Parasites of the Yellow Bass from Two Southern Indiana Lakes

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Sixty-two specimens of *Morone mississippiensis* were collected by rod and reel fishing from two Southern Indiana locations. They were measured, weighed, aged by scale readings and examined for protozoan and metazoan parasites. Six taxa of parasites were found. Hosts from Lake Monroe harbored fewer parasites and were significantly less often infested than those from Big Bayou Lake. Differences in infestation levels also occurred between host groups of different physiological condition and between various age groups of hosts.

The yellow bass *Morone mississippiensis* is a member of the temperate bass family Percichthyidae, members of which are referred to as the "true basses" in order to distinguish them from the black basses of the Centrarchidae. The range of *M. mississippiensis* centers around the Mississippi River and its overflow waters. In Indiana (with the exception of Lake Monroe) the species is mostly found in lowlands of the Wabash River drainage, where it inhabits quiet ponds and backwaters of large or medium-sized streams (9).

The only reported comprehensive examination of yellow bass for parasites was a general metazoan survey of fish parasites in 54 Louisiana watersheds in 1967 by Arnold *et al.* (1). These investigators examined 52 yellow bass and found that 73% were infested by one or more species of parasites. Also, Hoffman (4) listed 24 species of worms and crustaceans which had been recorded as parasites of this host, including several not found by Arnold *et al.*

In our study, samples were obtained from two Indiana locations: Lake Monroe in Monroe County, and Big Bayou Lake in Gibson County. All samples were collected by hook-and-line fishing, which unfortunately introduces some bias against procurement of young-of-the-year fish, as well as a lesser bias against age groups I and II (7). The Monroe fish were taken from five scattered sites on the reservoir, and the Big Bayou specimens from two sites. All fish were put into cold storage immediately after being caught and were processed at the earliest opportunity, always within 24 hours of capture. Each specimen was weighed and measured as to both standard and total lengths (5).

In order to locate multicellular parasites, the following tissues in each fish were examined macroscopically and under a dissecting microscope: the skin, fins, body surface mucous, gills, oral cavity, all viscera, the coelom and mesenteries. The brain and eyes of many specimens were examined. To locate protozoans, the following tissues were examined with the compound microscope in each fish: fresh blood samples, Geimsa-stained thin and thick blood smears, and iron-hematoxylin-stained smears from two levels of the intestine (2, 4, 5).

A sample of 15-20 scales was removed for age assessment of each specimen (6, 11).

A total of 49 fish was collected from Lake Monroe but only 13 could be obtained from Big Bayou. The relatively small number of fish in the latter sample raises questions regarding the statistical soundness of these samples. A collection the size of the Monroe sample (49 fish) is statistically sufficient to detect a target parameter (parasitism, in this case) in a population of one million fish with 10% parasite infestation. The estimated yellow bass population of Lake Monroe of one million fish was given by reservoir fisheries biologist Ron Ridenour in 1977 (10). At this estimate of population and at the 95% confidence level, the number of specimens in the Monroe sample is well above the required sample for a 10% infestation rate, 27 fish, and slightly under that required to detect a 5% infestation level, 57 fish (8). (In view of later results showing an infestation rate of 67% for all parasite taxa in the Monroe sample, rather than 5 or even 10%, it would appear that this collection is well within the required sample size.) In other words, the higher the postulated infestation rate, the smaller the sample can be to achieve statistical significance for a given population size and confidence level. The much smaller sample from Big Bayou cannot be tested for statistical significance because the population size there is unknown. However, if we assume a very much smaller population at Big Bayou than at Monroe (and assuming the 92% infestation rate found later for this sample), even 13 fish may be a sufficient sample.

In the Monroe sample 5 taxa of parasites (3 protozoans and 2 metazoans) were found. In the Big Bayou collections 6 taxa (3 protozoans and 3 metazoans) were observed (see Table 1). The protozoans encountered belonged to the genera *Hexamita*, *Babesioma*, and *Balantidium*. Metazoans located were the cestode *Proteocephalus ambloplites*,

TABLE 1. *Parasitic infestation level of* Morone mississippiensis *as a function of sample location. (Infestation is measured as the parasitized fish per site divided by the total fish collected per site.)*

Parasites	Monroe Sample (49 fish)		Big Bayou Sample (13 fish)		Combined Samples (62 fish)	
	Number	Percent	Number	Percent	Number	Percent
PROTOZOANS:						
Hexamita	19	39	7	54	26	42
Babesioma	6	12	4	31	10	16
Balantidium	5	10	2	15	7	11
METAZOANS:						
Proteocephalus	17	35	10	77	27	44
Neochasmus	6	12	3	23	9	15
Philometra	0	0	1	8	1	2
Parasitized Fish	33	67	12	92	45	73
Unparasitized Fish	16	33	1	8	17	27
Fish with 1 Metazoan	18	37	6	46	24	39
Fish with > 1 Metazoan	15	31	4	31	19	31

the trematode *Neochasmus umbellus*, and the nematode *Philometra*, species undetermined.

A statistical analysis of the incidence of parasite groups was made between the Monroe and the Big Bayou locations. Statistically significant differences were found in the incidence of *Babesioma*, cestodes, nematodes, and in the total number of metazoan parasites between sites (see Table 1). In other taxa and in the average number of parasites per fish, no statistically significant difference was found.

The samples from each lake were analyzed to determine whether significant differences occurred in the incidence and variety of parasite infestation as a function of sex; however, statistical analysis showed no significant differences. A slight seasonal effect was noted, in that fish taken in late summer appeared to harbor more parasites than those taken in late autumn. However the times of collection and the numbers of fish caught during each trip were of necessity too sporadic to quantify this effect.

Next, the samples were analyzed for possible differences in the incidence and variety of infestation as a function of host age. Significant differences occurred between age-group II and age-group IV fish in both site samples. This, however, might have been a reflection of the small number of fish collected in these age-groups. The greatest number of bass belonged to age-group III, which also showed the lowest infestation rate in all calculations—the Monroe, the Big Bayou and the combined samples. However, the small size of other age-groups raises doubts about statistical soundness when compared to the more than adequate sample of age-group III. We can only suggest that age-group III fish harbored fewer parasites than both younger and older age-groups.

In addition to aging the fish via scale examination, their physiological condition was calculated. This had two purposes: to identify possible differences in physiological condition between infested and non-infested fish, and to compare and contrast the conditions of fish at each of the locations in relation to their relative infestation levels. We used the length-weight formulas common to fisheries work (3, 5, 11) to produce a condition factor, K. Weights, lengths, ages, and other variables were tabulated and entered into a FORTRAN program which gave a K value for each fish. These were then averaged for each sample location and compared with those of other yellow bass populations from Clear Lake, Iowa, and Norris Lake, Tennessee (3), via a conversion factor. (These were the only data available from habitats at all similar and geographically close to the ones in our study.) Variation in those K values which would definitely not correlate with differences in either parasite infestation or lake ecology included variation with host age, with host sex and with seasonal changes. Age variation in K can be negated by ascertaining the age of the fish by scale examination (5). Variation in weight, size, and most other physiological parameters relevant to parasitism is normally not significant in *M. mississippiensis*, which is perhaps correlated with the lack of significant infestation differences as a function of sex. Lastly, seasonal K variation is usually confined to changes before and after spawning (9); therefore these collections, made in the fall, would be unaffected.

The average fish weight in the Big Bayou sample was 12.0 grams less than that of the Monroe sample, despite a slightly greater average length in the former (see Table 2). The condition factor variations between sites were significant at the 90% confidence level; at this level, fish from Big Bayou showed a poorer physiological condition than fish of roughly similar age from Monroe (see Table 3). These differences are not necessarily causally related to the higher parasitic incidence in the Big Bayou sample; however, the two factors do show a definite correlation. Parasitism may contribute to a diminished condition, but parasites also tend to infest fish which are initially diminished in condition.

TABLE 2. *Comparison of average lengths and weights of* Morone Mississippiensis *from the Monroe and Big Bayou locations.*

Sample	Standard Length (mm.)	Total Length (mm.)	Weight (grams)
Monroe	157	194	114.3
Big Bayou	165	203	102.3

The two sites differ ecologically. Pollution, especially that due to agricultural or livestock runoff, is probably greater at the Big Bayou location. On the other hand, Lake Monroe is used as a reservoir and has a shoreline with few commercial and residential establishments, with little runoff. Big Bayou Lake is much shallower and weedier, and the number and variety of forage fish is thought to be much greater in Monroe (10). The yellow bass population of Monroe has grown extremely rapidly in the past six years. In a series of cove-sampling studies in 1975, Indiana Department of Natural Resources personnel noted that this species comprised approximately 15% of the total fish taken, a tremendous increase over percentages found in earlier surveys (10). Yellow bass have never been stocked in Monroe, but since all local fish species were eliminated at the time the reservoir was impounded (by poisoning the feeding waterways for many miles upstream), the

TABLE 3. *Comparison of the average physiological condition of* Morone mississippiensis *from the Monroe, Big Bayou and combined samples. (K_T and K_S are the condition factors calculated for total and standard lengths, respectively: $K_T = \dfrac{\text{Weight} \bullet 10^5}{\text{Total length}^3}$, and $K_S = \dfrac{\text{Weight} \bullet 10^5}{\text{Standard length}^3}$.)*

Length	K, Monroe Sample	K, Big Bayou Sample	Variation Number	Between Lakes Percentage
Standard	2.91	2.28	0.63	25.1
Total	1.54	1.19	0.35	26.0

species was perhaps introduced surreptitiously by enthusiastic fishermen (7).

In contrast, yellow bass have inhabited selected areas of southwest Indiana for a much longer time. In the 1940's Hubbs and Lagler (5) located the species in various lakes and ponds throughout the area, although its incidence was fairly low. The creation of a reservoir often opens a number and variety of new ecological niches while eliminating others, and a successful species during its rapid growth phase would be expected to experience lower parasitic infestation rates and higher condition factors than would the same species in a less desirable locale.

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