



## Cave Aquatic Biota in CUPN Parks

### Importance / Issues

Cave aquatic ecosystems were selected for monitoring at three CUPN parks, Cumberland Gap National Historic Park (CUGA), Mammoth Cave National Park (MACA), and Russell Cave National Monument (RUCA), because subsurface waters in these parks support unique communities of aquatic organisms including the federally listed endangered Kentucky cave shrimp (*Palaemonias ganteri*) at MACA. Indeed, the counties in which RUCA, CUGA, and MACA are located rank first, fifth, and sixth, respectively, among the ten counties in the contiguous United States that account for >25% of endemic cave obligate fauna.

The water in cave aquatic ecosystems is ultimately derived from surface water. Because watersheds within CUPN's cave parks are recharged by land outside their boundaries how the land is used can contribute to the degradation of subsurface water in CUPN cave parks. Agricultural pollutants (e.g., animal waste) and some urban pollutants (e.g., parking lot and road runoff) can accumulate on the surface in "virtual storage" until rainfall events wash them into watersheds or directly into cave streams. Springs can also act as conduits from surface waters when they back flood into cave streams. Finally, the predicted rise in the frequency of extreme climate events (e.g., heavy precipitation) across the Southeast region may, through increasingly intense flooding, affect the diversity and distribution of organisms in cave aquatic ecosystems.

### Monitoring Objectives

1. Identify changes in occurrence among individual cave aquatic biota over time and space.
2. Determine whether trend data on cave aquatic communities reflect changes in abiotic (e.g., water quality parameters or habitat characteristics) or biotic (e.g., competition with "exotic" species) stressors.
3. Determine whether trend data on cave aquatic communities, based upon the parameters associated with abiotic or biotic stressors, differ among sites/watersheds within the cave aquatic ecosystem.
4. Provide information on long-term trends in distribution of cave aquatic biota to park managers and assist resource managers by determining the potential impacts of urbanization, habitat loss/degradation, management practices or other identified stressors on cave aquatic biota populations.
5. Provide data to meet legal mandates (e.g., monitor abundance trends for federally endangered *P. ganteri*) related to natural resource protection.



Eyeless cave fish (*Amblyopsis spelaea*) in Mystic River. Photo by Rick Olson.

### Management Applications

Resource managers can learn little about the impact of stressors on cave aquatic biota by relying solely on data gathered during water quality monitoring. In fact, the main purpose of water quality monitoring is to create a long-term data set for trend analysis and directly support and aid the interpretation of aquatic biological monitoring. The intent of this monitoring protocol is to ensure that a scientifically credible story about the ecological condition of cave aquatic biota and their responses to contingent climatic conditions, park management actions, land use changes, and other stressors can be told to park visitors and managers alike. These long-term data can contribute to the development of informative models of relationships between their population dynamics and key environmental factors and management actions by resource managers at CUPN host parks.

### Contacts

Dr. Kurt Helf  
Cumberland Piedmont Network  
P.O. Box 8  
Mammoth Cave, KY 42259  
(270) 758-2163