

Cryptobranchus alleganiensis bishopi (Ozark Hellbender): larval habitat and retreat behaviour

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The aquatic salamander *Cryptobranchus alleganiensis bishopi* (Ozark Hellbender) is a long-lived (est. 30-55 years), large-bodied (≤ 62 cm) species endemic to the Ozark region of southern Missouri and northern Arkansas, USA (Nickerson & Mays, 1973). This species has undergone dramatic population declines throughout its range (Trauth et al., 1992; Wheeler et al., 2003), resulting in its listing as an Endangered Species under the US Endangered Species Act in 2011 (U.S. Fish and Wildlife Service, 2011).

Little is known about larval *C. a. bishopi* habitat use and behaviour *in situ* because few have been found, including in pre-decline populations, but those that were observed occupied stream reaches typified by gravel rather than bedrock substrate (Nickerson & Mays, 1973; Nickerson et al., 2003). Some evidence suggests that larval *C. a. bishopi* utilise the interstitial spaces among the gravel and cobble as their primary habitat which has been posited as a measure to avoid predation and obtain macroinvertebrate prey (Nickerson et al., 2003).

On 19 July 2006 at 15:10 (US Central Time Zone) we observed two un-gilled larval *C. a. bishopi* (Total length₁ = 13 cm; 14.1 g; Total length₂ = 16.5 cm; 29.5 g) under the same rock during a snorkeling-based field survey in the North Fork of White River, Ozark County, MO (precise locality coordinates withheld due to collection concern and conservation status). As soon as we lifted the rock, the larvae began to quickly retreat into the interstitial spaces between the gravel and cobble. Before they fully retreated, we were able to carefully extract them by lifting a few (≤ 5) pieces of gravel and cobble which completely revealed the larvae. Neither larvae had any visible abnormalities, which have commonly been observed in adult *C. a. bishopi* in recent decades (Wheeler et al., 2002; Hiler et al., 2005). We carefully replaced the disturbed gravel, cobble, and cover rock in their original locations and orientations. Hellbenders were released at the bottom edge of the rock so that they could move back under the rock on their own. We observed them until they moved back underneath the rock to ensure that they were not predated during this transition. This observation demonstrates that when disturbed, larval *C. a. bishopi* will actively retreat into interstitial spaces, suggesting this behaviour and habitat use are adaptations for avoiding predation. However, direct observations of such behaviour in response to a predatory species have not

been published. The use of interstitial spaces by larval *C. a. bishopi* may make them particularly vulnerable to siltation and sedimentation. Siltation and sedimentation have been hypothesised as factors contributing to the decline of *C. a. bishopi* due to the degradation and reduction of habitat for both *C. a. bishopi* and their macroinvertebrate prey (Briggler et al., 2007).

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