Effects of Host Availability, Water Temperature, and Water Discharge on Populations of *Actinonais ligamentina* and *Truncilla truncata* Mussels in the St. Croix River, MN

Brandon Sansom¹, Dr. Dan Hornbach²,³, Mark Hove², and Dr. Kelly MacGregor⁴
Washington and Jefferson College, Biology Department and Environmental Studies Program, Washington, PA 15301
Macalester College, Departments of Biology², Environmental Studies³, and Geology⁴, St. Paul, MN 55105

**Introduction**

Freshwater mussels remain one of the most imperiled species in North America (Strayer, 2008). The development of the larval (glochidia) for most of these mussels requires their attaching to a host fish. Some mussels are considered host generalist, using many fish species as a host, while others are specialists, using only one or a few host species (Strayer, 2008).

Population densities of a host specialist, *Truncilla truncata* (Fig. 1A) have been declining at a location below a hydroelectric power dam in the St. Croix River, MN. However, densities of a host generalist, *Actinonais ligamentina* (Fig. 1B) have remained constant both above and below the dam. The objective of this research was to detect whether differences in host availability, water temperature, or water discharge are contributing to the differences in mussel densities.

**Methods**

- *Actinonais ligamentina* and *Truncilla truncata* were collected from Wild River and Interstate state parks in the St. Croix River, MN (Fig. 2).
- The length, width, eroded area, and annual rings were measured for each mussel (Fig. 3, 4).
- Eroded area vs. ring length regressions were used to estimate the most likely age of each annual ring (Fig. 5).
- Length vs. likely age logistic regressions were used to predict the most accurate age of each mussel; this predictive model was then applied to existing mussel data from Dan Hornbach and David Heath (WI DNR).
- Age distribution graphs were created in Mathematica (7.0) based on the most likely age of each mussel.

**Results – A) Age Distributions**

![Image](image1)

**Results – B) Host Fish Relationship**

![Image](image2)

**Results – C) Yearly Growth**

![Image](image3)

**Results – D) Discharge and GDD Effects**

![Image](image4)

**Conclusions**

- Using our age prediction model, mussel age can be determined based on shell length (Fig. 6A-C).
- The higher abundance of *A. ligamentina* host fish CPUE (Fig. 7A-B) may imply a more consistent recruitment at both Interstate and Wild River (Fig. 6I-II); the lower abundance of *T. truncata* host fish CPUE (Fig. 7A-B) may imply that sporadic mussel recruitment is closely linked to high year classes of host fish (Fig. 6II).
- Differences in growth for both species are related to discharge and water temperature. The lack of a relationship between water temperature and discharge with growth for either *A. ligamentina* or *T. truncata* suggests that other factors may be more important in controlling growth rates.
- No water gage to measure discharge at Wild River exists, so the methods and locations to obtain discharge data here should be further investigated.

**References**


I would like to thank Dan Hornbach, Mark Hove, Kelly MacGregor, and Macalester College for allowing me to participate in their research. This work was supported in part by the Undergraduate Science Education Program Grant No. S000623 from the Howard Hughes Medical Institute to Washington and Jefferson College. Special thanks to Mike Fast, Konrad Schmidt, Health Bankie, John Franck, and Larry Dammron for fish population data and to David Heath for additional mussel data at Interstate.