



Columbia Environmental Research Center

Publication Brief <http://www.cerc.usgs.gov/pubs/briefs/mussels.pdf>

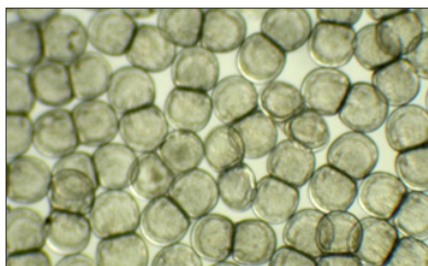
Contaminant Sensitivity of Freshwater Mussels

About 70% of North American freshwater mussel species are considered endangered, threatened, or of special concern. Contamination is considered one of the causal or contributing factors to the declines of these populations.

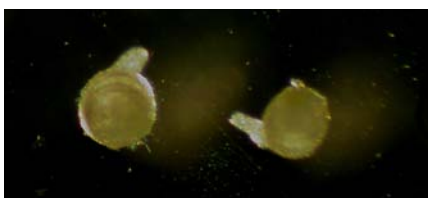
Consequently, biologists working to recover mussels have sought the help of toxicologists to identify specific pollutants of concern. The research reported in a series of 10 papers in the latest issue of the *Environmental Toxicology and Chemistry* scientific journal greatly advances freshwater mussel ecotoxicology, including an evaluation of the scientific validity of laboratory methods for conducting toxicity tests with early life stages of freshwater mussels, the application of these methods to assess the toxicity of common pollutants to mussels, and confirmation that stream concentrations of some pollutants exceed levels identified to be harmful to native mussels (1).

The USGS Columbia Environmental Research Center participated in the first research to develop standardized methods for conducting freshwater mussel toxicity tests, now accepted by the American Society for Testing and Materials (ASTM). The reliability of such standard tests was evaluated and is reported by Wang et al. (2), summarizing results of toxicity tests conducted repeatedly within a single laboratory and among five laboratories, evaluating toxicity test performance and variability within and among laboratories.

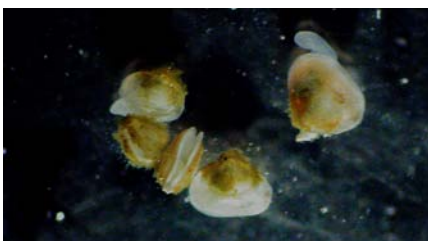
The toxicity of ammonia, copper, and chloride was evaluated in a series of acute laboratory toxicity tests (Wang et al. (3)) and chronic laboratory toxicity tests (Wang et al. (4)) in studies funded by the U.S. Fish and Wildlife Service and by the U.S. Environmental Protection Agency (USEPA). Data from these studies are being used to re-evaluate the current USEPA Water Quality Criteria for ammonia and copper.



Freshwater mussel glochidia.



Newly transformed juvenile mussels.



Two-month-old juvenile mussels.

Most freshwater mussels have a complex reproductive cycle involving a parasitic stage on fish. Sperm released by a male enters a female through the incurrent siphon, and fertilized eggs develop into larvae called glochidia that mature in specialized chambers (marsupia) of the female's gills. Glochidia are released into the water and must attach to the gills or fins of a suitable host fish. After one to several weeks of the parasitic stage, glochidia transform to juvenile mussels, detach from the fish, and drop to the stream or lake bottom to begin the free-living juvenile stage. Glochidia, newly transformed juveniles and two-month-old juvenile mussels were used in toxicity tests (2, 3, 4).

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Publication Citations:

1: Editorial Augspurger, T., Dwyer, J., Ingersoll, C., Kane. 2007. Advances and Opportunities in Assessing Contaminant Sensitivity of Freshwater Mussel (unionidae) Early Life Stages. Editorial. *Environmental Toxicology and Chemistry* 26(10):2025-2028.

2: Wang, N., Augspurger, T., Barnhart, C., Bidwell, J., Cope, G., Dwyer, J., Geis, S., Greer, I., Ingersoll, C., Kane, C., May, T., Neves, R., Newton, T., Roberts, A., and White, D. 2007. Intra- and Interlaboratory Variability in Acute Toxicity Tests with Glochidia and Juveniles of Freshwater Mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2029-2035.

3: Wang, N., Ingersoll, C., Hardesty, D., Ivey, C., Kunz, J., May, T., Dwyer, J., Roberts, A., Augspurger, T., Kane, C., Neves, R., and Barnhart, C. 2007. Acute Toxicity of Copper, Ammonia, and Chlorine to Glochidia and Juveniles of Freshwater Mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2036-2047.

4: Wang, N., Ingersoll, C., Greer, I., Hardesty, D., Ivey, C., Kunz, J., Brumbaugh, W., Dwyer, J., Roberts, A., Augspurger, T., Kane, C., Neves, R., and Barnhart, C. 2007. Chronic Toxicity of Copper and Ammonia to Juvenile Freshwater Mussels (Unionidae). *Environmental Toxicology and Chemistry* 26(10):2048-2056.