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FRESHWATER MUSSELS OF THE ILLINOIS RIVER: PAST, PRESENT, AND FUTURE

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ABSTRACT

Recent stream surveys throughout the United States have documented drastic declines in populations of freshwater mussels, which may be the most endangered group of animals in North America. A survey of the mussels of the Illinois River conducted in 1966 documented less than half of the species previously reported from the river. A variety of factors - including loss of habitat, siltation, herbicides and insecticides, pollution, loss of suitable host species, competition from introduced exotics species and overharvest - have been implicated in the loss of mussel diversity.

In the early part of the 20th century, enormous quantities of mussel shells were harvested and finished into buttons for clothing. The pearl button industry and mussel fishery were all but eliminated by the advent of plastics in the 1950s. Today, freshwater mussel shells are harvested and exported to Japan, where they are converted into beads and inserted into oysters to serve as nuclei for cultured pearls. The continued decline of freshwater mussel populations in the Illinois River and other streams underscores the need for more research on the basic biology of these animals in order to better manage and protect them from extirpation or extinction.

INTRODUCTION

North America has the most diverse freshwater mussel fauna in the world. Close to 300 species of mussels are known from the United States, and the vast majority of these are found east of the Rocky Mountains. Because of Illinois' location along the Mississippi, Ohio and Wabash rivers, it has historically supported a diverse freshwater mussel fauna. Seventy-eight of the 285 species of mussels known from North America have been reported from Illinois.

Recent stream surveys throughout the United States have documented drastic declines in mussel populations, and mussels may be the most endangered group of animals in North America. Thirteen species are considered globally extinct (Turgeon et al. 1988), 39 are on the federal endangered species list, and over 50 more have either been proposed or are candidates for listing in the near future. The Illinois Threatened and Endangered Species List currently contains 33 mussels (29 endangered, 4 threatened) (Illinois Endangered Species Protection Board 1990). Another 11 species are candidates for listing in Illinois, which brings the total of rare or listed species to 44, or 56% of the mussel species reported from the state (Cummings 1991).

FRESHWATER MUSSELS OF THE ILLINOIS RIVER

The Past

Historical information on the mussel fauna of the Illinois River and its tributaries is available in a number of publications (Calkins 1874; Strode 1891, 1892; Kelly 1899; Baker 1906; Wilson & Clark 1912; Danglade 1914; Eldridge 1914; Starrett 1971; Lewis & Brice 1980; Suloway 1981; Schanzle & Cummings 1991). The first comprehensive study of the mussels of the Illinois River was conducted from 1907 to 1912 by E. Danglade of the U.S. Bureau of Fisheries and was published in 1914.

The commercial harvest of freshwater mussels has long been an integral part of the cultural history of the people inhabiting the towns along the Illinois River. In the early part of the 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. It has been suggested that the first shells collected for the purpose of button manufacture came from the Illinois River at Peoria in 1872 (Danglade 1914; Coker 1919). The first shelling of any consequence in the Illinois River was not done until the spring of 1892 at Meredosia. This effort proved a failure however, and harvest in the Illinois was discontinued until 1907, when shellers, who had exhausted the supply of shells from the Wabash went looking for new rivers to exploit. 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 (Coker 1919). The harvest pressure was so intense that over 100 boats were observed working the same bed at one time. By 1912, 15 button factories were located on the river in Peoria, Beardstown, Meredosia, Naples, Pearl, and Grafton.

The intense fishing pressure resulted in a severe decline in the mussel fishery. By 1912 only about 400 boats were working the Illinois. The price paid for shells in 1912 was about $12 a ton. In 1913, 11,780,000 lb of shells were harvested from the Illinois River, at an estimated value of $88,350, or about $15 a ton. The harvest of mussels continued for the next 35 years, and increased demand for shells drove the price up to around $30 a ton by the 1940s. The fishery continued in this fashion until about 1950, when the the advent of plastics all but eliminated the pearl button industry and the harvest of mussels.

About 1962, renewed interest in the commercial harvest of Illinois shells was stimulated by the market demand created by the Japanese cultured pearl industry. In this industry freshwater mussels are harvested and exported to Japan, where they are converted into beads and inserted into oysters to serve as nuclei for cultured pearls. Soon after the renewal of interest in commercial harvest, it was decided that new data were needed on the distribution of mussels in the Illinois River.

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, including crowfoot bar or brail, dredge (dip net) and wading (Starrett 1971). A total of 4,249 mussels were collected alive from 429 sites along the entire Illinois River from Dresden to Grafton. In this survey Starrett collected less than half of the species (23 of 47: 49%) previously reported from the Illinois, and five of the 23 species of living mussels he collected were represented by single specimens (Table 1). Starrett divided the Illinois into four main areas: Upper River, Peoria Pool, La Grange Pool and Alton Pool (Figure 1). A comparison of mussels found in each of the four areas to those found in earlier studies revealed a drastic reduction in the number of species (Table 2).

Table 1. Freshwater Mussels (Unionacea) of the Illinois River. FE = Federally Endangered, FC = Federal Candidate Species, SE = Illinois State Endangered, ST = Illinois State Threatened, SC = State Candidate or Watch List Species. P = Peoria Pool, L = La Grange Pool, A = Alton Pool. Data from Starrett 1971.

	Museum Records pre - 1913	Individuals 1966-69	Pool 1966-69
FAMILY MARGARITIFERIDAE			
Cumberlandia monodonta (Say, 1829) FC, SE	X		
FAMILY UNIONIDAE			
Subfamily Ambleminae			
Amblema plicata (Say, 1817)	X	2650	P L A
Cyclonaias tuberculata (Rafinesque, 1820)	X		
Elliptio crassidens (Lamarck, 1819) ST	X		
Elliptio dilatata (Rafinesque, 1820) SC	X		
Fusconaia ebena (Lea, 1831) SC	X		
Fusconaia flava (Rafinesque, 1820)	X	1	A
Megalonaias nervosa (Rafinesque, 1820)	X	46	P L A
Plethobasus cyphyus (Rafinesque, 1820) ST	X	207	P L A
Pleurobema sintoxia (Rafinesque, 1820)	X		
Quadrula metanevra (Rafinesque, 1820)	X		
Quadrula nodulata (Rafinesque, 1820)	X		
Quadrula pustulosa (Lea, 1831)	X	66	L A
Quadrula quadrula (Rafinesque, 1820)	X	425	L A
Tritogonia verrucosa (Rafinesque, 1820)	X	390	P L A
Uniomerus tetralasmus (Say, 1831) ST	X	2	P
Subfamily Anodontinae			
Alasmidonta marginata Say, 1818	X		
Alasmidonta viridis (Rafinesque, 1820) SE	X		
Anodonta grandis Say, 1829	X	120	P L A
Anodonta imbecillis Say, 1829	X	5	P L A
Anodonta suborbiculata Say, 1831	X	1	L
Anodontoides ferussacianus (Lea, 1834)	X		
Arcidens confragosus (Say, 1829)	X	78	L A
Lasmigona complanata (Barnes, 1823)	X	13	P L A
Lasmigona compressa (Lea, 1829) ST	X		
Lasmigona costata (Rafinesque, 1820)	X		
Simpsonaias ambigua (Say, 1825) FC, SE	X		
Strophitus undulatus (Say, 1817)	X		
Subfamily Lampsilinae			
Actinonaias ligamentina (Lamarck, 1819)	X		
Ellipsaria lineolata (Rafinesque, 1820) SC	X		
Epioblasma triquetra (Rafinesque, 1820) SE	X		
Lampsilis cardium Rafinesque, 1820	X		
Lampsilis higginsi (Lea, 1857) FE, SE	X		
Lampsilis siliquoidea (Barnes, 1823)	X	8	P L
Lampsilis teres (Rafinesque, 1820)	X	53	P L A
Leptodea fragilis (Rafinesque, 1820)	X	64	P L A
Leptodea leptodon (Rafinesque, 1820) FC, SE	X		
Ligumia recta (Lamarck, 1819)	X		
Obliquaria reflexa Rafinesque, 1820	X	49	L A
Obovaria olivaria (Rafinesque, 1820)	X	1	A
Potamilus alatus (Say, 1817)	X		
Potamilus capax (Green, 1832) FE, SE	X	16	P L A
Potamilus ohiensis (Rafinesque, 1820)	X	42	P L A
Toxolasma parvus (Barnes, 1823)	X	1	A
Truncilla donaciformis (Lea, 1828)	X	1	A
Truncilla truncata Rafinesque, 1820	X	10	L A
Villosa iris (Lea, 1829) SE	X		

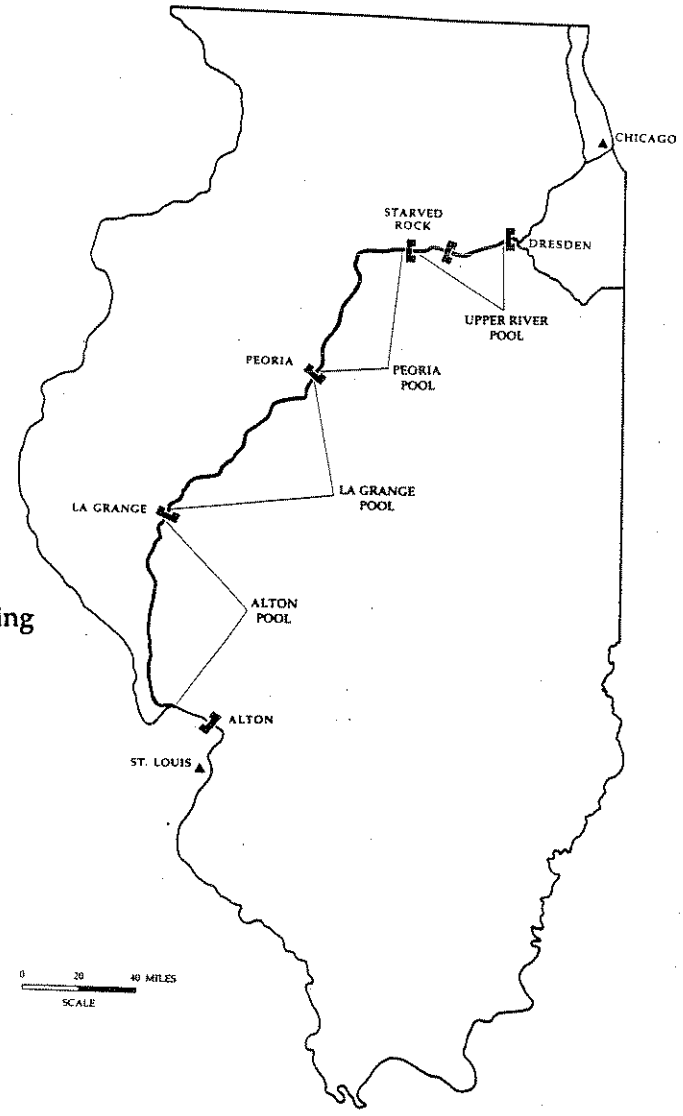

Figure 1. Map of the Illinois River showing the location of the major pools and dams.

Table 2. Number of species and individuals (1966-1969) of freshwater mussels found in the Illinois River, 1870-1969. (Data modified from Starrett 1971).

	Upper River	Peoria Pool	La Grange Pool	Alton Pool	Illinois River
Species 1870-1966	34	37	39	38	47
Species 1966-1969	0	13	18	20	23
Individuals 1966-1969	0	851	591	2807	4249

Upper River

The Upper River, as designated by Starrett, extended from the confluence of the Des Plaines and Kankakee rivers downstream to the Starved Rock Lock and Dam, a distance of 42 river miles (Figure 1). The pollution carried down from Chicago via the Sanitary and Ship Canal had an enormous impact on the mussel fauna of the Upper River in the early part of the century. The number of mussel species reported from Starved Rock had been drastically reduced from 34 in 1874 to only two by 1912 (Calkins 1874; Forbes & Richardson 1913). Although sewage treatment plants had improved water quality in the Upper River by 1966, not a single living mussel was collected in this stretch of the Illinois, and it was considered to be a poor environment for fishes as well (Starrett 1971; Mills et al. 1966; Table 2).

Peoria Pool

Peoria Pool runs from the Starved Rock Lock and Dam downstream to Peoria Dam (73 river miles). As with the Upper River, Peoria Pool suffered a significant decline in the number of species from 1874 to 1966 (Table 2). Whereas many of the species in the Upper River were thought to have been extirpated by the turn of the century, the loss of diversity in Peoria Pool occurred from 1912 to 1925. Danglade (1914) reported 32 species in Peoria Pool, 24 of which occurred above Peoria Lake. A 1925 survey of Peoria Pool found no live mussels above Peoria Lake (Richardson 1928). Although 15 species were found in Peoria Pool in 1966-1969, only 38 individuals of nine species were in the upper 56 miles of the pool. Although mussels are nowhere near as diverse as in the past, the finding of at least a few species in the upper part of Peoria Pool in 1966 indicated that conditions in this part of the river had shown some improvement (Starrett 1971).

La Grange Pool

La Grange Pool runs from the Peoria Dam to the La Grange Dam (78 river miles). Between 1870 and 1912 at least 39 species of mussels were known from the La Grange Pool (Starrett 1971). Richardson (1928) did not collect data on the mussel fauna of the La Grange Pool but did document the drastic reduction in the number of other organisms attributed to domestic and industrial pollution from Chicago and the Peoria-Pekin area. Thirty species of mussels were collected in the mainstream of the river between Peoria Dam and Havana in 1912, whereas only 11 species were reported from this section of the river in 1966 (Danglade 1914; Starrett 1971). A total of 18 species were collected in the La Grange Pool in 1966; this represents a reduction of 46% from 1870 (Table 2).

Alton Pool

Alton Pool runs from the La Grange Dam to the Mississippi River (80 river miles). At least 38 species of mussels have been found in the Alton pool since 1870 (Table 2). Thirty species were collected in Alton Pool in 1912 (Danglade 1914), whereas only 20 were found in 1966 (Starrett 1971). Conditions in Alton Pool in 1966 were favorable to mussels, and the largest populations in the entire Illinois River were found in this pool. Although water quality had improved somewhat, it clearly had not recovered enough to support the number of species and individuals known to have existed there in 1912. The number of species taken at Meredosia declined from 30 in 1912, to 18 in 1930, 16 in 1955, and 14 in 1966.

The results of the survey by Starrett indicated that from 1870 to 1966 the Illinois River changed from an excellent mussel stream to a relatively poor one. Twenty-four, or over half of the species that formerly inhabited the Illinois River, were no longer present by 1966. Of those 24 species, 12 are in trouble statewide and are listed as either endangered or threatened or are candidates for listing (Table 1). 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 run-off and reduce siltation in the basin.

The Present

It has been 25 years since the last mussel survey of the Illinois River, and the number of species and status of those still present are unknown. However, surveys of a few of the tributaries of the Illinois have been recently studied, including the Kankakee (Lewis and Brice 1980; Suloway 1981), Mackinaw (Cummings et al. 1988), Sangamon (Schanzle and Cummings 1991), and Vermilion (Cummings, unpubl. data) rivers. From those surveys it is evident that the rivers of Illinois have undergone a radical change, including the loss of many species that were historically widespread and common in the state.

Although no surveys have been conducted in recent years, some data on the mussel fauna of the Illinois River are available through the commercial harvest reports prepared by the Illinois Department of Conservation (Fritz 1990). Because of continued demand for shells to supply the cultured-pearl industry, commercial harvest on the Illinois River steadily increased from 24, 800 lb in 1979 to 1,462,200 lb in 1985. Although the number of shells harvested declined from 1986 to 1989, the catch still averaged 431,350 lb per year (Fritz 1990). In 1989, 585,081 lb of mussel shells were harvested from the Illinois River with an estimated wholesale value of $321,074. The 1990 statistics show some startling increases in the numbers being harvested and the price being paid for shells (Figure 2). In 1989, 523 lb of shells were taken from Peoria Pool of the Illinois River. In 1990 the number harvested from Peoria Pool grew to 372,21, a staggering increase of over 70,000% (Table 3). The location of the harvest is highly variable and will often change from pool to pool depending on the year. For example, in 1989, 97% of the total harvest for the Illinois River was from the Alton Pool, whereas in 1990 only 50% of the mussels collected from the river came from that pool.

Table 3. Freshwater mussel shells harvested (in pounds) from three pools in the Illinois River in 1989 and 1990 (in parentheses). (Data from Fritz 1990 and pers. comm. 1991).

Species	Peoria Pool	La Grange Pool	Alton Pool	TOTAL
Washboard	14 (17,025)	8,221 (54,662)	346,614 (225,137)	354,849 (296,824)
Threeridge	468 (328,290)	7,000 (87,854)	221,356 (309,227)	228,824 (725,371)
Mapleleaf	17 (11,895)	0 (15,104)	1367 (188)	1,384 (27,187)
Other	24 (15,000)	0 (15,600)	0 (0)	24 (30,600)
TOTAL	523 (372,210)	15,221 (173,220)	569,337 (534,552)	**585,081 (1,079,982)**

The number of mussels harvested appear to be driven by the price being offered for the shells. As the price increases, more and more people are attracted to harvesting. The number of licenses for harvesting increased from 1075 in 1990 to 1500 in 1991 (B. Fritz, pers. comm.) How long the resource can survive with the increase in pressure is unknown. Although season and length limits have been established to control the commercial harvest of mussels,

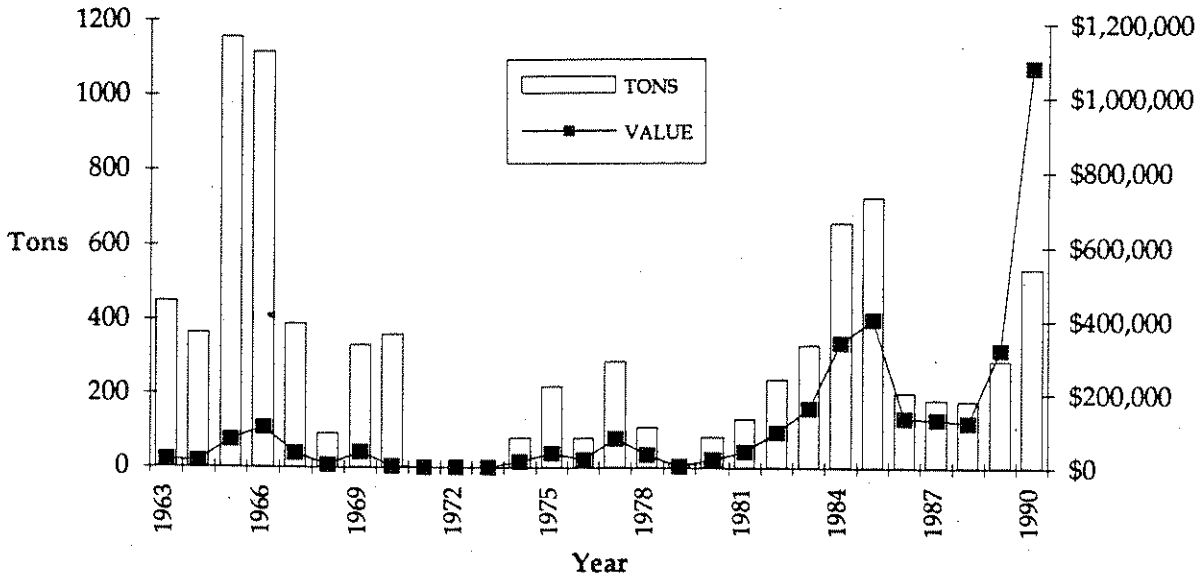

Figure 2. Number of tons and value in dollars of freshwater mussels harvested in the Illinois River, 1963-1990. (Data from Fritz 1990 and pers. comm. 1991).

little or no data are being collected on sustainable yield or standing crop estimates for particular pools. From a management standpoint it is obvious that more attention should be given to monitoring this biologically important resource.

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). Other factors include the smothering effects of siltation caused by poor land management, herbicide and insecticide run-off, pollution, loss of suitable host species, competition from introduced exotics and overharvest.

The continued survival of freshwater mussel populations in the Illinois and other rivers of our state is uncertain. Although a considerable fishery and commercial market exists for freshwater mussels, very few research dollars are spent studying the basic biology and life history requirements of these animals. Because many mussels are considered endangered by the state or federal government, some money has been allocated to research individual species. However, this is a reactive approach, and more resources are needed to begin to study and protect essential habitat for these unique and commercially important animals. The decline and elimination of freshwater mussels portend the loss of other less visible plants and animals from our streams. Even in times of fiscal restraint we cannot afford to cut back on efforts to document and monitor changes in our environment. Instead of reducing the budget of our natural resource agencies, we should be employing more systematists and sytematics-trained field biologists in order to provide information on how to protect our state's valuable natural heritage.

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