

PARASITES FROM FISH OF BUCKEYE LAKE, OHIO

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During the summer of 1930 a study was made of the parasitism of the fish of Buckeye Lake as a part of a survey conducted by the Ohio Division of Conservation.

Buckeye Lake is located in portions of Licking, Fairfield and Perry Counties. It is a long irregular body of water seven and one-half miles east to west, varying in width from one-fourth mile in the east to one and one-half mile in the widest portion of the west end. It covers an estimated area of 4,200 acres. The water-shed is a low table land three to five miles wide. Several small streams enter and the lake drains through a waste weir into the south fork of the Licking River. The lake was originally flooded and dikes maintained to supply water for a portion of the Ohio Canal system. There are many shallow areas filled with vegetation. The bottom is mainly composed of soft mud although in areas where dredging operations are conducted, sand and gravel is coming in.

There are several small islands, one of the largest being of a peculiar formation. It is an anchored, floating sphagnum peat bog of approximately forty acres. There are numerous small ponds on the southwest end of the island. One of these ponds was selected as a seining station. It contained young carp, three species of bullheads, and mud minnows. These fish were infected with larval *Spiroxys* sp.

There were thirty-nine additional seining stations where visits were made every two weeks and seine hauls taken with a fifty foot net where vegetation and bottom conditions would permit. In case the larger net could not be used, a fifteen foot seine was substituted. A fyke net was also set in different locations for ten day periods and lifted twice daily. Forty-eight hundred fish from this net were identified, measured, tagged and released. A few were retained for examination of their parasites. Certain fish not taken by other methods were secured in gill nets.

Fish were examined while the parasites were living, then parasites were preserved and later stained, mounted and iden-

tified. Five hundred and four fish belonging to thirty-eight species were examined. Of this number 334 or 66.2 per cent were parasitized. This is a somewhat higher degree of infection than that found by Bangham and Hunter (1939), for parasites of Lake Erie fish. There, 2156 fish belonging to 79 species yielded a 58.3 per cent infection with at least one parasitic species. There were fewer different species of parasites in Buckeye Lake fish but a heavier infection of parasitic protozoa, copepods and cysts of larval *Acanthocephala* was found. In 1938, the writer examined 1380 fish belonging to 45 species from southern Florida and found 88.2 per cent parasitized, (Bangham, in press). Here the increase in parasitism was chiefly due to large numbers of encysted trematode metacercariae and larval nematodes which have their adult stages in fish-eating birds. More different species of parasites were encountered in a study in 1939 of fish of Algonquin Park lakes. In this area, 560 fish belonging to 22 species were examined and 84.3 per cent were infected (Bangham, in press). In this region water birds also play an important part in the life cycles of many of the fish parasites.

At Buckeye Lake the gills of fish were frequently infested by parasitic copepods and less often by gill flukes. Channel catfish, small-mouth bass and large-mouth bass in several instances carried cysts of myxosporidian forms on their gill filaments. A sporozoan encysted in the body cavities of young gizzard shad was the only parasite found in this fish species. This form was found in ten of twelve young gizzard shad when examined in the fall. This form apparently caused the death of numerous young gizzard shad.

Trematodes were not as numerous as in the same species of fish from Lake Erie. There were but few encysted strigeids and the infections were usually light. Moderately heavy infestations of gill flukes belonging to the family Gyrodactylidae were found on the tallow-mouthed minnow, tadpole madtom, mud pickerel, small-mouth bass, large-mouth bass, green sunfish, bluegill, pumpkinseed, white crappie and white bass. Another group of gill trematodes was represented by a single specimen of *Octobothrium* sp. taken from the tallow-mouthed minnow. *Paramphistomum stunkardi* Holl was found in small numbers in individuals belonging to six species of Buckeye Lake fish. This trematode was described by Holl (1929) from the pumpkinseed and warmouth bass of North Carolina. It was reported by

Venard (1940) from ten species of fish. Buckeye Lake represents the most northern record reported in the distribution of this parasite.

Cestodes belonging to the family Caryophyllaeidae were fairly numerous in common suckers, hog suckers, carp and satin-finned minnows. Unfortunately most of the specimens were lost before they were stained and identified. The only record of the family Bothriocephalidae was a single specimen of *Bothriocephalus formosus* secured from a Johnny darter. This species was described by Mueller and Van Cleave (1932) from the trout perch of Oneida Lake. In 1934, Van Cleave and Mueller included the Johnny darter as another host of this cestode. Three species of adult cestodes belonging to the genus *Proteocephalus* were found, *P. pinguis* in the mud pickerel, *P. pearsei* in seven species and *P. ambloplitis* in a few small-mouth and large-mouth bass. Larval stages of this latter cestode were encysted in ten fish species but the infections were light.

The nematodes are represented by several species but always in small numbers. Acanthocephala were secured in greater abundance. Encysted *Leptorhynchoides thecatus* (Linton) were taken from 15 fish species while adults were secured from the intestinal tracts of 13. Larval *Neoechinorhynchus cylindratus* (Van Cleave) were encysted in the livers of blue gills and pumpkinseeds while adults of this acanthocephalan were carried by large-mouth and small-mouth bass and green sunfish.

In the list of fish hosts and their parasites which follow, the parasites are listed in order of abundance, the number in parenthesis following the species indicates the number of individuals carrying the designated parasite. The asterisk preceding the name of the parasite indicates an immature stage (usually an encysted form).

1. *Dorosoma cepedianum* (Le Sueur). Gizzard shad.
(Examined, 17. Parasitized, 5.)
Microsporidia (5).
2. *Carpionodes cyprinus cyprinus* (LeSueur). Carp sucker.
(Examined, 3. Parasitized, 0.)
3. *Catostomus commersonnii commersonnii* (Lacépède).
Common sucker.
(Examined, 23. Parasitized, 19.)
Glaridacris catostomi Cooper (15).
Biacetabulum infrequens Hunter (5).
Leptorhynchoides thecatus (Linton) (1).
Ergasilus versicolor Wilson (1).

4. *Hypentelium nigricans* (LeSueur). Hog sucker.
(Examined, 2. Parasitized, 1.)
Caryophyllaeidae (1).
5. *Erimyzon sucetta kennerlyi* (Girard). Chub sucker.
(Examined, 9. Parasitized, 5.)
Neoechinorhynchus crassus Van Cleave (5).
Ergasilus versicolor Wilson (1).
Ergasilus centrarchidarum Wright (1).
Ergasilus caeruleus Wilson (1).
6. *Moxostoma erythrurum* (Rafinesque). Golden sucker.
(Examined, 1. Parasitized, 0.)
7. *Cyprinus carpio* Linnaeus. Carp.
(Examined, 17. Parasitized, 8.)
Caryophyllaeidae (7).
**Spiroxys* sp. (1).
8. *Semotilus atromaculatus atromaculatus* (Mitchill). Creek chub.
(Examined, 4. Parasitized, 3.)
**Neascus vancleavei* (3).
9. *Notemigonus crysoleucas auratus* Rafinesque.
(Examined, 7. Parasitized, 0.)
10. *Notropis deliciosus stramineus* (Cope). Northern sand shiner.
(Examined, 7. Parasitized, 2.)
Caryophyllaeidae (1).
Allocreadium lobatum Wallin (1).
11. *Notropis spilopterus* (Cope). Satin-finned shiner.
(Examined, 17. Parasitized, 2.)
**Proteocephalus* sp.
**Neascus vancleavei* (Agersborg).
12. *Notropis cornutus chrysocephalus* (Rafinesque). Mississippi common shiner.
(Examined, 1. Parasitized, 0.)
13. *Ericymba buccata* Cope. Silver-jawed minnow.
(Examined, 5. Parasitized, 0.)
14. *Hyborhynchus notatus* (Rafinesque). Blunt-nosed minnow.
(Examined, 19. Parasitized, 9.)
**Neascus vancleavei* (Agersborg) (9).
15. *Camptostoma anomalum anomalum* (Rafinesque). Ohio tallow-mouthed minnow.
(Examined, 7. Parasitized, 5.)
**Neascus vancleavei* (Agersborg) (3).
Octobothrium sp. (2).
Allocreadium lobatum Wallin (2).
Gryodactylidae (1).
**Aganomema* sp. (1).
16. *Ictolurus lacustris punctatus* (Rafinesque). Southern channel catfish.
(Examined, 15. Parasitized, 15.)
Ergasilus versicolor Wilson (13.)

- Corallobothrium fimbriatum* Essex (9).
Henneguya exilis Kudo (3).
Corallobothrium giganteum Essex (1).
 **Proteocephalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).
Achtheres micropteri Wright (1).
17. *Ameiurus melas melas* (Rafinesque). Black bullhead.
 (Examined, 17. Parasitized, 14.)
 **Proteocephalus ambloplitis* (Leidy) (7).
Corallobothrium fimbriatum Essex (5).
Ergasilus versicolor Wilson (5).
 **Spiroxys* sp. (4).
 **Leptorhynchoides thecatus* (Linton) (1).
18. *Ameiurus nebulosus nebulosus* (LeSueur). Brown bullhead.
 (Examined, 14. Parasitized, 10.)
Ergasilus versicolor Wilson (7).
 **Proteocephalus ambloplitis* (Leidy) (6).
Corallobothrium fimbriatum Essex (4).
Leptorhynchoides thecatus (Linton) (2).
19. *Ameiurus natalis natalis* (LeSueur). Yellow bullhead.
 (Examined, 11. Parasitized, 11.)
Leptorhynchoides thecatus (Linton) (7).
 **Spiroxys* sp. (6).
Ergasilus versicolor Wilson (5).
Alloglossidium geminus (Mueller) (3).
Corallobothrium fimbriatum Essex (2).
 **Camallanus* sp. (2).
Phyllodistomum staffordi Pearse (2).
Paramphistomum stunkardi Holl (1).
20. *Schilbeodes gyrinus* (Mitchill). Tadpole madtom.
 (Examined, 15. Parasitized, 13.)
 **Leptorhynchoides thecatus* (Linton) (7).
 Gyrodactylidae (6).
Corallobothrium fimbriatum Essex (5).
 **Spiroxys* sp. (3).
Alloglossidium corti (Lamont) (2).
Ergasilus caeruleus Wilson (1).
 **Proteocephalus ambloplitis* (Leidy) (1).
21. *Esox vermiculatus* LeSueur. Mud pickerel.
 (Examined, 18. Parasitized, 13.)
Leptorhynchoides thecatus (Linton) (6).
 **Leptorhynchoides thecatus* (Linton) (6).
Paramphistomum stunkardi Holl (4).
Proteocephalus pinguis La Rue (3).
Macroderoides flavus Van Cleave and Mueller (2).
 Gyrodactylidae (1).
Microphallus ovatus Osborn (1).
22. *Umbra limi* (Kirtland). Western mud-minnow.
 (Examined, 4. Parasitized, 4.)

- **Spiroxys* sp. (4).
Hepaticola bakeri Mueller and Van Cleave (2).
23. *Fundulus notatus* (Rafinesque). Black-striped topminnow.
 (Examined, 11. Parasitized, 5.)
 **Leptorhynchoides thecatus* (Linton) (3).
 **Agamomema* sp. (1).
 **Proteocephalus* sp. (1).
24. *Labidesthes sicculus sicculus* (Cope). Northern brook silverside.
 (Examined, 6. Parasitized, 0.)
25. *Perca flavescens* (Mitchill). Yellow perch.
 (Examined, 17. Parasitized, 7.)
 **Neascus ambloplitis* Hughes (5).
 **Leptorhynchoides thecatus* (Linton) (3).
Proteocephalus pearsei La Rue (1).
 **Neascus* sp. (1).
 **Agamonema* sp. (1).
26. *Boleosoma nigrum nigrum* Rafinesque. Western Johnny darter.
 (Examined, 8. Parasitized, 1).
Bothriocephalus formosus Van Cleave and Mueller (1).
27. *Percina caprodes caprodes* (Rafinesque). Ohio log perch.
 (Examined, 12. Parasitized, 7.)
 **Leptorhynchoides thecatus* (Linton) (5).
 **Neascus* sp. (3).
 Microsporidia (3).
 **Camallanus* sp. (2).
28. *Poecilichthys caeruleus* (Storer). Rainbow darter.
 (Examined, 3. Parasitized, 2.)
 **Leptorhynchoides thecatus* (Linton) (2).
29. *Poecilichthys exilis* (Girard). Iowa darter.
 (Examined, 12. Parasitized, 12.)
 **Leptorhynchoides thecatus* (Linton) (12).
30. *Micropterus dolomieu dolomieu* (Lacépède). Small-mouth bass.
 (Examined, 34. Parasitized, 29.)
 **Proteocephalus ambloplitis* (Leidy) (15).
Ergasilus centrarchidarum Wright (13).
Leptorhynchoides thecatus (Linton) (10).
 **Leptorhynchoides thecatus* (Linton) (7).
Neochinorhynchus cylindratus (Van Cleave) (4).
 Myxosporidia (gill cysts) (4).
Ergasilus caeruleus Wilson (2).
Proteocephalus ambloplitis (Leidy) (2).
Proteocephalus pearsei LaRue (2).
Achtheres micropteri Wright (1).
 **Camallanus* sp. (1).
 **Agamomema* sp. (1).
Crepidostomum cornutum (Osborn) (1).
Paramphistomum stunkardi Holl (1).
 **Neascus ambloplitis* Hughes (1).
 Gyrodactylidae (1).

31. *Huro salmoides* (Lacépède). Large-mouth bass.
(Examined, 38. Parasitized, 38.)
Neoechinorhynchus cylindratus (Van Cleave) (18).
**Leptorhynchoides thecatus* (Linton) (18).
Ergasilus centrarchidarum Wright (15).
Myxosporidia (gill cysts) (14).
Leptorhynchoides thecatus (Linton) (12).
**Proteocephalus ambloplitis* (Leidy) (7).
Proteocephalus pearsei LaRue (4).
Gyrodactylidae (3).
**Neascus ambloplitis* Hughes (1).
Paramphistomum stunkardi Holl (1).
Ergasilus caeruleus Wilson (1).
Proteocephalus ambloplitis (Leidy) (1).
32. *Lepomis cyanellus* Rafinesque. Green sunfish.
(Examined, 15. Parasitized, 15.)
**Leptorhynchoides thecatus* (Linton) (15).
Paramphistomum stunkardi Holl (7).
Camallanus oxycephalus Word and Magath (3).
**Proteocephalus ambloplitis* (Leidy) (2).
Gyrodactylidae (2).
Ergasilus caeruleus Wilson (2).
Leech (1).
Proteocephalus pearsei LaRue (1).
**Agamomema* sp. (1).
Anallocreadium sp. (1).
Glochidia (gill cysts) (1).
33. *Lepomis megalotis megalotis* (Rafinesque). Southern long-eared sunfish.
(Examined, 4. Parasitized, 4.)
**Leptorhynchoides thecatus* (Linton) (4).
Paramphistomum stunkardi Holl (3).
**Proteocephalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).
34. *Lepomis gibbosus* (Linn.). Pumpkinseed.
(Examined, 20. Parasitized, 20.)
Ergasilus caeruleus Wilson (15).
**Leptorhynchoides thecatus* (Linton) (10).
**Neoechinorhynchus cylindratus* (Van Cleave) (5).
Leech (3).
Gyrodactylidae (3).
Anallocreadium sp. (1).
**Proteocephalus ambloplitis* Leidy (1).
Proteocephalus pearsei LaRue (1).
Myxosporidia (1).
Ergasilus centrarchidarum Wright (1).
Leptorhynchoides thecatus (Linton) (1).
35. *Lepomis macrochirus* Rafinesque. Bluegill.
(Examined, 39. Parasitized, 34.)
Ergasilus centrarchidarum Wright (20).

- **Proteocephalus ambloplitis* (Leidy) (15).
 **Leptorhynchoides thecatus* (Linton) (12).
Ergasilus caeruleus Wilson (9).
Camallanus oxycephalus Word and Magath (6).
Spinitectus carolini Holl (5).
 **Neoechinorhynchus cylindratus* (Van Cleave) (5).
Leptorhynchoides thecatus (Linton) (3).
 Gyrodactylidae (3).
Neascus vancleavei (Agersborg) (2).
 **Agamomema* sp. (2).
 Leech (2).
36. *Pomoxis annularis* Rafinesque. White crappie.
 (Examined, 23. Parasitized, 7.)
Cryptogonimus chyli Osborn (4).
 **Leptorhynchoides thecatus* (Linton) (2).
Ergasilus caeruleus Wilson (1).
 Leech (1).
 Gyrodactylidae (1).
 **Proteocephalus ambloplitis* (Leidy) (1).
Leptorhynchoides thecatus (Linton) (1).
37. *Pomoxis nigro-maculatus* (LeSueur). Black crappie.
 (Examined, 2. Parasitized, 2.)
 **Neascus vancleavei* (Agersborg) (2).
Cryptogonimus chyli Osborn (1).
Proteocephalus pearsei (1).
38. *Lepibema chrysops* (Rafinesque). White bass.
 (Examined, 27. Parasitized, 12.)
 Gyrodactylidae (4).
Proteocephalus pearsei LaRue (4).
Leptorhynchoides thecatus (Linton) (4).
Argulus stizostethii Kellicott (3).
Camallanus oxycephalus Ward and Magath (2).
 **Corallobothrium* sp. (1).

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