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Environmental Protection Agency
Health and Ecological Criteria Division
Office of Water (Mail Code 4304T)
1200 Pennsylvania Avenue NW
Washington, DC 20460

Dear U.S. Environmental Protection Agency:

Please accept these comments submitted on behalf of the Freshwater Mollusk Conservation Society on the Draft Updated Aquatic Life Ambient Water Quality Criteria for Aluminum in Freshwater (https://www.gpo.gov/fdsys/pkg/FR-2017-09-26/pdf/2017-20597.pdf).

The Freshwater Mollusk Conservation Society (FMCS) is dedicated to the conservation and advocacy of freshwater mollusks, North America's most imperiled animals. FMCS is an international professional scientific society made up of state, federal, academic, and private scientists and conservationists, many of whom work directly with the more than 200 endangered and threatened freshwater mollusks found worldwide. Our members are considered experts in the conservation and recovery of freshwater mollusks.

We are writing to advocate on behalf of a freshwater standard for aluminum that is protective of larval and juvenile forms of freshwater mollusks and of threatened and endangered species in particular. Freshwater mollusks are the most imperiled group of organisms in United States with nearly two-thirds of species being identified as at risk-of extinction. It is thus of utmost importance for the Environmental Protection Agency to develop water quality criteria that are protective of these sensitive organisms.

Mussels are particularly sensitive to contamination from dissolved metals (Naimo 1995). Aluminum can be lethal to mollusks and is added to water by some water treatment facilities to kill the young larvae of invasive mussels (Mackie and Kilgour 1995).

Several published studies indicate that native freshwater mollusks can be harmed by aluminum pollution. Wang et al. (2017) recently reported acute and chronic toxicity of aluminum to juvenile *Lampsilis siliquoidea*. Based on chronic toxicity results, the mussel ranks as the 4th most sensitive species tested to date. Huebner and Pynnonen (1992) found that exposure to increased aluminum decreased the viability of glochidia of the unionids *Anodonta anatina* and *Anodonta cygnea*.

Malley et al. (1988) added aluminum sulfate to an experimental lake in Ontario to test the effects on adult mussels of the addition of aluminum and increasing acid levels in soft water, and found that *Anodonta grandis grandis* experienced blood and tissue ionic changes indicative of stress and exhibited aluminum accumulation in tissues. The authors concluded that in increasingly acidic conditions with high levels of aluminum, adult mussels could experience significant damage to their shells.

In the Ahtavanjoki River in Finland, Taskinen et al. (2011) reported that the endangered freshwater pearl mussel *Margaritifera margaritifera* experienced low reproductive success attributable to high concentrations of aluminum and iron accompanied with periods of low pH. Though the adult mussels appeared to be tolerant to periods of water quality variation and were able to produce glochidia, the early life cycle stages of mussels in the river were not successfully recruited into the population due to metal exposure. In laboratory experiments on mussels collected from the river, exposure to high but environmentally realistic levels of aluminum was toxic to free glochidia with most individuals dying within 72 hours. Importantly, the survival of control glochidia was significantly higher than that of any group of glochidia that were exposed to aluminum at any level. The authors also found that the survival of juvenile mussels was lower in groups exposed to aluminum than in the control group.

Though aluminum is most readily uptaken by mollusks in acidic waters, Elangovan et al. (1997) found that the freshwater snail *Lymnaea stagnalis* accumulated significant levels of aluminum in neutral water in its soft tissues, gut, digestive gland and kidneys. Kadar et al. (2001) examined the effect of aluminum on the filtering behavior of the mussel *Anodonta cygnea* in neutral water at environmentally relevant concentrations and found that mussels closed their shells and avoided filtering at the higher concentration. Interestingly, the mussels exposed to the lower dose accumulated more aluminum in their tissues because they did not reduce filtering time in response to exposure as did the mussels exposed to the higher dose. They found that the mussels accumulated most of the aluminum in their kidneys and digestive glands. Their study provides evidence for the bioavailability and toxicity of aluminum to mussels at neutral pH.

In light of these studies demonstrating that aluminum can be harmful to mussels and snails in freshwaters, we urge you to implement criteria that are protective of all life stages mollusks. Inclusion of mussel chronic toxicity data in recalculation of the aluminum chronic criterion would help ensure that mollusks are protected.

Thank you for taking our comments into consideration.

Sincerely,

Heidi L. Dunn, President
Freshwater Mollusk Conservation Society

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