Morphological Differences of *Lampsilis radiata* and *Lampsilis siliquoidea*

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Introduction

Freshwater pearly mussels (Family: Unionidae) live in the sediments of rivers, streams, and lakes. Approximately 300 species are found in North America including the Great Lakes watershed. Although the group is highly diverse, it is the most imperiled taxon in the United States (Williams et al. 1993).

Often, the target of conservation and restoration strategies of threaten taxa like unionids, is the species, thus a correct identification is fundamental to guarantee the success of implemented measures. However, species boundaries, evolutionary relationships and geographic distributions of many unionid species remain unresolved.

Identification of two mussel species, *Lampsilis siliquoidea* and *L. radiata* is problematic where their distribution range overlaps because of the presence of intermediate forms in the Lower Great Lakes (Clarke and Berg 1959; Kat 1986; Strayer and Jirka 1997).

The objective of this research was to expand Clarke and Berg (1959) study looking at morphological differences between *Lampsilis siliquoidea* and *L. radiata* across the northern portion of their distribution range.

Methods

Clarke and Berg (1959) described morphologically *Lampsilis siliquoidea* and *L. radiata* in Central New York based on nacre color, ray width, periostracum (outer shell) color and posterior inflation (see below). Nine populations were sampled (Tonawanda Creek, Ellicott Creek, Nottawasagga River, Middle Maitland River, Lake Mendota, Johnsons Creek, Black River Bay, Sodus Bay and Youngs lake; Fig. 3) and male and females individuals of the target mussel species were collected (Fig. 1).

Figure 1. Collected *Lampsilis siliquoidea* individuals.

Data from Genesee River, Honeoye Creek, Susquehanna River, Lake Memphramagog and St. Lawrence River was taken from Clarke and Berg (1959).

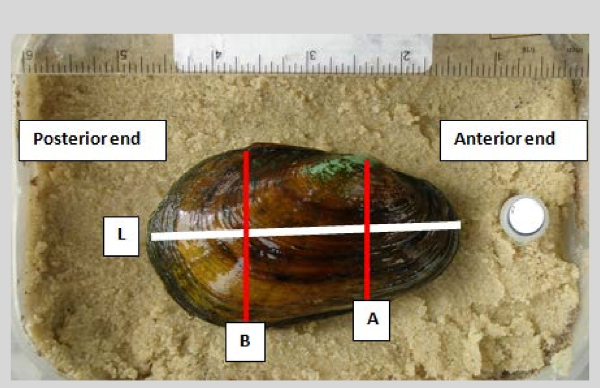


Figure 2. Shell measurements taken with Image J. *L*, length. *A* and *B* are shell height taken at 1/3 and 2/3 (respectively) of the shell length from the anterior end.

Upon collection, length, height and width were measured using a caliper. Each mussel was photographed at the site for further investigation. In the lab, using ImageJ (Rasband 1997, 2012), the length, width and height (mm) of the pictures of each mussel were measured. These were taken in the field (Fig. 2). It was found that these measurements showed less variation than the measurements taken in the field. Therefore, these were the measurements used in the data analysis.

Results

Lake Mendota should reveal typical *L. siliquoidea* morphological characteristics and Lake Memphramagog typical *L. radiata* characteristics; typical *L. siliquoidea* female is more inflated posteriorly (A/B >1.14) than *L. radiata* (A/B <1.14) (Clarke and Berg, 1959). For Lake Mendota the majority of the females have B/A indices around 1.14; consistent with the expectations. However, in Lake Memphramagog the indices have a wider distribution (Fig. 4).

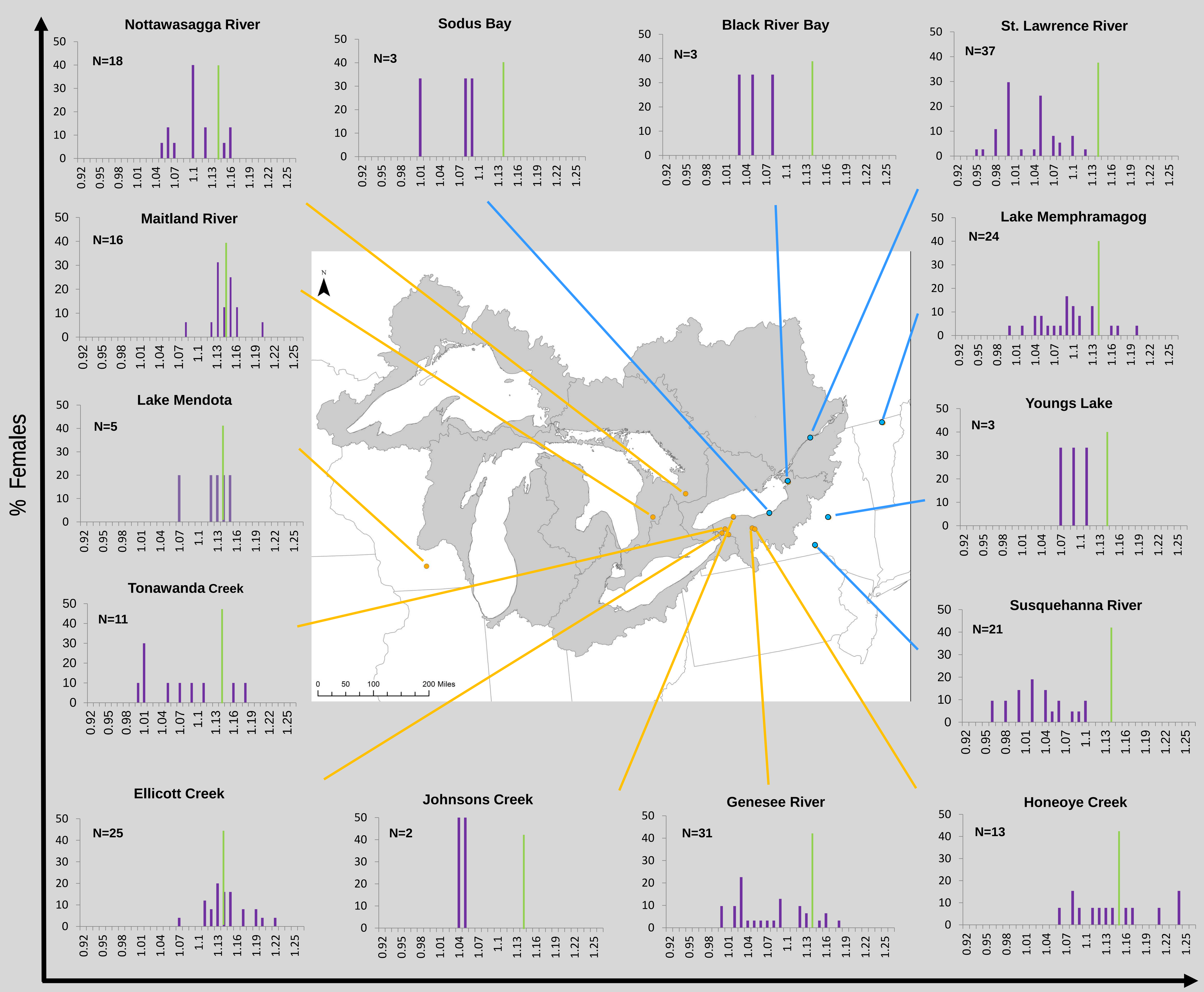


Figure 4. Percentage of number of female's posterior inflation index (B/A) per population across the sampled geographic range of *Lampsilis siliquoidea* (orange) and *L. radiata* (blue). Dark grey area is the Great Lakes watershed. Green vertical lines represent the B/A=1.14 typical of *L. siliquoidea* according to Clarke and Berg (1959).

The other *L. radiata* populations (Fig. 4; blue) show the expected *L. radiata* B/A indices and the expected ray width (e.g. Sodus Bay and Black River Bay; Fig. 5). The *L. siliquoidea* populations (Fig. 4; orange) show mixed results. In terms of inflation index (Fig. 4) some are typical *L. siliquoidea* (e.g. Ellicott Creek, Maitland River, Nottawasagga River and Honeoye Creek). However, Tonawanda Creek, Johnsons Creek and Genesee River show a wider distribution of the B/A indices and ray width. These populations show characteristics of both species which indicated that they co-exist or are intermixing. In the field was not possible to differentiate one species from the other in these locations.

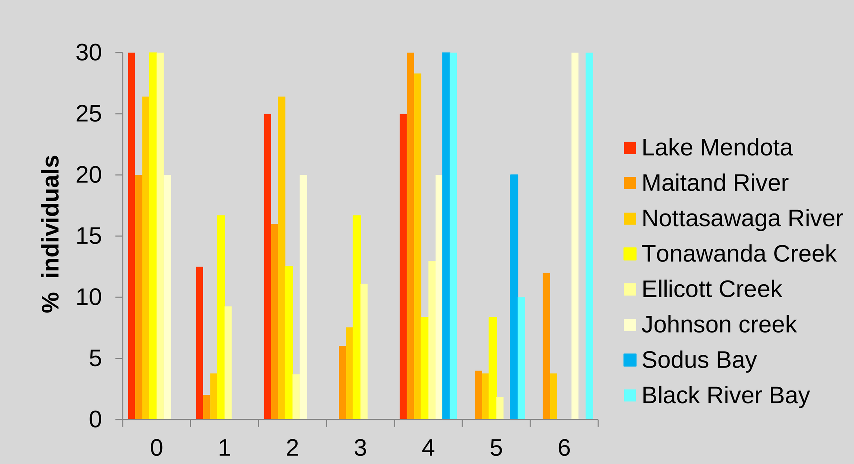


Figure 5. Frequency of individuals per ray width category per population. Categories as in Fig. 3 and color codes as in figure 4.

Methods (cont'd)

For analysis each mussel's posterior inflation index (B/A), length (L), and (B/L) ratio were calculated (Clarke and Berg, 1959) (Fig. 2). The ray width (Fig. 3) and periostracum color (Yellow, Brown-red, Black, Green) were also noted.

Figure 3 . *Lampsilis siliquoidea/radiata* ray width category. There are 7 categories; 0= no rays to 6= many wide rays.

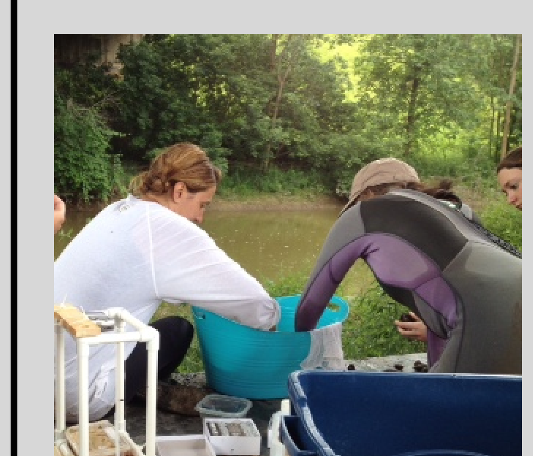
Percentage of female individuals per posterior inflation index and percentage of individuals (males and females) per ray width category were plotted per site and mapped (Fig. 4).

Conclusion

The extent of the zone where the morphological characters typical of both species are present within the same population is larger than previously described. Identification of the species solely based on morphological characteristic was not possible in these populations. Genetic analysis will help identify the species.

Research Implementation

- One of the tools we used in this project was the ImageJ Software. We intend to use this software when implementing the making connections state lab. We will take pictures of each student and each student will in turn use ImageJ to measure their height in centimeters



- We will use the results of our project as a tool to explain evolution of species later on in the year
- Mrs. Porto Hannes will do a lecture and demonstration to further explain our research to our classes
- We will infuse our ecology unit with the experience we gained from this project by explaining the effect of invasive species on native species.

References / Acknowledgements

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The authors are grateful to Dr. Joseph Gardella and the ISEP project. Also to Lyubov E Burlakova, Susan Daniel, Rachel Morganti and Vanessa Smilanski for their hard work in the field.