

Breeding Fantail Darters in Captivity

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There are an estimated 250 species of darters in North America, making them second in species richness only to minnows (Scharpf 2008). Darter spawning behavior can be divided into four categories based on egg deposition and substrate availability (Page and Swofford 1984). Proceeding from the more primitive to the more derived character state, spawning behavior categories include: buriers, attachers, clumpers, and clusterers. Buriers and attachers either bury their eggs in loose gravel or sandy substrate, or attach eggs to plants, respectively; neither have parental care. Male clumpers and clusterers guard a nest-site territory under a rock, and eggs are laid in a clump or in a single-layered cluster attached to the underside of the rock, respectively. Males also provide parental care in clumpers and clusterers, fanning and cleaning the developing eggs (Page and Swofford 1984).

Female darters in the subgenus *Catonotus* lay their eggs on the underside of a rock that is guarded by a male (Winn 1958). Males in this subgenus are territorial and compete for breeding sites, with large males out-competing smaller males for the best sites (Constantz 1979). Parental care provided by males has been shown to increase the survivorship of a clutch (Knouft and Page 2004). Males guard the developing eggs and provide parental care in the form of protection from predators, antimicrobial compounds, cleansing of the eggs to prevent the development of fungi, and fanning to increase oxygen flow to the eggs (Constantz 1979).

In May 2012 I collected 12 male and 12 female Fantail Darters from Indian Creek (DeKalb County, IL) in hopes of observing some Fantail Darter spawning and parental care in captivity. Fish were collected using a seine at the upstream portion of a riffle that consisted mostly of five- to fifteen-cm rocks. Fish were fed live and frozen blood worms daily and were kept on long days (16 hrs light/ 8 hrs dark) at 17°C to 19°C (63-66 F). One male and female pair was placed into an 18.9-L (5-gal) aerated tanks with one inch of gravel. There were a total of 12 tanks, one for each pair of darters. Each tank also contained a flat rock taken from the

darters' native creek, which was raised by setting it on smaller round rocks. This created a crevice under the flat rock that provided a territory for males to guard and space for egg attachment. Pairs were checked daily for evidence of spawning. After two weeks, only two pairs had spawned and had attached eggs under the rock provided. Both of the two pairs that spawned did so within three days of being placed together in the 18.9-L tank. Several females in pairs that did not attach eggs to the rock seemed to have released their eggs due to stress, possibly caused by being moved to a new environment or from harassment by males. In the two pairs that spawned successfully, the females were removed the day that eggs were observed on the underside of the rock. Males were allowed to stay with the nest to guard the eggs and male parental care behavior was observed for 10 minutes daily.

Male parental care activities increased in frequency as the eggs' development progressed. The males spent almost all of the time during daily 10 minute observation periods directly under the eggs. While the males were under the nest, their dorsal fin egg mimics and pre-dorsal pad, both of which are only present in breeding males (Bart and Page 1991), were touching the eggs. The males moved forward and backwards under the eggs frequently, which may have functioned to coat the eggs with antifungal mucus that is secreted in elevated amounts from the pre-dorsal pad in breeding males (Knouft et al. 2003). The males were also observed fanning the eggs with an increased frequency as the embryo development progressed. One male cannibalized all of his eggs five days after they were laid. The other male cannibalized all of his eggs after nine days; at this point, it appeared that a few fry had hatched from the eggs, but they had been eaten by the male.

Filial cannibalism is common and well documented in Fantail Darters. In a study on Fantail Darter filial cannibalism by Linström and Sargent (1997), the authors noted that partial cannibalism occurred when males had larger clutches of eggs and total cannibalism occurred when males had smaller clutches of eggs,

regardless of amount of food available to the males. Since my breeding observations were conducted in late May towards the very end of the darter breeding season, which begins in late March in northern Illinois populations (personal observation), the clutches of eggs were very small; in both pairs that spawned, the females laid less than 25 eggs. This is a very small number of eggs in comparison to the number that Linström and Sargent (1997) cite in their study, which included some clutches of over 300 eggs. The small number of eggs produced by females this late in the breeding season may have not been worth the energetic cost to the males of caring for the eggs. This may explain why the males cannibalized all off their eggs. However, it is not known why one male waited five days before cannibalizing his clutch and the other male waited until the fry reached hatching or near hatching to cannibalizing his clutch.

Literature Cited

- Bart Jr, H. L., and L. M. Page. 1991. Morphology and adaptive significance of fin knobs in egg-clustering darters. *Copeia* 1991: 80-86.
- Constantz, G. D. 1979. Social dynamics and parental care in the tessellated darter (Pisces: Percidae). *Proceedings of the Natural Academy of Sciences, Philadelphia* 313: 131-138.
- Knouft, J. H., L. M. Payer, and M. J. Plewa. 2003. Antimicrobial egg cleaning by the fringed darter (Perciformes: *Etheostoma crossopterus*): implications of a novel component of parental care. *Proceedings of the Royal Society of London. B* 270: 2405-2411.
- Knouft, J. H., and L. M. Page. 2004. Nest defense against predators by the male fringed darter (*Etheostoma crossopterus*), *Copeia* 2004: 915-918.
- Lindström, K., and R. C. Sargent. 1997. Food access, brood size and filial cannibalism in the fantail darter, *Etheostoma flabellare*. *Behavioral Ecology and Sociobiology* 40: 107-110.
- Page, L. M., and D. L. Swofford. 1984. Morphological correlates of ecological specialization in darters. *Environmental Biology of Fishes* 11: 139-159.
- Scharpf, C. 2008. Annotated checklist of North American freshwater fishes, including subspecies and undescribed forms. Part IV: Cottidae through Percidae. *American Currents* 34(4): 1-44.
- Winn, H. E. 1958. Comparative reproductive behavior and ecology of fourteen species of darters (Pisces-Percidae). *Ecological Monographs* 28: 155-191. 🐟



Nuptial Male Fantail Darter. Photo by Lance Merry