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ABSTRACT BOOK

Life on the edge: ecological and behavioral insights on stygobiont shrimp activity in ecotonal habitats

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Abstract

Animals that have adapted specifically to life underground are often seen as an evolutionary dead end. Nevertheless, some such stygobionts occur in springs, transitional zones that expose them to different selective pressures. Understanding their presence in these habitats provides insight into their ecological flexibility and potential for adaptation. This study aims to (i) assess the environmental factors that influence spring use by the highly mobile stygobiont caridean shrimp *Troglocaris planinensis* in northeastern Italy and (ii) compare the behavioral responses of cave and spring populations to surface-related cues. From June 2020 to January 2025, we surveyed 64 springs of the classic karst region, recording shrimp activity during both day and night and characterizing each site based on abiotic and biotic factors. In the laboratory, we tested whether individuals from cave and spring populations responded differently to light stimuli and chemical predator cues, as potential indicators of habitat-driven behavioral variation. We used generalized linear mixed model (GLMM) and/or LMM to assess relationships between the relative abundance of *T. planinensis* and environmental features, and to analyse responses to light and predatory cues. Field observations showed that shrimp activity in springs was significantly higher at night and lower in sites with a higher abundance of predatory fish, suggesting that environmental conditions strongly influence their surface presence. In contrast, laboratory experiments revealed no significant differences in behavioral responses to light or predation cues between cave and spring individuals, indicating that



habitat type alone may not drive immediate behavioral adaptations. These findings suggest that highly mobile stygobiont crustaceans can exploit ecotonal habitats dynamically, with their presence in springs being influenced by environmental factors. However, the lack of behavioral differences in controlled conditions raises questions about their perception of surface-associated pressures and the extent to which prolonged exposure to ecotonal environments might lead to evolutionary shifts. Further research is needed to explore whether these stygobionts exhibit long-term adaptive changes in response to surface habitats and what mechanisms may favor their exploitation of springs.

