

PARASITES FROM FISH COLLECTED IN PROXIMITY TO CATFISH CAGES

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ABSTRACT

An investigation was conducted to determine the effects of cage culturing channel catfish, *Ictalurus punctatus* (Rafinesque), on the native fish found in proximity to the cages. Monogenetic trematodes and copepods parasitizing fish collected were identified to genus. Nine genera of monogenetic trematodes and one genus of copepod were found. Comparisons were made between the number of fish parasitized at cage sites and control sites during three periods of time relative to catfish culture in cages. There were no significant differences between cage sites and control sites during any of the three periods.

INTRODUCTION

Fish culture in ponds and lakes was first practiced in China around 2000 B.C. according to Lee (1971). It was not until approximately the turn of the 20th century that cage culture of fishes came into use in parts of Asia (Thiemmedh, 1961).

Extensive research on aspects of cage culture of catfish, *Ictalurus punctatus* (Rafinesque), was conducted by Schmittou (1969a). He listed these advantages in cage culturing of fish:

1. Allows for intensive culture.
2. May be practiced in many types of water environment.
3. Allows for a combination of cultures in ponds, such as channel catfish in cages and largemouth bass - blue gill in open water.
4. Allows for closer observation of feeding activity and general health of the fish.
5. Provides an easier, more economical method for treating disease and parasites.
6. Allows an easy and complete harvest by simply lifting the cages from the water.
7. Permits the manipulation of harvest to fit the market.

There are at least two possible disadvantages to cage culturing of any kind of fish. Feeding caged fish introduces into the water nutrients that would not ordinarily be present. These nutrients could lower water quality in the vicinity of the cages. The second disadvantage is the potential for parasite epizootics, both on native fish and caged fish, as a result of crowded conditions around the cages (Kennamer, 1970; Lee, 1971; Matsuda, 1970; Schmittou, 1969a, b).

Becker, *et al.* (1966) studied the parasite fauna (pre-impoundment) of a bass population in a reservoir in Arkansas. This study and one by Smith (1971) on a reservoir in Texas were concerned with fish parasites in reservoirs, but there has been virtually no work on parasite incidence in connection with fish culture in cages.

Objectives of this research were to:

1. Identify parasites from native fish in Hartwell Reservoir.
2. Compare between cage sites and control sites the number of fish parasitized before, during, and after catfish were being held and fed in cages in Hartwell Reservoir.

MATERIALS AND METHODS

Parasites were taken from fish collected from each of six sites on Hartwell Reservoir (Fig. 1), an impoundment of approximately 60,000 acres on the upper Georgia - South Carolina border. Three of the sites each accommodated a series of six catfish cages in which channel catfish were fed daily from May 1972 through October 1972, and three of the sites were used as controls. Each cage site was paired with a control site. Each control site was as near as possible to its cage site without being so near as to be influenced by the cages themselves.

Fish were collected with experimental gill nets, 6 feet deep and 125 feet long. The length of the nets was divided into five panels, each 25 feet long. The mesh size progressed from 0.5 inch through 2.5 inch in increments of 0.5 inch. At cage sites the smallest mesh was placed next to the cages and gill nets were stretched away from the cages. Beginning March 10, 1972 through February 13, 1973, nets were set every four weeks in the late afternoon and were retrieved during early morning the following day. The experiment was divided into three periods: 1) before, 2) during, and 3) after culture of catfish in cages.

The first fish removed from each mesh size at each site was selected for examination for parasites. Techniques described by Rogers (1966) were used for preserving gills and the remainder of each fish carcass. Parasites from each fish were placed in separate 4-dram bottles containing 5% formalin and one drop of glycerin. Contents of each 4-dram bottle were examined under a binocular compound microscope. A representative of each genus of parasite found on each fish was mounted in glycerin on a glass microscope slide. This was sufficient for identification to genus of all mounts since the major taxonomical features (haptors, hooks, hooklets, cirri, and accessory pieces) are readily observable with 450x without staining.

All monogenetic trematodes were identified using keys devised by W. A. Rogers (unpublished mimeo). Copepods were identified using keys by Burris and Miller (1972), Wilson (1911), and Hoffman (1967). Possible host-parasite combinations were checked using Hoffman (1967) and Allison and Rogers (1970).

A representative sample of parasites from each type of fish was taken to the Southeastern Fish Parasite and Disease Project at Auburn, Alabama for verification of identification.

RESULTS AND DISCUSSION

Of 238 fish examined, 100 were infested with monogenetic trematodes, copepods, or both. Nine genera of monogenetic trematodes and one genus of parasitic copepod were observed. The genera were:

Trematoda: Monogenea

Dactylogyrus

Clavunculus

Actinocleidus

Urocleidus

Cleidodiscus

Pseuacanthocotyloides

Mazocraeoides

Neodiscocotyle

Gyrodactylus

Crustacea: Copepoda

Ergasilus

Of 12 species of fish parasitized, 67% had a light infestation rate (1 to 10 parasites/fish), 15% had a medium infestation rate (11 to 25 parasites/fish), and

18% had a heavy infestation rate (26+ parasites/fish). None of the heavily parasitized fish showed any sign of illness or physical abnormality. Data concerning total numbers of fish collected and parasitized are found in Table 1. Table 2 lists species of fish collected and the infesting parasites.

Period I

During period 1, base information was collected from both cage sites and control sites. Table 3 lists the parasite load of fish caught during period 1, before catfish were introduced into the cages, at both cage sites and control sites. Parasite infestation was 40.5% at the cage sites and 35.7% at control sites. At the cage sites, 17 of 42 fish were parasitized; control sites had 10 of 28 fish parasitized.

Period II

Table 4 lists the parasite load of fish collected during period 2, when catfish were being cultured in the cages. During this period, parasite infestation was 44.3% at cage sites and 44.4% at control sites. Twenty-seven of 62 fish were parasitized at cage sites and 20 of 45 fish were parasitized at control sites.

Period III

Table 5 lists the parasite levels during period 3 when catfish had been removed from the cages. During four collections made in this period, infestation rate was 48.5% at cage sites and 35.0% at control sites. The observed number of parasitized fish at cage sites was 17 of 35 and at control sites was nine of 26.

A Chi square test of independence indicated no significant difference ($P=0.05$) in parasitism between fish from cage sites and those from control sites during any of the three periods. These statistics indicate that catfish culture may have no adverse effects on ecto-parasitism of native fish populations, especially in an oligotrophic reservoir such as Hartwell Reservoir.

Monogenetic Trematodes

As shown in Table 6, monogenetic trematodes infested 37.4% of fish collected at the cage sites and 31.3% of fish collected at control sites. There was no significant difference between the numbers of fish parasitized at cage sites and control sites. Trematodes parasitized 48.3% of game fish and only 27.2% of non-game fish. Only four species of fish (goldfish, warmouth, walleye, and yellow perch) were free of monogenetic trematodes. However, less than five specimens of each fish were collected.

Parasitic Copepods

Ergasilus, the only genus of copepod found, (Table 7) parasitized 20.7% of the game fish and 8.6% of the non-game fish. This genus occurred in 12.2% of fish collected from cage sites and in 14.2% of fish collected from control sites. There was no significant difference between numbers of fish parasitized at cage sites and control sites.

SUMMARY

The bodies and gills of 238 fish collected from March 10, 1972 through February 13, 1973 were examined for parasitic trematodes and copepods. The fish were collected from six sites on Hartwell Reservoir, a man-made impoundment of approximately 60,000 acres located on the upper Georgia - South Carolina border. A control site, in close proximity to each cage site, was used on a comparative basis with the cage site. Collections were made during three time periods: 1) before catfish were placed in cages, 2) when catfish were being cultured in cages, 3) after catfish were removed from cages.

1. Twelve species of fish were host to monogenetic trematodes, of which there were nine genera.
2. Eleven species of fish were host to *Ergasilus*, a parasitic copepod.
3. Trematodes were found on more game fish than on non-game fish.
4. Copepods were found on more game fish than on non-game fish.
5. At cage sites and control sites, no significant difference was found in total numbers of fish parasitized with monogenetic trematodes, copepods, or both.
6. During periods of pre-culturing, culturing, and post-culturing, no significant difference was found in numbers of fish parasitized with monogenetic trematodes and parasitic copepods.
7. Although 18% of the infested fish had a heavy parasite load, there were no noticeable lesions or hemorrhaging on the fish.
8. There were no new host-parasite relationships determined.

Table 1. Total numbers of each type fish collected each sampling period and the numbers of those collected that were parasitized.

Date: Species*	3-10-72		4-5-72		5-31-72		6-28-72		7-26-72	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	Col	Par
Gizzard Shad	0	0	2	1	5	2	2	1	7	2
Threadfin Shad	0	0	0	0	4	0	6	1	3	0
Carp	0	0	4	2	1	0	4	1	4	1
Goldfish	0	0	0	0	0	0	0	0	0	0
Golden Shiner	4	0	0	0	1	1	1	1	1	1
Carp sucker	0	0	0	0	6	2	2	0	0	0
White Catfish	0	0	0	0	1	0	0	0	0	0
Bullhead Catfish	2	0	3	1	2	1	1	1	2	2
White Bass	6	3	2	1	3	2	3	1	0	0
Hybrid Bass	1	0	1	0	0	0	3	1	0	0
Largemouth Bass	2	1	2	2	0	0	1	1	2	2
Warmouth	0	0	0	0	0	0	0	0	0	0
Bluegill	3	2	1	1	2	2	4	4	2	1
Black Crappie	2	0	2	2	3	1	1	0	2	2
Walleye	2	0	0	0	0	0	0	0	0	0
Yellow Perch	0	0	2	0	1	0	0	0	0	0

¹number collected ²number parasitized

*Scientific nomenclature found in Appendix.

Table 1. (Continued)

Date: Species*	8-23-72		9-15-72		10-13-72		11-10-72		12-08-72	
	Col	Par	Col	Par	Col	Par	Col	Par	Col	Par
Gizzard Shad	3	3	2	1	6	2	6	3	5	3
Threadfin Shad	3	0	3	0	2	0	3	0	2	0
Carp	1	0	4	2	0	0	1	0	2	0
Goldfish	0	0	0	0	0	0	0	0	1	0
Golden Shiner	0	0	1	1	0	0	0	0	1	1
Carp sucker	2	0	3	0	3	1	0	0	0	0
White Catfish	3	2	1	1	2	2	1	0	1	0
Bullhead Catfish	2	0	1	0	0	0	2	0	0	0
White Bass	0	0	0	0	0	0	3	3	3	3
Hybrid Bass	0	0	0	0	0	0	0	0	0	0
Largemouth Bass	0	0	2	2	3	2	0	0	0	0
Warmouth	1	0	0	0	0	0	0	0	0	0
Bluegill	1	1	1	1	2	1	0	0	0	0
Black Crappie	1	1	1	1	0	0	2	1	1	0
Walleye	0	0	0	0	0	0	0	0	0	0
Yellow Perch	0	0	0	0	2	0	0	0	0	0

*Scientific nomenclature found in Appendix.

Table 1. (Continued)

Date: Species*	01-16-73		02-13-73		Species Totals		
	Col ¹	Par ²	Col	Par	Col	Par	Par
Gizzard Shad	2	0	1	0	41	18	43.9
Threadfin Shad	1	0	1	1	28	2	7.1
Carp	2	0	1	0	24	6	25.0
Goldfish	0	0	0	0	1	0	0.0
Golden Shiner	1	0	1	0	11	5	45.5
Carp sucker	1	0	0	0	17	3	17.6
White Catfish	0	0	0	0	9	5	55.5
Bullhead Catfish	2	1	3	1	20	7	35.0
White Bass	3	3	3	3	26	19	73.1
Hybrid Bass	0	0	0	0	5	1	20.0
Largemouth Bass	1	1	0	0	13	11	84.6
Warmouth	0	0	0	0	1	0	0.0
Bluegill	0	0	0	0	16	13	81.3
Black Crappie	1	1	2	1	18	10	55.5
Walleye	1	0	0	0	3	0	0.0
Yellow Perch	0	0	0	0	5	0	0.0

¹number collected²number parasitized

*Scientific nomenclature found in Appendix.

Table 2. List of monogenetic trematodes and parasitic copepods that were found to infect fishes collected in this experiment.

Host	Trematode	Copepod
GIZZARD SHAD	<i>Mazocraeoides</i>	<i>Ergasilus</i>
	<i>Pseudanthocotylodes</i>	
	<i>Gyrodactylus</i>	
THREADFIN SHAD	<i>Mazocraeoides</i>	<i>Ergasilus</i>
	<i>Dactylogyrus</i>	
CARP	<i>Dactylogyrus</i>	<i>Ergasilus</i>
GOLDEN SHINER	<i>Dactylogyrus</i>	<i>Ergasilus</i>
	<i>Gyrodactylus</i>	
CARPSUCKER	<i>Neodiscocotyle</i>	<i>Ergasilus</i>
WHITE CATFISH	<i>Cleidodiscus</i>	<i>Ergasilus</i>
BULLHEAD	<i>Cleidodiscus</i>	<i>Ergasilus</i>
	<i>Gyrodactylus</i>	
	<i>Urocleidus</i>	
WHITE BASS	<i>Gyrodactylus</i>	<i>Ergasilus</i>
HYBRID BASS	<i>Urocleidus</i>	
LARGEMOUTH BASS	<i>Actinocleidus</i>	<i>Ergasilus</i>
	<i>Clavunculus</i>	
	<i>Gyrodactylus</i>	
	<i>Urocleidus</i>	
BLUEGILL	<i>Actinocleidus</i>	<i>Ergasilus</i>
	<i>Gyrodactylus</i>	
	<i>Urocleidus</i>	
BLACK CRAPPIE	<i>Cleidodiscus</i>	<i>Ergasilus</i>
	<i>Gyrodactylus</i>	

Table 3. Numbers of fish collected and numbers of fish parasitized at cage (1, 3, 5) and control (2, 4, 6) sites during period I.

Species*	Site #						Total		% Par
	1		3		5		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	0	0	0	0	2	1	2	1	50.0
Threadfin Shad	2	0	0	0	0	0	2	0	0.0
Carp	3	0	1	1	1	1	5	2	40.0
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	3	1	0	0	0	0	3	1	33.3
Carp sucker	1	0	2	0	1	1	4	1	25.0
White Catfish	0	0	0	0	0	0	0	0	-
Bullhead Catfish	1	0	2	0	1	1	4	1	25.0
White Bass	2	1	0	0	5	3	7	4	57.1
Hybrid Bass	1	0	0	0	0	0	1	0	0.0
Largemouth Bass	0	0	2	2	0	0	2	2	100.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	1	1	1	1	2	2	100.0
Black Crappie	4	3	2	0	0	0	6	3	50.0
Walleye	0	0	0	0	2	0	2	0	0.0
Yellow Perch	0	0	1	0	1	0	2	0	0.0
TOTALS	17	5	11	4	14	8	42	17	40.5

¹number collected

²number parasitized

*Scientific nomenclature found in Appendix.

Species*	Site #						Total		% Par
	2		4		6		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	2	1	2	1	1	0	5	2	40.0
Threadfin Shad	1	0	1	0	0	0	2	0	0.0
Carp	0	0	0	0	0	0	0	0	-
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	0	0	2	0	0	0	2	0	0.0
Carp sucker	1	0	1	1	0	0	2	1	50.0
White Catfish	0	0	0	0	1	0	1	0	0.0
Bullhead Catfish	0	0	1	1	2	0	3	1	33.3
White Bass	1	0	0	0	3	2	4	2	50.0
Hybrid Bass	1	0	0	0	0	0	1	0	0.0
Largemouth Bass	0	0	1	1	1	0	2	1	50.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	1	1	3	2	4	3	75.0
Black Crappie	1	0	0	0	0	0	1	0	0.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	1	0	0	0	0	0	1	0	0.0
TOTALS	8	1	9	5	11	4	28	10	35.7

¹number collected ²number parasitized
*Scientific nomenclature found in Appendix.

Table 4. Numbers of fish collected and numbers of fish parasitized at cage (1, 3, 5) and control (2, 4, 6) sites during period II.

Species*	Site #						Total		% Par
	1		3		5		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	4	3	3	1	7	4	14	8	57.1
Threadfin Shad	1	0	5	0	4	0	10	0	0.0
Carp	5	1	2	0	1	0	8	1	12.5
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	3	3	0	0	0	0	3	3	100.0
Carp sucker	0	0	3	1	0	0	3	1	33.3
White Catfish	2	1	1	1	0	0	3	2	66.7
Bullhead Catfish	0	0	2	0	1	0	3	0	0.0
White Bass	0	0	0	0	0	0	0	0	-
Hybrid Bass	0	0	0	0	3	1	3	1	33.3
Largemouth Bass	2	2	0	0	1	1	3	3	100.0
Warmouth	1	0	0	0	0	0	1	0	0.0
Bluegill	1	1	3	2	2	2	6	5	83.3
Black Crappie	2	2	1	1	0	0	3	3	100.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	1	0	0	0	1	0	2	0	0.0
TOTALS	22	13	20	6	20	8	62	27	44.3

¹number collected ²number parasitized
*Scientific nomenclature found in Appendix.

Table 4. (Continued)

Species*	Site #						Total		% Par
	2		4		6		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	2	1	2	0	2	0	6	1	16.7
Threadfin Shad	4	0	2	0	1	1	7	1	14.3
Carp	2	0	2	2	1	1	5	3	60.0
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	0	0	0	0	0	0	0	0	-
Carp sucker	7	0	0	0	0	0	7	0	0.0
White Catfish	0	0	3	3	0	0	3	3	100.0
Bullhead Catfish	0	0	2	2	1	1	3	3	100.0
White Bass	1	0	0	0	2	1	3	1	33.3
Hybrid Bass	0	0	0	0	0	0	0	0	-
Largemouth Bass	1	1	3	2	1	1	5	4	80.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	0	0	4	3	4	3	75.0
Black Crappie	1	1	1	0	0	0	2	1	50.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	0	0	0	0	0	0	0	0	-
TOTALS	18	3	15	9	12	8	45	20	44.4

¹number collected ²number parasitized
 *Scientific nomenclature found in Appendix.

Table 5. Numbers of fish collected and numbers of fish parasitized at cage (1, 3, 5) and control (2, 4, 6) sites during period III.

Species*	Site #						Total		% Par
	1		3		5		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	2	2	3	0	4	2	9	4	44.4
Threadfin Shad	0	0	2	0	4	1	6	1	16.7
Carp	0	0	1	0	0	0	1	0	0.0
Goldfish	0	0	0	0	1	0	1	0	0.0
Golden Shiner	3	1	0	0	0	0	3	1	33.3
Carp sucker	0	0	1	0	0	0	1	0	0.0
White Catfish	0	0	1	0	0	0	1	0	0.0
Bullhead Catfish	0	0	0	0	0	0	0	0	-
White Bass	1	1	1	1	6	6	8	8	100.0
Hybrid Bass	0	0	0	0	0	0	0	0	-
Largemouth Bass	0	0	0	0	0	0	0	0	-
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	0	0	0	0	0	0	-
Black Crappie	0	0	3	2	1	1	4	3	75.0
Walleye	0	0	0	0	1	0	1	0	0.0
Yellow Perch	0	0	0	0	0	0	0	0	-
TOTALS	6	4	12	3	17	10	35	17	48.5

¹number collected ²number parasitized
 *Scientific nomenclature found in Appendix.

Table 5. (Continued)

Species*	Site #						Total		% Par
	2		4		6		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	3	0	2	2	0	0	5	2	40.0
Threadfin Shad	0	0	1	0	0	0	1	0	0.0
Carp	1	0	0	0	4	0	5	0	0.0
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	0	0	0	0	0	0	0	0	-
Carp sucker	0	0	0	0	0	0	0	0	-
White Catfish	1	0	0	0	0	0	1	0	0.0
Bullhead Catfish	2	2	2	0	3	0	7	2	28.6
White Bass	0	0	2	2	2	2	4	4	100.0
Hybrid Bass	0	0	0	0	0	0	0	0	-
Largemouth Bass	1	1	0	0	0	0	1	1	100.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	0	0	0	0	0	0	-
Black Crappie	0	0	0	0	2	0	2	0	0.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	0	0	0	0	0	0	0	0	-
TOTALS	8	3	7	4	11	2	26	9	35.0

¹number collected ²number parasitized

*Scientific nomenclature found in Appendix.

Table 6. Numbers of fish collected and numbers of fish parasitized with monogenetic trematodes at cage (1, 3, 5) and control (2, 4, 6) sites during the experiment.

Species*	Site #						Total		% Par
	1		3		5		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	6	5	6	1	13	7	25	13	52.0
Threadfin Shad	3	0	7	0	8	0	18	0	0.0
Carp	8	1	4	1	2	1	14	3	21.4
Goldfish	0	0	0	0	1	0	1	0	0.0
Golden Shiner	9	4	0	0	0	0	9	4	44.4
Carp sucker	1	0	6	1	1	0	8	1	12.5
White Catfish	2	1	2	1	0	0	4	2	50.0
Bullhead Catfish	1	0	4	0	2	1	7	1	14.3
White Bass	3	2	1	1	11	8	15	11	73.3
Hybrid Bass	1	0	0	0	3	1	4	1	25.0
Largemouth Bass	2	1	2	1	1	1	5	3	60.0
Warmouth	1	0	0	0	0	0	1	0	0.0
Bluegill	1	1	4	3	3	3	8	7	87.5
Black Crappie	6	3	6	2	1	1	13	6	46.2
Walleye	0	0	0	0	3	0	3	0	0.0
Yellow Perch	1	0	1	0	2	0	4	0	0.0
TOTALS	45	18	43	11	51	23	139	52	37.4

¹number collected ²number parasitized

*Scientific nomenclature found in Appendix.

Table 6. (Continued)

Species*	Site #						Total		% Par
	2		4		6		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	7	2	6	3	3	0	16	5	31.3
Threadfin Shad	5	0	4	0	1	1	10	1	10.0
Carp	3	0	2	1	5	1	10	2	20.0
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	0	0	2	0	0	0	2	0	0.0
Carp sucker	8	0	1	1	0	0	9	1	11.1
White Catfish	1	0	3	2	1	0	5	2	40.0
Bullhead Catfish	2	2	5	3	6	1	13	6	46.2
White Bass	2	0	2	2	7	4	11	6	54.5
Hybrid Bass	1	0	0	0	0	0	1	0	0.0
Largemouth Bass	2	1	4	0	2	1	8	2	25.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	1	1	7	5	8	6	75.0
Black Crappie	2	0	1	0	2	0	5	0	0.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	1	0	0	0	0	0	1	0	0.0
TOTALS	34	5	31	13	34	13	99	31	31.3

¹number collected²number parasitized

*Scientific nomenclature found in Appendix.

Table 7. Numbers of fish collected and numbers of fish parasitized with copepods at cage (1, 3, 5) and control (2, 4, 6) sites during the experiment.

Species*	Site #						Total		% Par
	1		3		5		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	6	0	6	0	13	2	25	2	8.0
Threadfin Shad	3	0	7	0	8	1	18	1	5.5
Carp	8	0	4	0	2	0	14	0	0.0
Goldfish	0	0	0	0	1	0	1	0	0.0
Golden Shiner	9	2	0	0	0	0	9	2	22.2
Carp sucker	1	0	6	0	1	1	8	1	12.5
White Catfish	2	0	2	1	0	0	4	1	25.0
Bullhead Catfish	1	0	4	0	2	0	7	0	0.0
White Bass	3	0	1	0	11	2	15	2	13.3
Hybrid Bass	1	0	0	0	3	0	4	0	0.0
Largemouth Bass	2	2	2	1	1	1	5	4	80.0
Warmouth	1	0	0	0	0	0	1	0	0.0
Bluegill	1	0	4	0	3	0	8	0	0.0
Black Crappie	6	3	6	1	1	0	13	4	30.8
Walleye	0	0	0	0	3	0	3	0	0.0
Yellow Perch	1	0	1	0	2	0	4	0	0.0
TOTALS	45	7	43	3	51	7	139	17	12.2

¹number collected²number parasitized

*Scientific nomenclature found in Appendix.

Table 7. (Continued)

Species*	Site #						Total		% Par
	2		4		6		Col	Par	
	Col ¹	Par ²	Col	Par	Col	Par	Col	Par	
Gizzard Shad	7	0	6	0	3	0	16	0	0.0
Threadfin Shad	5	0	4	0	1	0	10	0	0.0
Carp	3	0	2	2	5	1	10	3	30.0
Goldfish	0	0	0	0	0	0	0	0	-
Golden Shiner	0	0	2	0	0	0	2	0	0.0
Carp sucker	8	0	1	1	0	0	9	1	11.1
White Catfish	1	0	3	1	1	0	5	1	20.0
Bullhead Catfish	2	1	5	0	6	0	13	1	7.7
White Bass	2	0	2	0	7	1	11	1	9.1
Hybrid Bass	1	0	0	0	0	0	1	0	0.0
Largemouth Bass	2	1	4	3	2	0	8	4	50.0
Warmouth	0	0	0	0	0	0	0	0	-
Bluegill	0	0	1	1	7	1	8	2	25.0
Black Crappie	2	1	1	0	2	0	5	1	20.0
Walleye	0	0	0	0	0	0	0	0	-
Yellow Perch	1	0	0	0	0	0	1	0	0.0
TOTALS	34	3	31	8	34	3	99	14	14.2

¹number collected²number parasitized

*Scientific nomenclature found in Appendix.

Appendix Table 1. Common and scientific nomenclature for fishes cited.

Common Name	Scientific Name
Gizzard Shad	<i>Dorosoma cepedianum</i> (Lesuer)
Threadfin Shad	<i>Dorosoma petenense</i> (Gunther)
Carp	<i>Cyprinus carpio</i> (L.)
Goldfish	<i>Carassius auratus</i> (L.)
Golden Shiner	<i>Notemigonus crysoleucas</i> (Mitchell)
Carp sucker	<i>Carpionodes carpio</i> (Rafinesque)
White Catfish	<i>Ictalurus catus</i> (L.)
Bullhead	<i>Ictalurus</i> spp.
White Bass	<i>Morone chrysops</i> (Rafinesque)
Hybrid Bass	<i>Morone</i> spp. (<i>saxatilis</i> x <i>chrysops</i>)
Largemouth Bass	<i>Micropterus salmoides</i> (Lacepede)
Warmouth	<i>Chaenobryttus gulosus</i> (Cuvier)
Bluegill	<i>Lepomis macrochirus</i> (Rafinesque)
Black Crappie	<i>Pomoxis nigromaculatus</i> (Lesuer)
Walleye	<i>Stizostedion vitreum</i> (Mitchell)
Yellow Perch	<i>Perca flavescens</i> (Mitchell)

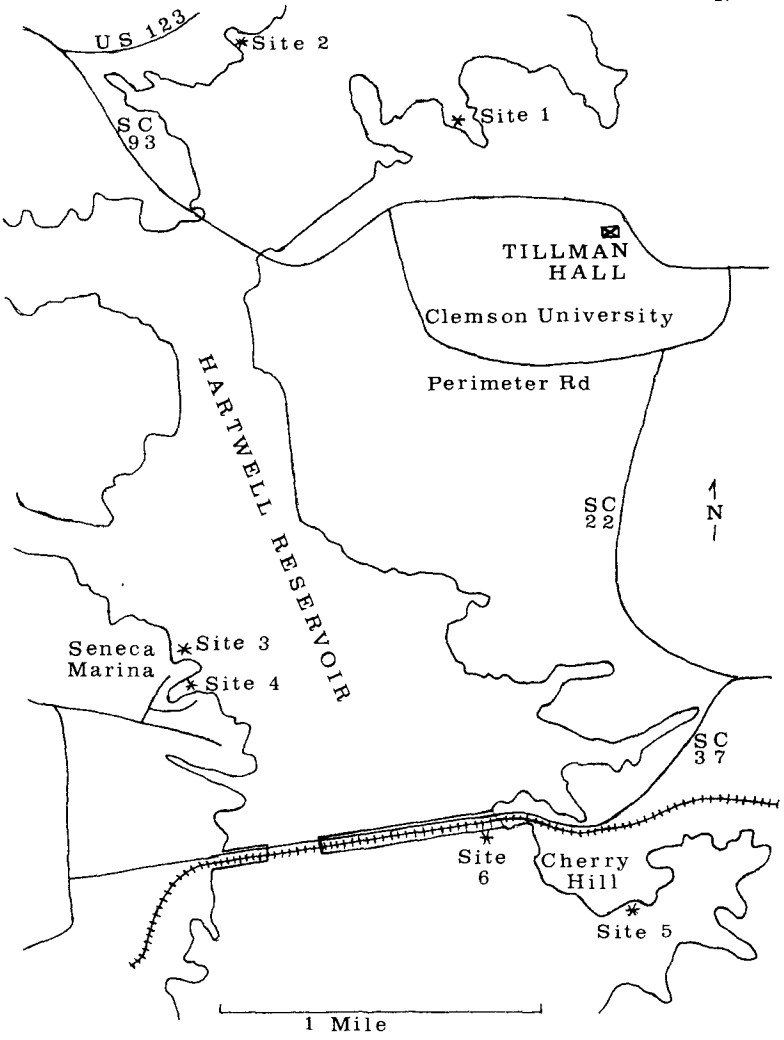


Figure 1. Study sites in cage culture experiment on Hartwell Reservoir.

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