

## The Silent Crisis

Hundreds of thousands die every year. This isn't some great war, but it is just as important. The recent announcement by the U.S. Fish and Wildlife of the extinction of twenty-one species of mussels has shed light on the severity of this silent crisis. Many were alarmed by this number, but it's not the end of the story. In Kentucky alone, there are several dozen species of mussels on the endangered list, and the list is exponentially increasing.

You may be wondering, "What even is a mussel?" Freshwater mussels are animals that live out of sight on the bottoms of lakes and are vital filter feeders that use their tube-like siphons to pump water into the gill chambers. Larger particles, such as phytoplankton, get lodged between gills while the rest of the water gets pumped back out. When this process is repeated enough, they can filter nearly 20 gallons daily! While these bivalves collect the necessary nutrients required to survive, they eliminate undesired toxins from the water, acting as water purifiers.

Mussels have complex life cycles that involve a delicate relationship with fish. When male gametes are released, the female mussel siphons fertilized eggs. When water is polluted, the female faces a dilemma, unable to siphon gametes without risking poisoning. The mother mussel then has to wait until a specific fish comes near, or else the offspring will die; with the construction of dams, many fish species' paths are blocked, causing millions of mussels to perish in waiting. Through instincts, she releases her glochidia, or parasitic larvae, into the water by the thousands. The glochidia attach to the gills of the fish, which serve as the nursery for the baby mussels until they become ready to detach. After a few weeks, they will have developed to the point where they are no longer dependent on the fish. They separate from the fish as juvenile mussels. Thereafter, the cycle repeats.

Mussels impact aquatic wildlife in many ways, one of which earns them the nickname "canaries in a coal mine" (Mussel Conservation Society, 2023), also known as indicator species of water quality. This means they can designate whether a particular place suits specific aquatic life. According to the XERCES Society for Invertebrate Conservation, "Mussel beds also create habitat for other aquatic invertebrates, which in turn are eaten by fish." When these mussel beds clean waters, sunlight can reach further down, allowing new plant life to flourish. They also push back excess products into the water, including nutrients they don't need, which aquatic insects can eat. While mussels help sustain other life in many different ways, few are helping mussels.

Conservation 'muscle' is essential for these mussels. Mussel populations are declining rapidly in the Midwest and South, including Kentucky. One of the earliest causes of mussels' population decline in the 20th century was the construction of dams across the rivers. "The Big South Fork of Cumberland River once held 55 species of mussels. It is now home to 25 species." (Claypool, 2023) According to Wendell Haag, co-author of "A Distributional Atlas of the Freshwater Mussels of Kentucky" "The Cumberland River is a large river that historically supported an extremely diverse upland mussel fauna including many endemic species, but Wolf Creek Dam eliminated virtually all mussels in the river" Dams can cause many side effects, such as habitat fragmentation, reducing host fish availability, and altering water quality. Habitat fragmentation isolates specific populations, leading to extinction. In addition, when dams block fish from their regular routes, a reduction of host fish occurs, which is detrimental to the life of a mussel. Without fish as a mode of transportation, mussels cannot disperse themselves among many vast ecosystems. The biggest drawback of building dams is their negative impact on water quality. When water becomes contaminated, mussels that play a vital role filter out the pollutants.

Unfortunately, this also means that they absorb the toxins, which ultimately leads to their poisoning.

As freshwater mussels' names state, they enjoy fresh water. However, as more and more people use water from rivers and lakes, water scarcity has occurred, which poses a significant threat to the survival of these creatures. To ensure freshwater conservation and minimize water pollution, you can play your part in supporting these animals.

There are many simple and efficient ways to conserve water. According to the United States Environmental Protection Agency, "[Water conservation practices include] eliminating single-pass cooling, optimizing cool tower efficiency, and monitoring your water meter." Eliminating single-pass cooling stops cooling systems that use water only once and then release it, or monitoring your water meter can help you detect leaks and cause you to be aware of your water usage. By conserving your water, you can impact the lives of mussels and the many other species that depend on clean water for their home.

In the aquatic orchestra of nature, native mussels once danced in perfect harmony. Invasive species threaten the delicate rhythm of these underwater performers. Their unwelcome presence poses a silent threat, putting the very existence of our aquatic maestros at risk. The main threat is the zebra mussel, which attaches to the native mussel, forcing the native mussel to stay sessile. The zebra mussels also remove the algae from the water so the native mussels cannot feed, which inhibits the growth of the native mussels. Other invasive species transmit diseases and harm mussel populations—invasive predators such as crayfish prey on mussels. Unfortunately, mussels don't have many defense mechanisms, so they become vulnerable.

Freshwater mussels are among the most endangered organisms on Earth, yet there is a lack of effort from communities around the state, country, and world. Although this isn't a great

war, soon, it will be, simply because mussels are the future of our existence. The commitment to conservation is our armor, and scientific knowledge is our weaponry in the ongoing battle to protect and sustain the delicate balance of our natural world. Are you willing to help fight for Team Earth?

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