Unionid Mussels in Kansas: Overview of Conservation Efforts and Harvest Regulations

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Abstract. Kansas supports over 40 species of unionid mussels, with the diversity centered in the southeastern portion of the state. The state's mussel fauna has experienced a long decline that continues today. Stream dewatering, impoundments, siltation, pollution from agricultural and mine run-off, and commercial harvest are believed to be major reasons for this decline. Commercial harvest, negligible in recent decades, increased in the late 1980s due to demands of the cultured pearl industry. The 1991 harvest was estimated at 279 tons. In response to concerns of overharvest and general decline, restrictive harvest regulations were adopted in 1990 and revised in 1992. Harvest is now limited to four species with minimum size limits and is permitted only in certain southeastern watersheds. Lists of state-threatened and state-endangered species also were revised in 1992. Previously, only *Anodonta suborbiculata* was listed; currently 10 mussels are listed as threatened or endangered. Special permits for threatened and endangered wildlife are issued under a no net loss policy and will provide increased protection for freshwater mussels.

Introduction

Kansas is located on the western edge of the Mississippi Basin and has a freshwater mussel fauna of over 40 species. Mussel diversity is highest in the southeastern portion of the state, which receives 30–40 inches of rainfall per year. The principal rivers in southeastern Kansas are the Verdigris, Fall, Neosho, and Spring (Arkansas Drainage Basin), and the Marais des Cygnes (Missouri Basin). They are characterized by high substrate diversity and unionid faunas of 30 to 40 species.

As one proceeds west into progressively drier portions of the state (20–30 inches of rainfall per year), stream conditions and the mussel fauna change markedly. West of the Flint Hills, most streams have a shifting sand bottom and experience highly fluctuating water levels. Streams in central and western Kansas generally support five or fewer species, although some, such as the Chikaskia and Little Arkansas rivers, formerly had 10–20 species of mussels.

The glaciated region in the northeastern part of the state has lower substrate diversity than areas to the south. The mainstem of the Kansas River currently supports only about five species of mussels, although some of its tributaries have higher diversity.

Early collectors (Call 1885 a–c, 1886, 1887; Popenoe 1885; Scammon 1906) provide us with a glimpse of the unionid fauna shortly after the time of Anglo-European settlement. These data have proved invaluable in determining changes in mussel populations over the past 100 years. Unfortunately, documentation of collections from these studies was at best limited to illustrations of selected species, and many early records remain in question.

Based on these early records, freshwater mussels have experienced substantial declines that began over 100 years ago. Many factors have been implicated in the decline of unionid populations, but actual documentation of causes is extremely limited. Almost certainly, the first major historical changes occurred with the introduction of intensive agriculture at the time of Anglo-European settlement. Today, many of the streams with the healthiest mussel faunas are in watersheds that retain large tracts of native vegetation. Many of these streams are located in or drain the Flint Hills, a large block of tallgrass prairie used for livestock grazing.

Other factors contributing to the destruction or deterioration of mussel habitat are impoundments, stream channelization, and dewatering. Over the past 40 years, some 20 major flood-control reservoirs have been constructed, and small channel and watershed dams are now common in most drainages. Dewatering has affected mussel populations in portions of central and western Kansas where, due principally to groundwater pumping for agriculture, formerly perennial streams now experience no-flow

conditions. Numerous pollutants from agricultural and urban sources—fertilizers, herbicides, animal waste, and industrial toxins—affect water quality in Kansas. Commercial harvest of mussels, originally for the button industry and more recently for the cultured pearl industry, is another stress on unionid populations.

Evidence of the decline of unionids in Kansas is based largely on range contraction by individual species and qualitative data on species abundances in various watersheds (e.g., Murray and Leonard 1963, Cope 1979, Schuster and Dubois 1979, Liechti and Huggins 1977, Kansas Department of Health & Environment unpublished data). Cope (1983) conducted the first quantitive surveys of the traditionally harvested streams in southeastern Kansas. He documented an average mussel density of 6 unionids/m^2 (range 2–11) at mussel beds with a history of commercial harvest. Conversations Cope had with shellers suggested that densities at some of these sites were at least 10-fold higher in the 1960s.

Threatened and Endangered Species

Kansas law related to threatened and endangered species dates back to 1975 when the state legislature adopted the Nongame and Endangered Species Conservation Act. This law gave the Kansas Department of Wildlife and Parks (KDWP) the authority to recommend and enact conservation measures for nongame species and to develop three lists: endangered, threatened, and species in need of conservation. The first lists were approved in 1979 and subsequently revised according to a five-year review plan in 1986 and 1992. As of 1 July 1992, 24 animal species were listed as endangered, 33 were listed as threatened, and 69 were listed as species in need of conservation (KAR 115-15-1 and 115-15-2). Table 1 shows the currently listed species of freshwater mussels: 6 endangered species, 4 threatened species, and 12 species in need of conservation. In addition, the U.S. Fish and Wildlife Service has designated four species as federal candidates (category C2) for listing as threatened or endangered species. The progressive increase in the number of mussels on the state list between 1979 and 1992 reflects not so much a change in the biological status of these species, but rather the availability of more data and a greater awareness of the plight of Kansas' mussel fauna.

The ecological status of the 22 state-listed mussels varies considerably. Many of the threatened and endangered species have experienced severe range contractions and now occur in scattered, remnant populations, typically in the Spring, Neosho, Fall, and/or Verdigris rivers. Many such

Table 1. Conservation status of Kansas mussels (E = endangered, T = threatened, C = species in need of conservation, C2 = candidate for federal listing as threatened or endangered).

Scientific name	Common name	State status 1979	State status 1986	State status 1992	Federal status
Alasmidonta marginata	elktoe		C	E	
Anodonta suborbiculata	flat floater	E	E	E	
Anodontoides ferussacianus	cylindrical papershell		C	C	
Arcidens confragosus	rock-pocketbook			T	
Cyprogenia aberti	western fanshell		C	E	C2
Ellipsaria lineolata	butterfly		C	T	
Elliptio dilatata	spike			C	
Epioblasma triquetra	snuffbox		C	C	C2
Fusconaia flava	Wabash pigtoe			C	
Lampsilis rafinesqueana	Neosho mucket		C	E	C2
Lampsilis siliquoidea	fat mucket			C	
Lampsilis teres	yellow sandshell			C	
Lasmigona costata	fluted-shell		C	T	
Megalonaias nervosa	washboard			C	
Pleurobema coccineum	round pigtoe			C	
Ptychobranchus occidentalis	Ouachita kidneyshell		C	T	C2
Quadrula cylindrica	rabbitsfoot		C	E	
Quadrula nodulata	wartyback	T	C	C	
Strophitus undulatus	squawfoot			C	
Truncilla donaciformis	fawnsfoot			C	
Truncilla truncata	deertoe			C	
Venustaconcha pleasi	bleedingtooth mussel			E	

"populations" are represented chiefly by older individuals with little or no evidence of recruitment. Mussels on the list of species in need of conservation have invariably undergone substantial range contractions, but reproducing, moderate-density populations of many of these species still exist.

Kansas law requires that KDWP protect critical habitat of endangered and threatened species. A special action permit is required for any person or organization sponsoring a development project that involves public funds or has permitting requirements from another state or federal agency. The action permit will assure no significant long-term adverse impact on a species as a result of the project. Provisions are made for requiring mitigating or compensating measures to avoid unacceptable losses of endangered or threatened animals and their habitat.

For privately sponsored projects that do not use public funds or have no other permit requirements, only the animal is protected, not the habitat. All streams in the state except the Kansas River, Missouri River, and Arkansas River are under private ownership, and this limits public review and control of activities affecting stream systems.

If a listed species is taken by lawful activities, such as during commercial harvest, it is not illegal if immediately released. Provisions are made for a special permit to be issued by the KDWP for scientific purposes or to enhance the propagation or survival of the affected species. In special cases a permit can be issued to process, sell, or transport these listed species.

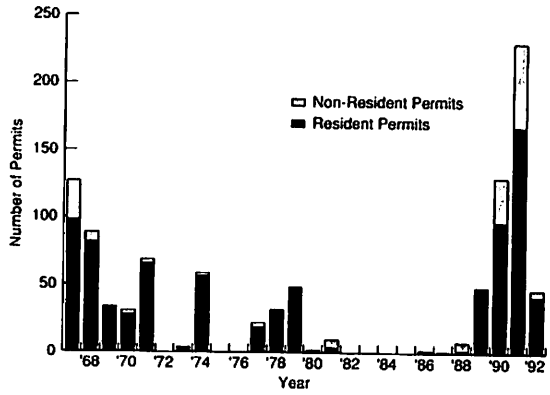

Figure 1. Number of resident and nonresident permits sold each year for the commercial harvest of freshwater mussels in Kansas.

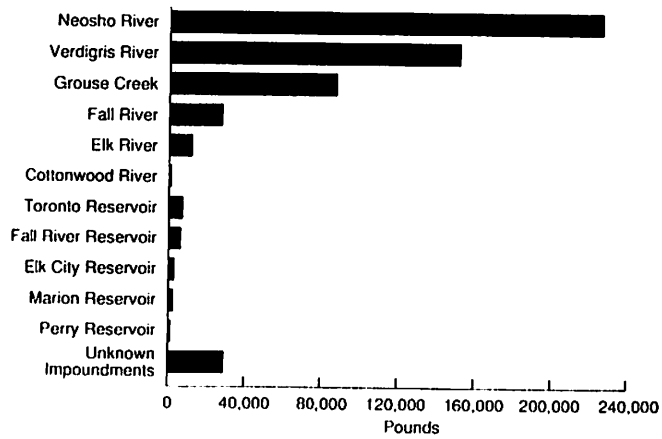

Figure 2. Reported harvest of mussels from Kansas streams and reservoirs in 1991.

Commercial Harvest

About 1900, a sizeable industry developed in southeastern Kansas to supply shells for buttons. One factory in Iola was processing 30 tons of shells a week in 1918 (Angelo 1992). The button industry in Kansas persisted into the 1930s, by which time the mussel beds were becoming depleted.

Records do not show evidence of major harvests again in Kansas until the late 1960s, when there was a peak in the number of commercial harvest permits sold (Figure 1). In 1970, buyers estimated a harvest of 300 tons. Because reliable estimates of harvest do not exist until 1983, the level of mussel harvest prior to this time is not known.

Periods of heavy harvest can only be extrapolated from the number of permits sold each year (Figure 1). Periods of substantial harvest seem to have occurred from 1967 to 1971, to a lesser extent in the late 1970s, and again from 1989 to present.

Reported harvests in recent years were 45 tons in 1989 (estimated value $28,510), 115 tons in 1990, and 279 tons in 1991. Drought conditions in 1991 made mussel beds unusually accessible to hand collecting, which is the favored and only legal harvest technique in Kansas. Harvest from streams in 1991 was 253 tons, or 91% of the total, with the remaining 25 tons, or 9%, taken from reservoirs (Figure 2). In 1990, some 84% of the harvest was reported to have been taken from streams, with the remainder being taken from large reservoirs and community lakes.

Shells from many Kansas streams are low in quality. Due to poor fracture characteristics or, in some drainages, dark stain layers in the nacre, many shells have little or no commercial value.

The commercial harvest of mussels has been regulated in Kansas for many decades. Up until the 1980s, regulations were designated by wildlife agency staff and written on individual permits.

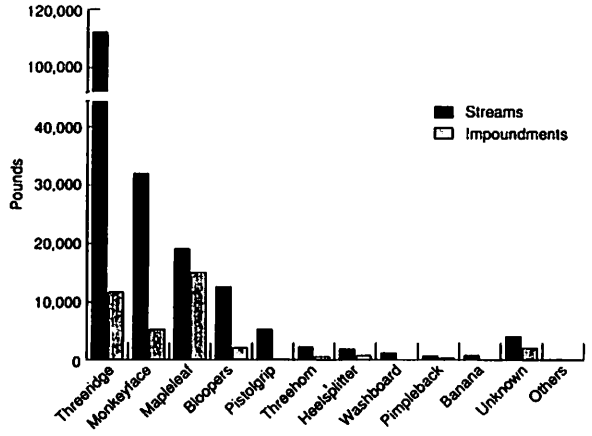

Figure 3. Reported harvest of various mussel species in Kansas in 1990.

Thus, regulatory conditions may have varied from year to year and from permit to permit. Generally, harvest was limited to traditional harvest streams (Neosho, Fall, Verdigris and Elk rivers). Few other restrictions were placed on the commercial harvest of mussels until recent years. A chronology of selected regulatory changes affecting mussel harvest is presented below:

- In 1978, minimum size limits were imposed. Shells were required to be at least 1¾ inches in the longest dimension.
- Beginning in 1983, harvesters were required to report the weights of mussels harvested by species.
- In 1984, following recommendations by Cope (1983), mussel refuges closed to all harvest were established on three streams (Neosho River, 3.4 stream miles; Fall River, 9.9 stream miles; Verdigris River, 6.7 stream miles).
- From 1982 to present, resident commercial harvest permits ranged in price from $25 to $100. Nonresident harvest permits during this period ranged from $200 to $400. All license proceeds go into the general revenue fund and are not earmarked for mussel research or management.

Prior to 1991, all mussels except those on the endangered, threatened, and species in need of conservation lists could be legally harvested, and commercial harvesters collected at least 10 species (Figure 3). In 1991, legal harvest was limited to the four most commonly harvested species—threeridge (*Amblema plicata*), monkeyface (*Quadrula metanevra*), mapleleaf (*Quadrula quadrula*), and bleufer (*Potamilus purpuratus*; also known as "blooper")—and the Asian clam (*Corbicula fluminea*). This tightening of

Table 2. Names of mussels of commercial value in Kansas (from Cope 1983). Common names are those used by commercial harvesters and by Turgeon et al. (1988).

	Common name	
Scientific name	AFS (1988)	Shellers
Amblema plicata	threeridge	threeridge
Quadrula metanevra	monkeyface	monkeyface or Indianhead
Quadrula quadrula	mapleleaf	mapleleaf
Quadrula pustulosa	pimpleback	mapleleaf
Quadrula nodulata *	wartyback	mapleleaf
Fusconaia flava	Wabash pigtoe	mapleleaf
Pleurobema coccineum	round pigtoe	mapleleaf
Ellipsaria lineolata *	butterfly	mapleleaf
Cyprogenia aberti *	western fanshell	mapleleaf
Potamilus purpuratus	bleufer	blooper (purple phase)
Lampsilis rafinesqueana *	Neosho mucket	blooper (white phase)
Lampsilis cardium	plain pocketbook	blooper

* Species not legally harvestable due to conservation status.

regulations was in part a response to the renewed interest in commercial harvest and concerns about overharvest. It was also the first attempt to make harvest regulations compatible with threatened and endangered species law. The commercially important species of mussels in Kansas and the morphospecies recognized by shellers (Cope 1983) are shown in Table 2. Shellers tend to lump similar-appearing taxonomic species, as exemplified by "mapleleaf," which may include five different taxonomic species, and "blooper," which may include three taxonomic species. A number of these species are classified as endangered, threatened, and species in need of conservation, and as such, cannot be legally harvested. To reduce confusion between similar species, in 1990 KDWP began distributing an identification guide with all commercial permits.

Current KDWP commercial harvest regulations are based on a 1992 revision of harvest laws (KAR 115-17-6 to 115-17-9). These regulations are similar to those adopted in recent year by states in the Upper Mississippi River region and are paraphrased below.

To commercially harvest mussels in Kansas, a commercial fishing license is required at a cost of $75 for residents and $400 for nonresidents. To obtain this license the musseler applies to the KDWP and must fill out an application providing the following information:

1. Name, address, and telephone number of applicant.
2. Location of mussel storage and processing.

3. Maintenance of a current record of activities and submission of a quarterly report as follows:
   a. Total weight of each mussel species harvested and/or sold.
   b. A separate entry with date and total weight of each mussel species sold.
   c. Name, address, and license number of person buying the shells.

The harvest season extends from April 1 through September 30 with no daily bag or possession limit. The minimum shell heights are as follows:

- Threeridge, mapleleaf and bleufer, 3 inches.
- Monkeyface, 2¾ inches.
- Asian clam, no minimum size.

The waters open for commercial mussel harvest are limited to:

- Federal reservoirs and other authorized public impoundments.
- Fall, Verdigris, Neosho, and Elk rivers, excluding mussel refuge areas.

Any person buying mussels for resale or export from Kansas must have a $200 mussel dealer permit (KAR 115-7-14). An application for the permit is available from the KDWP and must include the applicant's name, address, and telephone number and the location of stored mussels. A dealer can only buy mussels from a licensed commercial musseler or another dealer. He can only sell species that are legal and to persons authorized to purchase or sell mussels. Each dealer permittee will submit a quarterly record book. The information required for both the buyer and seller is as follows:

- Name, address, telephone number, and permit number of person selling or buying mussels.
- Total shell weight for each mussel species purchased and/or sold, with a separate entry for each purchase or sale and the date of the transaction.

A dealer must process and sell mussels no more than 30 days after the permit expires on 31 December.

Conclusions

Recent years have seen important changes in regulations affecting freshwater mussel harvest in Kansas, spurred by increasing public awareness of the plight of mussels and recent increases in demand by the cultured pearl industry. The number of species afforded special conservation status has increased from 2 in 1979 to 22 in 1992. Harvest regulations, formerly lax, have been stiffened substantially in the past several years. Regulations now specify harvest waters, species, minimum size limits, and seasons and contain reporting requirements.

The effect of these new regulations on mussel populations has yet to be determined. We hope they reduce adverse impacts on mussel populations by limiting activities such as commercial harvest, stream channelization, bridge construction, and gravel dredging. However, these laws are unlikely to result in the restoration of currently degraded streams.

Other water-related programs and policies currently being implemented, developed, or at least discussed in Kansas may prove to have the biggest long-term effect on mussel conservation. These address issues such as minimum stream flow laws, establishment of riparian corridors, improved agricultural conservation practices, and surface water quality standards.

Acknowledgments

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