SPAWNING BY THREE CAVITY-NESTING FISHES IN A CULVERT

by P.A. Cochran, St. Norbert College, De Pere, Wisconsin, & J.D. Lyons, Wisc. Dept. of Natural Resources, Fitchburg, Wisconsin

Abstract

Fantail Darters (Etheostoma flabellare) *and, to a lesser extent, Johnny Darters* (E. nigrum) *and Mottled Sculpins* (Cottus bairdi), *spawned within a culvert beneath rock slabs originally provided to stabilize its ends. Culverts and bridge crossings may benefit fish species of some reproductive guilds by providing increased microhabitat diversity.*

During a study of spatial and temporal patterns of spawning-site use by Johnny and Fantail Darters (E. nigrum and E. flabellare) in Marsh Creek, a small tributary of the Wisconsin River in Dane County, Wisconsin (Cochran and Lyons, 1986), we collected evidence of spawning by these two species within a road culvert. A third species, the Mottled Sculpin (Cottus bairdi), also spawned within the culvert. All three species are "guarding speleophils" (cavity spawners), defined by Balon (1975) as those fishes that spawn and guard their eggs in cavities or on the underside of cover objects such as rocks or logs.

The culvert is a 9.75-meter length of corrugated metal pipe (slightly elliptical in cross section, 1 meter from top to bottom) beneath Beckman Road (T-8-N, R-6-E, Sec. 7). Water depth within the culvert varied with sampling date and position, but was generally within 20-40 centimeters. Slabs of dolomite, originally placed as filler to stabilize the banks at the ends of the culvert, provided abundant potential spawning sites; elsewhere in Marsh Creek, spawning sites were rare and consisted primarily of woody debris (Cochran and Lyons, 1986).

Of the three species, Fantail Darters nested most frequently within the culvert. During 1982, nests of this species were found throughout the downstream half of the culvert, with one to seven nests found on each of six sampling dates from April 16-June 24. In 1983, many slabs had washed into the culvert from its upstream end, and Fantail Darter nests were present throughout its entire length on April 29 (15 nests) and May 16 (14 nests), the only sampling dates. Although many eggs were laid on rocks positioned over sand or gravel, in at least some cases nests were found over the bare metal surface of the culvert.

Only two Johnny Darter nests were found within the culvert, on April 23, 1982, and April 29, 1983. This species spawned more frequently in deeper, slower water, such as the pool immediately upstream (Cochran and Lyons, 1986).

Of the five Mottled Sculpin nests discovered in Marsh Creek during our study, one was positioned less than 0.5 meter downstream from the culvert on April 16, 1982, and one was found within the culvert on April 29, 1983 (when nests of all three species were noted). Although we found few sculpin nests, we regularly observed male sculpins in spawning colors, including some within the culvert.

Culverts and bridge crossings may have negative impacts on fish populations, though mitigation is possible (Swales and O'Hara, 1980, Schnick et al., 1982, and references therein). In some cases, at least some fish species may benefit. For example, Kratt (1981) documented spawning by Arctic Grayling (Thymallus arcticus) within a culvert in a stream where spawning would not otherwise have occurred. In another case, spawning Walleye (Stizostedion vitreum) used a gravel reef included with a bridge reconstruction in Wisconsin (McNight, 1985).

Culverts and bridge crossings may indirectly benefit fishes in several ways by providing increased microhabitat diversity. Constriction of channels during construction may cause deepening upstream, which in the present study provided habitat conducive for spawning by Johnny Darters. Within and downstream from constrictions, increased current speed may result in coarser, more thoroughly scoured substrates and riffle-like habitat, suitable for spawning by other species. Rubble or other materials used to stabilize channels or banks may provide cover and nesting sites for speleophilous fishes. This happened in Marsh Creek, where cover objects and spawning occurred much less frequently away from the culvert.

Speleophilous fishes may also benefit from the trash often found at bridge crossings, as noted by Burr and Mayden (1982) for madtoms. During the present study, a metal sign plate within the culvert was consistently used as a spawning site by Fantail Darters during both years.

In the present study, spawning occurred within the culvert despite reduced light intensities and photoperiods possibly altered from those outside. A fortuitous benefit of spawning within a culvert may be reduced predation by visually-hunting avian predators, such as the kingfishers and green herons we observed along Marsh Creek.

Berkman and Rabeni (1987) suggested that the concept of reproductive guilds can aid in predicting responses by fish assemblages to stream alterations. Reproductive guilds are groups of sympatric species with similar reproductive behavior and spawning habitat. Because they have similar ecological requirements, the members of a reproductive guild can be expected to respond to environmental changes in similar ways. Of the fish species present in our study section of Marsh Creek, including Northern Pike (Esox lucius), Grass Pickerel (Esox americanus vermiculatus), Central Mudminnows (Umbra *limi*), and Spotfin Shiners (*Notropis spilopterus*), only members of the speleophilous guild apparently benefited from the culvert. Our observations are merely suggestive, however, and we cannot firmly conclude that the culvert benefited populations of speleophilous fishes. That conclusion would require measurable changes in populations from pre-existing conditions, and we did not collect such data. Indeed, it is conceivable that the culvert could have negatively affected the populations in question by concentrating spawning adults and making them more vulnerable to predators. We hope that future studies will address these possibilities.

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