Session4A: **Mussels: Impacts of Pharmaceuticals/temperature – updated research**
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Temperature sensitivities of freshwater mussels and implications for population management

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Freshwater mussels fulfill an essential role in aquatic communities, but are also one of the most rapidly declining faunal groups in North America. Rising water temperatures, caused by global climate change, industrial discharges, or land development, can further challenge impaired unionid communities. In this study, upper thermal tolerances were determined for the early life stages of eight species of freshwater mussels: *Lampsilis siliquoidea*, *Potamilus alatus*, *Ligumia recta*, *Ellipsaria lineolata*, *Lasmigona complanata*, *Megalonaias nervosa*, *Alasmidonta varicosa*, and *Villosa delumbis*. Mussels were held at three acclimation temperatures (17°C, 22°C, 27°C) and exposed to a range of common and extreme water temperatures (20 - 42°C) in standard acute laboratory tests. The average median effective temperature (ET50) among species in 24 h tests with glochidia was 33.7°C, ranging from 29.1 to 37.5°C. The mean ET50 in 96 h juvenile tests was 34.8°C, and ranged from 32.9 to 36.7°C. As an indicator of sublethal thermal stress, heart rate patterns for seven species of juvenile mussels were assessed through direct observation; *L. recta* and *V. delumbis* displayed significant changes in heart rate associated with increasing temperature. Three juvenile freshwater mussel species, *L. siliquoidea*, *P. alatus*, and *L. recta*, were also exposed to a sublethal copper concentration to examine the effect of copper on thermal tolerance. Survival trends showed evidence of interactive effects between copper and temperature for all three species, suggesting this is an area that warrants further study. Additionally, thermal tolerance data for freshwater mussels and their host fish were compared to determine if the community structure of these systems is at risk from rising environmental temperatures; relationships were complicated with mussels being both more and less thermally sensitive than certain host fish species.

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