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# *Technical Papers*

OF THE BUREAU OF SPORT FISHERIES AND WILDLIFE

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## **54. Annotated List of Parasites of the Bluefish Pomatomus saltatrix**

By Herbert G. Anderson, Jr.



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# ANNOTATED LIST OF PARASITES OF THE BLUEFISH POMATOMUS SALTATRIX

By

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ABSTRACT.--In this study of bluefish on the Atlantic coast, 22 of the 31 previously recorded parasites of bluefish were observed and 6 not previously recorded--a total of 37 parasites, 16 of frequent occurrence.

The parasites of the bluefish Pomatomus saltatrix (Linnaeus) from the Atlantic coast of the United States have not been studied intensively. Edwin Linton surveyed marine fish parasites of the Woods Hole, Mass., region from 1887 to 1941. He also made surveys at Beaufort, N.C. (1905), Bermuda (1908a), and Tortugas, Fla. (1908b). Linton recorded three species of acanthocephalans in bluefish from Woods Hole and a different species in hosts from Beaufort. Five species of trematodes were described from Woods Hole and six from Beaufort. Three of these were common to bluefish of both regions. Nine species of cestodes were described from Woods Hole and nine from Beaufort. Five occurred in both regions. Four forms of immature nematodes were described from bluefish at Woods Hole and three at Beaufort. Two species were found to occur in both regions. Linton (1905) recorded one parasitic copepod from bluefish at Beaufort but none at Woods Hole.

The number of each fish species examined was reported by Linton only in the collections made at Beaufort. Because his list of fish species at Woods Hole is extensive, it is presumed that samples of individuals of these species were small. Linton usually disregarded the size range and sex of fish examined.

Note.--The author's present address is Central Connecticut State College, New Britain, Conn. 06050. This paper is based on a thesis submitted to the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

McMahon (1964) reported a monogenetic trematode on bluefish from Chesapeake Bay. A parasitic isopod was identified on bluefish by Richardson (1905). Four parasitic copepods were identified from bluefish by Wilson (1917, 1932); each of these was recorded from fish at Woods Hole, Mass., and one from Beaufort, N.C. MacCallum (1927) recorded a trematode from a bluefish at the New York Aquarium which does not usually infest this species under natural conditions, and Nigrelli (1936) recorded a light infestation of a dinoflagellate (protozoan) on bluefish also held at the New York Aquarium.

## COLLECTION OF BLUEFISH

Bluefish were collected from 10 areas along the Atlantic coast of the United States (fig. 1) in 1962 and 1963 and were examined for parasites. The sampling schedule and sample size are shown in table 1.

Fish were iced immediately after capture, transported to the laboratory, and frozen. Some specimens were refrigerated at  $-20^{\circ}\text{C}$ . for periods up to 16 weeks, but most were examined within 4 weeks. Comparisons of the parasites in fresh and preserved fish from the same sample showed rapid disintegration of the intestinal cestode Scolex pleuronectis Müller. The flesh, viscera, body cavity, eyes, brain, and blood of each fish were examined for parasites.

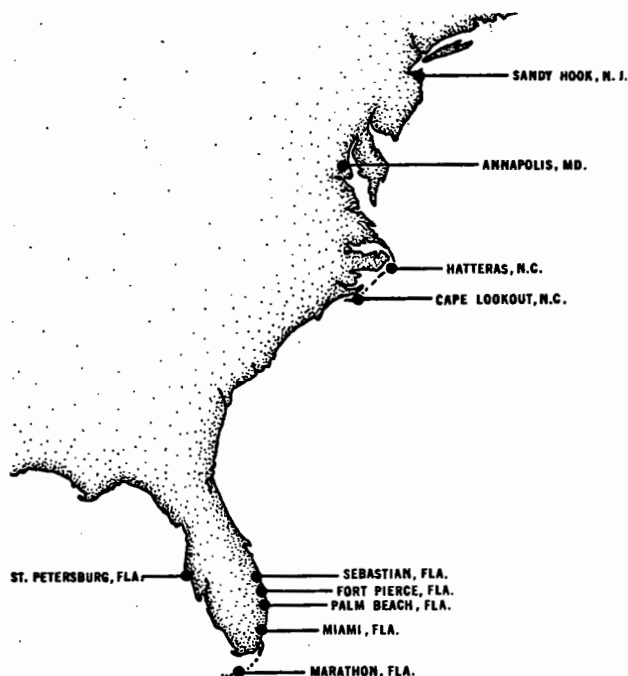


Figure 1.--Atlantic and Gulf coast sampling locations from which bluefish were collected for the study.

TABLE. 1.--Sampling schedule and sample size

Sampling period and locality	Number of bluefish	
	Adult	Juvenile
May-October 1962:		
Sandy Hook, N.J. (July-August)...	67	0
Hatteras, N.C. (July-August)....	35	0
Palm Beach, Fla. (September)....	17	2
Miami, Fla. (May).....	8	0
November 1962-April 1963:		
Cape Lookout, N.C. (April).....	21	19
Fort Pierce, Fla. (February)....	28	0
Marathon, Fla. (January).....	70	0
St. Petersburg, Fla. (March)....	20	3
May-October 1963:		
Sandy Hook, N.J. (July).....	49	0
Annapolis, Md. (August).....	4	16
Hatteras, N.C. (May and July)....	39	11
Sebastian, Fla. (June).....	29	0

Parasites were preserved in 10 percent formalin. Some whole mounts were prepared according to techniques described by Gray (1952).

Preliminary identification of parasites was made from wet mounts and verified from stained and unstained permanent mounts.

Records of the fork length, sex, stage of maturity, and gross stomach contents of each

fish are available from the Sandy Hook Marine Laboratory, Highlands, N.J.

## LIST OF PARASITES

Thirty-one species of parasites have previously been recorded in bluefish. This study added six new species to the list. Two of the parasites were found only in aquarium-held fish and may not occur on bluefish under natural conditions.

The following general account of the parasites summarizes those found during the present study as well as bluefish parasites cited in literature.

### PHYLUM ARTHROPODA SUBORDER ISOPODA FAMILY CYMOTHOIDAE

#### 1. Livoneca ovalis (Say, 1818)

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras, N.C., and Sebastian, Fla.

Site.--Gills.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Richardson, 1905), and seven other host species from Woods Hole and along the Atlantic and Gulf Coastal States to Biloxi, Miss. (Richardson, 1905).

### SUBCLASS COPEPODA FAMILY CALIGIDAE

#### 2. Caligus schistonyx Wilson, 1905

Locality.--Marathon and St. Petersburg, Fla.

Sites.--Oral and gill cavities.

Previously reported hosts and localities.--Bluefish and Brevoortia tyrannus from Woods Hole, Mass. (Wilson, 1905), Lepisosteus osseus and Mugil cephalus from Alligator

Harbor, Fla. (Pearse, 1952), and other unidentified host species at Beaufort, N.C. (Wilson, 1932).

#### FAMILY LERNAEIDAE

##### 3. Lernaenicus radiatus (LeSueur, 1824)

Locality.--This parasite was not found in bluefish during the present study.

Site.--Skin of various parts of the body.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Wilson, 1932), and 10 other host species from Woods Hole, Long Island, N.Y., and the North American coast (Wilson, 1932).

##### 4. Lernaenicus longiventris Wilson, 1917

Locality.--Sandy Hook, N.J., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Palm Beach, and Marathon, Fla.

Site.--Skin.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Wilson, 1932), and eight other host species from Woods Hole, Nantucket, R.I., Norfolk, Va., Beaufort, N.C. (Wilson, 1932), Miami, Fla. (Pearse, 1951), and Mazatlan, Sinaloa (Causey, 1960).

#### FAMILY DICHELESTHIIDAE

##### 5. Lernanthropus pomatomi Rathbun, 1888

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Palm Beach, Miami, Marathon, and St. Petersburg, Fla.

Site.--Gills.

Previously reported hosts and localities.--Bluefish from Vineyard Sound, Mass. (Rathbun, 1888), Beaufort, N.C. (Linton, 1905; Wilson, 1922), and Woods Hole, Mass. (Wilson, 1932), and two other host species from Sinaloa and Nayarit (Causey, 1960).

#### PHYLUM ACANTHOCEPHALA ORDER PALAEACANTHOCEPHALA FAMILY RHADINORHYNCHIDAE

##### 6. Telosentis tenuicornis (Linton, 1891)

Locality.--Hatteras and Cape Lookout, N.C., and Fort Pierce and Marathon, Fla.

Site.--Intestinal wall.

Previously reported hosts and localities.--Bluefish from Beaufort, N.C. (Linton, 1905), and 17 other host species from Woods Hole, Mass. (Linton, 1892), Newport, R.I., Beaufort, N.C. (Linton, 1905), Bermuda (Linton, 1908a), Tortugas (Linton, 1908b), and Galveston Bay, Tex. (Chandler, 1935).

#### FAMILY GORGORHYNCHIDAE

##### 7. Serrasentis socialis (Leidy, 1851)

Locality.--Sandy Hook, N.J., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Palm Beach, Miami, Marathon, and St. Petersburg, Fla.

Site.--Body cavity and mesenteries.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1901b), and 16 other host species from Woods Hole (Linton, 1889, 1901b), Beaufort, N.C. (Linton, 1905), Miami, Fla. (Ward, 1954), and Galveston and Port Isabel, Tex. (Bullock, 1957).

#### FAMILY POMPHORHYNCHIDAE

##### 8. Pomphorhynchus proteus (Westrumb, 1821)

Locality.--Sandy Hook, N.J., Hatteras, N.C., and Palm Beach, Fla.

Site.--Intestinal wall.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1901b), and seven other host species from Woods Hole (Linton, 1901b), and from Beaufort, N.C. (Linton, 1905).

FAMILY POLYMORPHIDAE

9. Corynosoma incrassatus (Linton, 1891)

Locality.--Marathon and St. Petersburg, Fla.

Site.--Intestinal wall.

Previously reported hosts and localities.-- Bluefish and two other host species from Woods Hole, Mass. (Linton, 1891).

PHYLUM PLATYHELMINTHES  
CLASS CESTODA  
ORDER TETRAPHYLLIDEA

10. Scolex pleuronectis Müller, 1788

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Marathon, and St. Petersburg, Fla.

Site.--Cystic duct, gall bladder, and intestine.

Previously reported hosts and localities.-- Bluefish from Woods Hole, Mass. (Linton, 1901b, 1925), and Beaufort, N.C. (Linton, 1905), and over 60 other host species from Woods Hole (Linton, 1901b, 1925), Beaufort (Linton, 1905), Bermuda (Linton, 1908a), and Galveston Bay, Tex. (Chandler, 1935).

ORDER TRYPANORHYNCHA  
FAMILY LACISTORHYNCHIDAE

11. Lacistorhynchus bulbifer (Linton, 1889)

Locality.--Not found in bluefish during the present study.

Site.--Viscera and intestinal wall.

Previously reported hosts and localities.-- Bluefish and 30 other host species from Woods Hole, Mass. (Linton, 1891, 1925).

FAMILY TENTACULARIIDAE

12. Nybelinia bisulcata (Linton, 1889)

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras, N.C., and Fort Pierce and Sebastian, Fla.

Site.--Viscera.

Previously reported hosts and localities.-- Bluefish from Woods Hole, Mass. (Linton, 1925), and Beaufort, N.C. (Linton, 1905), and 51 other host species from Woods Hole (Linton, 1925), Beaufort (Linton, 1905), Miami, Fla. (Ward, 1954), Bermuda (Linton, 1908a), and Japan (Yamaguti, 1959).

FAMILY DASYPHYNCHIDAE

13. Callitetrarhynchus gracilis (Rudolphi, 1819)

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Palm Beach, Miami, Marathon, and St. Petersburg, Fla.

Site.--Viscera.

Previously reported hosts and localities.-- Bluefish from Woods Hole, Mass. (Linton, 1901b, 1925), and Beaufort, N.C. (Linton, 1905), and 24 other host species from Woods Hole (Linton, 1901b, 1925), Beaufort (Linton, 1905), Florida (Schuler, 1938), Miami, Fla. (Ward, 1954), Bermuda (Linton, 1908a), and Galveston Bay, Tex. (Chandler, 1935).

FAMILY OTOBOTHRIDAE

14. Otobothrium dipsacum Linton, 1897

Locality.--Marathon, Fla.

Site.--Viscera.

Previously reported hosts and localities.-- Bluefish from Woods Hole, Mass. (Linton, 1897, 1901b, 1925), and 11 other host species

from Woods Hole (Linton, 1925), Pensacola, Fla. (Linton, 1925), Beaufort, N.C. (Linton, 1905), and Miami, Fla. (Ward, 1954).

15. Otobothrium crenacolle Linton, 1890

Locality.--Sandy Hook, N.J., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Marathon, and St. Petersburg, Fla.

Site.--Stomach mucosa, mesenteries, and viscera.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1925), and Beaufort, N.C. (Linton, 1905), and 35 other host species from Woods Hole (Linton, 1891, 1925), Beaufort (Linton, 1905), Tortugas (Linton, 1908b), and Bermuda (Linton, 1908a).

FAMILY PTEROBOTHRIDAE

16. Pterobothrium filicolle (Linton, 1889)

Locality.--Hatteras, N.C., and Fort Pierce, Sebastian, Palm Beach, Marathon, and St. Petersburg, Fla.

Site.--Viscera.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1897, 1901b, 1925), New York (Linton, 1897), and Beaufort, N.C. (Linton, 1905), and at least 25 other host species from Woods Hole (Linton, 1901b, 1925), Beaufort (Linton, 1905), Tortugas (Linton, 1908b), and India (Yamaguti, 1959).

17. Pterobothrium malleum (Linton, 1924)

Locality.--Was not found in bluefish during the present study.

Site.--Mesenteries and viscera.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1897, 1901b), and Beaufort, N.C. (Linton, 1905), and at least six other host species from Woods Hole (Linton, 1897, 1901b, 1925),

Beaufort (Linton, 1905), Galveston Bay, Tex. (Chandler, 1935), and the Indian Ocean (Southwell, 1929).

ORDER PSEUDOPHYLLIDEA  
FAMILY PTYCHOBOTHRIDAE

18. Clestobothrium crassiceps (Rudolphi, 1819)

Locality.--Was not found in bluefish during the present study.

Site.--Intestine.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1941), and nine other host species from Woods Hole (Linton, 1941). Yamaguti (1959) reported it in nine genera, including Pomatomus, from North America.

FAMILY BOTHRIOCEPHALIDAE

19. Bothriocephalus sp. Linton, 1941

Locality.--This parasite was not found in bluefish during the present study.

Site.--Viscera.

Previously reported hosts and localities.--Bluefish and 26 other host species from Woods Hole, Mass. (Linton, 1941).

CLASS TREMATODA  
ORDER MONOGENEA  
FAMILY MICROCOTYLIDAE

20. Microcotyle pomatomi Goto, 1900

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Palm Beach, Miami, Marathon, and St. Petersburg, Fla.

Site.--Gills.

Previously reported hosts and localities.--Bluefish from Newport, R.I. (Goto, 1900), Woods Hole, Mass. (Goto, 1900; Linton, 1901b),



Beaufort, N.C. (Linton, 1905; Pearse, 1949), Chesapeake Bay, Md. (McMahon, 1964), "off Port Aransas, Texas" (Koratha, 1955), Alligator Harbor, Fla. (Hargis, 1956), and the Black Sea (Bychowsky, 1961).

Note.--In a recent paper "Studies on Larval Monogenea of Fishes from the Chesapeake Bay Area, Part I, "by N. Kingston, W. A. Dillon, and W. J. Hargis, Jr., 1969 (Journal of Parasitology, vol. 55, no. 3, p. 544-558), the authors reported two genera found in autopsied bluefish. Besides Microcotyle pomatomi Goto listed herein, they also found Gotocotyla acanthophallus (MacCallum and MacCallum, 1913) Yamaguti, 1963. Gotocotyla was not found or reported in the present study.

ORDER DIGENEA  
FAMILY ALLOCREADIIDAE

21. Opecoeloides vitellosus (Linton, 1901a)

Locality.--Sandy Hook, N.J., Hatteras and Cape Lookout, N.C., and Fort Pierce, Fla.

Site.--Stomach and intestinal chyme.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1901a, 1901b), and Beaufort, N.C. (Linton, 1905), and 37 other host species from Woods Hole (Linton, 1901a, 1901b), Beaufort (Linton, 1905), and Bermuda (Linton, 1908a).

22. Lepocreadium pyriforme (Linton, 1889)

Locality.--Sandy Hook, N.J.

Site.--Intestine.

Previously reported hosts and localities.--Bluefish and eight other host species from Woods Hole, Mass. (Linton, 1901b, 1940).

FAMILY HEMIURIDAE

23. Brachyphallus crenatus (Rudolphi, 1802)

Locality.--Annapolis, Md., and Sebastian, Marathon, and St. Petersburg, Fla.

Site.--Liver.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1898, 1940), and at least 17 other host species from Woods Hole (Linton, 1940), Barents Sea, Boreal Atlantic, Boreal Pacific (Polyanski, 1961), Bering Sea, Okhotsk Sea, and Sea of Japan (Strelkov, 1956).

24. Sterrhurus monticellii (Linton, 1899)

Locality.--Sandy Hook, N.J., Annapolis, Md., Hatteras and Cape Lookout, N.C., and Fort Pierce, Sebastian, Marathon, and St. Petersburg, Fla.

Site.--Stomach chyme.

Previously reported hosts and localities.--Bluefish from Woods Hole, Mass. (Linton, 1901b, 1940), and Beaufort, N.C. (Linton, 1905), and 32 other host species from Woods Hole (Linton, 1901b, 1940), Beaufort (Linton, 1905), Bermuda (Linton, 1908a), and Tortugas (Linton, 1908b).

FAMILY BUCEPHALIDAE

25. Rhipidocotyle transversale Chandler, 1935

Locality.--This parasite was not found in bluefish during the present study.

Site.--Viscera.

Previously reported hosts and localities.--Bluefish from Beaufort, N.C. (Linton, 1905), and at least 13 other host species from Woods Hole, Mass. (Linton, 1901b, 1940), Beaufort, N.C. (Linton, 1905), Galveston Bay, Tex. (Chandler, 1935), Grand Isle, La., Rockport and Port Aransas, Tex., and York River, Va. (Sparks, 1957).

26. Bucephaloides arcuatus (Linton, 1901a)

Locality.--Sebastian, Palm Beach, Miami, Marathon, and St. Petersburg, Fla.

Site.--Intestinal caeca.

Previously reported hosts and localities.--  
At least eight host species but not bluefish,  
from Woods Hole, Mass. (Linton, 1901a, 1940),  
Beaufort, N.C. (Linton, 1905), Miami, Fla.  
(Ward, 1954), Tortugas (Manter, 1940), and the  
Red Sea (Sparks, 1957).

## FAMILY ACANTHOCOLPIDAE

27. Stephanostomum dentatum (Linton, 1901a)

Locality.--Was not found in bluefish during  
the present study.

Site.--Kidneys.

Previously reported hosts and localities.--  
Bluefish from Beaufort, N.C. (Linton, 1905),  
and nine other host species from Woods Hole,  
Mass. (Linton, 1901a, 1940), Beaufort, N.C.  
(Linton, 1905), and Tortugas (Manter, 1947).

28. Stephanostomum tenue (Linton, 1898)

Locality.--Sandy Hook, N.J., Hatteras, N.C.,  
and Sebastian and Marathon, Fla.

Site.--Kidneys.

Previously reported hosts and localities.--  
Bluefish from Woods Hole, Mass. (Linton,  
1940), and Beaufort, N.C. (Linton, 1905), and  
17 other host species from Woods Hole (Lin-  
ton, 1898, 1940), Beaufort (Linton, 1905), and  
Sandy Hook Bay, N.J. (Nigrelli and Atz, 1943).

## FAMILY UNKNOWN

29. Distoma fenestratum Linton, 1905

Locality.--Fort Pierce and Marathon, Fla.

Site.--Heart and kidneys.

Previously reported hosts and localities.--  
At least 20 host species, but not bluefish, from  
Woods Hole, Mass. (Linton, 1940), Beaufort,  
N.C. (Linton, 1905), Bermuda (Linton, 1908a),  
Tortugas (Linton, 1910), Bahamas, "off the  
Mississippi River," and Grand Isle, La.  
(Sparks, 1957).

PHYLUM ASCHELMINTHES  
CLASS NEMATODA

Four forms of immature nematodes were  
described from bluefish at Woods Hole and  
three at Beaufort. Two forms were found in  
both regions. All were collectively identified  
by Linton (1901b, 1905) as Ascaris sp.

ORDER DRACUNCULOIDEA  
FAMILY PHILOMETRIDAE30. Philometra globiceps (Rudolphi, 1819)

Locality.--Sandy Hook, N.J., Annapolis, Md.,  
Hatteras, N.C., and Sebastian, Palm Beach,  
Miami, and St. Petersburg, Fla.

Site.--Ovaries.

Previously reported hosts and localities.--  
Bluefish from Woods Hole, Mass. (Linton,  
1901b), Beaufort, N.C. (Linton, 1905), and  
North Carolina coast (Lassiter, 1962), and  
seven other host species from Woods Hole  
(Linton, 1901b), Beaufort (Linton, 1905),  
Bermuda (Linton, 1908a), and Naples, Italy  
(Yamaguti, 1961).

## 31. ORDER ASCARIDIDEA

Locality.--Sandy Hook, N.J., Annapolis, Md.,  
Hatteras and Cape Lookout, N.C., and Fort  
Pierce, Sebastian, Palm Beach, Miami, Ma-  
rathon, and St. Petersburg, Fla.

Site.--Viscera.

Previously reported hosts and localities.--  
Bluefish from Woods Hole, Mass. (Linton,  
1901b), and Beaufort, N.C. (Linton, 1905), and  
at least 31 other host species from Beaufort,  
N.C. (Linton, 1905).

PHYLUM PROTOZOA  
CLASS MASTIGOPHORA  
ORDER DINOFLAGELLATA  
FAMILY GYMNODINIIDAE32. Oodinium ocellatum Brown, 1931

Locality.--This parasite was not found in  
bluefish during the present study.

Site.--Gills and skin.

Previously reported hosts and localities.-- Bluefish at the New York Aquarium (Nigrelli, 1936) and numerous other host species from the East Indies, the West Indies (Brown, 1934), North American waters (Nigrelli, 1936), the New York Aquarium (Nigrelli, 1936), and the Aquarium of the Zoological Society of London (Brown, 1931).

PHYLUM PLATYHELMINTHES  
CLASS TREMATODA  
FAMILY CAPSALIDAE

33. Benedenia melleni MacCallum, 1927

Locality.--This parasite was not found in bluefish during the present study.

Site.--Skin.

Previously reported hosts and localities.-- Bluefish and numerous other host species from the New York Aquarium (MacCallum, 1927) and Europe (Bychowsky, 1961).

## DISCUSSION

Thirty-one species of parasites have been previously recorded from bluefish. The following species commonly parasitize this host: Microcotyle pomatomi, Lernanthropus pomatomi, Callitetrarhynchus gracilis, Serrasentis socialis, Sterrhurus monticellii, Scolex pleuronectis, Philometra globiceps, Lernaeenicus longiventris, Otobothrium crenacolle, Pterobothrium filicolle, Nybelinia bisulcata, Proso-rhynchus, Bucephaloides arcuatus, Distoma fenestratum, Trypanorhyncha sp., and unidentified immature nematodes.

Parasites of adult bluefish found to be rare include Lepocreadium pyriforme, Otobothrium dipsacum, Livoneca ovalis, Brachyphallus crenatus, Otobothrium vitellosus, Stephanostomum tenue, Telosentis tenuicornis, and Pom-

phorhynchus proteus. Species not found in this study but recorded as rare are Stephanostomum dentatum, Benedenia melleni, Oodinium ocellatum, Lernaeenicus radiatus, Pterobothrium malleum, Clestopothrium crassiceps, Lacistorhynchus bulbifer, Rhipidocotyle transversale, and Bothriocephalus sp.

Two species listed as parasites of bluefish were not previously recorded from this host: Bucephaloides arcuatus (Linton) and Distoma fenestratum Linton. An encysted trematode of the genus Proso-rhynchus, family Bucephalidae, occurred frequently in the kidneys. Lack of differentiation of adult structures prevented complete identification. A cestode of the order Trypanorhyncha occurred frequently in the intestinal caeca, but the immature embryo within the blastocyst could not be identified. A single specimen of a female rhadinorhynchid acanthocephalan was collected from the intestinal wall of an adult male bluefish from Sebastian, Fla., on June 26, 1963. A single specimen of a paramphistomid trematode was collected from the stomach chyme of an adult male bluefish from Hatteras, N.C., on July 31, 1963. Unidentified parasites were stained and mounted. Complete identification of the immature forms will require reference to a developmental series.

The geographical range of 21 species of parasites of bluefish was extended by this study. The frequency distribution for each of these parasites in bluefish and the localities from which they were recorded are presented in tables 2 to 5.

Some species of parasites of bluefish were collected from all localities studied and are also reported by Linton, Wilson, or Richardson from bluefish from Woods Hole and Beaufort. Others show geographical discontinuity.

The incidence and number of parasites of adult and juvenile fish were studied at each locality and were correlated with size and sex of the host.

TABLE 2.--Parasite incidence and intensity of the parasite-mix of adult bluefish, May to October 1962

[Parasite-mix expressed as the average number per specimen parasitized]

Parasite	Sandy Hook, N.J.				Hatteras, N.C.				Palm Beach, Fla.		Miami, Fla.	
	July		August		July		August		September		May	
	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity
<u>M. pomatomi</u> .....	28	7.4	30	4.2	10	4.8	23	5.6	17	12.9	7	4.8
<u>L. pomatomi</u> .....	15	10.6	12	8.4	11	14.2	19	6.4	16	6.7	6	5.8
<u>S. socialis</u> .....	4	4.0	1	2.0	1	1.0	13	4.1	11	3.0	1	1.0
<u>C. gracilis</u> .....	1	1.0	2	1.0			2	2.5	2	1.0	2	1.0
<u>Ascarididea</u> .....	5	2.0	27	2.1	10	7.4	10	3.1	9	5.2	4	12.5
<u>L. longiventris</u> ....	1	1.0	2	2.5	3	3.6	1	1.0	3	1.0		
<u>P. globiceps</u> .....	24	4.5	18	--	1	2.0	5	--	17	7.0	4	45.6
<u>S. pleuronectis</u> ....	1	10.0	10	--			1	--				
<u>O. crenacolle</u> .....			1	1.0								
<u>O. vitellosus</u> .....	1	1.0	1	1.0								
<u>N. bisulcata</u> .....			3	1.0								
<u>L. pyriforme</u> .....	1	1.0	1	6.0								
<u>P. filicolle</u> .....							6	1.5	2	1.5		
<u>B. arcuatus</u> .....											5	16.5
<u>P. proteus</u> .....									1	9.0		
<u>Trypanorhyncha</u> sp. ..									4	1.2		
Sample size.....	29		38		11		24		17		8	

TABLE 3.--Parasite incidence and intensity of the parasite-mix of adult bluefish, November 1962 to April 1963

[Parasite-mix expressed as the average number per specimen parasitized]

Parasite	Cape Lookout, N.C. April		Ft. Pierce, Fla. February		Marathon, Fla. January		St. Petersburg, Fla. March	
	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity
<u>M. pomatomi</u> .....	11	5.0	4	2.0	10	2.0	4	4.2
<u>L. pomatomi</u> .....	12	4.5	17	2.6	56	4.6	15	9.1
<u>S. socialis</u> .....	4	1.2	9	1.6	12	1.5	3	1.0
<u>C. gracilis</u> .....	4	2.0	8	1.2	7	1.0	6	1.3
<u>Ascarididea</u> .....	16	4.2	22	9.4	65	--	19	9.6
<u>L. longiventris</u> ....	3	1.3	1	1.0	1	1.0		
<u>P. globiceps</u> .....							1	--
<u>S. pleuronectis</u> ....	3	--	17	--			6	--
<u>O. crenacolle</u> .....	14	19.1	16	59.3	57	71.4	18	89.2
<u>O. vitellosus</u> .....			1	3.0				
<u>N. bisulcata</u> .....			1	1.0				
<u>Prosorhynchus</u> sp. ...	1	1.0	2	9.0	29	5.1	8	4.0
<u>P. filicolle</u> .....			1	1.0	5	1.2	3	1.0
<u>D. fenestratum</u> .....			1	1.0	26	2.6		
<u>S. monticellii</u> .....	7	3.7	2	5.5	8	2.6	7	6.2
<u>T. tenuicornis</u> .....	1	1.0	2	1.0	3	1.0		
<u>B. arcuatus</u> .....					35	17.3	18	15.7
<u>O. dipsacum</u> .....					1	1.0		
<u>S. tenue</u> .....					1	1.0		
<u>C. incrassatus</u> .....					4	3.5	4	1.0
<u>C. schistonyx</u> .....					1	1.0	1	2.0
<u>B. crenatus</u> .....					1	3.0	1	1.0
<u>Trypanorhyncha</u> sp. ..	5	1.8			13	3.0		
Sample size.....	21		28		70		20	

TABLE 4.--Parasite incidence and intensity of the parasite-mix of adult bluefish, May to October 1963  
[Parasite-mix expressed as the average number per specimen parasitized]

Parasite	Sandy Hook, N.J.		Annapolis, Md.		Hatteras, N.C.				Sebastian, Fla.	
	July		August		May		July		June	
	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity
<i>M. pomatomi</i> .....	40	4.0	3	2.6	15	3.2	11	3.1	16	2.0
<i>L. pomatomi</i> .....	5	3.0	2	4.0	17	5.4	11	4.9	24	4.4
<i>S. socialis</i> .....	7	1.2			4	1.5	5	1.2	3	6.0
<i>C. gracilis</i> .....	9	1.2	1	1.0	5	2.0	5	1.8	6	1.1
Ascarididea.....	45	6.3	4	4.5	22	3.8	14	6.7	26	6.6
<i>L. longiventris</i> .....	1	1.0			2	1.5			8	1.3
<i>P. globiceps</i> .....	27	--			6	2.0	2	--	1	--
<i>S. pleuronectis</i> .....	22	--	1	--	5	--	1	--	12	--
<i>O. crenacolle</i> .....	28	22.3			20	31.6	6	20.6	20	27.0
<i>O. vitellosus</i> .....					3	3.0				
<i>N. bisulcata</i> .....	10	1.6	1	2.0			3	2.0	6	1.1
<i>Prosorhynchus</i> sp. ....	11	2.4			5	3.4	2	2.5	19	14.0
<i>P. filicolle</i> .....							1	2.0	1	2.0
<i>S. monticellii</i> .....	14	2.4	4	9.2	6	1.6	3	1.0	4	1.0
<i>B. arcuatus</i> .....									1	6.0
<i>P. proteus</i> .....	1	1.0					2	2.0		
<i>S. tenue</i> .....	3	28.3					2	1.5	1	15.0
<i>B. crenatus</i> .....									1	1.0
<i>L. ovalis</i> .....							1	1.0	1	1.0
<i>Trypanorhyncha</i> sp. ....	33	2.6	3	1.3	9	1.0	9	3.2	12	4.3
Sample size.....	49		4		25		14		29	

TABLE 5.--Parasite incidence and intensity of the parasite-mix of juvenile bluefish, collected from September 1962 to July 1963  
[Parasite-mix expressed as the average number per specimen parasitized]

Parasite	Annapolis, Md.		Hatteras, N.C.		Cape Lookout, N.C.		Palm Beach, Fla.		St. Petersburg Fla.	
	August, 1963		July, 1962		April, 1963		September, 1962		March, 1963	
	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity
<i>M. pomatomi</i> .....	7	4.5	1	6.0	11	4.9	2	5.0	1	1.0
<i>L. pomatomi</i> .....	6	2.6	4	2.7	7	2.5	2	4.0	3	2.6
<i>S. socialis</i> .....					1	1.0	1	3.0	1	1.0
<i>C. gracilis</i> .....									2	1.0
Ascarididea.....	9	1.4	9	4.2	10	--	2	7.0	3	5.0
<i>L. longiventris</i> .....					1	1.0				
<i>P. globiceps</i> .....	2	--	1	1.0			2	8.0		
<i>S. pleuronectis</i> .....	7	--	2	--	2	--			3	--
<i>O. crenacolle</i> .....			1	1.0	3	1.6			2	4.5
<i>O. vitellosus</i> .....					4	1.0				
<i>Prosorhynchus</i> sp. ....			1	1.0					1	1.0
<i>P. filicolle</i> .....									1	1.0
<i>S. monticellii</i> .....	12	5.1	3	3.3	2	1.0			1	1.0
<i>B. arcuatus</i> .....							1	3.0		
<i>B. crenatus</i> .....	1	1.0								
<i>L. ovalis</i> .....	2	1.5								
<i>T. tenuicornis</i> .....			1	1.0						
<i>Trypanorhyncha</i> sp. ....	5	2.2	4	4.0	1	1.0	1	2.0		
Sample size.....	16		11		19		2		3	

## SUMMARY

A survey was made of the parasites of bluefish from the Atlantic coast of the United States. Studies also were made to determine the incidence and number of parasites of adult and juvenile fish. Bluefish were collected near St. Petersburg, Marathon, Miami, Palm Beach, Fort Pierce, and Sebastian, Fla., near Cape Lookout and Hatteras, N.C., and at Annapolis, Md., and Sandy Hook, N.J. The number of adult specimens collected from 10 areas during 1962-1963 was 387. Fifty-one juvenile bluefish were collected from five fishing grounds during this period.

Of the 31 parasites previously recorded from bluefish, 22 species were found during this study. In addition to parasites previously recorded, six parasites not known from this host were found. However, because of the immaturity of the parasite or because too few specimens were found, four could not be identified. The other two were Bucephaloides arcuatus (Linton) and Distoma fenestratum Linton. Thus a total of 37 parasites of bluefish are known, of which 16 occur frequently.

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