

Maryland's Freshwater Mussels

A Declining Resource

By James M. McCann



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The eastern elliptio (top right) and eastern floater (bottom right) are among the largest freshwater mussels in Maryland and the only species that remain relatively common and widespread. The small bivalve on the left is the Asiatic clam, an invasive non-native species that can displace native mussels.

In recent years, scientists have learned that freshwater mussels — seemingly unremarkable animals and distant cousins to the beleaguered eastern oyster — play an amazingly vital role in freshwater ecosystems, one that is intricately tied to the health of our watersheds. They also have unique life cycles, behavioral adaptations and evolutionary histories.

Sadly, freshwater mussels are one of the most endangered groups of animals in the world. In the United States, over 70 percent of the approximately 300 species are declining, endangered or extinct. Compared to other major animal groups (e.g., birds and mammals), they are by far the nation's most imperiled species. Here in Maryland, freshwater mussels show a similar trend,

one that sends a clear message about the state of our streams and rivers.

Just the Facts

Freshwater mussels belong to the order Unionoida, a subgroup of bivalves (animals with a single pair of hinged shells or valves) comprising 840 species worldwide. They are distinguished from all other bivalves by a unique shell structure, pearly nacre on the inside of the shells, lack of byssal threads (fibrous strands used by some bivalves like the zebra mussel to permanently attach themselves to substrates), and a unique life history that requires a host fish.

North America supports the greatest number of freshwater mussels in the world with 297 species. Most of this diversity lies in the southeastern U.S., a region with unrivaled

mussel diversity and among the world's great centers of freshwater biodiversity.

Freshwater mussels exhibit a variety of shapes, sizes and colors, a reflection in part of their physical adaptations to different aquatic habitats. At maturity, they range in size from 1.5 to 11 inches in length and can weigh as much as 3 to 5 pounds. They are among the longest-lived animals in the world. The lifespan of most species range from 8 to 100 years with a maximum recorded age of 150 years. Adult mussels are generally sedentary, spending most of their lives filter-feeding partly buried in a stream or lake bottom.

Part of the Plan

Freshwater mussels play important roles in aquatic food webs, nutrient cycling



A DNR team of biologists spend a day in the “office” conducting freshwater mussel surveys.

and water quality. Like oysters in coastal waters, mussels have an enormous filtering capacity. A single mussel can filter 0.5 to 1.25 gallons of water per hour. This may not seem like a lot until one considers that even in a small stream just 10 to 15 feet wide, a thriving mussel population can number in the tens of thousands with densities exceeding 30 animals per square foot.

In a study on the lower Hudson River, researchers found that mussels filtered an astounding 5.3 million gallons per day, roughly equal to the river’s daily summer discharge! As mussels filter-feed, they ingest large quantities of algae, bacteria, zooplankton, sediment and suspended organic matter. In doing so, they reduce stream turbidity and convert organic matter into forms that can be utilized as food and nutrients by a greater variety of animals and aquatic plants.

Healthy Mussels, Healthy Rivers

In a healthy stream or river, the total biomass of freshwater mussels can be tremendous, exceeding that of all other aquatic animals including fish. With such high biomass and longevity, mussel populations provide important long-term storage of huge quantities of nitrogen, phosphorous and calcium.

Mussels also represent an important food source for a variety of animals including muskrats, raccoons, otters and great blue herons. Small juvenile mussels are eaten by crayfish, waterfowl and fish species such as freshwater drum, suckers and catfish.

Mussels also enhance stream and river bottoms for other aquatic life. Like earthworms in our soils, mussels gently mix and churn the substrate, filter sediment and

add organic matter. Scientists are finding that other aquatic animals such as caddisflies, mayflies, and juvenile fishes can be more abundant in the vicinity of mussel beds and that mussels can increase growth rates of submerged aquatic vegetation (SAV).

A Complicated Life

Perhaps the most fascinating aspect of freshwater mussel ecology is their complex life cycle. Mussels have a unique



DNR biologists mark, age and measure mussels as part of long-term population monitoring efforts for rare, threatened and endangered species. The mussel on the left is the state endangered triangle floater; the four mussels on the right are dwarf wedgemussels, a federally endangered species.



The Creeper Mussel

larval stage during which the larvae, called glochidia, must attach to the gills, fins or scales of an appropriate host, usually a fish. This host fish relationship allows the glochidia to successfully metamorphose into adult mussels and, importantly, to disperse.

Different mussel species require different host fish species. Some mussels can utilize a variety of fish species. Others, including some of our most endangered mussels, are limited to just one or two hosts, which may also be rare. The glochidia, about the size of a tiny grain of sand, remain attached to the host, typically for 2 to 3 weeks, during which they metamorphose into juvenile mussels. Following metamorphosis, the juvenile mussel drops off the host and burrows deep into the sediment where it remains for 2 to 4 years until sexually mature.

Female mussels have developed elaborate behaviors and tissue modifications to help ensure that glochidia successfully attach to the correct host. Some mussel species release their glochidia in stringy mucous webs that attach to the fins of the host fish as they swim by.

In other species, the female's mantle tissue is modified to resemble the natural prey of their host fish, such as worms, insect larvae or small fish. These lures, containing a hidden packet of glochidia called a conglutinate, are waved or dangled in the current to entice unsuspecting host fish. As it is seized, the conglutinate bursts and releases the glochidia that then attach to the host.

Fighting to Survive

To determine the status of freshwater mussels in Maryland, DNR's Natural Heritage Program has conducted over 1,300 surveys in streams, rivers and impoundments throughout the state. These data along with historical records and other sources reveal that although none of the State's 16 native species have been extirpated, most have declined and 56 percent (9 of 16 species) are now rare. Today, four species are listed as endangered in Maryland including the federally endangered dwarf wedgemussel. Two other species, the Atlantic spike and creeper, are state listed as in need of conservation.

Among the most imperiled species are the endangered brook floater and green floater. Although once fairly widespread in the Piedmont and Ridge and Valley physiographic regions, only a few small populations of each species remain. Similar declines have occurred in surrounding states.

Maryland's most common and widespread mussel is, by far, the eastern elliptio. Although it occurs nearly statewide, this species too has declined in some watersheds, particularly in the more developed counties.

Disappearing Habitat

The greatest threat to Maryland's freshwater mussels is the loss and degradation of their aquatic habitats due

to suburban sprawl and poor farming practices. Non-native species can also impact mussels through competition, predation and by altering aquatic communities. Of particular concern are recent invaders like the zebra mussel, Asiatic clam and rusty crayfish.

Dams too can have a profound impact on mussels and have led to the extinction of some species in southeastern states. Dams not only inundate stream and river habitat but also block host fish movement, particularly those of migratory host fish such as shad, herring and eels. Poorly designed stream culverts can have a similar effect on fish movement.

Climate change poses yet another threat. With projected sea-level rises of as much as 2 to 3 feet by 2099, the lower nontidal sections of many coastal streams and rivers, including sections that support rare and endangered mussel species, will become increasingly saline, eliminating mussel populations.

Familiar Challenges, Familiar Answers

For those familiar with the problems facing the Chesapeake Bay, these are all well-known themes. Freshwater mussels remind us that much is at stake in the Bay's tributaries. DNR continues to work on a variety of fronts to protect and restore our streams and rivers, including those that support rare or endangered mussels. These efforts include working with land planning agencies to protect watersheds from development impacts, establishing forest buffers along streams, removing or redesigning dams and culverts to restore fish movement, and protecting endangered species habitats through acquisition, conservation easements and appropriate management of DNR lands.

How freshwater mussels fare reflects the condition of our streams and rivers and, in turn, how we treat our watersheds and ultimately the Bay. ■

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