioneer work was done by Linton (1907-10) followed by an extensive study by Manter from 1930-49. Linton also did some pioneer work on the other parasitic helminths of Dry Tortugas, but this work has not been followed up as has the work on the trematodes. It was observed by Linton, however, that Acanthocephala and Nematoda, both in adult and larval stages, are relatively scanty in fishes of Dry Tortugas and in fishes of other southern regions (Bermuda and North Carolina) as compared with their occurrence in fishes at Woods Hole, Massachusetts. Larval cestodes, also, were relatively scanty except adult Tetracystidae and Trypanorhyncha in selachians which compared favorably with the numbers found in the Woods Hole, Massachusetts, area.

Chandler (1935a), in a study of 23 species of fish from various parts of Galveston Bay, pointed out a great excess of immature over adult stages of parasites, 15 of 25 of the species identified being larval or immature stages; a scarcity of flukes and adult tapeworms (no elasmobranchs were included in the study); a predominance of Acanthocephala as common adult parasites; and very marked differences in the helminth fauna in local areas, even in the very limited region included in the study. These differences are probably associated with the local distribution of definitive hosts in the case of immature species and of intermediate hosts in the case of adult species. Of 10 species of adults and 15 of immature species, 9 of the former and 11 of the latter were previously undescribed species. This is in contrast to the findings of Manter in oceanic species of fish from Dry Tortugas and suggests, as remarked above, that many new species of fish helminths will be found when the parasites of nonmigratory species of the shores and bays of the western and southern sides of the Gulf are studied.

In preliminary studies on marine fishes from Corpus Christi Bay, Tex., Aaron Seamster (1950) reported in a personal communication that of 30 fish examined, belonging to 16 species, parasites were found in 27. The heaviest load was in the yellow-tail, *Bairdiella chrysura*. However, only 1 specimen, *Menticirrhus americanus*, was infested with an acanthocephalan, *Illiosentis furcatus*, and only 1 specimen, *Synodus foetens*, with a nematode. A few cestode infections were reported.

In addition to the trematodes, cestodes, acanthocephalans, and nematodes considered in the following sections a few other parasitic or semi-parasitic helminths have been reported from the Gulf. Several polyclad turbellarians are associated with particular marine organisms on which they are predatory in a semi-parasitic fashion. *Stylochus frontalis* is common in Gulf

oysters. Other species are *Stylochus ellipticus* commonly attacking barnacles, and *Hoploplana inquilina*, attacking the oyster drill (*Thais floridana*). *Hoploplana inquilina* was studied at Barataria Bay, Louisiana, by Schechter (1943), and the others were reported from Apalachicola Bay, Florida, by Pearse and Wharton (1938).

Another helminth recorded from the Gulf is a nemertean, *Carcinonemertes carcinophila* (Kolliker 1845) Coe, 1902, a variety of which, *C. c. imminuta*, was found living on the egg masses of *Callinectes sapidus*, blue crab, at Grand Isle, Louisiana.

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NOTE.—Bibliography follows chapter on Nematoda, p. 358.

# TREMATODA OF THE GULF OF MEXICO

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Trematodes of the Gulf of Mexico have been studied chiefly at the former Biological Laboratory of the Carnegie Institution at Dry Tortugas, Florida. The rich fauna there of fishes, mollusks, and Crustacea would suggest a great variety and abundance of these parasites, and such has been proved to be the case. Early in the history of the Laboratory, Linton (1910) and Pratt (1910-16) described species of trematodes from Tortugas. Linton's work in particular indicated the unusual variety of trematode species occurring within fishes there. Later, Miller (1925-29) studied larval stages (cercariae) of trematodes from mollusks; McCoy (1929, 1930) studied the life cycles of two species; and the author (Manter, 1930-49) made extensive taxonomic studies of his collections at Tortugas during 1930-32. As a result, the trematodes of fishes, both surface water species and species down to a depth of about 500 fathoms, are relatively well known. Little study has been made of these parasites elsewhere in the Gulf. Viguera (1935, 1940) has reported a few species from Cuba; while Chandler (1935), Von Wicklen (1946), and Read (1947) described several species from Galveston Bay. Faust and Tang (1936) described one species from Biloxi Bay, Mississippi.

I am indebted to Dr. Luis R. Rivas for checking and correcting the scientific names of the fish hosts and also for suggestions for the common names of these fishes.

## MONOGENEA

The following species of Monogenea have been reported from the gills of fishes at Key West or Tortugas:

1. *Cyclocotyla neomaenis* (MacCallum, 1917) Price, 1943.  
Host: *Lutjanus analis*, Gray snapper.  
Reported by MacCallum (1917).
2. *Cyclocotyla hysteroncha* Fujii, 1944.  
Hosts: *Bathystoma striatum*; *Brachygenys chrysargyreus*; *Haemulon flavolineatum*, French grunt.  
Reported by Fujii (1944).

3. *Hexastoma macracanthum* Fujii, 1944.  
Host: *Euthynnus alleteratus*, Little tuna.  
Reported by Fujii (1944).
4. *Heterocotyle floridana* (Pratt, 1910) Price, 1938.  
Host: *Aetobatus freminvillii*, Stingaree.  
Reported by Pratt (1910).
5. *Udonella caligorum* Johnston, 1835.  
Host: On a copepod on gills of *Lutjanus griseus*, Gray snapper.  
Reported by Linton (1910).
6. *Protomicrocotyle mirabile* (MacCallum, 1918) Johnston and Tiegs, 1922.  
Host: *Caranx latus*, Horse-eye jack.  
New record. MacCallum described the species from *Caranx hippos*, Jack crevalle, from the New York Aquarium.

The following four species have been reported from other parts of the Gulf region:

7. *Capsala poeyi* (Viguera, 1935) Price, 1938.  
Host: Skin of *Makaira ampla*, Blue marlin, from Havana, Cuba.  
Reported by Viguera (1935).
8. *Encotyllabe monticelli* Viguera, 1940.  
Host: *Calamus bajonado*, Jolt-head porgy, from north coast of Cuba.  
Reported by Viguera (1940).
9. *Entobdella squamula* (Heath, 1902) Johnston, 1929.  
Host: Undetermined fish "presumably from Gulf of Mexico."  
Reported by Price (1939).
10. *Neoheterobothrium affine* (Linton, 1898) Price, 1939.  
Host: *Paralichthys* sp., Flounder, from Grand Isle, La.  
Reported by Melugin (1940). This species is known from two species of *Paralichthys* at Woods Hole, Mass.

This small number of species of Monogenea reported does not mean they are uncommon parasites, but rather that they have not been collected and studied. I have a number of species still incompletely studied collected from fishes at Tortugas. Most of them are undescribed species.

## ASPIDOGASTREA

1. *Lobatostoma ringens* (Linton, 1907) Eckmann, 1932.  
Hosts: *Calamus calamus*, Saucer-eye porgy;  
*Calamus bajonado*, Jolt-head porgy.  
Reported by Linton (1910).
2. *Stichocotyle cristata* Faust and Tang, 1936.  
Host: *Rhinoptera bonasus*, Cow-nosed ray  
from Biloxi Bay, Miss.  
Reported by Faust and Tang (1936).

A large aspidogastrid, *Lophotaspsis vallei*, occurs in the loggerhead turtle, *Caretta caretta*. It will be discussed with the trematodes of turtles.

## DIGENEA

Approximately 200 species of digenetic trematodes are known from fishes of the Gulf of Mexico, mostly from its eastern region. Linton (1910) reported 53 species from fishes at Tortugas. All except one of these were also collected by the author. Manter (1947, 1949) lists 190 species of digenetic trematodes, including 1 species of aspidogastrid, from the fishes at Tortugas. This number is relatively large compared with the number known from marine fishes of New England, Great Britain, or the Mediterranean, although Yamaguti has reported a larger number from Japanese fishes. The richness of the trematode fauna of the Gulf of Mexico is associated with the great variety of fishes, mollusks, and Crustacea in that region. These four groups are ecologically associated in that trematodes require a molluscan host for their larvae and frequently use Crustacea as second intermediate hosts. Thus, trematode parasites constitute a very common and widespread element in the ecological picture of a region such as Tortugas.

Apparently only 13 other records of trematodes from Gulf of Mexico fishes have been published (Chandler, 1935, 1941; Melugin, 1940; Vigueras, 1940, 1940a, 1940b; Von Wicklen, 1946; Read, 1947). Of these species, four are known at Tortugas. In the list following, the record is from Tortugas or Key West unless otherwise noted.

## GASTEROSTOMATA

## Family BUCEPHALIDAE

1. *Bucephalopsis longicirrus* Nagaty, 1937; synonym: *Bucephalopsis arcuatus* (Linton, 1900) Eckmann, 1932. New synonymy.  
Also known from Red Sea.  
Host: *Sphyaena barracuda*, Barracuda.

2. *Bucephalopsis "bennetti"* Melugin, 1940.  
Host: *Paralichthys lethostigma*, Flounder.  
Reported by Melugin (1940) from Grand Isle, Louisiana. The name "bennetti" was printed in this abstract by Melugin, but the trematode was not described, hence the name is a *nomen nudum*.
3. *Bucephalopsis longoviferus* Manter, 1940.  
Host: *Sphyaena barracuda*, Barracuda.
4. *Bucephalus kathetostomae* (Manter, 1934) Manter, 1940.  
Host: *Kathetostoma albigutta*, Stargazer.
5. *Bucephalus priacanthi* Manter, 1940.  
Host: *Priacanthus arenatus*, Glass-eyed snapper.
6. *Bucephalus scorpaenae* Manter, 1940.  
Host: *Scorpaena plumieri*, Scorpion fish.
7. *Bucephalus varicus* Manter, 1940.  
Hosts: *Caranx bartholomaei*, Yellow jack; *latus*, jack; *C. ruber*, Runner.
8. *Dollfustrema gravidum* Manter, 1940.  
Host: *Gymnothorax moringa*, Moray.
9. *Proisorhynchus atlanticus* Manter, 1940.  
Hosts: *Mycteroperca microlepis*, Gag; *M. teroperca venosa*, Yellow-fin grouper.
10. *Proisorhynchus ozakii* Manter, 1934.  
Host: *Epinephelus niveatus*, Snowy grouper
11. *Proisorhynchus promicropsi* (Linton, 1905) Eckmann, 1932. Host: *Promicrops itaiara*, Jewfish
12. *Rhipidocotyle angusticollis* Chandler, 1941.  
Host: *Sarda sarda*, Bonito.  
Reported from the Texas coast near Freeport by Chandler (1941).
13. *Rhipidocotyle adbaculum* Manter, 1940.  
Host: *Scomberomorus regalis*, Cero.
14. *Rhipidocotyle baculum* (Linton, 1905) Eckmann, 1932.
15. *Rhipidocotyle barracudae* Manter, 1940.  
Host: *Sphyaena barracuda*, Barracuda.
16. *Rhipidocotyle longleyi* Manter, 1934.  
Host: *Synagrops bellus*.
17. *Rhipidocotyle nagatyi* Manter, 1940.  
Host: *Euthynnus alletteratus*, Little tuna.
18. *Rhipidocotyle transversale* Chandler, 1935.  
Host: *Menidia menidia*, Silverside.  
Reported from Galveston Bay, Texas, by Chandler (1935).

## PROSOSTOMATA

## Family PARAMPHISTOMATIDAE

19. *Cleptodiscus reticulatus* Linton, 1910.  
Host: *Pomacanthus arcuatus*, Black angelfish

20. *Macrorchitrema havanensis* Vigueras, 1940.  
Host: *Holacanthus tricolor*, Rock beauty.  
Reported from north coast of Cuba by  
Vigueras (1940).
- Family PRONOCEPHALIDAE**
21. *Pleurogonius candibulus* (Linton, 1910) Ruiz,  
1946.  
Hosts: *Angelichthys ciliaris*, Queen angelfish;  
*Pomacanthus arcuatus*, Black angelfish.
22. *Barisomum erubescens* Linton, 1910.  
Hosts: *Angelichthys ciliaris*, Queen angelfish;  
*A. isabelita*, Angelfish; *Pomacanthus arcu-*  
*atus*, Black angelfish; *Scarus croicensis*,  
Parrotfish.
- Family MEGASOLENIDAE**
23. *Hapladena varia* Linton, 1910.  
Hosts: *Acanthus coeruleus*, Blue tang; *A.*  
*hepatus*, Doctorfish.
24. *Hapladena ovalis* (Linton, 1910) Manter, 1947.  
Hosts: *Sparisoma pachycephalum*, Parrotfish;  
*Pseudoscarus coelestinus*, Parrotfish.
25. *Hapladena leptotelea* Manter, 1947.  
Host: *Pomacanthus arcuatus*, Black angelfish.
26. *Megasolena estrix* Linton, 1910.  
Hosts: *Kyphosus incisor*, Yellow chub; *K.*  
*sectatrix*, Bermuda chub.
- Family OPISTHOLEBETIDAE**
27. *Opistholebes adcotylophorus* Manter, 1947.  
Host: *Diodon holacanthus*, Balloonfish.
- Family LEPOCREADIIDAE**
28. *Lepocreadium trulla* (Linton, 1907) Linton, 1910.  
Host: *Ocyurus chrysurus*, Yellowtail.
29. *Lepocreadium bimarimum* Manter, 1940.  
Host: *Lachnolaimus maximus*, Hogfish.
30. *Pseudocreadium anandrum* Manter, 1947.  
Host: *Calamus calamus*, Saucer-eye porgy.
31. *Dermadena lactophrysi* Manter, 1946.  
Hosts: *Lactophrys tricornis*, Cowfish; *L.*  
*trigonus*, Trunkfish; *L. triqueter*, Trunkfish.
32. *Opechona gracilis* (Linton, 1910) Manter, 1947.  
Host: *Harengula clupeiola*, Pilchard.
33. *Apocreadium balistis* Manter, 1947.  
Host: *Balistes vetula*, Queen triggerfish.
34. *Homalometron elongatum* Manter, 1947.  
Host: *Gerres cinereum*, Broad shad.
35. *Crassicutis marina* Manter, 1947.  
Hosts: *Eucinostomus lefroyi*, Mojarra; *Gerres*  
*cinereus*, Broad shad.
36. *Postporus epinepheli* (Manter, 1947) Manter,  
1949.  
Host: *Epinephelus morio*, Red grouper.
37. *Postporus mycteropercae* (Manter, 1947) Manter,  
1949.  
Host: *Mycteroperca venenosa*, Yellow-fin  
grouper.
38. *Lepidapedon levenseni* (Linton, 1907) Manter,  
1947.  
Host: *Epinephelus morio*, Red grouper.
39. *Lepidapedon elongatum* (Bebour, 1908) Nicoll,  
1915.  
Hosts: *Coelorrhynchus carminatus*, Grenadier;  
*Epigonus occidentalis*; *Laemonema bar-*  
*batulum*; *Urophycis chesteri*.
40. *Lepidapedon lebouri* Manter, 1934.  
Host: Unidentified *Macrouridae*.
41. *Lepidapedon nicolli* Manter, 1934.  
Host: *Epinephelus niveatus*, Snowy grouper.
42. *Lepidapedon racion* (Cobbold, 1858) Stafford,  
1904.  
Host: *Coelorrhynchus carminatus*, Grenadier.
43. *Myzoxenus lachnolaimi* Manter, 1947.  
Host: *Lachnolaimus maximus*, Hogfish.
44. *Myzoxenus vitellosus* Manter, 1934.  
Hosts: *Calamus calamus*, Saucer-eye porgy;  
*Decodon puellaris*, Cuban hogfish.
45. *Bianium plicatum* (Linton, 1928) Stunkard,  
1931.  
Hosts: *Sphoeroides spengleri*, Southern puf-  
fer; *Sphoeroides* sp., Puffer; *Monacanthus*  
*hispidus*, Filefish.
46. *Multitestis chaetodoni* Manter, 1947.  
Hosts: *Chaetodon ocellatus*, Butterfly fish;  
*C. capistratus*, Butterfly fish.
47. *Rhagorthis odhneri* Manter, 1931.  
Hosts: *Alutera schoepfi*, Orange filefish;  
*Monacanthus ciliatus*, Fringed filefish.
48. *Enenterum aureum* Linton, 1910.  
Hosts: *Kyphosus sectatrix*, Bermuda chub;  
*K. incisor*, Yellow chub.
49. *Cadenatella americana* Manter, 1949.  
Host: *Kyphosus incisor*, Yellow chub.
- Family OPECOELIDAE**
50. *Opegaster synodi* Manter, 1947.  
Host: *Synodus foetens*, Lizardfish.
51. *Opecoeloides brachyteleus* Manter, 1947.  
Host: *Upeneus martinicus*, Yellow goatfish.
52. *Opecoeloides elongatus* Manter, 1947.  
Host: *Upeneus maculatus*, Red goatfish.
53. *Opecoeloides polyfimbriatus* Read, 1947.  
Host: *Synodus foetens*, Lizardfish.  
Reported from Galveston Bay, Texas, by  
Read (1947).

54. *Opecoeloides polynemi* Von Wicklen, 1946.  
Host: *Polynemus octonemus*, Thread-fin fish.  
Reported from Galveston Bay by Von Wicklen (1946).
55. *Pseudopecoeloides gracilis* Manter, 1947.  
Host: *Trachuroops crumenophthalma*, Goggle-eye jack.
56. *Pseudopecoeloides equesi* Manter, 1947.  
Hosts: *Eques lanceolatus*, Ribbonfish; *E. acuminatus*, Ribbonfish.
57. *Pseudopecoeloides carangis* (Yamaguti, 1938) Yamaguti, 1940.  
Hosts: *Caranx bartholomaei*, Yellow jack; *C. ruber*, Runner.
58. *Pseudopecoelus priacanthi* (MacCallum, 1921) Manter, 1947.  
Hosts: *Priacanthus arenatus*, Glass-eye snapper; *P. cruentatus*, Big-eye.
59. *Pseudopecoelus tortugae* von Wicklen, 1946.  
Host: *Coelorhynchus carminatus*, Grenadier.
60. *Pseudopecoelus vulgaris* (Manter, 1947) von Wicklen, 1946.  
Hosts: 16 species of fishes collected from depths of 50 to 315 fathoms (see Manter, 1934, p. 293).
61. *Neopecoelus scorpaenae* Manter, 1947.  
Hosts: *Scorpaena grandicornis*, Scorpion fish; *S. brasiliensis*.
62. *Neopecoelus holocentri* Manter, 1947.  
Host: *Holocentrus coruscus*, Squirrelfish.
63. *Genitocotyle atlantica* Manter, 1947.  
Hosts: *Carapus affinis*, Pearlfish; *Haemulon flavolineatum*, French grunt; *Malacoctenus macropus*, Blenny; *Opisthognathus* sp., Jawfish; *Syngnathus robertsi*, Pipefish.
64. *Opecoelina helicoleni* Manter, 1934.  
Host: *Helicolenus maderensis*.
65. *Opecoelina scorpaenae* Manter, 1934.  
Host: *Scorpaena cristulata*, Scorpion fish.
- Subfamily Plagioporinae**
66. *Plagioporus crassigulus* (Linton, 1910) Price, 1934.  
Hosts: *Calamus bajonada*, Jolt-head porgy; *C. calamus*, Saucer-eye porgy; *Decodon puellaris*, Cuban hogfish; *Diplodus holbrookii*, Spot-tail pinfish.
67. *Hamacreadium consuetum* Linton, 1910.  
Host: *Haemulon plumieri*, White grunt.
68. *Hamacreadium gulella* Linton, 1910.  
Hosts: *Lutjanus analis*, Muttonfish; *L. griseus*, Gray snapper.
69. *Hamacreadium mutabile* Linton, 1910.  
Hosts: *Lutjanus analis*, Muttonfish; *L. apodus*, Schoolmaster; *L. griseus*, Gray snapper; *L. jocu*, Dog snapper; *L. synagris*, Lane snapper; *Anisotremus virginicus*, Porkfish; *Ocyurus chrysurus*, Yellowtail.
70. *Hamacreadium oscitans* Linton, 1910.  
Hosts: *Anisotremus virginicus*, Porkfish; *Brachygenys chrysargyreus*, Bronze grunt; *Haemulon carbonarium*, Caesar grunt; *H. plumieri*, White grunt; *H. sciurus*, Yellow grunt.
71. *Helicometra execta* Linton, 1910.  
Hosts: *Doratonotus megalepis*; *Eques acuminatus*, Ribbonfish; *Haemulon plumieri*, White grunt; *H. sciurus*, Yellow grunt; *Halichoeres bivittatus*, Slippery dick; *H. poeyi*; *H. radiatus*; *Labrisomus bucciferus*; *L. haitensis*; *Lachnolaimus maximus*, Hogfish; *Mycteroperca venenosa*, Yellow-fin grouper; *Thalassoma bifasciatum*, Slippery dick.
72. *Helicometra fasciata* (Rud., 1819) Odhner, 1902.  
Hosts: *Prionotus alatus*, Sea robin; *Prionodes* sp.; *Bellator militaris*.
73. *Helicometra torta* Linton, 1910.  
Hosts: *Epinephelus morio*, Red grouper; *E. striatus*, Nassau grouper.
74. *Stenopera equilata* Manter, 1933.  
Host: *Holocentrus ascensionis*, Squirrelfish.
75. *Helicometrina nimia* Linton, 1910.  
Hosts: 14 species of fishes including cardinal fish, porgies, snappers, and scorpion fishes.
76. *Helicometrina parva* Manter, 1933.  
Host: *Halichoeres bivittatus*, Slippery dick.
77. *Podocotyle pearsei* Manter, 1934.  
Host: *Urophycis chesteri*.
78. *Eurycreadium vitellosum* Manter, 1934.  
Host: *Laemonema barbatulum*.
- Subfamily Horatrematinae**
79. *Horatrema crassum* Manter, 1947.  
Hosts: *Odontoscion dentex*, Corvina; *Eques acuminatus*, Ribbonfish; *E. lanceolatus*, Ribbonfish; *Haemulon carbonarium*, Caesar grunt.
- Subfamily Notoporinae**
80. *Neonotoporus yamagutii* Manter, 1947.  
Host: *Trachuroops crumenophthalmus*, Goggle-eye.
- Family ACANTHOCOLPIDAE**
81. *Monorchistephanostomum gracile* Vigueras, 1942.  
Host: *Sphyaena barracuda*, Barracuda.  
Reported from north coast of Cuba by Vigueras (1942).



82. *Stephanostomum* sp.  
Host: *Galeichthys felis*, Sea catfish.  
Recorded by Melugin (1940) from Grand Isle, La.
83. *Stephanostomum casum* (Linton, 1910) MacFarlane, 1936.  
Hosts: *Ocyurus chrysurus*, Yellowtail; *Lutjanus analis*, Muttonfish; *Lutjanus griseus*, Gray snapper.
84. *Stephanostomum lineatum* Manter, 1934.  
Hosts: *Laemonema barbatulum*; *Phycis cirratus*; *Urophycis regius*.
85. *Stephanostomum microstephanum* Manter, 1934.  
Host: *Epinephelus niveatus*, Snowy grouper.
86. *Stephanostomum megacephalum* Manter, 1940.  
Host: *Caranx latus*, Horse-eye jack.
87. *Stephanostomum promicropsi* Manter, 1947.  
Host: *Promicrops itaiara*, Jewfish.
88. *Stephanostomum sentum* (Linton, 1910) Manter, 1947.  
Hosts: *Calamus bajonado*, Jolt-head porgy; *C. calamus*, Saucer-eye porgy; *Haemulon sciurus*, Yellow grunt; *H. plumieri*, White grunt.
89. *Stephanostomum coryphaenae* Manter, 1947.  
Host: *Coryphaena hippurus*, Dolphin.
90. *Stephanostomum dentatum* (Linton, 1900) Manter, 1931.  
Hosts: *Epinephelus adsencionis*, Rock hind; *E. morio*, Red grouper; *Mycteroperca venenosa*, Yellow-fin grouper.
91. *Stephanostomum ditrematis* (Yamaguti, 1939) Manter, 1947.  
Hosts: *Caranx latus*, Horse-eye jack; *C. ruber*, Runner.
- Family ZOOGONIDAE**
92. *Steganoderma parexocoeti* Manter, 1947.  
Host: *Parexocoetus mesogaster*, Flying fish.
93. *Steganoderma hemiramphi* Manter, 1947.  
Host: *Hemiramphus brasiliensis*, Halfbeak.
94. *Steganoderma elongatum* Manter, 1947.  
Host: *Strongylura timucu*, Houndfish.
95. *Diptherostomum americanum* Manter, 1947.  
Host: *Brachygenys chrysargyreus*, Bronze grunt.
96. *Deretrema fusillum* Linton, 1910.  
Hosts: *Abudefduf saxatilis*, Sergeant major; *Decodon puellaris*; *Ocyurus chrysurus*, Yellowtail; *Priacanthus arenatus*, Big-eye; *Upeneus parvus*, Goatfish.
97. *Diplangus pazillus* Linton, 1910.  
Hosts: *Anistoremus virginicus*, Porkfish; *Balistes vetula*, Queen triggerfish; *Brachygenys chrysargyreus*, Bronze grunt; *Haemulon flavolineatum*, French grunt; *H. plumieri*, White grunt; *H. sciurus*, Yellow grunt; *H. macrostomum*, Gray grunt.
98. *Diplangus parvus* Manter, 1947.  
Hosts: *Haemulon flavolineatum*, French grunt; *H. carbonarium*, Caesar grunt.
99. *Diplangus mioleithus* Manter, 1947.  
Hosts: *Haemulon album*, Margate fish; *H. parra*, Sailor's choice.
100. *Brachyenteron parexocoeti* Manter, 1947.  
Host: *Parexocoetus mesogaster*, Flying fish.
101. *Brachyenteron peristedioni* Manter, 1934.  
Host: *Peristedion platycephalum*.
- Family FELLODISTOMATIDAE**
102. *Pycnadena lata* (Linton, 1910) Linton, 1911.  
Host: *Calamus calamus*, Saucer-eye porgy.
103. *Pycnadenoides calami* Manter, 1947.  
Host: *Calamus bajonado*, Jolt-head porgy.
104. *Bacciger harengulae* Yamaguti, 1938.  
Host: *Harengula clupeola*, Pilchard.
105. *Antorchis urna* (Linton, 1910) Linton, 1911.  
Hosts: *Angelichthys ciliaris*, Queen angelfish; *A. isobelita*, Angelfish; *Pomacanthus arcuatus*, Black angelfish.
106. *Megalomyzon robustus* Manter, 1947.  
Host: *Lachnolaimus maximus*, Hogfish.
107. *Proctoeces erythraeus* Odhner, 1911.  
Hosts: *Calamus bajonado*, Jolt-head porgy; *C. calamus*, Saucer-eye porgy.
108. *Mesolecitha linearis* Linton, 1910.  
Host: *Acanthurus caeruleus*, Blue tang.
109. *Tergestia laticollis* (Rud., 1819) Odhner, 1911.  
Hosts: *Auxis thazard*, Frigate mackerel; *Euthynnus alletteratus*, Little tuna.
110. *Tergestia pectinata* (Linton, 1905) Manter, 1940.  
Hosts: *Trachurops crumenophthalmus*, Goggle-eye; *Priacanthus arenatus*, Big-eye.
111. *Tergestia acuta* Manter, 1947.  
Host: *Caranx bartholomaei*, Yellow jack.
112. *Benthotrema plenum* Manter, 1943.  
Host: Unidentified Lizard fish.
113. *Lissoloma brotulae* Manter, 1934.  
Host: *Brotula barbata*.
114. *Lomasoma gracilis* (Manter, 1934) Manter, 1935.  
Host: *Peristedion miniatum*.

115. *Lomasoma monolenei* (Manter, 1934) Manter, 1935.  
Host: *Monolene antillarum*.
116. *Lomasoma wardi* (Manter, 1934) Manter, 1935.  
Hosts: *Coelorhynchus carminatus*, Grenadier;  
*Urophycis regius*.
117. *Megenteron crassum* Manter, 1934.  
Host: *Diplacanthopoma brachysoma*.
118. *Steringophorus magnus* Manter, 1934.  
Host: Unidentified eel.
119. *Steringophorus profundus* Manter, 1934.  
Host: *Argentina striata*.
- Family HAPLOSPLANCHNIDAE**
120. *Haploplanchnus acutus* (Linton, 1910) Manter, 1937.  
Hosts: *Strongylura raphidoma*, Houndfish;  
*Strongylura timucu*, Houndfish.
121. *Haploplanchnus adacutus* Manter, 1937.  
Hosts: *Abudefduf marginatus*, Sergeant major;  
*Halichoeres bivittatus*, Slippery dick;  
*H. maculipinna*, Slippery dick.
122. *Haploplanchnus brachyurus* Manter, 1937.  
Hosts: *Cryptotomus auropunctatus*, Parrotfish;  
*Pseudoscarus guacamaia*, Rainbow parrotfish;  
*Pseudoscarus coelestinus*, Parrotfish;  
*Sparisoma aurofrenatum*, Parrotfish;  
*S. spinidens*, Parrotfish; *S. viride*, Parrotfish.
123. *Haploplanchnus kyphosi* Manter, 1947.  
Hosts: *Kyphosus sectatrix*, Bermuda chub;  
*H. incisor*, Yellow chub.
124. *Haploplanchnus obtusus* (Linton, 1910) Manter, 1937.  
Hosts: *Acanthurus coeruleus*, Blue tang; *A. hepatus*, Doctorfish.
125. *Haploplanchnus pomacentri* Manter, 1937.  
Hosts: *Pomacentrus leucostictus*, Beau gregory;  
*P. xanthurus*, Beau gregory.
126. *Haploplanchnus sparisomae* Manter, 1937.  
Hosts: *Sparisoma pachycephalum*, Parrotfish;  
*P. viride*, Parrotfish.
- Family MONORCHIDAE**
127. *Genolopa ampullacea* Linton, 1910.  
Hosts: *Bathystoma striatum*; *B. rimator*, Tomtate;  
*Brachygenys chrysargyreus*, Bronze grunt;  
*Haemulon album*, Margate fish; *H. carbonarium*, Caesar grunt;  
*H. flavolineatum*, French grunt; *H. macrostomum*, Gray grunt;  
*H. plumieri*, White grunt; *H. sciurus*, Yellow grunt;  
*Synodus foetens*, Lizardfish.
128. *Hurleytrema chaetodoni* Manter, 1942.  
Hosts: *Chaetodon capistratus*, Butterfly fish;  
*C. ocellatus*, Butterfly fish.
129. *Hurleytrema eucinostomi* Manter, 1942.  
Host: *Eucinostomus lefroyi*, Mojarra.
130. *Monorchis latus* Manter, 1942.  
Hosts: *Anisotremus virginicus*, Porkfish;  
*Haemulon plumieri*, White grunt.
131. *Paraproctotrema brevicacuum* Manter, 1942.  
Host: *Caranx bartholomaei*, Yellow jack.
132. *Postmonorchis orthoprists* Hopkins, 1941.  
Host: *Haemulon flavolineatum*, French grunt.
133. *Proctotrema longicaecum* Manter, 1940.  
Host: *Anisotremus virginicus*, Porkfish.
134. *Proctotrema truncatum* (Linton, 1910) Manter, 1940.  
Hosts: *Haemulon album*, Margate fish; *H. flavolineatum*, French grunt;  
*H. plumieri*, White grunt; *H. sciurus*, Yellow grunt.
135. *Proctotrema parvum* Manter, 1942.  
Host: *Haemulon flavolineatum*, French grunt.
- Family BIVESICULIDAE**
136. *Bivesicula hepsetiae* Manter, 1947.  
Host: *Hepsetia stipes*, Hardhead.
- Family GORGODERIDAE**
137. *Phyllodistomum carangis* Manter, 1947.  
Host: *Caranx ruber*, Runner.
138. *Xystretum solidum* Linton, 1910.  
Hosts: *Balistes capriscus*, Triggerfish; *Lactophrys triquetra*, Trunkfish.
139. *Xystretum pulchrum* (Travassos, 1921) Manter, 1947.  
Host: *Sphoeroides splengleri*, Southern puffer.
- Family MEGAPERIDAE**
140. *Megapera gyrina* (Linton, 1907) Manter, 1934.  
Host: *Lactophrys tricornis*, Trunkfish.
141. *Megapera orbicularis* (Manter, 1933) Manter, 1934.  
Host: *Lactophrys tricornis*, Trunkfish.
142. *Megapera ovalis* (Manter, 1933) Manter, 1934.  
Host: *Monacanthus hispidus*, Filefish.
143. *Megapera pseudura* (Manter, 1933) Manter, 1934.  
Host: *Lactophrys tricornis*, Trunkfish.
144. *Thysanopharynx elongatus* Manter, 1933.  
Host: *Lactophrys tricornis*, Trunkfish.
- Family CRYPTOAGONIMIDAE**
145. *Siphodera vinalwardsii* (Linton, 1899) Linton, 1910.  
Host: *Ocyurus chrysurus*, Yellowtail.
146. *Metadena crassulata* Linton, 1910.  
Host: *Lutjanus analis*, Muttonfish.

147. *Metadena globosa* (Linton, 1910) Manter, 1947.  
Host: *Lutjanus griseus*, Gray snapper.
148. *Metadena adglobosa* Manter, 1947.  
Host: *Lutjanus griseus*, Gray snapper.
149. *Metadena brotulae* (Manter, 1934) Manter, 1947.  
Hosts: *Brotula barbata*; *Lophius piscatorius*, Angler fish.
- Family HEMIURIDAE**
150. *Hemiurus* sp. of Manter, 1934.  
Host: *Peristedion imberbe*.
151. *Parahemiurus merus* (Linton, 1910) Woolcock, 1935.  
Hosts: *Abudefduf saxatilis*, Sergeant major; *Harengula clupei*, Pilchard; *Ocyurus chrysurus*, Yellowtail; *Synodus foetens*, Lizardfish; *Trachurops crumenophthalmus*, Goggle-eye jack.
152. *Anahemiurus microcercus* Manter, 1947.  
Hosts: *Calamus bajonado*, Jolt-head porgy; *C. calamus*, Saucer-eye porgy; *Eucinostomus lefroyi*, Mojarra.
153. *Lecithochirium mecosaccum* Manter, 1947.  
Hosts: *Synodus foetens*, Lizardfish; *S. poeyi*, Lizardfish.
154. *Lecithochirium microstomum* Chandler, 1935.  
Hosts: *Ancylopsetta dilecta*, Flounder; *Promicrops itaiara*, Jewfish; *Megalops atlanticus* Tarpon.  
Reported also by Chandler (1935) from *Trichiurus lepturus*, Cutlass fish, in Galveston Bay and from the same host at Grand Isle, La., by Melugin (1940).
155. *Lecithochirium* sp. of Manter, 1934.  
Host: *Urophycis regius*.
156. *Lecithochirium texanum* (Chandler, 1941) Manter, 1947.  
Host: *Sarda sarda*, Bonito.  
Reported by Chandler (1941) from Texas coast near Freeport.
157. *Sterrhurus floridensis* Manter, 1934.  
Hosts: At least 21 species of fishes at Tortugas (see Manter, 1947).
158. *Sterrhurus fusiformis* (Luhe, 1901) Looss, 1907.  
Hosts: *Gymnothorax moringa*, Spotted moray; *G. funebris*, Black moray.
159. *Sterrhurus microcercus* Manter, 1947.  
Host: *Fistularia tubaccaria*, Trumpet fish.
160. *Sterrhurus praeclarus* Manter, 1934.  
Host: *Merluccius* sp.
161. *Dissosaccus laevis* (Linton, 1898) Manter, 1947.  
Hosts: *Helicolenus maderensis*; *Peristedion longispathum*; *P. minutum*; *P. platycephalum*.
162. *Lethadena profunda* (Manter, 1934) Manter, 1947.  
Hosts: *Pronotogrammus aureorubens*; *Xenodermichthys capet*.
163. *Adinsoma robustum* (Manter, 1934) Manter, 1947.  
Hosts: *Chaunax pictus*, Frogfish; *Chlorophthalmus truculentus*; *Merluccius* sp.; *Paralichthys oblongus*, Flounder; *Urophycis chesteri*; *U. regius*.
164. *Ectenurus virgulus* Linton, 1910.  
Hosts: *Bothus ocellatus*, Flounder; *Harengula clupei*, Pilchard; *Trachurops crumenophthalmus*, Goggle-eye jack.
165. *Parectenurus americanus* Manter, 1947.  
Hosts: *Caranx bartholomaei*, Yellow jack; *Synodus foetens*, Lizardfish.
166. *Dinurus tornatus* (Rud., 1819) Looss, 1907.  
Host: *Coryphaena hippurus*, Dolphin.
167. *Dinurus breviductus* Looss, 1907.  
Host: *Coryphaena hippurus*, Dolphin.
168. *Dinurus longisinus* Looss, 1907.  
Host: *Coryphaena hippurus*, Dolphin.
169. *Dinurus barbatus* (Cohn, 1903) Looss, 1907.  
Host: *Coryphaena hippurus*, Dolphin.
170. *Dinurus scombr* Yamaguti, 1934.  
Host: *Euthynnus alletteratus*, Little tuna.
171. *Stomachicola rubea* (Linton, 1910) Manter, 1947.  
Hosts: *Gymnothorax funebris*, Black moray; *G. moringa*, Moray.  
Reported from *Synodus foetens* at Grand Isle, La., by Melugin (1940). It also occurs at Tortugas (Linton, 1910).
172. *Aponurus laguncula* Looss, 1907.  
Host: *Ocyurus chrysurus*, Yellowtail.
173. *Aponurus intermedius* Manter, 1934.  
Hosts: *Chaunax pictus*; unidentified eel; unidentified sole.
174. *Brachadena pyriformis* Linton, 1910.  
Hosts: *Bathystoma striatum*; *Brachygenys chrysargyreus*, Bronze grunt; *Calamus bajonado*, Jolt-head porgy; *Chaetodon aya*, Butterfly fish; *C. sedentarius*; *Haemulon album*, Margate fish; *H. macrostomum*, Gray grunt; *H. parra*, Sailor's choice; *H. plumieri*, White grunt; *Ogcocephalus cubifrons*, Batfish.
175. *Lecithaster acutus* (Linton, 1910) Manter, 1947.  
Hosts: *Acanthurus hepatus*, Doctor fish; *A. caeruleus*, Blue tang.

176. *Leurodera decora* Linton, 1910.  
Hosts: *Anisotremus virginicus*, Porkfish; *Brachygenys chrysargyreus*, Bronze grunt; *Haemulon carbonarium*, Caesar grunt; *H. parra*, Sailor's choice; *H. plumieri*, White grunt; *H. sciurus*, Yellow grunt; *H. flavolineatum*, French grunt; *Lutjanus griseus*, Gray snapper; *Acanthurus hepatus* (?), Doctor fish.
177. *Theletrum fustiforme* Linton, 1910.  
Host: *Pomacanthus arcuatus*, Black angelfish. Reported also from *P. arcuatus* and *P. paru*, French angelfish, from the north coast of Cuba by Viguera (1940a).
178. *Derogenes crassus* Manter, 1949.  
Host: *Callionymus agassizii*.
179. *Derogenes varicus* (Mueller, 1784) Looss, 1901.  
Hosts: *Helicolenus maderensis*; *Merluccius* sp.; *Scorpaena cristulata*; *Setarches parmatum*; *Urophycis regius*.
180. *Gonocerca crassa* Manter, 1934.  
Hosts: *Ancylopsetta dilecta*; *Brotula barbata*; *Coelorhynchus carminatus*; *Lophius piscatorius*; *Merluccius* sp.; *M. bilinearis*; *Paralichthys oblongus*; *Paralichthys* sp.; *P. squamilentus*; *Phycis cirratus*; *Saurida normani*; *Setarches parmatum*; *Synodontid*; *Synodus intermedius*; *Urophycis regius*.
181. *Gonocerca phycidis* Manter, 1925.  
Hosts: *Coelorhynchus carminatus*, Grenadier; *Merluccius* sp.; *Urophycis regius*.
182. *Gonocercella atlantica* Manter, 1940.  
Host: *Monacanthus hispidus*, Filefish.
183. *Parasterrhurus anurus* Manter, 1934.  
Host: *Argentina striata*.
184. *Hemiperina nicolli* Manter, 1934.  
Hosts: *Chaunax pictus*, Frogfish; *Dibranchius atlanticus*; *Diplacanthopoma brachysoma*.
185. *Hysterolecitha rosea* Linton, 1910.  
Hosts: *Acanthurus bahianus*, Ocean tang; *A. caeruleus*, Blue tang; *A. hepatus*, Doctor fish.
186. *Macradena perfecta* Linton, 1910.  
Host: *Acanthurus caeruleus*, Blue tang.
187. *Macradenina acanthuri* Manter, 1947.  
Host: *Acanthurus caeruleus*, Blue tang.
188. *Opisthodena dimidia* Linton, 1910.  
Hosts: *Kyphosus sectatrix*, Bermuda chub; *K. incisor*, Yellow chub.
189. *Dictysarca virens* Linton, 1910.  
Host: *Gymnothorax funebris*, Black moray.
190. *Hirudinella ventricosa* (Pallas, 1774) Baird, 1853.  
Host: *Coryphaena hippurus*, Dolphin.
191. *Sclerodistomum sphaeroidis* Manter, 1947.  
Host: *Sphaeroides spengleri*, Southern puffer.
192. *Tetrochetus coryphaenae* Yamaguti, 1934.  
Host: *Coryphaena hippurus*, Dolphin.
193. *Prosogonotrema bilabiatum* Viguera, 1940.  
Host: *Ocyurus chrysurus*, Yellowtail. Reported from north coast of Cuba by Viguera (1940b). Viguera considered it in a new family.

#### Family APOROCOTYLIDAE

194. *Deontacylix ovalis* Linton, 1910.  
Hosts: *Kyphosus sectatrix*, Bermuda chub; *K. incisor*, Yellow chub.
195. *Cardicola cardiocolum* (Manter, 1947) Short, 1953.
196. *Cardicola laruei* Short, 1953.  
Host: *Cynoscion arenarius*, White trout; *C. nebulosus*, Speckled trout.

### HOST SPECIFICITY OF TREMATODES OF MARINE FISHES OF THE GULF OF MEXICO

Monogenea are rather highly specific in regard to their hosts. Most species are known to infect in nature only a single host species. If there are several hosts they are usually related.

Host specificity among the Digenea varies considerably. It is not marked among a number of species infecting birds and mammals. Judging from the collection records at Tortugas, trematodes of fishes there have very considerable host specificity. Considered from the species level of 189 species collected (Manter 1947) 105 or 55.5 percent were found in only 1 species of host; 43 from 2 hosts, 14 from 3 hosts, etc., although 1 species occurred in 14 hosts, 1 in 16 hosts, and 1 in 21 hosts. While it must be admitted that non-occurrence of a trematode within a certain species of host does not necessarily mean it cannot infect that host, data derived from numerous examinations indicate rather clearly that such species do not do so under natural conditions. The fishes studied were mostly shallow-water species living not far from one another. The fact that a few species do in fact infect a wide variety of hosts indicates that food habits are not necessarily a barrier. The only experimental testing of host specificity in this region was that by McCoy (1930) who found that *Hamacreadium mutabile* and *H. gullella* developed only in three species of the snapper family, Lutjanidae, and did not infect

any of five other species of fishes belonging in five other families.

If a trematode species occurs in 2 or several hosts, the hosts are usually related. For example, 138 trematode species (73 percent of those collected) were limited to a single host genus. Only rarely is a trematode species found in fishes belonging in different families. Little is known regarding the host specificity of larval stages for their intermediate hosts. It is sometimes greater, particularly for the molluscan host, than that of the adult parasite.

This tendency of trematodes to occur in a limited number of hosts which are usually related gives added interest to the geographical distribution of these parasites. During my study of Tortugas trematodes, I was frequently impressed to discover that the hosts of the same or a related trematode in distant oceans proved to be a fish related to the host at Tortugas.

## GEOGRAPHICAL DISTRIBUTION OF TREMATODES OF FISHES AT TORTUGAS, FLORIDA

### TREMATODES FROM 50 FATHOMS OR BELOW

Systematic dredgings south of Loggerhead Key under the direction of Dr. W. H. Longley in the summers of 1930-32 presented an unusual opportunity for collection of trematode parasites down to depths of some 500 fathoms (Manter, 1934). It was found that fishes down to that depth were as commonly infected as fishes of shallow (surface) waters, 49 species being collected from about 90 species of fishes. These trematodes are almost entirely different species from those occurring in the nearby surface water; only 3 species from below 100 fathoms occurred in lesser depths and 2 of these are atypical (*Distomum fenestratum* is an immature, very non-specific species, while *Sterrhurus floridensis* has so little host specificity that precocious maturity in a crustacean host is suggested). Even at 50 fathoms only 3 additional species (*Deretrema fusillum*, *Myzoxenus vitellosus*, and *Helicometrina nimia*) occur in surface waters at Tortugas. This marked difference in the deeper water fauna might be expected since the fishes and invertebrates are also different species.

A more interesting aspect of the deeper water trematode fauna is the affinity it shows for distant, cool or cold water faunas. Manter (1934) noted

a number of species found only at 50 fathoms or below at Tortugas but known from surface waters of the North Atlantic. Studies since 1934 add 2 species which do extend into surface waters at Tortugas and some 6 species found in distant oceans. The following table shows the distribution of these species. Numbers in parentheses indicate the number of host species involved. The table is based on a total of 41 adult species definitely identified.

TABLE 1.—Distribution of trematode fauna

Species	Depth	Other localities
	<i>fathoms</i>	
a. Species reported elsewhere (1934)		
<i>Helicometra fasciata</i> (3) .....	50-60	Great Britain (10). European (20). Mexican Pacific (2).
<i>Derogenes varicus</i> (5) .....	125-200	Maine coast (6). North Atlantic (many). North Pacific (many). Galapagos Islands (1).
<i>Dissosaccus laevis</i> (4) .....	165-200	Woods Hole (1), deepwater.
<i>Gonocerca phycidis</i> (3) .....	160-300	Maine coast (1).
<i>Lepidapedon elongatum</i> (4) .....	160-300	Maine coast (6). British Isles (1). Woods Hole (6).
<i>Lepidapedon racion</i> (1) .....	200-325	Now known from Japan (1). Maine coast (1). British Isles (4). Woods Hole (4).
<i>Sterrhurus floridensis</i> (8) .....	50-197	Tortugas (shallow), (many).
b. Species reported elsewhere since 1934		
<i>Deretrema fusillum</i> (1) .....	50	Woods Hole (1). Tortugas, shallow (1).
<i>Derogenes crassus</i> (1) .....	90	Japan (1), deepwater (?). Tasmania (1), shallow.
<i>Gonocerca crassa</i> (12) .....	40-300	Japan (1), deepwater (?).
<i>Lecithochirium microstomum</i> (1) ..	100	Tortugas (1), shallow.
<i>Lepidapedon nicolli</i> (1) .....	90	Mexican Pacific (1), shallow.
<i>Myzoxenus vitellosus</i> (1) .....	50-60	Tortugas (1), shallow.
<i>Proserhynchus ozakii</i> (1) .....	90	Mexican Pacific (1), shallow.
<i>Pseudopecoeloides vulgaris</i> (16) ..	50-315	Puget Sound (1), shallow.

The above data suggest that a bathymetric barrier between the trematode faunas of surface waters and of depths 100 fathoms or more at Tortugas is more effective than any existing between the deeper fauna and distant cool oceans. The deep-sea fauna itself is evidently very widespread, but a number of its trematode species occur in more shallow depths near or in the Arctic and Antarctic Seas.

The above comparisons have been on the species level. It is of some further interest to note that of 13 new genera named in 1934 from deep water at Tortugas, 7 involving 15 species have since been reported elsewhere as follows: One (1 species) from Woods Hole; four (11 species) from Japan; two (3 species) from Tasmania. The species from Tasmania were in shallow-water fishes.

A remarkable incident occurred in connection with *Lepidapedon nicolli* and *Proisorhynchus ozakii*. These two species, new at the time, both occurred at Tortugas at 90 fathoms in the same individual fish, a snowy grouper, *Epinephelus niveatus*. In 1934, I collected these same two species again from a single fish, an "unidentified, spotted, grouper-like fish" from the Pacific Ocean at Isabel Island, Mexico. It is unfortunate that this fish could not be further identified. As far as I can learn, *Epinephelus niveatus* does not occur in the Pacific.

#### TREMATODES FROM SURFACE WATER FISHES

A comparison of 142 species of trematodes from less than 50 fathoms at Tortugas with faunas known elsewhere reveals, in general, (1) that the Tortugas fauna is very unlike that of the coast of Maine or Massachusetts, the European Atlantic or the Mediterranean, and (2) it is strikingly similar to the fauna at Bermuda and the tropical American Pacific.

Of the 142 species at Tortugas, 28 species (19.8 percent) occur at Bermuda (Hanson 1950). This similarity is to be expected since many of the same species of fishes occur in both regions. In fact, at least 21 of the 28 species of trematodes occur in the same host species in both regions.

The only other part of the world where such trematodes have been collected sufficiently to give adequate sampling and which compares with the similarity to Bermuda is the tropical American Pacific. Considering species from 50 fathoms or less, 24 or 16.8 percent of 142 Tortugas species occur in the American Pacific. Also, there is reason to believe this similarity is even greater than this figure indicates. Three additional species in the Pacific occur in Bermuda fishes which occur at Tortugas; still three more species are now reported (Pearse 1949) from Beaufort, N. C., in fishes which occur at Tortugas. Thus, the probable total is at least 30 species, a figure practically identical with that derived from comparison with Bermuda. Furthermore, if fishes down to 100 fathoms were considered, the Pacific percentage would be slightly higher.

Thus, based on our present knowledge, one can conclude that the Tortugas trematode fauna of surface-water fishes is very similar to that of Bermuda, as would be expected, and equally as similar to that of the tropical American Pacific,

as might not be expected. There is one striking difference among these regions. Whereas at Bermuda the species of host fishes are, in general, identical with those involved at Tortugas, in the Pacific the hosts are, with very few exceptions, different but related species. As far as the trematodes are concerned, the tropical American Pacific occupies a position comparable to that of Bermuda in relation to Tortugas, almost as though there were no land barrier between the two oceans. It is well known that this land barrier has not always existed. Have the trematode parasites retained their specific identity while their hosts, perhaps both fish and molluscan, have evolved into slightly different species? Trematode distribution suggests that just as the Gulf Stream has made Bermuda practically an outpost of the Gulf of Mexico and Caribbean faunas, the tropical and subtropical American Pacific is also such an outpost persisting as evidence of the prehistoric continuity of the two oceans.

Further evidence of an ancient influence of inter-oceanic continuity is the relative dissimilarity of the Tortugas fauna to such adjacent regions as Beaufort, N. C. Here the trematodes have been as well sampled as in the Pacific, and only 15 of the Tortugas species are known there. This number is hardly more than half the number known to occur in the Pacific. If the trematodes were accidentally distributed by migrants such as birds, this difference would not be expected. Fourteen Tortugas species, from less than 50 fathoms, occur at Woods Hole, Mass. Eleven occur in Japanese waters. This extension of species far into the Pacific is reflected in the Bermuda fauna. Five of the Bermuda species occur in Japan and six in the tropical American Pacific, as compared with seven at much nearer Woods Hole, six at Beaufort, three in the European Atlantic, and three in the Mediterranean (Hanson 1950). This greater affinity of the Bermuda trematodes for Japanese than for European waters is better understood in the light of the Pacific affinities of the Tortugas fauna.

The distribution of these trematodes is, of course, a result of numerous and complex factors. For example, a few of the species considered here are parasites of open sea fishes with a very wide range. Their parasites would be expected to have a wide distribution. Omission of these species, however, would not materially change the

proportional figures. The species from deeper water were considered separately because parasites from these depths have not been studied in most regions. Presumably, these species have a wide distribution at appropriate depths. If sufficient numbers of species are involved, the exceptional cases or errors in identification will be minimized. In most cases, such factors would probably more or less balance one another in the various localities. However, it seems to me that the figures available are not suitable for statistical analysis because of factors which cannot be given numerical value. For example, from purely geographical considerations one would expect the Pacific fauna to be very different from Tortugas, separated as it is by a land barrier and with practically no possibility of contact by way of the Antarctic or the partly fresh-water Panama Canal. More complete knowledge of these parasites in all regions is needed. As this knowledge is gained it seems probable that a very interesting host-parasite-distribution picture will unfold, particularly at the specific and generic levels.

### TREMATODES OF TURTLES

Four species of marine turtles occur in the Gulf of Mexico. These are the loggerhead turtle, *Caretta caretta*, the green turtle, *Chelonia mydas*, the hawk-bill turtle, *Eretmochelys imbricata*, and the leathery or leatherback turtle, *Dermochelys coriacea*. All four of these turtles have a very wide distribution in warm seas. They are very favorable hosts for trematodes, some of which also appear to be widely distributed, others being reported as yet only from certain localities. The actual distribution of these trematodes can be known only after the examinations made in various regions are more or less equivalent. Until then, the presence of a species is more significant than its apparent absence. With only two exceptions, the trematodes described from marine turtles are all Digenea. Since a molluscan host is also required in their life cycle it is probable that a number of these trematodes will have a distribution limited by the distribution of the molluscan host.

Considering the wide individual range of these turtles in the open sea, a surprising variety of trematodes succeed in parasitizing them. Fifty-one species have been reported from *Chelone mydas*, 30 from *Caretta caretta*, and 9 from *Eretmo-*

*chelys imbricata*. It is an interesting fact that none of these trematodes is known to occur as an adult parasite of fishes.<sup>1</sup> Furthermore, despite the aquatic life of the turtles, these trematodes belong to reptilian parasitic groups (families and genera). Turtles have no representatives of such common trematode families of fishes as Hemiuridae, Opecoelidae, Fellodistomatidae, etc. A similar situation exists in connection with the trematodes of marine mammals which are quite different from species occurring in either turtles or fishes.

Only a few turtles from the Gulf have been examined for parasites. Additional records, particularly from *Chelone* and *Eretmochelys*, could easily be made. Such records would make possible comparisons between the parasites of this region and other seas.

### TREMATODES OF CARETTA CARETTA

Fifteen species of trematodes from *Caretta caretta* at Tortugas, Fla., have been reported by Linton (1910), Pratt (1914), Manter (1932), and Luhman (1935). These are as follows:

#### ASPIDOGASTREA

##### ASPIDOGASTRIDAE

1. *Lophotaspis vallei* (Stossich, 1899) Looss, 1902.

#### DIGENEA

##### PRONOCEPHALIDAE

2. *Cricocephalus albus* (Kuhl & van Hasselt, 1822) Looss, 1899.
3. *Diaschistorchis pandus* (Braun, 1901) Johnston, 1913.
4. *Pleurogonius trigonocephalus* (Rud., 1809) Looss, 1901.
5. *Pyelosomum longicaecum* Luhman, 1935.

##### BRACHYCOELIIDAE

6. *Cymatocarpus undulatus* Looss, 1899.
7. *Orchidasma amphiorchis* (Braun, 1899) Braun, 1901.

##### PLAGIORCHIDAE

8. *Pachypsolus ovalis* Linton, 1910.
9. *Pachypsolus tertius* Pratt, 1914.
10. *Styphlotrema solitarius* (Looss, 1899) Odhner, 1910.

##### RHYTIDODIDAE

11. *Rhytidodes secundus* Pratt, 1914.

##### GORGODERIDAE

12. *Phyllodistomum cymbiforme*, (Rud., 1819) Braun, 1899.

<sup>1</sup> The presence of a single specimen of *Orchidasma amphiorchis* in *Coryphaena hippurus* reported by Manter (1931) is without doubt an accidental and temporary condition probably due to recent ingestion of a young turtle by the fish.

## DIGENEA—Continued

## SPIRORCHIDAE

13. *Hapalotrema synorchis* Luhman, 1935.
14. *Neospiroorchis pricei* Manter & Larson, 1950.
15. *Caretticola bipora* Manter & Larson, 1950.

Five of these species (*Pyelosomum longicaecum*, *Pachypsolus ovalis*, *P. tertius*, *Rhytidoeds secundus*, and *Hapalotrema synorchis*) are known as yet only from the Gulf of Mexico.

## TREMATODES OF CHELONIA MYDAS, THE GREEN TURTLE

Lists by Hughes, Higginbotham, and Clary (1941) and Ruiz (1946) show that 51 species of trematodes have been reported from *Chelonia mydas* in various parts of the world. Of these, 10 species or about one-fifth of the total, are also known from *Caretta caretta*. I believe no other species of host is known to harbor as many as 50 species of trematodes. Surely, no other reptile approaches this number.

No definite records of species have been published from this host in the Gulf of Mexico. Manter (1930) states that he collected three species of trematodes from *Chelonia* at Tortugas but had not then identified them. This collection is still incompletely studied. Two of the species, however, can be reported as *Desmogonius desmogonius* Stephens, 1911, known from the same host from the coast of Nicaragua; and *Polyangium linguatula* (Looss 1899) Looss 1900, known from the Mediterranean and from Brazil. More examinations of *Chelonia mydas* will, without doubt, reveal additional species in Gulf waters. Ruiz (1946) reports 10 species from this host from the coast of Brazil. Price (1939a) reports *Rhytido-doides intestinalis* Price, 1939, and *R. similis* Price, 1939, from a *Chelonia mydas* which died in the Washington Zoo but does not state the origin of the turtle.

## TREMATODES OF ERETMOCHELYS IMBRICATA, THE HAWK-BILL TURTLE

Apparently only one trematode has been reported from this turtle in the Gulf region. It is *Diaschistorchis pandus* (Braun) reported from Cuba by Vigueras (1935). This trematode has an almost world-wide distribution and also infects *Caretta caretta* and *Chelonia mydas*. Five species of trematodes are known from *E. imbricata* from

Japanese waters, two from Australia, one from Bermuda, and one from Ireland.

## TREMATODES OF DERMOCHELYS CORIACEA, THE LEATHERY OR LEATHERBACK TURTLE

Apparently only one species of trematode, *Pyelosomum renicapite* (Leidy 1856) Ruiz 1946, has been recorded from this turtle and none from the Gulf of Mexico. However, Dr. A. C. Chandler informs me (by correspondence) he has collected this species of trematode from a leather-back turtle washed up near Galveston, Texas, some years ago.

## TREMATODES OF BIRDS OF THE GULF OF MEXICO

Almost no study of trematodes collected from birds from the Gulf of Mexico has been made. Obviously such trematodes must be numerous. It seems beyond the scope of this paper to assemble the scattered records of trematodes collected elsewhere even from birds which occur in the Gulf.

Pratt (1911), Linton (1928), and Manter (1930) all mention *Galactosomum cochleariforme* (Rud.) as present in *Fregata magnificens*, the man-of-war bird, at Tortugas, and Chandler (1951) recorded *Galactosomum fregatae* and a new strigeid, *Schwartzitrema seamsteri*, from a specimen of this bird near Corpus Christi, Tex.

Records from oceanic birds from the Caribbean region include:

- Galactosomum johnsoni* Price, 1934, from *Sula leucogastra*, brown booby, from Puerto Rico.
- Galactosomum fregatae* Prudhoe, 1949, from *Fregata magnificens*, man-of-war bird, from Trinidad.
- Galactosomum darbyi* Price, 1934, from *Pelecanus occidentalis*, brown pelican, from Dominican Republic.
- Mesostephanus appendiculatoides* (Price, 1934) Lutz, 1935, from *Pelecanus occidentalis*, brown pelican, from Dominican Republic.
- Mesostephanus fajardensis* (Price, 1934) Lutz, 1935, from *Sula leucogaster*, brown booby, from Puerto Rico.

## TREMATODES OF MAMMALS

Marine mammals, particularly dolphins and whales, are commonly infected with trematodes. No collections from such hosts, however, appear to have been made in the Gulf of Mexico.

Sokoloff and Caballero (1932) described a trematode, *Schizamphistoma manati* from a manatee,



*Manatus latirostris*, from the delta of the Panuco River, near Tampico, Mexico.

## STUDIES ON LARVAL STAGES AND LIFE CYCLES OF TREMATODES OF THE GULF OF MEXICO

Miller (1925, 1926, 1927, 1929) and Miller and McCoy (1929) have studied cercariae collected chiefly from snails from coral reefs near the Biological Laboratory at Tortugas. Most of these studies were on the behavior of the cercariae and only brief preliminary descriptions of the cercariae were given. The cercariae were named alphabetically as Cercaria A, Cercaria B, etc. In 1929, Cercaria P was referred to as *Cercaria floridensis*. As is usual among marine mollusks, only a small percentage of individuals are infected. During the first season (1925) Miller examined 4,341 mollusks belonging to 33 genera and including 50 species and varieties, and found only 45 individuals including 9 species infected. Miller's later work indicates that the incidence of infection may vary greatly from year to year. Altogether, 22 species of cercariae were studied. The type of each cercaria is indicated. The following list includes the mollusks found infected and the cercariae found in each:

<i>Astrea americana</i>	
Cercaria A.....	cotylocercous.
Cercaria B.....	cotylocercous.
<i>Astrea longispina</i>	
Cercaria C.....	immature sporocysts.
<i>Cerithium litteratum</i>	
Cercaria D.....	gymnocephalous.
Cercaria E.....	gymnocephalous.
Cercaria F.....	huge-tailed monostome.
Cercaria G.....	Xiphidiocercaria.
Cercaria P.....	binoculate, lophocercous.
Cercaria Q.....	triloculate monostome.
Cercaria R.....	large furcocercous.
Cercaria S.....	distome, gymnocephalous.
Cercaria T.....	huge-tailed monostome.
Cercaria U.....	huge-tailed monostome.
Cercaria W.....	huge-tailed monostome.
<i>Cerithium algicola</i>	
Cercaria H.....	gymnocephalous.
<i>Columbella mercatoria</i>	
Cercaria I.....	cotylocercous (?)
Cercaria J.....	cotylocercous.
<i>Crepidula aculeata</i>	
Cercaria K.....	trichocercous.
Cercaria L.....	cystophorous.
<i>Glyphis listeri</i>	
Cercaria M.....	cotylocercous.

<i>Pinna carnea</i>	
Cercaria N.....	gasterostome.
<i>Thais deltoidea</i>	
Cercaria O.....	echinostome.

Except for the life cycles studied by McCoy (1929, 1930) little attempt has been made to associate these cercariae with adult trematodes. The problem is usually difficult because many characters used in classification do not appear in the cercaria. The mollusks studied might be infected with trematodes from such birds as the pelican, tern, or frigate bird, or from marine turtles, as well as from fishes. McCoy proved that Cercaria A developed into *Hamacreadium mutabile*, and Cercaria B into *Hamacreadium gulella*. He believed Cercaria P developed into some species of *Acanthochasmus*. Second intermediate hosts were *Thalassoma bifasciatum*, bluehead, or *Halichoeres bivittatus*, slippery dick. Manter (1932, 1933a) found that Cercaria J from *Columbella mercatoria* penetrated into and encysted in the shrimp, *Lyssmata intermedia*. He found in this same shrimp and in *Crangon formosum* the metacercariae of *Helicometrina nimia*. He also pointed out that Cercaria L greatly resembles a common juvenile trematode known as *Distomum fenestratum*.

Schechter (1943) reports cercariae of *Parorchis acanthus* from the oyster-drilling snail, *Thais floridana haysae* from Barataria Bay, La. The adult of this echinostomid trematode is a parasite of birds, *e. g.*, the herring gull, *Larus argentatus*. It has been reported from Cuba by Viguera (1940a) from the flamingo, *Phoenicopterus ruber*, and from *Nycticorax nycticorax hoactli*.

Cable and McLean (1943) described a "rattenkonig" cercaria, *C. clausii* Monticelli, from the gastropod, *Lamellaria leucosphaera*, from the west coast of Florida. Miller (1929) described the same colonial aggregation of individuals for his Cercaria W from *Cerithium litteratum* at Tortugas.

Larval stages of gasterostomes are common parasites of bivalves. Oysters both of the Atlantic and Gulf coasts are commonly infected with such larvae. Pearse and Wharton (1938) reported "*Bucephalus gracilescens* (Rudolphi)" from oysters in Apalachicola Bay, Fla. A study of these gasterostome larvae in oysters of the Gulf of Mexico is being made by Sewell H. Hopkins of Texas A. and M. Research Foundation.

The miracidium of *Lophotaspis vallei*, an aspidogastriid of the loggerhead turtle was studied by Manter (1932). Wharton (1939) discovered that a juvenile stage of this trematode occurred in the flag conch, *Fasciolaria gigas*, collected in Gulf County, Fla. As Wharton indicated, miracidia doubtless penetrate the conch and develop without reproduction to the infective stage. Turtles would thus become infected by eating infected conchs.

### SUMMARY

Over 200 species of Trematoda reported from fishes of the Gulf of Mexico include 10 species of Monogenea, 2 species of Aspidogastrea, and 196 species of Digenea. Of the Digenea, 18 species are gasterostomes, 178 species are prosostomes. Most of these trematodes have been studied only from the eastern portion of the Gulf at Tortugas, Fla.

Trematodes of other vertebrates of the Gulf have been studied very little. Fifteen species have been reported from *Caretta caretta*, the loggerhead turtle, at Tortugas. Two species are reported in this paper from *Chelonia mydas*, the green turtle. Three species of Trematoda are known in the Gulf. At least five other species have been reported from oceanic birds in the Caribbean, birds which are also common in the Gulf.

Larval stages of trematodes in mollusks of the Gulf include 22 species of cercariae at Tortugas. Cercariae of *Parorchis acanthus* have been reported from *Thais floridana* from the Louisiana coast. Here also oysters are commonly infected with gasterostome larvae.

Only three life cycles are known. *Hamacreadium mutabile* and *H. gulella*, adults of which occur in Lutjanidae (snappers), develop in a snail, *Astrea americana*, and then utilize *Thalassoma bifasciatum*, bluehead, or *Halichoeres bivittatus*, slippery dick, as second intermediate host. Juvenile stages of *Lophotaspis vallei* from the loggerhead turtle infect the flag conch, *Fasciolaria gigas*.

A discussion of geographical distribution of trematodes of fishes points out (1) that the trematodes of fishes from 100 fathoms or deeper show practically no affinity to trematodes of surface waters of the Gulf but do show considerable affinity to species from fishes of distant but cold waters, (2) the trematode fauna of surface waters

(less than 50 fathoms) shows a marked similarity to such faunas at Bermuda and in the tropical American Pacific, a similarity approximately twice as great as is shown to Beaufort, N. C., or Woods Hole, Mass. Further study of this phenomenon, at both the generic and specific level, is suggested.

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## CESTODA

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The first work on cestodes of Gulf fishes was done by Linton on material collected by him at the Biological Laboratory of the Carnegie Institution at Dry Tortugas, Florida, in the summers of 1906-1908. They are discussed in Linton (1908b, 1909). No further work was done until Chandler (1935a, 1935b) reported some observations on helminths of fish in Galveston Bay, Texas. Perez Vigueras (1936), in a report of helminths in Cuba, reported three unidentified larvae of Trypanorhyncha from teleosts off the province of Havana. Potter (1937) described one additional new species of cestode from Dry Tortugas, and Shuler (1938) reported on some cestodes collected from this same locality by Manter in 1930-1932, adding one more valid new species. Chandler (1942) reported on some cestodes from sharks taken near Englewood, Florida, adding two new species. Seamster (1950, personal communication) reported a few cestode infections from fishes taken in or near Corpus Christi Bay, Texas. Other than these few and incomplete investigations the cestodes of fishes in the Gulf of Mexico have not been studied. Further studies will undoubtedly yield many new species and bring to light interesting geographical relations with the fauna of the Caribbean Sea, the North Atlantic, and the Pacific Coast of Mexico. No cestodes have yet been reported from marine reptiles or mammals in the Gulf.

The cestode fauna so far known consists almost entirely of Tetraphyllidea and Trypanorhyncha which, as adults, parasitize practically all elasmobranchs in the Gulf and, as larvae, are found very commonly in the flesh or viscera of teleosts, often in such food fishes as members of the families Sciaenidae, Serranidae, and Lutjanidae. Although incapable of development in man they cause considerable economic loss because of popular antipathy to "wormy" fish. On the Texas coast the drum, *Pogonias cromis*, and to a

lesser extent other sciaenid fishes, very frequently harbor the plerocerci of *Poecilancistrum robustum* or related species which are known to fishermen as "spaghetti worms" because of their great length. The adults of these worms are probably parasitic in a shark or ray as are other Trypanorhyncha. Some city health departments have considered banning drum from the markets because of their very frequent infestation, but the writer has counseled against this since these fish are an important cheap source of protein food.

### TETRAPHYLLIDEA

#### Family DISCULICIPITIDAE

*Disculiceps pileatus* (Linton, 1890) Joyeux and Baer, 1935.  
Host: *Carcharinus leucas*, cub shark.

#### Family CEPHALOBOTHRIIDAE

*Hexacanalís (?) marsupium* (Linton, 1916) Dollfus, 1948.  
Host: *Stoasodon narinari*, spotted sting ray; Dry Tortugas (Linton).

#### Family PHYLLOBOTHRIIDAE

- Phyllobothrium foliatum* Linton, 1890.  
Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).
- Phyllobothrium mustelis* (van Beneden, 1850) (= *Orygmatobothrium angustum* Linton, 1890.)  
Host: *Carcharinus leucas*, cub shark; Dry Tortugas (Linton).
- Phyllobothrium lactuca* van Beneden, 1850.  
Host: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Shuler).
- Phyllobothrium dasybati* Yamaguti, 1934.  
Host: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Shuler).
- Phyllobothrium tumidum* Linton, 1922.  
Host: *Scoliodon terraenovae*, sharp-nosed shark; Dry Tortugas (Shuler).
- Phyllobothrium centrurum* Southwell, 1925 (= *Anthocephalum gracile* Linton, 1890).  
Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).
- Phyllobothrium* sp.  
Host: *Dasyatis sabina*, southern sting ray; Corpus Christi Bay (Seamster).

*Rhinebothrium flexile* Linton, 1890.

Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).

*Echeneibothrium minimum* van Beneden, 1850.

Host: *Dasyatis sabina*, southern sting ray; Corpus Christi Bay (Seamster).

*Anthobothrium laciniatum* Linton, 1890.

Hosts: *Hypoprion brevirostris*; Dry Tortugas (Shuler); *Carcharinus leucas*, cub shark; Dry Tortugas (Linton).

*Anthobothrium variabile* (Linton, 1890) Southwell, 1925.

Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).

*Anthobothrium* sp.

Host: *Dasyatis sabina*, southern sting ray; Corpus Christi Bay (Seamster).

#### Family ONCHOBOTHRIDAE

*Acanthobothrium brevissime* Linton, 1909.

Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).

*Acanthobothrium coronatum* (Rud., 1819) van Beneden, 1850 (= *Onchobothrium tortum* Linton, 1916).

Host: *Stoasodon narinari*, spotted sting ray; Dry Tortugas (Linton).

*Acanthobothrium* sp.

Host: *Dasyatis sabina*, southern sting ray; Corpus Christi Bay (Seamster).

*Thysanocephalum thysanocephalum* (Linton, 1889) Braun, 1900.

Host: *Galeocerdo cuvier*, tiger shark; Dry Tortugas (Linton).

*Thysanocephalum rugosum* Chandler, 1942.

Host: *Galeocerdo cuvier*, tiger shark; Englewood, Fla. (Chandler).

*Cylindrophorus lasius* (Linton, 1890) Southwell, 1925.

Host: *Carcharinus leucas*, cub shark; Dry Tortugas (Linton).

*Cylindrophorus exceptus* (Linton, 1924) Southwell, 1925.

Host: *Carcharinus leucas*, cub shark; Rockport, Tex. (Seamster).

*Pedibothrium globicephalum* Linton, 1909.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Pedibothrium longispine* Linton, 1909.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Pedibothrium brevispine* Linton, 1909.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Platybothrium hypoprioni* Potter, 1937.

Host: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Potter).

*Onchobothrium* sp. Linton, 1907.

Host: *Stoasodon narinari*, spotted sting ray; Dry Tortugas (Linton).

#### Family PROTEOCEPHALIDAE

*Proteocephalus australis* Chandler, 1935a.

Host: *Lepisosteus osseus*, long-nosed gar; Galveston Bay (Chandler).

*Proteocephalus elongatus* Chandler, 1935a.

Host: *Lepisosteus osseus*, long-nosed gar; Galveston Bay (Chandler).

*Scolex pleuronectis* Muller, 1788 (= *S. polymorphus* Rud., 1819, of many writers).

A larval form in intestine, cystic duct, or gall bladder of many teleost fishes including *Epinephelus striatus*, *Auxis thazard* (not a Gulf fish; probably *Euthynnus alletteratus*), *Mycteroperca bonaci*, *Lutjanus griseus*, and *Ocyurus chrysurus* at Dry Tortugas (Linton), and *Galeichthys felis* and *Bagre marina* from Galveston Bay (Chandler).

### TRYPANORHYNCHA

#### Family TENTACULARIIDAE

*Nybelinia palliata* (Linton, 1924) Joyeux and Baer, 1936.

Host: *Sphyrna zygaena*, hammer-head shark; Englewood, Fla. (Chandler).

#### Family EUTETRARHYNCHIDAE

*Eutetrarhynchus lineatus* (Linton, 1909) Dollfus, 1942.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton, Shuler).

#### Family OTOBOTHRIDAE

*Otobothrium penetrans* Linton, 1907.

Hosts: *Carcharinus leucas*, cub shark; Dry Tortugas (Linton); *Carcharinus limbatus*, spot-fin ground shark; *Scoliodon tertiae-novae*, sharp-nosed shark; Dry Tortugas (Shuler).

*Otobothrium curtum* (Linton, 1909) Dollfus, 1942.

Hosts: *Galeocerdo cuvier*, tiger shark; immature, *Mycteroperca bonaci*, black grouper; *Epinephelus striatus*, Nassau grouper; Dry Tortugas (Linton).

*Otobothrium crenacolle* Linton, 1890.

Host: *Carcharinus leucas*, cub shark; Dry Tortugas (Linton).

*Poecilancistrum robustum* (Chandler, 1935b) Dollfus, 1942.

Hosts: Im. *Cynoscion nebulosus*, spotted sea trout; Galveston Bay (Chandler); also abundant in *Pogonias cromis* on Texas coast (Chandler, unpublished).

*Diplootobothrium springeri* Chandler, 1942.

Host: *Sphyrna tudes*, hammer-head shark; Englewood, Fla. (Chandler).

#### Family DASYRHYNCHIDAE

*Dasyrhynchus variouncinatus* (Pintner, 1913) Pintner, 1928

(= *Tentacularia insignis* (Linton, 1924) Shuler, 1938; *Dasyrhynchus insigne* Chandler, 1942).

Host: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Linton, Shuler).

*Callitetrarhynchus gracilis* (Rud., 1819) Dollfus, 1942

(= *Rhynchobothrium speciosum* Linton, 1897; *Tentacularia lepida* Chandler, 1935a; *Tentacularia pseudodera* Shuler, 1938).

Hosts: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Shuler); Im., *Epinephelus straitus*, Nassau grouper, *Mycteroperca bonaci*, black grouper, *M. venenosa*, yellow-fin grouper, *Lutjanus griseus*, gray snapper; Dry Tortugas (Linton); *Galeichthys felis*, gaff-topsail catfish, *Bagre marina*, sea catfish; Galveston Bay (Chandler).

## Family LACISTORHYNCHIDAE

*Grillotia perelica* (Shuler, 1938) Dollfus, 1942.

Host: *Negaprion brevirostris*, yellow shark; Dry Tortugas (Shuler).

*Grillotia* sp. (identified as *G. heptanchi* group by Dollfus).

Host: Im., *Cynoscion nebulosus*, Rockport, Tex. (unpublished).

## Family PTEROBOTHRIIDAE

*Pterobothrium heteracanthum* Diesing, 1850 (= *Syndesmobothrium fillicolle* Linton, 1890; *Synbothrium fillicolle* Linton (1897); *Gymnorhynchus gigas* Chandler, 1935).

Hosts: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton); Im., *Calamus calamus*, saucer-eye porgy; Dry Tortugas (Linton); *Galeichthys felis*, gaff-topsail catfish, *Micropogon undulatus*, croaker; Galveston Bay (Chandler).

*Pterobothrium lintoni* (MacCallum, 1916) Dollfus, 1942 (= *Tetrarhynchus erinaceus* Linton, 1897; *Gymnorhynchus malleus* (Linton, 1924; Chandler, 1935).

Host: Im., *Galeichthys felis*, gaff-topsail catfish; Galveston Bay (Chandler).

## Incertae Sedis

*Rhynchobothrium simile* Linton, 1909 (possibly a *Lacistorhynchus* according to Dollfus, 1942).

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Rhynchobothrium tenuispine* Linton, 1890.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Rhynchobothrium binuncum* Linton, 1909.

Host: *Dasyatis sabina*, southern sting ray; Dry Tortugas (Linton).

*Rhynchobothrium exile* Linton, 1909 (probably a *Calitetrarhynchus* according to Pintner, 1931; Dollfus disagrees).

Host: *Galeocerdo cuvier*, tiger shark; Dry Tortugas (Linton). In addition, various unidentified species of *Rhynchobothrium*, both adults and larvae, were reported from various fishes from Dry Tortugas by Linton (1909). Perez Viguera reported three species of larval *Trypanorhyncha* from marine teleosts off Havana, Cuba, and Seamster (personal communication) reported a "*Tetrarhynchus* sp." from *Carcharinus leucas* off Rockport, Tex.

## PSEUDOPHYLLIDEA

## Family PTYCHOBOTHRIIDAE

*Ptychobothrium belones* (Duj., 1845) Lönnberg, 1869 (= *Dibothrium restiforme* Linton, 1891).

Hosts: *Strongylura notata*, needlefish, *S. raphidoma*, houndfish; Dry Tortugas (Shuler).

*Clestopbothrium crassiceps* (Rud., 1819) Lühe, 1899.

Hosts: *Merluccius bilinearis*, silver hake, *Chlorophthalmus truculentus*, green-eye, *Merluccius* sp.; Dry Tortugas (Shuler).

*Bothriocephalus* sp. (Linton, 1908) (= *Dibothrium* sp., Linton, 1908).

Host: Im., *Hepsetia stipes*, silverside; Dry Tortugas (Linton).

## CYCLOPHYLLIDEA

## Incertae Sedis

*Glossocercus cyprinodontis* Chandler, 1935 (probably *Dilepididae*).

Host: Im., *Cyprinodon variegatus*; Galveston Bay (Chandler).

*Cysticercoides menidia* Chandler, 1935.

Host: Im., *Menidia berrylina peninsulae*, silversides; Galveston Bay (Chandler).

NOTE.—Bibliography follows chapter on Nematoda, p. 358.





## ACANTHOCEPHALA

By ASA C. CHANDLER, *Rice Institute*

In contrast to the trematodes and cestodes, very few species of Acanthocephala have been reported from Gulf animals. To some extent, certainly, this is due to the scantiness of investigations, particularly on parasites of fishes of bays and estuaries, but enough work has been done to make it evident that the Acanthocephala are not as abundant in the Gulf as they are in more northern waters, e. g., Woods Hole, Massachusetts. Linton (1907) called attention to this relative scarcity of Acanthocephala, both of species and of individuals, in southern seas, for he observed it not only at Dry Tortugas in the Gulf but also at Beaufort, North Carolina, and at Bermuda. In a later collection at Dry Tortugas (Linton 1909) he remarked that Acanthocephala were found in only 7 of the 32 species of fish examined, and in every case few or even only 1 was found, all belonging to a single species which he called *Echinorhynchus pristis*, now known as *Nippostrongylus ornatus*. In a personal communication Seamster (1950) reported only 1 specimen of 30 fish examined in Corpus Christi Bay, Texas, representing 16 species, to harbor an acanthocephalan. Chandler (1935a), on the other hand, in an examination of 23 species of teleost fish from Galveston Bay represented by from 1 to over 100 specimens of each found a predominance of Acanthocephala as common adult parasites. However, no clasmobranchs were examined so the varied tetracyllidean and trypanorhynchan cestodes found practically universally in the spiral valves of these hosts did not come into the picture. The three adult species of Acanthocephala found were all fairly common in their respective hosts and were the only adult parasites that one could depend on finding in repeated examinations of particular hosts. Acanthocephala will probably be found to be fairly common in fishes frequenting the shores and shal-

low bays throughout the Gulf where small Crustacea, which probably serve as intermediate hosts, abound; but they will probably not be found abundantly in oceanic or reef-dwelling fishes.

### EOACANTHOCEPHALA

#### Family NEOECHINORHYNCHIDAE

*Actatorhynchus verecundus* Chandler, 1935a

Host: *Cyprinodon variegatus*; Galveston Bay (Chandler)

### PALAEACANTHOCEPHALA

#### Family GORGORHYNCHIDAE

*Gorgorhynchus gibber* Chandler, 1934

Host: *Galeichthys felis*, gaff-topsail catfish; Galveston Bay (Chandler)

*Nippostrongylus ornatus* (Van Cleave, 1918) Van Cleave and Lincicome, 1940 (= *Rhadinorhynchus pristis* (Rud., 1802) of Linton, 1891-1909)

Hosts: *Auxis thazard* (*Euthynnus alletteratus*?), frigate mackerel, *Haemulon sciurus*, yellow grunt, *Haemulon plumieri*, white grunt, *Lutjanus griseus*, gray snapper, and four other species, unnamed; Dry Tortugas (Linton)

*Filisoma fidum* Van Cleave and Manter, 1947

Host: *Kyphosus sectatrix*, rudder fish; Dry Tortugas (Van Cleave and Manter)

#### Family RHADINORHYNCHIDAE

*Illiosentis furcatus* Van Cleave and Lincicome, 1939

Host: *Menticirrhus americanus*, southern kingfish; Grand Isle, La. (Van Cleave and Lincicome), Corpus Christi Bay, Tex. (Seamster)

*Telosentis tenuicornis* (Linton, 1891) Van Cleave, 1947

Hosts: *Micropogon undulatus*, croaker, *Leiostomus xanthurus*, spot; Galveston Bay (Chandler)

#### Family CENTRORHYNCHIDAE

*Arhythmorhynchus duocinctus* Chandler, 1935a

Host: Im., *Paralichthys lethostigmus*, southern flounder; Galveston Bay (Chandler)

NOTE.—Bibliography follows chapter on Nematoda, p. 358.



## NEMATODA

By ASA C. CHANDLER, *Rice Institute*

Remarkably few nematodes, either adults or larvae, have been identified in fishes or other animals of the Gulf. The only work done on them known to the writer is Linton's work at Dry Tortugas (1907-1909) and my own work on fishes of Galveston Bay (1935a). In addition, a single species of oxyurid, *Laurotravassoxyuris travassosi*, was described by Perez Viguera (1938) from a teleost on the north coast of Cuba.

Linton called attention to the fact that nematodes were sparingly represented, as were Acanthocephala, in the fishes he examined at Dry Tortugas as compared with the large numbers, particularly of encysted immature forms, in fishes at Woods Hole, Massachusetts. In the Gulf fishes immature encysted forms were found in only 7 of 32 species examined and in small numbers in all except the yellow-fin grouper, *Mycteroperca venenosa*, whereas in the north such nematodes were found in the viscera of a large number of species of fishes, often in great numbers. Linton found adult nematodes in only 6 species of fish, "(1 elasmobranch and 5 teleosts)" but except for the species found in the stomach of a nurse shark only 1 or 2 specimens were found in a host.

Chandler found nematodes, like Acanthocephala, to be relatively more frequent in the inshore fishes of Galveston Bay than in the oceanic and reef fishes examined by Linton, but they could certainly not be considered abundant, either in species or individuals. In 23 species of teleosts studied 3 adult nematodes were found, each represented by only 1 or 2 specimens in single host individuals. Nine species of immature nematodes were found, but only two, both belonging to the genus *Contracaecum*, occurred frequently in their particular hosts and then in only moderate numbers. Seamster (1950), in a personal communication, reported finding 1 nematode infestation in 30 fish belonging to 16 genera from Corpus Christi Bay; this nematode was not identified.

Most of the nematodes found by Linton have been inadequately described and have not been given specific names. The larval forms found by Chandler were all described as fully as the material available would permit and were all tentatively designated new species until the adults become known.

### ASCARIDATA

#### Family OXYURIDAE

*Laurotravassoxyuris travassosi* Perez Viguera, 1938.

Host: *Holacanthus tricolor*, rock beauty; Havana (Perez Viguera).

#### Family ASCARIDIDAE

*Acanthocheilus* sp. Linton, 1909.

Host: *Ginglymostoma cirratum*, nurse shark; Dry Tortugas (Linton).

*Amphicaecum parvum* Chandler, 1935a.

Host: Im., *Dorosoma cepedianum*, gizzard shad; Galveston Bay (Chandler).

*Contracaecum chaunaxi* Olsen, 1952.

Host: *Chaunax* sp.; Dry Tortugas (Olsen).

*Contracaecum collieri* Chandler, 1935a.

Hosts: Im., *Cyprinodon variegatus*, broad killifish, *Paralichthys lethostigmus*, southern flounder; Galveston Bay (Chandler).

*Contracaecum histiophori* Yamaguti, 1935.

Host: *Istiophorus americanus*; Florida coast (Olsen).

*Contracaecum ogcocephali* Olsen, 1952.

Host: *Ogcocephalus radiatus*; Dry Tortugas (Olsen).

*Contracaecum robustum* Chandler, 1935a.

Hosts: Im., *Mugil cephalus*, mullet, *Fundulus* sp. (probably *grandis*), common killifish; Galveston Bay (Chandler).

*Goezia minuta* Chandler, 1935a.

Host: *Bagre marina*, sea catfish; Galveston Bay (Chandler).

*Heterotyphlum eurycheilum* Olsen, 1952.

Host: *Promicrops itaiara*; Dry Tortugas (Olsen).

*Rhaphidascaris anchoviellae* Chandler, 1935a.

Hosts: Im., *Anchoa epsetus*, striped anchovy, *Menidia berrylina peninsulae*, silversides; Galveston Bay (Chandler). Immature ascarids in small numbers recorded by Linton (1907) from the following hosts at Dry Tortugas: *Sphyraena barracuda*, *Haemulon sciurus*, *H. flavolineatum*, *H. macrostomum*, *Mycteroperca bonaci*, *M. venenosa*, *Ocyurus chrysurus*, *Epinephelus striatus*, and *Hepsetia stipes*.

*Rhaphidascaris lutiani* Olsen, 1952.

Host: *Lutianus analis*; Dry Tortugas (Olsen).

*Terranova ginglymostomae* Olsen, 1952.

Host: *Gingylostoma cirratum*; Dry Tortugas (Olsen).

*Terranova secundum* (Chandler, 1935) Olsen, 1952.

Host: Im., *Trichiurus lepturus*, cutlass fish; Galveston Bay (Chandler).

*Terranova trichiuri* (Chandler, 1935) Olsen, 1952.

Host: Im., *Trichiurus lepturus*, cutlass fish; Galveston Bay (Chandler).

#### Family CUCULLANIDAE

*Dichelyne fastigatus* Chandler, 1935a.

Host: *Sciaenops ocellatus*, redbfish; Galveston Bay (Chandler).

*Dichelyne diplocaecum* Chandler, 1935a.

Host: *Ictalurus furcatus*, channel cat, usually found in fresh water, Galveston Bay (Chandler).

#### Family PHILOMETRIDAE

*Philometra* sp. (Linton, 1907) (= *Ichthyonema* sp. Linton, 1907).

Hosts: *Lutjanus griseus*, gray snapper, *Strongylura marina*, billfish; Dry Tortugas (Linton).

#### Incertae Sedis

*Agamonema immanis* Chandler, 1935a (possibly a *Philometra*).

Hosts: *Fundulus* sp. (*grandis*?), *Cyprinodon variegatus*, killifishes; Galveston Bay (Chandler).

*Agamonema vomitor* Chandler, 1935a.

Host: *Ictalurus furcatus*, channel cat (usually found in fresh water); Galveston Bay (Chandler).

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