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# Hyperinfection with the Bass Tapeworm, *Proteocephalus ambloplites* (Cestoda), in the Black Basses *Micropterus punctulatus* and *M. dolomieui* from Certain Arkansas Reservoir Lakes

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*Proteocephalus ambloplites* is a tapeworm that lives as an adult in the intestinal tract of black bass (*Micropterus* spp.). The life cycle is complex and hosts include first a microcrustacean followed by a small fish as a second intermediate host. In the small fish the parasite transforms into a metacestode larval stage, the plerocercoid, which migrates through the gut into the coelom where it awaits ingestion by the final host. The plerocercoid form of *P. ambloplites* can be found in a number of freshwater fishes that can act as intermediate hosts (Hoffman 1999). When a bass eats the infected small fish, the plerocercoids penetrate the gut and invade parenteric organs, most importantly, the gonads which can cause reduced fertility in the host fish. Certain plerocercoids under the stimulus of a water temperature change will reinvade the gut to become tapeworm adults. (Esch and Huffines 1969, Fischer and Freeman 1969, Fischer 1973). The major importance of this parasite is the effect on bass reproduction when the bass tapeworm plerocercoids are in large numbers in gonadal tissue.

All three major *Micropterus* species (*M.salmoides, M. dolomieui*, and *M. punctulatus*) are known to be infected with both the adult tapeworms and their plerocercoid larvae. Preliminary data from our necropsies of bass for infections with *Clinostomum marginatum* metacercaria indicated that *P. ambloplites* infections were heavier in Arkansas than previously reported. This study was initiated to determine the extent of these infections in black bass from Arkansas lakes. Bass were collected from tournament fishermen in 1988-89 from selected Arkansas reservoir lakes, transported to the University of Arkansas for Medical Sciences and necropsied for the presence of plerocercoids of *P. ambloplites*. Definition of population characteristics followed that of Bush et al. (1997) and were as follows: Prevalence (percent of fish infected), maximum abundance (largest number of parasites in a single host), mean abundance (average number of parasites per fish) and its standard deviation. The findings of this study are summarized in Table 1. Mean intensity (average number of parasites for infected fish only) and its standard deviation are not included since this report was to compare the extent of the plerocercoid infections in the Arkansas reservoirs with older literature and in those studies these values are not given. The variance of a mean intensity reported with 100% prevalence, as seen in Table 1, is equivalent to the variance of a mean abundance of 100% prevalence.

Very few (<0.1 percent) adult tapeworms were found in any of the collections. Also, the plerocercoid numbers in the present study may be a result of seasonal effects (late spring, summer) because the plerocercoid larvae are generally not found in bass during the winter in northern climes, but reoccur in large numbers again in the spring (Esch and Huffines 1973, Fischer 1973). However, Eure (1976) found that plerocercoids could be found year-round in a reservoir in South Carolina. Studies in Arkansas have found plerocercoids in Arkansas black bass in the winter (Cloutman 1975, Kilambi and Becker 1977), but any temporal relationship between adult tapeworms and plerocercoids in the State's reservoirs is still to be definitively determined.

Table 1 shows data from this study, data from other Arkansas waters, and other selected locales from North America that have the highest reported abundances of plerocercoid infection. The current data for spotted bass (*M. punctulatus*) and largemouth data (*M. salmoides*) are both from Lake Maumelle in Pulaski County. The infected smallmouth (*M. dolomieui*) were collected from Bull Shoals Lake. All of the data in Table 1 represent the largest mean abundances for individual collections in each study but collections of other bass hosts were also made from the same bodies of water, but with smaller abundances being reported in the other bass populations. An exception is the Gull Lake, Michigan data which included all bass collections that were made in that locale for a given year.

Table 1 shows that the infrapopulations of *P. ambloplites* plerocercoids in spotted bass from Lake Maumelle are hyperinfections and among the highest reported for bass anywhere and are the highest ever for spotted bass. The intensity of the smallmouth infection from Bull Shoals Lake, although not as high, can also be considered a hyperinfection based on comparative literature reports. Largemouth bass in Lake Maumelle have many fewer plerocercoids than seen in the other two bass. This discrepancy between largemouth and other bass has also been noted before in the Gull Lake study (Gilliland and Muzzall 2004). They found that largemouth plerocercoid prevalence was 100% with a mean intensity of 18.1 (±12.9 SD). This agrees with the degree of infection seen in the largemouth bass from Lake Maumelle in Arkansas. It might seem that the largemouth may have a natural resistance to tapeworm infections, relative to the other 2 species. However, Szalai and Dick (1990) found infected largemouth in a reservoir in Saskatchewan, Canada to have plerocercoid numbers equivalent

Table 1. Population parameters of selected plerocercoid infections of the bass tapeworm, *Proteocephalus ambloplites*, in Arkansas and North America. LM = largemouth, SM = smallmouth, and SP = spotted bass. Only the parameters of prevalence, maximum abundance, and mean abundance (standard deviation) are listed. Daly et al. refers to the present study. ---- are unrecorded data.

| Investigators | N | Locale | Bass | Prevalence | Max. Abundance | Abundance |
|---|---|---|---|---|---|---|
| Daly et al. this study | 17 | Arkansas | SM | 100 | 117 | 35.5 (± 34) |
| Daly et al. this study | 55 | Arkansas | SP | 100 | 200 | 66.3 (± 43) |
| Daly et al. this study | 8 | Arkansas | LM | 75 | 52 | 12.4 (± 17) |
| Becker et al., 1978 | 347 | Arkansas | SP | 91.5 | ---- | 12.3 (----) |
| Cloutman, 1975 | 89 | Arkansas | LM | ---- | ---- | 7.4 (----) |
| Kilambi and Becker, 1977 | 12 | Arkansas | SM | 4 | 7 | 0.3 (± 2.02) |
| Gilliland and Muzzall, 2004 | 54 | Michigan | SM | 100 | 200 | 72.5 (± 44.8)** |
| Szalai and Dick, 1990 | 8* | Saskatchewan | LM | 100 | ---- | 99.0 (± 116)** |

*Largest bass hosts only
**Mean intensities (SD)

to those found in Arkansas and Michigan smallmouth and Arkansas spotted black bass (Table 1). The reasons for these geographical variations between the black bass species are unknown and could be due to a number of regional factors such as habitat preference or forage fish diet and perhaps even an inherent strain immunity (The Saskatchewan largemouth were hatchery-raised and introduced).

The most important pathology produced by these tapeworm larvae is destruction of the host gonadal tissue, but in Arkansas reservoirs the overall effect of such large numbers of plerocercoids on bass fecundity is yet to be ascertained.

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