



# WETLAND MATTERS

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## FRESHWATER MUSSELS: 'AQUATIC CANARIES IN THE COAL MINE'

BY KEVIN S. CUMMINGS AND  
RICHARD V. ANDERSON, PH.D.

Prior to modification by human activity, the Illinois River hosted a rich mussel community. In the 19th century, the river's diversity of substrates, current patterns, fish communities, high levels of organic matter, and good water quality created ideal conditions for mussels. Human activity in the river and its drainage basin, however, has altered these conditions, resulting in a decline in density and diversity of mussels.

The situation is not unique to the Illinois River. Recent stream surveys have documented drastic declines in populations of freshwater mussels across the United States. Today mussels are thought to be the most endangered group of animals in North America. More than 70% of the approximately 300 identified species are either threatened, endangered, or of special concern. On the Illinois, only 27 species have been observed recently, although 47 species had been observed in 1870.

### THE VALUE OF MUSSELS

Mussels are valued for their ability to filter large quantities of water. Indeed, a quarter pound mussel can filter more than 3.5 gallons/day. Mussels also stabilize the soft substrates of their home streambed (National Native Mussel Conservation Committee, 1998). In fact, the aquatic food web



*Barges traveled the Illinois River (circa 1912) to purchase mussel shells from the commercial musseler camps and transport them to button factories. For more than 50 years, from 1891 to 1948, river mussels fueled a thriving Illinois button industry. U.S. Bureau of Fisheries photo, courtesy of the Illinois State Museum.*

depends on them as fodder for fish, otters, muskrats, waterfowl, and crawdads. Mussels also are useful indicators of fish populations because in their larval stage they depend on a host fish. For decades, river towns depended on income from mussels, harvesting them first for buttons and later for export to Japan to be used as nuclei in cultured pearls.

Mussels are sometimes referred to as aquatic “canaries in the coal mine” because they portend the loss of other less visible plants and animals from streams. As stationary animals—not able to move out of pollution’s way—they have also been called “in-place biological monitoring stations.”

What these “stations” tell us is not altogether good news: The continued survival of freshwater mussel populations in the Illinois and other rivers of our state is uncertain. There are several causes for decline of freshwater mussels, including:

- Smothering effects of siltation due to poor land management;
- Loss of habitat by damming and channelizing of the waterway;
- Herbicide and insecticide runoff;

- Other forms of chemical pollution, and;
- Competition from introduced exotic species such as the zebra mussel.

## LOOKING BACK AT BUTTONS

The commercial harvest of freshwater mussels has long been an integral part of the cultural history of river towns. In the early 20th century, enormous quantities of mussel shells were harvested, cooked out, and shipped to factories where they were cut and finished into buttons for clothing. Although it proved to be a failure, the first shelling of any volume along the Illinois began in 1892 at Meredosia. Harvesting in the Illinois was discontinued until 1907, when shellers, who had exhausted the supply of shells from the Wabash River, went looking for new rivers to exploit.

These harvesters were riding the fashion trend, begun in the 1890s, that made pearl buttons the clothing fastener of choice. Federal laws supported the fashion trend: In 1887 and again in 1890, Congress passed anti-import bills to protect the Midwestern mussel industry, making freshwater shells

## WHAT IS A MUSSEL?

Mussels belong to the phylum called “Mollusca,” a diverse group of more than 50,000 species, including clams, oysters, sea slugs, snails, octopus, and squid. All mollusks have at least three similarities: 1) a *mantle* (a body covering with specialized glands, sensory organ and respiratory surfaces); 2) a *foot* (muscular and used for locomotion and digging); and 3) a *visceral area* (containing various organ systems).

Many, but not all, mollusks have a hard protective outer covering (a shell) produced by the mantle. Organisms in this phylum can be grouped into seven

classes according to the type and number of shells produced. Mussels belong to the Class Bivalvia (sometimes called Pelecypoda) that includes animals with two shells: the clams and mussels.

The terms clam and mussel are often used interchangeably. In freshwater, the term mussel is used for all large bivalves that only have one set of ridges or teeth on the inside edge of each shell, while clams have two sets of teeth. Along with the dorsal hinge ligament, these teeth keep the shells in line and prevent them from slipping from side-to-side.



*By 1912, fifteen button factories were located on the river in Peoria, Beardstown, Meredosia, Naples, Pearl, and Grafton. Button cutters (above) rest on a pile of shells outside a button factory in 1919. U.S. Bureau of Fisheries photo, courtesy of the Illinois State Museum.*

the cheapest, most desirable source of buttons.

Commercial harvest in the Illinois River reached its peak in 1909, when there were about 2,600 boats engaged in mussel fishing between Peru and Grafton. Most boats were outfitted with handmade “crowfoot bars”—large hooks shaped like crows’ feet—hanging by chains from 10- to 14-foot bars. Musselers, or “clammers” as they sometimes called themselves, dragged the hooks across the bottom of the river, snagging mussels whose open valves then clamped onto the hooks. When the bar was removed from the water, so were the mussels. Musselers set up camps along the banks to cook out the mussels and stack the shells for collection by barges. The harvest pressure was so intense that more than 100 boats sometimes were observed working the same bed at one time. By 1912, 15 button facto-

ries were located on the river in Peoria, Beardstown, Meredosia, Naples, Pearl, and Grafton.

The fishing pressure resulted in a severe decline in the mussel fishery. By 1912 only about 400 boats were working the Illinois, making about \$12 a ton. In 1913, more than 11 million pounds of shells were harvested, at an estimated value of \$88,350, or about \$15 a ton.

The mussel harvest continued for the next 35 years, and the increased demand for shells drove the price up to around \$30 a ton by the 1940s. The fishery continued until about 1948, when the last button plant on the river closed, driven out of business by the advent of plastics, zippers, and metal clasps.

About 1962, renewed interest in the commercial harvest of Illinois shells was stimulated by the Japanese cultured pearl industry. Harvest of freshwater mussels began for

export to Japan. Beads are cut from the shells to be inserted into oysters as nuclei for cultured pearls. This renewed interest in commercial harvest created a need for new information on the distribution of mussels in the Illinois River.

## COUNTING THE DECLINE

In 1966 William C. Starrett of the Illinois Natural History Survey conducted a comprehensive survey of the Illinois River using a variety of collecting techniques. A total of 4,249 live mussels was collected from 429 sites along the entire Illinois River from Dresden (near the confluence with the Kankakee and Des Plaines rivers) to Grafton. In this survey, Starrett collected fewer than half of the species—23 out of 47—previously reported from the Illinois. (The earliest historical information on the mussel fauna of the river and its tributaries is from 1874.) Of the 23 species Starrett collected, five were represented by single specimens only (Starrett, 1971).

The results of Starrett's survey indicated that from 1874 to 1966 the Illinois River changed from an excellent mussel stream to a relatively poor one (see map on page 5). Starrett blamed the reduction on a combination of domestic, industrial, and agricultural pollution and stressed the need for a strong soil conservation plan to control rapid runoff and reduce siltation in the basin.

Thirty years later researchers from the Illinois Natural History Survey Forbes Biological Field Station resurveyed the mussels of the Illinois. Of the 23 species found, four were represented by single individuals and one other species was represented by only two live mussels.

Not all was negative, however. Twelve

species of mussels were found in the Upper River where none had been found in the 1960s. The initial decline in species in this reach had been attributed to the radical decline in water quality as a result of pollution from the Chicago Sanitary and Ship Canal (completed in 1900). As more rigorous water quality regulations in the late 20th century have been implemented, water quality in this river reach has improved. The mussel population has responded accordingly.

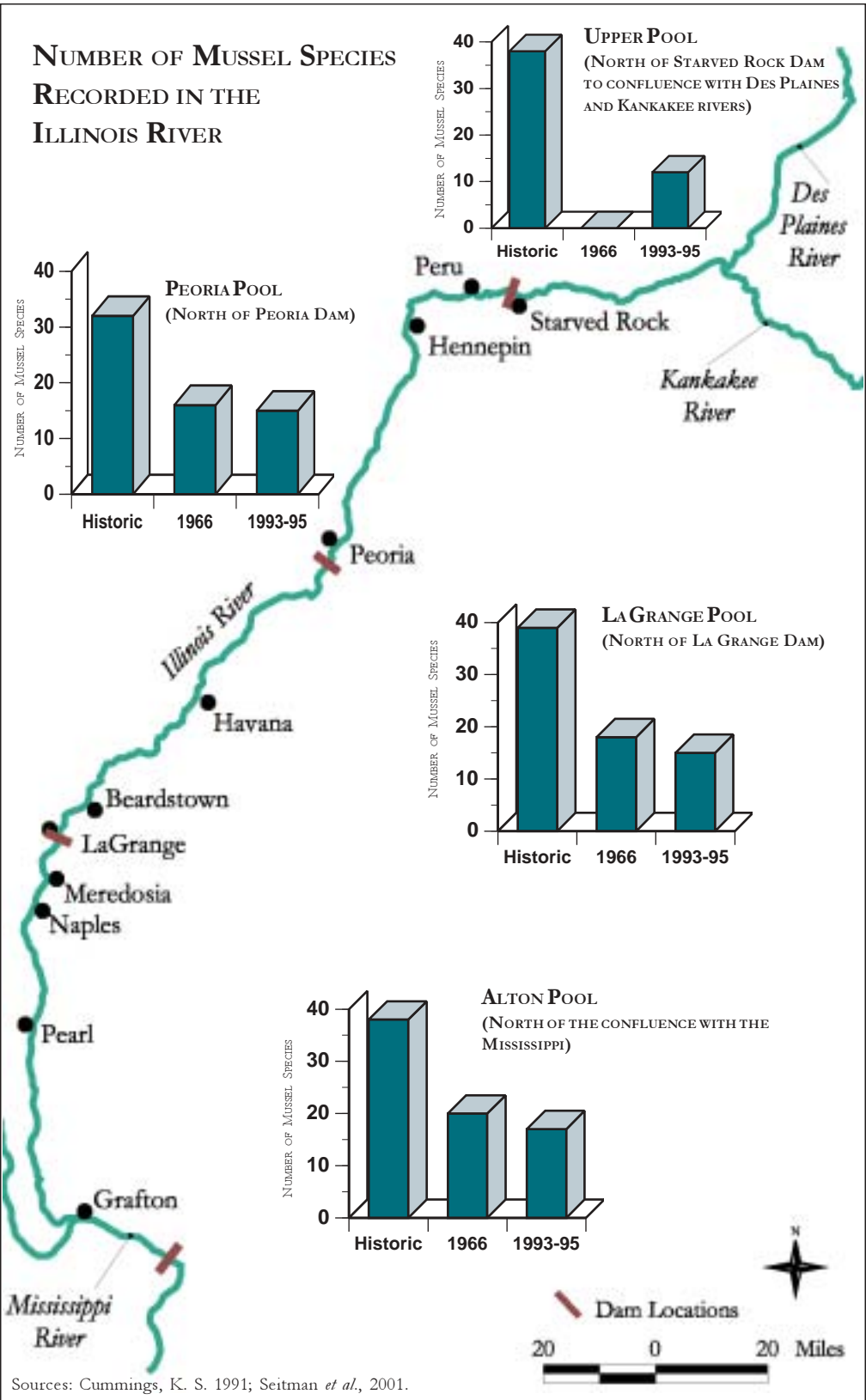
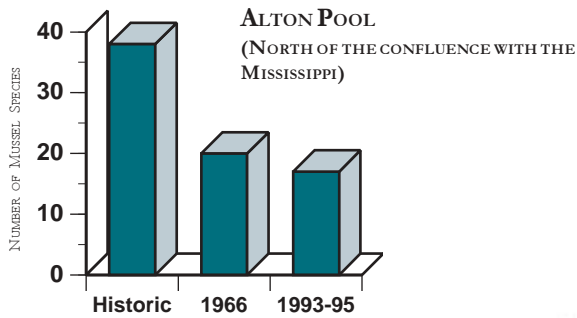
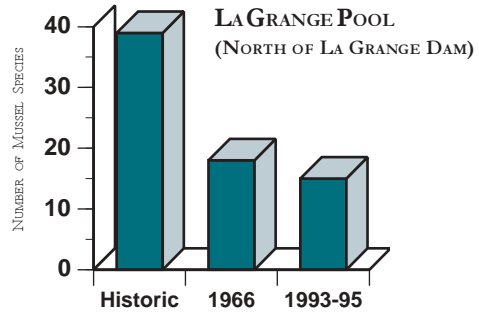
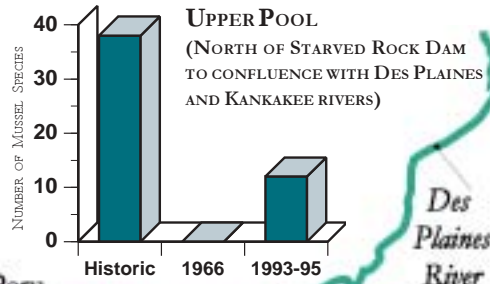
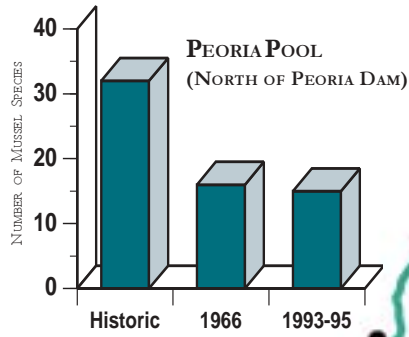
Another recent study (1994 to 1999) on the uppermost pool documented a significant recolonization in the Upper River. Twelve species were found, including five species not found anywhere in the river in the 1966 survey. This is an improvement from only two species observed in 1912 and none in 1966 in the Upper Pool.

The source of mussel recolonizers observed in the 1990s survey is most likely glochidia, the juvenile stage of mussels that lives as parasites in fish gills and fins. Glochidia are carried to the river from other locations by fish, particularly fish moving upstream from downstream reaches and fish moving down tributaries, such as the Kankakee River, into the upstream section as water quality improved.

For example, mucket (*Actinonaias ligamentina*), elktoe (*Alasmidonta marginata*), plain pocketbook (*Lampsilis cadium*), fatmucket (*L. siliquoidea*), fluted-shell (*Lasmingona costata*), and pistolgrip (*Tritogonia verrucosa*) all probably originated in tributaries. The flat floater (*Anodonta suborbiculata*), pink heelsplitter (*Potamilus alatus*), and deertoe (*Truncilla truncata*) likely recolonized from the middle reaches of the Illinois River (Sietman *et al.*, 2001).

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# NUMBER OF MUSSEL SPECIES RECORDED IN THE ILLINOIS RIVER



Sources: Cummings, K. S. 1991; Seitman *et al.*, 2001.

## THE FUTURE

A variety of factors are responsible for the decline in mussel diversity. Foremost among them is loss of habitat through direct alteration of the waterway (i.e., dams, channelization, levees), and the smothering effects of siltation caused by poor land

management. Herbicide and insecticide runoff, other forms of chemical pollution, and competition from introduced exotic species (e.g., zebra mussels) also play an important role in their decline.

Habitat restoration does not only involve the mainstem, but the entire watershed as well. Land use, management practices, and

## BACKWATER LAKES IDEAL FOR MUSSEL RECOLONIZATION

Backwater lakes of the Illinois River Valley once harbored many freshwater bivalve mollusks. Today, however, both the quality and quantity of these lakes are diminished, extinguishing an important mussel habitat.

Many lakes were destroyed by the construction of drainage and levee districts across the floodplain. By 1922, these districts had eliminated approximately half of the bottomland lakes. The remaining lakes rapidly filled with sediments due to increased flood heights caused by the levees, river training due to commercial navigation, and agricultural practices in the drainage basin.

As a result, almost no mussels are present in the Illinois River's few remaining backwater lakes. Starrett (1966) found no mussels in Meredosia Lake, only one in Lake Matanzas, and seven species in Quiver Lake.

However, restoration of backwater lakes could provide new hope for mussel populations. As drainage and levee districts in the floodplain are acquired for the purpose of reestablishing the bottomland lakes, a highly productive floodplain river ecosystem will develop. A good example of this effort is The Wetlands Initiative's Hennepin & Hopper Lakes Restoration Project.

Because freshwater mussels have a parasitic larval stage that attaches to fish, mus-

sels will likely recolonize when they are introduced into the restored habitat with their fish host. This passive process of recolonization, however, may take many years.

Alternatively, scientists could relocate mussel populations from other areas of the Illinois River to the restored bottomland lakes. Typically lake-like environments are inhabited by thin shelled, quickly growing mussel species such as the giant floater (*Pyganodon grandis*), paper pondshell (*Utterbackia imbecillis*), pondhorn (*Uniomorus tetrasmus*), lilliput (*Toxolasma parvus*), and flat floater (*Anodonta suborbiculata*). Several other cosmopolitan species may also become residents of the lakes, such as the threeridge (*Amblema plicata*) and mapleleaf (*Quadrula quadrula*). All of these mussel species have been reported in the Illinois River and have fish hosts that are found in the Illinois River.

Of particular interest for rapid introduction into restored bottomland lakes might be the pondhorn that can withstand periods of desiccation and the flat floater whose range is expanding northward along the Illinois River basin. Both of these species will burrow deeply into mud sediments during periods of drought and can develop dense populations. There are also locally abundant populations that could be used as a source of colonizers.

tributary health all impact the mainstem. Landowners and other natural resource stewards can help reverse mussel loss. The most important practice is to plant buffer strips along streams to prevent erosion and to keep the topsoil from washing into creeks and rivers.

Another key vehicle of habitat restoration is to preserve existing wetlands or create new ones adjacent to streams to retain water and sediments, prevent flooding, and slow the flow into rivers. By doing so, we may be able to reduce, if not eliminate, the need for dredging the mainstem.

Our highest conservation priority should be to preserve existing high quality aquatic habitat before it is destroyed. Restoring a natural area is far more expensive than protecting it before the damage is done.

Because so few of these high quality areas remain, however, it is critical that restoration projects that re-create or restore wetlands proceed. Projects conducted by The Wetlands Initiative and The Nature Conservancy, as well as federal land conservation programs such as the Conservation Reserve Enhancement Program (CREP), have provided much needed resources in improving the Illinois River watershed. As funds for these programs are increased, the aquatic fauna of Illinois will greatly multiply, benefiting both humans and other wildlife.

To fully restore the freshwater mussel communities of the state, research and restoration strategies will need to be developed for tributaries, in addition to the mainstem rivers. Many of the tributaries of the Illinois have been studied in the past 20 years. It is evident that mussels in all of the drainages examined thus far have undergone drastic declines.

Although they are an important part of our ecosystem and could be commercially valuable, mussels currently garner few research dollars. More resources are needed to study and protect essential habitat for

these unique and important animals. As large-scale restoration occurs on the Illinois River, research into the life cycle and response of freshwater mussels will be useful to scientists and ecologists seeking to understand how best to manage these ecosystems.

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## ABOUT THE AUTHORS

Kevin Cummings is a research scientist and the curator of mollusks in the Center for Biodiversity at the Illinois Natural History Survey, 607 E. Peabody Dr., Champaign, IL 61820, [ksc@inhs.uiuc.edu](mailto:ksc@inhs.uiuc.edu).

Richard V. Anderson is professor and chairman in the biological sciences department, Western Illinois University, Macomb, Illinois, [R-Anderson1@wiu.edu](mailto:R-Anderson1@wiu.edu).

*For information and photographs on the history of the mussel industry along the Illinois River, visit the Illinois State Museum's on-line exhibit 'Harvesting the River' at [www.museum.state.il.us/RiverWeb/harvesting/harvest/mussels](http://www.museum.state.il.us/RiverWeb/harvesting/harvest/mussels) or visit the web site of the Illinois Natural History Survey at [www.inhs.uiuc.edu/cbd/collections/mollusk/molluskintro.html](http://www.inhs.uiuc.edu/cbd/collections/mollusk/molluskintro.html).*

# THE WETLANDS INITIATIVE

53 WEST JACKSON BOULEVARD, SUITE 1015  
CHICAGO, ILLINOIS 60604-3703  
PHONE (312) 922-0777  
FAX (312) 922-1823  
email: [twi@wetlands-initiative.org](mailto:twi@wetlands-initiative.org)  
[www.wetlands-initiative.org](http://www.wetlands-initiative.org)

The Wetlands Initiative is a non-profit corporation dedicated to restoring the wetland resources of the Midwest to reduce flood damages, improve water quality, and increase wildlife habitat and biodiversity. TWI's mission is to promote restoration in ways that provide environmental and economic benefits to society and landowners.

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