— NOTE —

Agonistic Behavior of Juvenile Largemouth Bass and Smallmouth Bass

ABSTRACT

Juvenile largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieu*) were videotaped in aquaria and in a river, and were observed exhibiting 18 types of agonistic behavior. Behavioral patterns included attempts to injure, threatening displays, and appeasement postures. Field observations confirmed that juvenile smallmouth bass can display complex agonistic behavior within 50 days of hatching.

Most studies of the social behavior of centrarchid fishes have focused on agonistic and courtship behavior of adults (Miller 1975, Henderson and Chiszar 1977, Casterlin and Reynolds 1979). However, Brown (1985) documented that largemouth bass (*Micropterus salmoides*) can exhibit agonistic behavior within the first two months of life. Although he hypothesized that agonistic behavior was an important mechanism for initiating dispersal and maintaining social hierarchies, Brown did not describe the behavioral patterns he observed. The purpose of this paper is to describe types of agonistic behavior that we have observed being exhibited by juvenile largemouth bass and smallmouth bass (*M. dolomieu*).

The observations described here were collected during two independent studies of competition and habitat use of the two species. The first study (Winemiller 1981) was conducted in 1980 and used juvenile largemouth and smallmouth bass (79-165 mm, total length) collected from a farm pond and Four Mile Creek in Preble and Butler counties, Ohio, and maintained in intra- and interspecific combinations in 1140-l aquaria at a density of six individuals per tank. In the second study (Sabo 1993), 50 juvenile smallmouth bass (45-100 mm, total length) were observed in the North Anna River in Hanover County, Virginia, during 1991. In both cases, the behavior of juveniles was videotaped and sequences that included agonistic displays were reviewed at 3 frames/sec.

The most obvious types of agonistic behavior were attempts to injure a targeted individual by chasing, biting, nipping, butting, or mouth-fighting. Adult largemouth bass exhibit all these behavioral patterns when guarding nests (Miller 1975) except for mouth-fighting, which was similar to the type of behavior exhibited by cichlids (Baerends and Baerends-Van Roon 1950). Nipping was a special type of biting that occurred at slow swim speeds and involved scraping of mandibular teeth across the body of the target.

More striking in terms of behavioral complexity were the threatening displays employed by the two species. Some displays, such as nudging and tail-beating, involved contact that was not injurious to the target. Other displays, including charging, gaping, and circling, involved no contact at all between initiator and target. All of these behavioral patterns are exhibited by the adults of other centrarchid genera (Casterlin and Reynolds 1979,. Henderson and Chiszar 1977). We also

observed juveniles of both species flaring their brachiostegal rays in a frontal display similar to that exhibited by cichlids (Baerends and Baerends-Van Roon 1950).

We observed three displays without contact (lateral displays, snapping, and displacement) that have not previously been described for centrarchids. Lateral displays were the most frequently exhibited. During some encounters, two individuals would orient head-to-tail, erect their medial fins, and first the initiator and then the target would orient their dorsal aspects towards each other. In other instances, an initiator moved its head towards the target's flank and turned on its side. The latter action always caused the target to flee. Curiously, while there is no description of adult centrarchids exhibiting this behavior, adult great white sharks, *Carcharodon carcharias*, perform a type of ritualized combat that closely resembles a lateral display (Klimley 1994).

Snapping involved rapid, partial opening and closing of the jaws with little premaxillary protrusion or opercular flaring. An initiator could displace a target by approaching and then immediately occupying the region recently abandoned by the target. Alternatively, an initiator sometimes positioned itself parallel to the target, waited for the target to move, and then occupied the target's space (i.e. sidling).

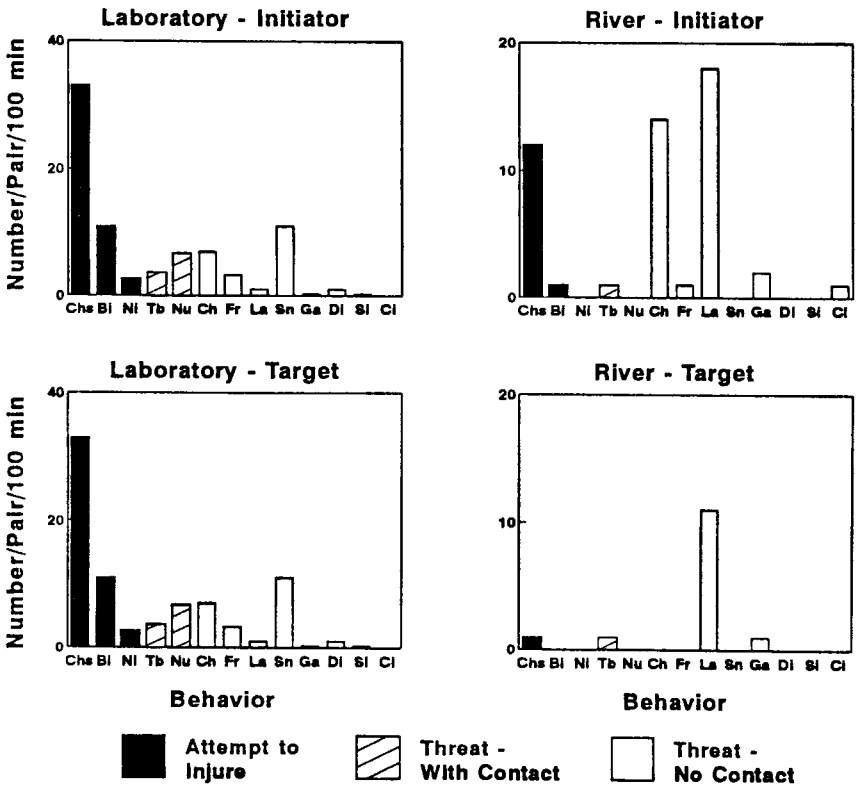

Figure 1. Frequencies at which juvenile largemouth and smallmouth bass exhibited types of agonistic behavior in aquaria and in the North Anna River. (Chs = chase, Bi = bite, Ni = nip, Tb = tail-beat, Nu = nudge, Ch = charge, Fr = frontal display, La = lateral display, Sn = snap, Ga = gape, Di = displace, Si = sidle, Ci = circle).

The targets of agonistic behavior most frequently fled from initiators but sometimes responded with an attempt to injure or threatening display of their own. In some instances, they responded with a tail-up appeasement posture (Sulak 1975). While in this posture, some juveniles exhibited a slow, exaggerated waving of the caudal fin.

Juvenile largemouth bass and smallmouth bass exhibited the same behaviors, but there were some noticeable differences in behaviors exhibited by individuals in the laboratory and in the river. In the river, targets of agonistic behavior frequently responded with a threatening display, but targets in the laboratory usually appeased or fled from agonistic behavior (Figure 1). However, when targets in the laboratory did respond aggressively, they frequently attempted to injure initiators. Although these observations suggest that these species may interact differently in the two environments, it is impossible to directly compare laboratory observations with those from the river because of methodological differences between the two studies.

The juveniles observed in the river were tracked from the time they were spawned, so we can confirm that smallmouth bass exhibit complex agonistic behavior within 50 days of hatching. As is obvious from the behavioral description, these types of behavior are usually associated with spawning or nesting behavior in adult fishes. The appearance of this behavior so early in life suggests that almost from birth the most important competitors these species must contend with are the other members of their cohort. Further investigation of agonistic behavior should yield valuable insights into the ontogenetic development and consequences of social interaction for juvenile largemouth and smallmouth bass.

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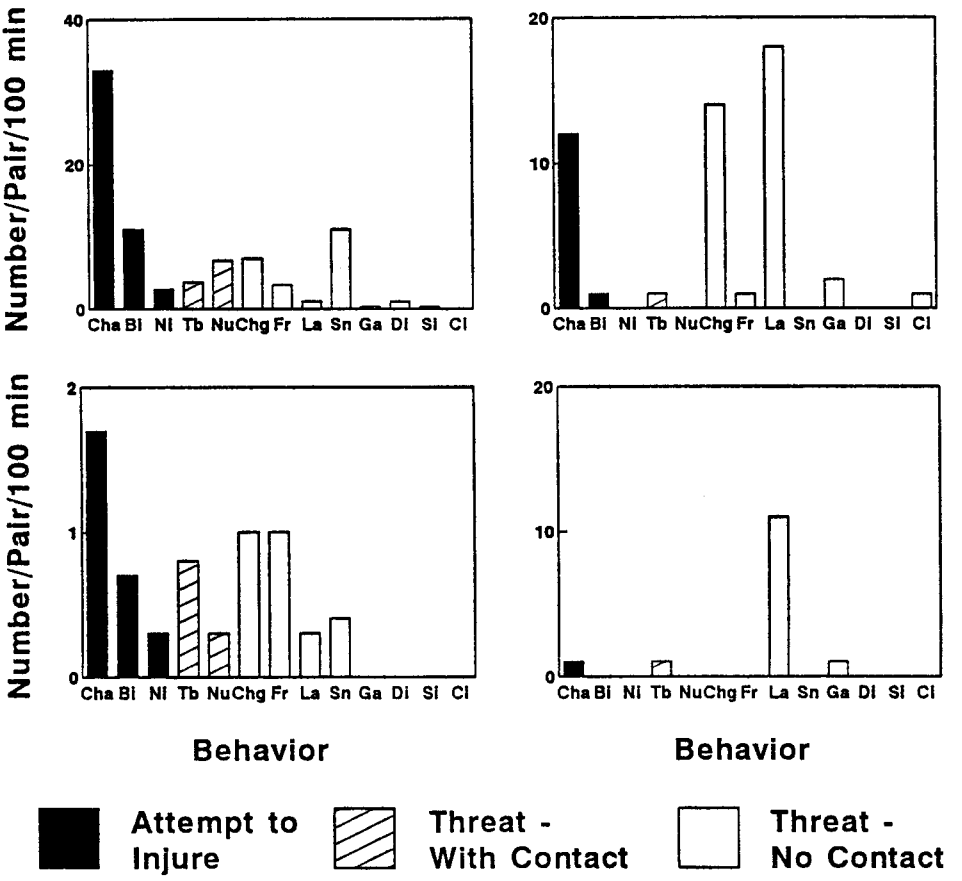
Figure 1 should appear as below:



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