Freshwater Mussels: A Neglected and Declining Aquatic Resource

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The United States has the greatest diversity of freshwater mussels in the world. Of the five families and roughly 1,000 species occurring globally, nearly 300 species and subspecies in the families Unionidae and Margaritiferidae reside here (Turgeon et al. 1988). The number of mussels historically known for each state varies tremendously (Fig. 1), but the diversity of freshwater mussels in just the Southeast is unmatched by any other area in the world.

Mussels were an important natural resource for Native Americans, who used them for food, tools, and jewelry. During the late 1800's and early 1900's, mussel shells supported an important commercial fishery; shells were used to manufacture pearl buttons until the advent of plastic buttons in the 1940's. Today the commercial harvest of freshwater mussel shells is exported to Asia for the production of spherical beads that are inserted into oysters, freshwater mussels, and other shellfish to produce pearls.

There are no federal regulations on the harvest of mussels, except those species on the federal list of endangered or threatened species. Several states, however, regulate size, species, gear used, and season that mussels can be taken. Japanese demand for the high-quality U.S. mussel shells in recent years pushed the price to $13/kg ($6/lb) in 1991. Shell exports peaked in 1991 at more than 8 million kg (9,000 tons), but demand declined in 1992 and 1993 and has leveled off to about 4 million kg (4,500 tons; Baker 1993).

Determining Status

In reviewing the conservation status of freshwater mussels, we included all species and subspecies recognized in the American Fisheries Society list of common and scientific names of mollusks from the United States and Canada

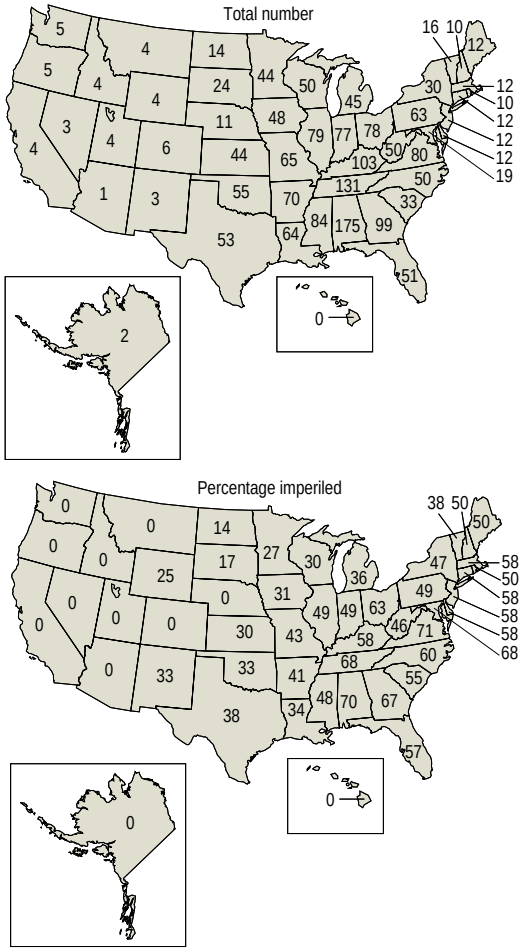

Fig. 1. Number of species and subspecies of freshwater mussels historically known to occur within each state and the percentage now classified as imperiled.

(Turgeon et al. 1988). Distribution data and conservation status were obtained from research publications, books, original data from biologists, and a recent synopsis by Williams et al. (1993).

The status categories were based on information for each species throughout its geographic range. The conservation status categories for a mussel species were defined as follows: endangered—in danger of extinction throughout all or a significant portion of its range; threatened—is likely to become endangered throughout all or a significant portion of its range; special concern—may become threatened or endangered by relatively minor disturbances to its habitat; undetermined—historical and current distribution and abundance have not been evaluated recently; and currently stable—distribution and abundance are seemingly stable, or may have declined in portions of range but not in need of immediate conservation.

Courtesy J.D. Williams, NBS

Freshwater mussels from the Tombigbee River at Memphis Landing, Pickens County, Alabama. Southern combshell (*Epioblasma penita*); female, top, male, bottom.

Decline of Mussels

The decline of freshwater mussels, which began in the late 1800's, has resulted from various habitat disturbances, most significantly, modification and destruction of aquatic habitats by dams and pollution. Freshwater habitats suffer not only from direct alterations by humans but indirectly from abuse of terrestrial habitats, such as from siltation, especially evident if one compares the levels of imperilment of aquatic versus terrestrial species. Master (1990) recognized 55% of North America's mussels as extinct or imperiled, compared to only 7% of the continent's bird and mammal species.

Aquatic habitat loss comes in a variety of forms such as from effects of dams, dredging, and channelization, or from more subtle effects of siltation and contaminants associated with construction and agriculture. Dams, with their altered flow regimes and attendant reservoirs, have caused the extirpation of 30%-60% of the native mussel species in selected U.S. rivers (Williams et al. 1992; Layzer et al. 1993). Siltation resulting from deforestation, poor agricultural and land-use practices, and removal of riparian vegetation can destabilize the stream bottom and eliminate benthic organisms such as mollusks (Ellis 1931). Many streams that look healthy can be polluted by contaminants like heavy metals, pesticides, and acid mine drainage. The effects of pollution and habitat alteration on mussels were reviewed by Fuller (1974).

Competition from non-native mollusks also has contributed to the loss of native mussel populations. The Asian clam (*Corbicula fluminea*), introduced to the U.S. west coast in the 1930's, has invaded nearly every watershed nationwide (McMahon 1983). Local population explosions of the Asian clam have adversely affected some, but not all, native mussels (Belanger et al. 1990; Leff et al. 1990). The recently introduced zebra mussel (*Dreissena polymorpha*) appears poised to decimate many of the remaining mussel populations. Zebra mussels were discovered in the United States at Lake St. Clair in 1988 and spread rapidly throughout the Great Lakes. In 1991 they were found in the Illinois River, and by late 1991 had spread to the Tennessee River (Nalepa and Schloesser 1992). They are now found throughout the Mississippi River and portions of its major tributaries, even to southern Louisiana. During the next 10-20 years, zebra mussels will most likely spread throughout most of the United States and southern Canada.

The adverse modification and destruction of aquatic habitats, along with the introduction of nonindigenous species, have resulted in the decline of freshwater mussels. The percentage of imperiled mussel species for eastern states is high (Fig. 1). Of the 297 native mussel species in the United States, 71.7% are considered endangered, threatened, or of special concern (Fig. 2), including 21 mussels that are endangered and presumed extinct. Seventy species (23.6%) are considered to have stable populations (Fig. 2), although many of these also have declined in abundance and distribution. Many

species in the latter group occur in larger rivers and reservoirs and are projected to suffer severe declines as the zebra mussel invades these ecosystems.

The rapid decline of mussels during this century went almost unnoticed until the past 30 years. Although most of the described threats to survival of mussels have existed for more than a century, the increased geographic area covered by these threats and the cumulative effects of human expansion and development have now overwhelmed aquatic systems.

The demise in both populations and species diversity of our mussel fauna is likely occurring in other freshwater mollusks (especially snails) and aquatic organisms, but too few surveys have been conducted to record such trends. Conservation and restoration should focus on the ecosystem and watershed level instead of directing concerns to the individual species. To effectively carry out such a broad recovery effort will require an unparalleled level of cooperation and coordination of private, state, and federal agencies. Perhaps even more critical to the success of ecosystem and watershed conservation is the involvement of the general public, conservation organizations, and private corporations. If the decline of aquatic mollusks continues, we will witness the greatest extinction of these organisms experienced in modern times.

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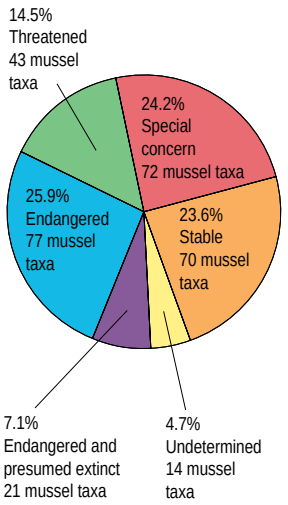

Fig. 2. The percentage of the U.S. mussel fauna classified by conservation status category: undetermined, endangered and presumed extinct, endangered, threatened, special concern, and stable.

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