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EARLY LIFE HISTORY AND CONSERVATION STATUS OF THE MONKEYFACE, *THELIDERMA METANEVRA* (MOLLUSCA: BIVALVIA) IN MINNESOTA AND WISCONSIN

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ABSTRACT

Conservation and restoration of freshwater mussel species requires an understanding of current and historical distributions as well as key aspects of life history. Most freshwater mussels (Unionoida) depend on particular species of host fish for the development and dispersal of the parasitic glochidia larvae. The degree of host specificity varies and is not well known for many mussel species. We tested 90 fish species in 18 families as potential hosts for the Monkeyface mussel (*Theliderma metanevra*), determined its brooding period, and assessed its distribution and current status in Minnesota and Wisconsin. *Theliderma metanevra* brood embryos and glochidia from late April-early August in the St. Croix River. In laboratory experiments, glochidia metamorphosed on 21 cyprinid species (11 genera) but not on other taxa, confirming the host association between *Theliderma* spp. and minnows. The historical and recent distribution of *T. metanevra* in the upper Midwest reflects geological dispersal barriers as well as its apparent sensitivity to a range of human disturbances. These results contribute to an understanding of the evolutionary diversification of the tribe Quadrulini and inform efforts to conserve this regionally threatened species.

KEY WORDS *Quadrula metanevra*, freshwater mussels, host fish, minnows, distribution, brooding

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GENOTOXIC RESPONSE OF UNIONID MUSSEL HEMOLYMPH TO HYDROGEN PEROXIDE AND POLYCYCLIC AROMATIC HYDROCARBONS

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ABSTRACT

The single cell gel electrophoresis or comet assay is widely used to detect DNA damage in isolated cells following exposure to genotoxic compounds. This assay, although commonly used with marine bivalve tissue and circulatory fluid, has received little use or demonstration in freshwater mussels of the order Unionida. Because such a large proportion (>70%) of this faunal group is globally imperiled and is being adversely impacted by environmental contaminants, including many genotoxicants, the aim of this study was to assess the applicability of the comet assay in unionid mussel hemolymph sampled non-lethally with a reference genotoxicant, hydrogen peroxide (H_2O_2) and polycyclic aromatic hydrocarbons (PAHs), a class of common environmental pollutants of genotoxic action. DNA damage was evaluated in samples of hemolymph from *Elliptio complanata* in both *in vitro* and *in vivo* exposures and quantified using the endpoints % tail DNA, or the percentage of DNA in the comet tail and OTM or olive tail moment, the product of the fraction of DNA in the tail and tail length. Hemocytes were isolated and the comet assay was performed on control, 160 µM H_2O_2, and PAH treated cells. From the *in vitro* exposures, 160 µM H_2O_2, as well as the 50 and 100 µg/L total PAH treatments yielded statistically significant ($p < 0.05$) levels of DNA damage, with the H_2O_2 yielding an average of 39.7 % tail DNA and 13.3 OTM and the two PAH treatments yielding 40.7 % and 38.6 % tail DNA, and 12.4 and 11.0 OTM, respectively. An *in vivo* PAH exposure with adult *E. complanata* did not detect a similar genotoxic response to that detected with *in vitro* exposure, indicating that additional research and evaluation may be necessary before implementing the widespread use of a non-lethal, unionid mussel hemolymph based genotoxicity screening tool for environmental biomonitoring.

KEY WORDS Comet Assay, Freshwater Mussel, Unionid, Genotoxic, Hemolymph, PAH

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FRESHWATER MUSSELS OF THE POWELL RIVER, VIRGINIA AND TENNESSEE: ABUNDANCE AND DISTRIBUTION IN A BIODIVERSITY HOTSPOT

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ABSTRACT

The Powell River, located in southwestern Virginia and northeastern Tennessee, is a tributary of the Clinch River in the headwaters of the Tennessee River system. Historically, the Powell River had a diverse freshwater mussel fauna of 46 species. Various surveys conducted over the past century have recorded a decline in mussel densities and diversity throughout much of the river, due to historical and on-going anthropogenic impacts. In 2008 and 2009, random timed-search, systematic search, and quadrat sampling of 21 sites were completed to document species richness, relative abundance, density, and size-class structure of resident mussel populations. During the random timed search (10 sites) and systematic search (10 additional sites) portions of the survey (n=1,399 person-h), surveyors collected 15,084 mussels of 29 species. Catch-per-unit-effort ranged from 0.33 to 22.12 mussels/person-h. We observed living individuals (n = 412) of 9 of the 17 federally endangered species previously reported in the river (*Dromus dromas*, *Epioblasma brevidens*, *E. triquetra*, *Fusconaia cor*, *Lemiox rimosus*, *Plethobasus cyphyus*, *Quadrula cylindrica strigillata*, *Q. intermedia*, and *Q. sparsa*) and two candidate species for federal protection (*Pleuronaia dolabelloides* and *Ptychobranchus subtentum*). We recorded 19 species from 18 sites, including 5 endangered species during quadrat sampling efforts. Mean densities ranged from 0.00 to 2.25 mussels/m^2 among sites sampled. Relatively recent recruitment was also evident for 16 of 29 species; including 4 endangered species (*D. dromas*, *E. brevidens*, *Q. intermedia*, and *Q. sparsa*). The mussel fauna of the lower Powell River continues to represent one of the most diverse in the United States. Outside of the Powell River, only 2 or 3 populations remain for most of the listed species extant in the river. Given these qualities, the Powell River deserves recognition as a location for focused conservation efforts to protect its diverse mussel assemblage.

KEY WORDS Freshwater mussels, Powell River, Survey, Endangered Species, Biodiversity