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Ecology and Conservation Needs of Hydrobiid Snails

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The aquatic snail family Hydrobiidae ranges worldwide and comprises about 1000 named species in 200 genera. Generally feeding on algae, they are only 1-2 mm in size and complete their life cycle in one year. Many of the approximately 200 North American species are "living fossils" that flourished during the Pleistocene but now occur only as narrow endemics in one or a few small spring systems. The systematic relationships of most North American species have only recently been addressed, principally by malacologists Robert Hershler and Fred Thompson, and many species likely remain undiscovered and undescribed. Currently, 5 species are listed by USFWS as endangered, 10 are considered to merit listing as endangered or threatened, and 84 are under review for possible listing.

Hydrobiids inhabit artesian spring ecosystems with permanent, flowing, highly oxygenated waters. The waters may be highly mineralized but must be relatively unpolluted. When hydrobiids occupy a significant portion of a spring system, it indicates that the system is functioning and intact. With the help of seven Natural Heritage Programs (those in Arizona, California, Florida, Idaho, New Mexico, Nevada and Utah), I examined ecological data for 59 species reported as rare or threatened, or which occur in a narrow range in springs and their associated outflows. I omitted from the data set the group inhabiting the ground water system of the Edwards aquifer around Austin, Texas, which are known only from well water samples.

Of these 59 species, most occur at only a single site while most of the remaining occur at only two or three sites. Maximum occupied range, calculated as the greatest linear distance between two occupied points, was estimated in miles for 58 of the species. Of those, 25 (43%) are known to occupy a range less than 0.1 mile, and only 5 have a range greater than 10 linear miles. Substrates occupied by each of 50 species were grouped into seven types. Species in the subfamily Littoridininae were most often reported on vegetation, including algal mats, and on soft substrates such as mud and flocculent, but they were reported also on fine substrates such as silt and sand and on tufa. Species in the Hydrobiinae were reported from the same substrates as Littoridininae and also from wood, from stones, including pebbles and cobble, and from boulders and bedrock. It is not clear whether substrate associations reflect particular substrate preferences or hydrologic regimes of the occupied springs and spring runs, which in turn influence substrate availability.

The extreme endemism of the species surveyed, as measured by the number of occurrences and restricted species ranges, suggests that they may be extremely vulnerable to human disturbance. Threats to viability were assessed or identified for 53 species. When more than one threat was identified for a species, the two most prominent threats were tabulated. Decrease in water quantity due to aquifer depletion and/or surface water diversion was identified as a threat for 33 species. Declines in water quality due to habitat destruction (from impoundment, dredging, or cattle trampling) and/or pollution (nutrient or chemical) was identified as a threat for 21 species. Recreation, such as swimming or hot spring bathing, was identified as a threat for 10 species.

Pyrgulopsis roswellensis, *taken from an alkaline spring at Bitter Lake National Wildlife Refuge, Chavez County, New Mexico. Photo: William Radke.*

Species on public land and on private land designated for conservation offer some degree of long-term protection of the spring ecosystems of the snails. The number of occurrences for 59 hydrobiids was tallied by land ownership. Eighty-five (65%) of the reported occurrences are on public lands or private conservation lands, 44 occurrences (33%) are on private lands other than those with a conservation interest, and 3 occurrences (2%) are on tribal lands. Springs in western states are frequently in private ownership, often as inholdings or adjacent to large tracts of public land, while in Florida (the only eastern state included in this study) many springs are in the state park system.

The aquifer source and hydrology of most of the spring systems is not well understood. Because of this, hydrobiid ecosystems tend to be defined in reference to the surface waters of the host springs. Hydrobiid-occupied springs typically occupy a small surface area, although a few spring systems, such as the Ash Meadows system in Nevada and the Cuatro Cienegas system in Coahuila, Mexico, are quite large and are habitat to several endemic species in various subsets of springs within a large system. Regardless of their surficial aspects, the conservation and management of spring systems needs to consider the interconnectedness and hydrology of these systems. The potentially large zone of influence on the hydrology of artesian springs argues for management at regional or large ecosystem levels rather than at the level of single isolated springs.

The following recommendations are designed to sustain spring ecosystems for hydrobiids using a threat assessment and control approach.

1) Identify all springs in the landscape with hydrobiid snails and prioritize them for conservation in a landscape context. In prioritization, consider the relative imperilment of the snails and other taxa, the quality of the spring community, the threats to the ecosystem, and the potential to control these threats.
2) Identify factors that may potentially influence these systems, especially the quality and quantity of their water. It is useful to model each system.
3) Monitor water quantity and quality in priority spring ecosystems. This usually will require ground water monitoring as well. Concurrently and quantitatively monitor occupied hydrobiid habitats and hydrobiids within the targeted springs. Also monitor other likely sources of stress to these systems.
4) Identify key sources of stress to the ecological integrity of the targeted spring ecosystems.
5) Work with land owners and managers to abate or otherwise control these sources of stress, and assess the success of these efforts over time.

In New Mexico, we have begun to implement these recommendations on the spring systems at Bitter Lake National Wildlife Refuge.

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