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## William Bartram's Early Observation of Nest Association Between Cyprinid Fishes

# William Bartram's Early Observation of a Nest Association Between Cyprinid Fishes

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Interspecific nest associations among fishes, especially those involving cyprinids, have received substantial attention in recent years (e.g., Vives, 1990; Johnston, 1991, 1994a, 1994b; Johnston and Kleiner, 1994;). It may be of historical interest, therefore, to note an 18th century observation of this phenomenon by the prominent American naturalist William Bartram (1739-1823), even though he did not recognize it as such.

Bartram's contributions to North American ichthyology were reviewed by Berra (1989); some of his accounts on fishes of the southeastern United States, including the observation discussed herein, were grouped together by Cruickshank (1961). These accounts were excerpted from Bartram's (1791) report of his collecting trips during the period 1773-1776. The relevant passage is presented by Cruickshank (1961) under the heading, "The Gold Fish (Bartram's Minnow) in a Creek Flowing into Broad River, Georgia":

*The waters at this place were still and shoal and flowed over a bed of gravel just beneath a rocky rapid. In this eddy shoal were a number of little gravelly pyramidal hills whose summits rose almost to the surface of the water, very artfully constructed by a species of small crayfish which inhabited them. Here seemed to be their citadel, or place of retreat for their young against the attacks and ravages of their enemy, the gold fish. These, in numerous bands, continually infested them, except at short intervals, when small detachments of veteran crayfish sallied out upon them from their cells within the gravelly pyramids, at which time a brilliant fight presented. The little gold fish instantly fled from every side, darting through the transparent waters like streams of lightning; some even sprang above the surface into the air, but all quickly returned to the charge, surrounding the pyramids as before, on the retreat of the crayfish; in this manner the war seemed to be continual.*

[Like Cruickshank (1961), Van Doren (1947) used the phrase "brilliant fight" in the passage just quoted, but Slaughter (1996) used the phrase "brilliant sight."]

What Bartram misinterpreted as the constructions of crayfish were obviously the gravel mound nests of a cyprinid (Maurakis et al., 1991). Although Cruickshank (1961) did not provide an identification of the "gold fish" or "Bartram's minnow" in her glossary, Berra (1989) noted that Bartram wrote about the yellowfin shiner (*Notropis lutipinnis*) from the Broad River, Madison County, Georgia, and Slaughter (1996) equated the "gold-fish" with *N. lutipinnis*. This species is well

known as a nest associate of the bluehead chub (*Nocomis leptocephalus*), which builds a pebble mound nest (Maurakis et al., 1992), and the relationship may be obligatory for the shiner (McAuliffe and Bennett, 1981; Wallin, 1989, 1992). Indeed, Bartram's description of his "gold fish," as excerpted below from Cruickshank (1961), may be an amalgamation of observations of the spawning colors of the two species (e.g., Page and Burr, 1991), although it leans more heavily toward the shiner, which would have been by far numerically dominant (Wallin, 1989) and probably in a position of more ready visibility:

*The gold fish is about the size of the anchovy, nearly four inches long, of a neat slender form; the head is covered with a salade of an ultramarine blue, the back of a reddish brown, the sides and belly of a flame or of the color of a fine red lead; a narrow dusky line runs along each side, from the gills to the tail; the eyes are large, with the iris like burnished gold.*

It should be noted that *Notropis lutipinnis* from the Broad River system have been the target of recent biochemical and morphological analyses (Wood and Mayden, 1992), which suggest that they represent a distinct form closely related to the greenhead shiner (*Notropis chlorocephalus*). The latter species is also a nest associate of the bluehead chub (Johnston, 1991).

What of the crayfish noted by Bartram? They were probably preying on cyprinid eggs. Vives (1990), for example, reported attempts by crayfish to enter the spawning pits on mounds constructed by hornyhead chubs (*Nocomis biguttatus*), and predation is an important element in discussions of the potential costs and benefits to participants in nest associations (Johnston, 1991; Johnston and Page, 1992). Benefits to fishes that nest in pebble mounds may be associated with the positioning of eggs within the interstices among pebbles, where they may be protected from at least some predators and from siltation in a microenvironment that is supplied with a flow of water sufficient to aerate the eggs. Bartram's use of the phrase "cells within the gravelly pyramids" may reflect the porous nature of the mounds he observed.

Johnston (1994a) cited Cope (1869) in support of the claim that nest association has been known for over a hundred years. Like Bartram, however, Cope (1869) misinterpreted his observations of mound nests. He inferred that catostomids had deposited their eggs beneath the piles of stones he observed in the Roanoke River, and he thought that several species of cyprinids gathered at the mounds only to feed on the suckers' eggs.

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