

INCIDENCE AND SEASONAL VARIATIONS OF *EPISTYLIS* AMONG FISHES IN NORTH CAROLINA RESERVOIRS¹

by

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ABSTRACT

Epistylis infections were found on 16 fish species in the Yadkin and Catawba River reservoirs in North Carolina during 1974-75. Families most affected were Ictaluridae, Percichthyidae, and Centrarchidae. Highest incidence of the disease occurred during the summer and fall months. The most common infection site among most species of fishes was inside the mouth. A positive correlation was found between total fish length and *Epistylis* infection rate among *Lepomis auritus*, *Lepomis macrochirus*, and *Micropterus salmoides*. The bacterium, *Aeromonas hydrophila*, often was isolated from *Epistylis*-infected fishes and was believed responsible for two large fish kills.

"Red-sore" disease due to the protozoan *Epistylis* has been diagnosed from almost all of the Southeastern states (Rogers, 1971). Rogers stated that the disease is most prevalent during winter and spring; often infects fishes of the family Centrarchidae; and apparently is enhanced by high levels of organic nutrients.

Epistylis was recognized as a serious disease problem in the Yadkin and Catawba River reservoirs in North Carolina in 1972. Many fishermen reported the presence of red sores on several game fish species. Initial investigations revealed that *Epistylis* and the bacterium *Aeromonas hydrophila* were present in the lesions on fishes collected from reservoirs in both river systems (Miller and Chapman, in press). These samples indicated that *Epistylis* had caused the initial lesions, which allowed *A. hydrophila* to gain entry into the fishes.

Miller and Chapman's preliminary study showed that a serious problem existed and identified the causative organisms. However, more information was needed concerning the periodicity of the disease and the species of fishes most affected. Therefore, this study was carried out to determine the incidence and seasonal variations of *Epistylis* infections on the fishes that inhabit the Yadkin and Catawba River reservoirs.

The authors wish to express their appreciation to the personnel of the North Carolina Department of Agriculture's Rollins Animal Disease Laboratory for incubating and identifying bacterial cultures.

MATERIALS AND METHODS

Five reservoirs on the Yadkin and Catawba rivers in the western Piedmont region of North Carolina were selected for inclusion in the study (Figure 1). Maximum pool area ranged from 1,664 ha for Lake Hickory to 13,162 ha for Lake Norman. All were over 45 years old except Lake Norman (13 yrs) and all have had recent epidemics of *Epistylis* disease.

Fish sampling was conducted monthly from July 1974 through June 1975 on Lakes Hickory, Norman, and Wylie (Catawba River). High Rock and Badin lakes (Yadkin River) were sampled monthly from July 1974 through August 1975. Sampling was carried out by gill netting, trammel netting, and electrofishing. A minimum of two nets were set

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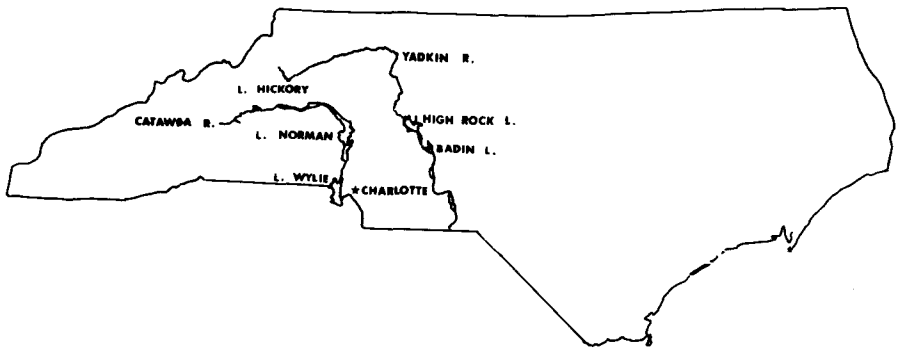


Figure 1. Map of North Carolina showing reservoirs sampled on Yadkin and Catawba rivers.

overnight in each reservoir and fished the following morning. Concurrently, electrofishing samples were collected along a portion of the shoreline of each reservoir to secure a representative sample of the fish species inhabiting the littoral zone.

All fishes captured were measured and examined for external lesions. The presence or absence of *Epistylis* in a lesion was determined in the field by viewing a scraping of the lesion under a binocular microscope at 40X. A fish was counted as having *Epistylis* only if visual confirmation of the organism could be made. The physical locations of all *Epistylis*-caused lesions were recorded.

During routine sampling at each reservoir, five or six fishes having external lesions were sacrificed for bacteriological examination. Most of these samples were taken in summer and fall when lesions most commonly were encountered. Trypticase soy agar plates were inoculated in the field with samples from epidermal lesions and from kidneys of each fish. The plates were then transported to the North Carolina Department of Agriculture's Rollins Animal Disease Laboratory in Raleigh, North Carolina, for incubation and identification of bacterial cultures. In addition to those fish with lesions, a few apparently healthy control fishes from each reservoir were sacrificed for bacteriological examination.

RESULTS

Epistylis infestations were confirmed on 16 fish species in the Yadkin and Catawba River reservoirs (Table 1). Thirteen of the affected species belonged to the families Ictaluridae, Percichthyidae, and Centrarchidae. Individuals from these families represented 98 percent of all *Epistylis*-infected fishes. Within these families, the disease was widespread and affected most species captured. *Epistylis* infections were never observed on three species of ictalurids (*Ictalurus furcatus*, *Ictalurus nebulosus*, and *Pylodictus olivarius*) and two species of centrarchids (*Lepomis microlophus* and *Pomoxis nigromaculatus*). However, these fishes were captured infrequently and representative samples may not have been collected.

The physical location of *Epistylis* lesions varied among different families infected. The most common infection site was inside the mouth. Among the Ictaluridae, lesions were confined entirely to the mouth and none were observed on any other part of the body. Multiple lesion sites were common on percichthyids and centrarchids. Many infected fishes from these two families had very ostensible lesions along the lateral sides of the body which severely marred their appearance. *Epistylis* colonies on the fins, head, and caudal area were relatively rare and were confined to the centrarchids and percids. An exception was the bluegill (*Lepomis macrochirus*) on which the fins represented a frequent infection site.

Seasonal variations in *Epistylis* infection rates among Ictaluridae, Percichthyidae and Centrarchidae were similar for both the Yadkin and Catawba reservoirs (Figures 2 and 3).

Table 1. List of fish species collected with *Epistylis* and the location of the infestations expressed as a percentage of infected fishes examined (data pooled from five reservoirs).

Species	No. fish with <i>Epistylis</i>	Location of <i>Epistylis</i>			
		Mouth	Sides	Fins and tail	Head and opercle
<i>Dorosoma cepedianum</i>	5	0.0	100.0	0.0	0.0
<i>Notemigonus crysoleucas</i>	2	0.0	100.0	0.0	0.0
<i>Ictalurus catus</i>	20	100.0	0.0	0.0	0.0
<i>Ictalurus platycephalus</i>	5	100.0	0.0	0.0	0.0
<i>Ictalurus punctatus</i>	11	100.0	0.0	0.0	0.0
<i>Morone americana</i>	39	94.9	25.8	0.0	0.0
<i>Morone chrysops</i>	19	73.7	36.8	0.0	0.0
<i>Morone saxatilis</i>	5	60.0	80.0	0.0	0.0
<i>Lepomis auritus</i>	70	84.3	18.6	12.9	8.6
<i>Lepomis cyanellus</i>	16	68.8	25.0	12.5	0.0
<i>Lepomis gibbosus</i>	16	100.0	37.5	25.0	6.3
<i>Lepomis gulosus</i>	21	42.9	73.7	0.0	0.0
<i>Lepomis macrochirus</i>	134	31.2	53.6	32.0	4.0
<i>Micropterus salmoides</i>	59	62.7	23.7	10.2	11.9
<i>Pomoxis annularis</i>	5	100.0	0.0	0.0	0.0
<i>Perca flavescens</i>	3	0.0	0.0	100.0	0.0

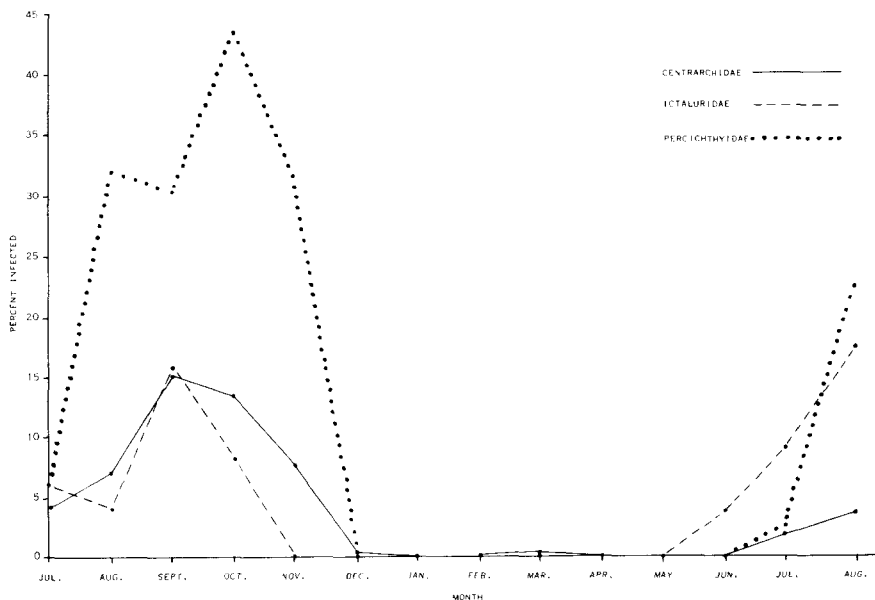


Figure 2. Monthly incidence of *Epistylis* infections among three families of fishes in two Yadkin River reservoirs, July 1974-August 1975.

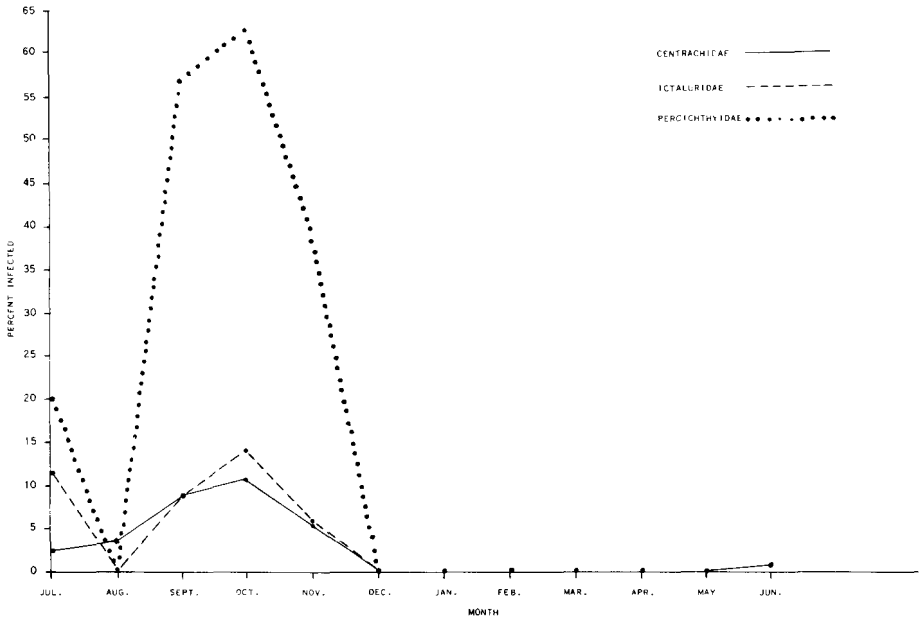


Figure 3. Monthly incidence of *Epistylis* infections among three families of fishes in three Catawba River reservoirs, July 1974-June 1975.

Incidence generally increased through the summer, reached a peak in September or October, and then fell sharply to zero in December. Almost no infection was detected during the winter and early spring months. *Epistylis* infections reappeared in the Yadkin reservoirs among ictalurids during June and among other fishes in July. Upon termination of the study in August, infection rates were increasing in all three families. In the Catawba reservoirs, *Epistylis* had reappeared only on the centrarchids when sampling was terminated in June.

Incidence of *Epistylis* was consistently higher among Percichthyidae than other families. Of the 484 percichthyids examined from the five reservoirs during the study, over 14 percent were diseased. The highest incidence within this family occurred in the Catawba reservoirs during October, when 62.5 percent of the fishes examined were parasitized.

Infection rates among centrarchids and ictalurids were similar, but usually much less than that found in the percichthyids. A total of 8,118 centrarchids were captured from the five reservoirs and four percent had *Epistylis*. Highest incidence of *Epistylis* among centrarchids were 15 percent in the Yadkin reservoirs and 11 percent in the Catawba reservoirs. Slightly over three percent of the 1,168 ictalurids examined exhibited *Epistylis* lesions. Highest infection rates observed were 17.5 and 14.5 percent in the Yadkin and Catawba reservoirs, respectively.

Sufficient numbers of largemouth bass, bluegill, and redbreast sunfish were captured to examine the relationship between fish length and incidence of *Epistylis* infections (Figures 4 and 5). Five hundred and sixty-three largemouth bass were examined from July to November 1974. When these fish were grouped by 2.5 cm intervals, a positive correlation was found between bass length and infection rate ($r=0.444$, $P<0.05$). When arranged into length groups of 15 cm intervals, a much stronger correlation was displayed ($r=0.9803$, $P<0.01$). Thus, while the incidence of *Epistylis* on all largemouth bass was 10.9 percent during these months, the incidence increased to 20 percent on bass greater than 30.5 cm (legal size in North Carolina). No *Epistylis* colonies were detected on bass less than 9.0 cm in length.

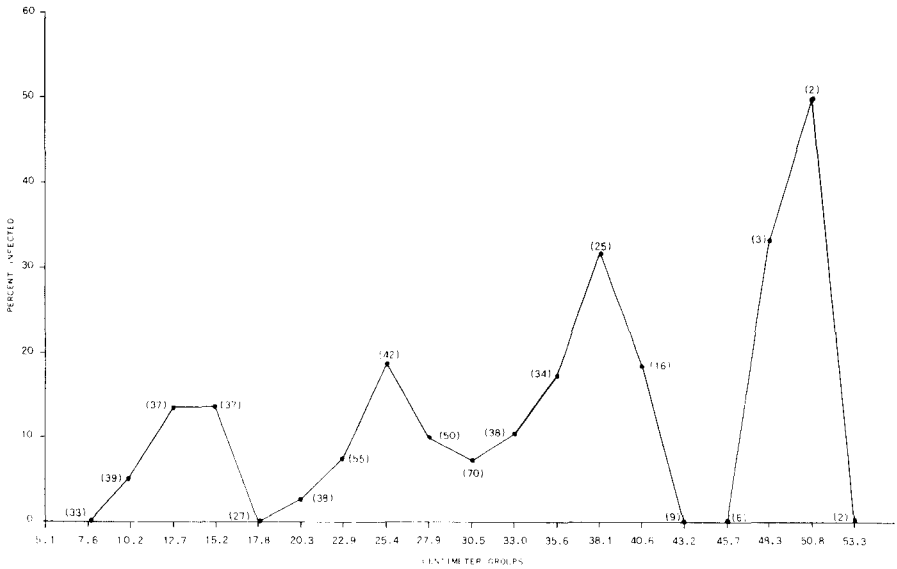


Figure 4. *Epistylis* infection rates among largemouth bass by centimeter groups. Number of fish examined in each group in parentheses (data pooled from five reservoirs, July-November 1974).

Infection rates were very strongly correlated with total length for bluegill ($r=0.874$, $P<0.01$) and redbreast sunfish ($r=0.917$, $P<0.01$). Incidence on bluegill increased from 2.6 percent on 10.2 cm fish to 25 percent on 20.3 cm fish. Infection rates among redbreast sunfish generally paralleled that for bluegill and ranged from 1.0 percent on 7.6 cm fish to 28.1 percent on 17.8 cm fish.

Bacterial cultures were prepared from 151 fishes during the study. *Aeromonas hydrophila* was found in 64 percent of all cultures made from fishes having *Epistylis* lesions. A *hydrophila* also was present in 54 percent of the fishes having lesions, but no visible *Epistylis*. Twenty-two control fish with no visible lesions were sacrificed for bacteriological examination and only one (4 percent) harbored *A. hydrophila*.

DISCUSSION

Epistylis infestations on fishes in the Yadkin and Catawba River reservoirs appear to follow a definite annual cycle. Rogers (1971) stated that *Epistylis* disease is cyclic and is most prevalent during winter and spring. During this study, the disease was most prevalent during summer and fall and least prevalent in the winter and spring. However, *Epistylis*-infected fishes were found during winter months in the discharge canal of Duke Power Company's Marshall Steam Station on Lake Norman (these fishes not included in the results). Jensen, et al, (1974) reported that surface water temperatures in the discharge canal exceeded ambient temperatures by 10°C or more during the winter. This suggested that incidence of the disease may have been responsive in part to water temperature changes. However, studies on the influence of water quality changes upon *Epistylis* disease cycles are greatly needed.

The affinity of *Epistylis* for sport fishes has been noted by Rogers (1971) and Miller and Chapman (in press). Over 98 percent of all infected fishes collected in this study were sport fishes. This, coupled with the higher incidence among larger fishes in the family Centrarchidae, makes the disease highly visible to anglers. The presence of unsightly *Epistylis* lesions on sport fishes detracts from the angling experience and, in the eyes of

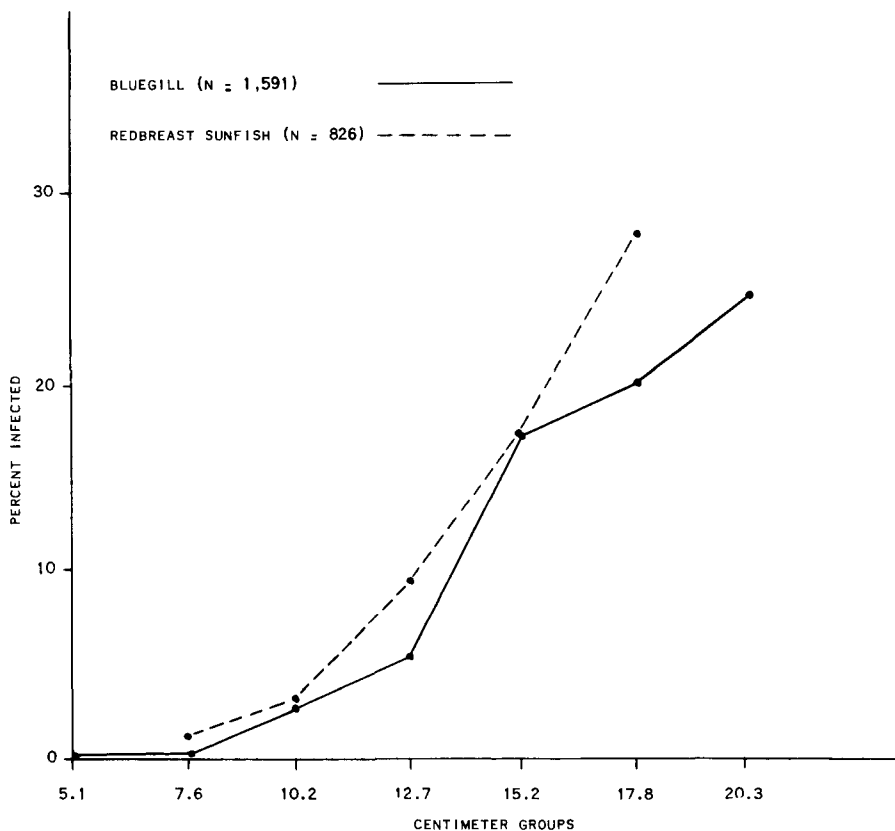


Figure 5. *Epistylis* infection rates among bluegill and redbreast sunfish by centimeter groups (data pooled from five reservoirs, July-November 1974).

many fishermen, renders the catch unfit for human consumption. These factors have caused great consternation among anglers fishing in waters where *Epistylis* epizootics occur.

Of greater concern than the cosmetic effects of the lesions was the apparent relationship between *Epistylis* lesions and *Aeromonas hydrophila* infections. Amlachner (1970) reported that *A. hydrophila* can be transmitted by external parasites and Lewis and Bender (1960) identified the bacterium as a fish pathogen. The high incidence of *A. hydrophila* infection among fishes parasitized by *Epistylis* in the Yadkin and Catawba River reservoirs indicated that the bacterium is gaining entrance to the fishes through the *Epistylis* lesions.

Both *Epistylis* and *A. hydrophila* were found on moribund fishes from Badin Lake during the fall of 1973 (Miller and Chapman, in press). More than 37,000 fish died at that time and over 90 percent were of the family Percichthyidae. A lesser kill occurred on the same lake during this study. Again, percichthyids were the fishes most affected and *Epistylis* and *A. hydrophila* were confirmed on moribund fishes. If these mortalities were the result of infection by *A. hydrophila*, then white perch, white bass, and striped bass appear to be particularly susceptible to the pathogen. This presents a very serious problem since these fishes were also the most vulnerable to *Epistylis* infections.

A continuation of epidemics like those experienced in 1973-75 could severely reduce North Carolina's percichthyid fisheries in future years. Since treatment for the disease in reservoirs is highly impractical, a greater knowledge of the factors influencing *Epistylis* epizootics is needed.

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