

Clamming Up: The Unexpected Natural History and Conservation of Freshwater Mussels in the Fox River and Tributaries

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1. Freshwater mussels are an important part of aquatic ecosystems globally.
 - a. As filter feeders they remove biological material from the water and integrate the chemicals of their ecosystem
 - b. As large animals moving through the substrate, they may have an important role in bioturbation (e.g. Vaughn and Spooner 2006)



Photos by T. Levine from the Mukwonago River 2014 (c)

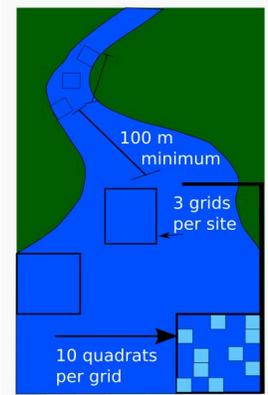
2. Mussels have played an extensive and important role in the cultures of North America
 - a. Native North American civilizations made use of mussels in a variety of ways and tools made of their shells have been found
 - b. Mussels were exploited for their pearly nacre, which was used for buttons.
 - i. This industry was enormous, leaving mounds of shells from the use of these shells throughout the country
 - c. Pearls and seed materials for cultured pearls have also been prized products from mussel shells.



Photo by T. Levine from remains of a facility near Paducah, KY in 2007 (c)

- d. For details and images, visit:
<http://www.museum.state.il.us/RiverWeb/harvesting/harvest/mussels/index.htm>
- 3. Mussels possess a complex life cycle, including larval parasitic and free-living adult stages
 - a. Larval parasitism on fish helps mussels to disperse and recolonize habitats not accessible to larvae
 - i. This parasitic phase is often overlooked, but reflects much of the diversity of this group, see: <http://unionid.missouristate.edu/> with info and video!
 - 1. Adaptations to facilitate encystment of parasitic larvae (called glochidia) on fishes include:
 - a. Packages of larvae that imitate aquatic insects
 - b. Modified mantles that extend beyond the margin of the shell
 - c. Nets of larvae
 - d. Head-trapping of fish hosts
 - b. Juveniles excyst from fishes and drop off to live in the benthos - likely the least well understood life stage
 - c. Adults are mobile, filter-feeders that use a single foot to pull themselves through the substrate
- 4. Mussels of the Fox River
 - a. Illinois portion of the Fox River:
 - i. Schanzle 2004 INHS Biological Notes
 - 1. Reported 23 species live from basin
 - 2. Reported 4 species only found dead from basin
 - 3. Substantial declines occurred from earlier survey by Matteson
 - a. 10 stations sampled in both surveys:
 - i. 20 species found in earlier survey, 14 found later
 - ii. Tiemann et al 2007 Northeastern Naturalist; Tiemann, Cummings and Mayer 2007 Transactions of the Illinois Academy of Science:
 - 1. 34 species historically present in the Fox River System
 - 2. 26 species for which recent evidence is available from the Fox River System
 - 3. 6 species found live in Fox Mainstem

4. Evidence of IL State Threatened species (valves only):
 - a. *Cyclonaias tuberculata*, Purple wartyback
 - b. *Elliptio dilatata*, Spike
5. Evidence of IL State Endangered species: *Villosa iris*, Rainbow mussel
6. Significant impacts from dams are evident
 - a. No mussels found in impoundments
 - b. Mussels upstream distribution limited by dams
- b. Wisconsin portion of the Fox River:
 - i. 21 species found since 1970
 - ii. Much of the remaining species richness is likely in tributaries, not mainstem
 - iii. *Villosa iris*, Rainbow mussel is state endangered and a population exists in the Mukwonago River
 - iv. Summary data available from Wisconsin Aquatic and Terrestrial Resource Inventory: <http://wiatri.net/inventory/mussels/>
5. Mukwonago River (a tributary of the Fox River in WI)
 - a. Goals:
 - Monitor mussel community over time, contribute to long term work by L. Kitchel, WI DNR
 - Describe how mussel community changes within lower stretch of the river
 - Better understand ecology of lure producing mussels
 - b. Completed both catch per unit effort survey (2 collector hours) and quadrat survey (aligned with methods from WI DNR - see figure at right)
 - c. CPUE Survey:
 - i. 12,309 mussels recovered, in 62 people hours
 - d. Quadrat survey



CPUE Survey

<i>Pleurobema sintoxia</i>	44.1%
<i>Elliptio dilatata</i>	30.4%
<i>Venustaconcha ellipsiformis</i>	9.3%
<i>Dreissena polymorpha</i>	6.1%
<i>Lampsilis cardium</i>	3.8%

Quadrat Survey

<i>Pleurobema sintoxia</i>	28%
<i>Venustaconcha ellipsiformis</i>	25%
<i>Elliptio dilatata</i>	23%
<i>Lampsilis cardium</i>	9%
<i>Dreissena polymorpha</i>	5%

e. A few conclusions:

- i. Substantially more richness, biomass and abundance near dam than near Fox
- ii. Few zebra mussels and Asian clams in survey, may not be a problem currently, but should be monitored for a change in abundance or spread within the river
- iii. Proportions changed between methods, but overall richness were similar

f. Understanding lures of the mussels

- i. At least two distinct lure morphologies noted for *Lampsilis cardium*



Lampsilis with contrasting lure types in 2014, Photos by T. Levine (c)

- ii. Displays seem to peak at 6 am and 6 pm
- iii. Spotted lures (139) are more common than striped (27)
- iv. More large mussels displayed spotted lures than striped lures

Videos from Mukwonago: <https://youtu.be/LeFZ0ILZIPw>, <https://youtu.be/sfk67D98F8A>

g. *Villosa iris* is an important species to monitor

- i. Conservation status reflects vulnerability and reduced range within Fox River
- ii. Unique lure (crayfish) may depend on clear waters to successfully elicit attacks

Conclusions:

Share data among agencies, academics and contractors - full database could be useful, maybe based on work in Mukwonago River by TNC

Look for diversity in the tributaries of the Fox River

Consider the role of dams in the Fox River and elsewhere

Study lure-producing mussels and their ecology