

OCCURRENCE OF FRESHWATER MUSSELS (UNIONIDAE) IN SURVEYED STREAMS OF SOUTHEASTERN PENNSYLVANIA, 2000-2010

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INTRODUCTION

Since the end of the 20th century, freshwater mussels (unionids) throughout the United States have experienced a rapid decline in community diversity and population density, with approximately 75 per cent of the current fauna considered at risk. Many of the potential causes are well documented including habitat disturbance and degradation, declining water quality, run-of-river obstructions preventing upstream movement of fish hosts, competition with invasive bivalves, and siltation. Historically, water bodies throughout Pennsylvania have included ~66 species in over 25 genera, with ~13 species being native to the Delaware River watershed. In the early 20th century, when the last comprehensive mussel surveys were completed, at least 8 native species were found in southeast Pennsylvania.

Between 2000 and 2010, surveys were conducted above the head of tide in numerous streams in southeast PA. The object of the surveys was to document the current status of select unionid populations, compare with early 20th century historic records and explore whether sufficient mussels were available to be used in the Freshwater Mussel Restoration Program (FMRP). Initiated in 2007 by the Partnership for the Delaware Estuary, the FMRP seeks to restore freshwater mussel numbers, resilience and population diversity through a mix of conservation, habitat expansion, and reintroduction.

METHODS

Between 2000 and 2010, staff from the Academy of Natural Sciences and the Partnership for the Delaware Estuary surveyed sites around the Philadelphia area (Philadelphia, Chester, Delaware, Bucks and Montgomery Counties) for the presence of freshwater mussels (see below). These collections represent what may have been the most intensive mussel surveys in the southeastern Pennsylvania region since A. E. Ortmann's early 20th century study.



The current surveys were conducted by walking the stream banks and wading with the aid of polarized sunglasses and viewing buckets. Snorkeling was also conducted at a few sites. All live mussels were identified and measured in the field or brought back for confirmation of identification. When found, all relic shells were collected and taken back for taxonomic confirmation.



Zoe Ruge and Sylan Klein (l. to r.) with mussels collected from Ridley Creek.

RESULTS

- Live mussels were found at ~1/4 of the sites surveyed (Fig. 1).
- Survey species list included *Elliptio complanata*, *Pyganodon cataracta*, *Strophitus undulatus*, and *Alasmidonta undulata*.
- *Elliptio complanata* was recorded at ~90% of the sites where mussels were found while *Pyganodon cataracta*, *Strophitus undulatus* and *Alasmidonta undulata* were found at <10% of all sites we encountered living mussels.
- Numbers of mussels collected were highest at the Ridley Creek, Brandywine Creek and Manatawny Creek sites.
- Relic shells were found at many sites where live mussels were recorded, and at some sites where no living mussels were seen, providing additional data suggesting that at least one species of freshwater mussel inhabits Crum Creek and Skipack Creek (e.g.), upstream of our study area.
- Surveys in streams originally visited by Ortmann (Fig. 2) revealed significant declines in mussel species numbers and diversity.

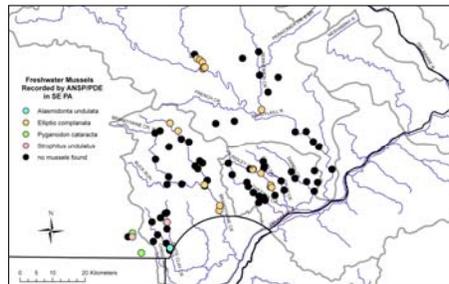


Figure 1. Results of ANS/PDE mussel surveys conducted between 2000 and 2010.

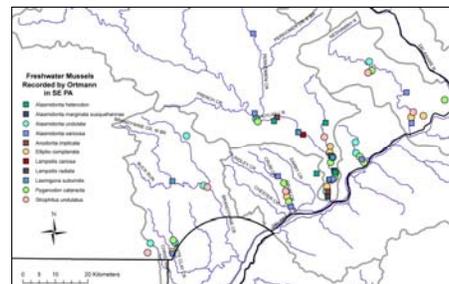


Figure 2. Results of Ortmann mussel survey conducted between 1908 and 1910.



Examples of freshwater mussel taxa historically found within the middle Delaware River drainage (top row, left to right) *Ligumia nasuta*, *Leptodea ochracea*, and *Lampsilis cariosa*, (middle, left to right) *Strophitus undulatus*, *Pyganodon cataracta* and *Elliptio complanata*, and (bottom) *Anodonta imbecilis*. (David M. Warren / Philadelphia Inquirer Staff Photographer).

Discussion and Next Steps

As in other regions of the United States, historic changes in water quality, available habitat, and host fish availability may have affected freshwater mussel populations throughout our study area. The majority of stream reaches searched were slightly to moderately affected by urban development and siltation. Most survey sites where live mussels were found had significant riparian cover. For example, mussels were abundant in Ridley Creek (mainly within the State Forest) where deep woods border the stream. In addition, many of the stream reaches where mussels were not found have a similar depth (~50cm to ~100cm) and benthic substrate (sand/silt/cobble/gravel/boulder). However, the Brandywine Creek study sites were much narrower (~10m vs. ~50m) and the substrate more consistent (sand/silt/gravel). These abiotic characteristics may explain why mussels were still found in this stream. More study is needed to discern the relative differences among these streams in geomorphology, impediments to fish host movements, food resources, and basic water quality parameters to explain why mussels remain in some areas but not others.

Although the majority of stream segments surveyed were devoid of any living freshwater mussels, more extensive surveys, including additional streams in Delaware, Chester, Montgomery and Bucks counties are warranted. These results indicate that some freshwater mussel taxa are able to survive and reproduce in many of our study streams. This bodes well for future propagation and re-introduction of multiple freshwater mussel species throughout southeast PA (Freshwater Mussel Restoration Program; see posters by Padeletti et al. and Wood-Tucker et al.), potentially using broodstock for diverse species that we recently discovered in the tidal freshwater portion of the Delaware River (see poster by Kreeger et al.). Freshwater mussels are keystone aquatic organisms and their successful re-introduction may lead to increased water quality, more diverse benthic habitats for other macroinvertebrates and fishes, and other vital ecosystem services within the watershed.

Acknowledgments

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