

Sustaining America's Aquatic Biodiversity

Why Is Aquatic Biodiversity Declining?

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When a species goes extinct, all the genetic information carried by individuals of that species is lost forever, never to be reproduced again. Extinction is a terrible waste of life and a loss of potential solutions to future problems such as possible cures to disease and solutions for survival in a changing world. Water animals and plants are our aquatic heritage, and sustaining their biodiversity must be our legacy to future generations.

Declining biodiversity worldwide is a major and ongoing environmental dilemma.

Although aquatic biodiversity has been declining continually, species extinction rates have gone from about one species per year over the past 600 million years to hundreds of species per year in recent times. More than 500 species in the United States are extinct and presumed gone forever, and about one-third of the animals and plants are at risk.

Aquatic fauna in the United States are more threatened than any other life forms. Freshwater species in the United States are disappearing at a rate two to five times faster than native land animals, and at a rate equal to those of the tropical rain forest fauna.

At issue are about 800 species of fishes, 300 species of mussels, 300 species of crayfishes, 150 species of salamanders, 100 species of frogs and toads, and 500 species of snails that inhabit freshwater lakes and streams in the United States.

Aquatic organisms serve as important indicators of water quality and ecosystem health. For example, a fish kill or the disappearance of mussels or crayfish from a stream can alert citizens to a water pollution problem.

Unfortunately, many of these animals have declined sharply in numbers and distribution in the past 20 years. At present, nearly 20 percent of our freshwater fishes, 45 percent of our mussels, 48 percent of our

crayfishes, and 20 percent of our aquatic snails are imperiled, meaning they are either extinct, endangered, threatened, or of special concern. Of the 230 species of amphibians (90 frogs and toads, and 140 salamanders) that depend on aquatic habitats, 40 percent are disappearing and alarming numbers of individuals are missing limbs; such deformities have been documented in 44 states.



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Biodiversity involves more than protecting endangered species. It requires an understanding that most species and their ecosystems are interconnected and form an interdependent web of life that includes humans.

The greater the biodiversity, the greater the stability of an environment, and vice versa. For example, large tracts of undisturbed forest modify their own environments by stabilizing air temperatures, capturing rainfall, recycling water vapor, and preventing the accumulation of carbon dioxide and greenhouse gases.

Habitat fragmentation (isolation) and destruction are the leading threats to aquatic biodiversity. Aquatic habitats are being drained, channeled, or polluted at increasing rates. Freshwaters are the most threatened ecosystems and aquatic animals are at the greatest risk.

The destruction of wetlands is largely the result of human population increases and development pressure. For example, riversides are premium development properties, attracting large numbers of people and houses that threaten erosion and water pollution.

The impact of development and human changes to our aquatic landscapes has caused massive reductions in our aquatic species biodiversity. Certain fish, snails, mussels, crayfish, and other aquatic creatures have completely disappeared. Others have been substantially and continually reduced in numbers over the years. Tragically, many species are lost before we even know that they existed.

Habitat Loss

Aquatic habitats are the areas where water plants and animals live and obtain shelter, water, nutrients, and food for survival. Loss of habitat is the major reason why aquatic biodiversity is declining. Many of our native aquatic habitats were lost as early pioneers cleared the land, drained and filled wetlands, and cleared streamside forests.

More than one-half of the original wetlands in the United States have been drained and filled in the past 300 years. Agriculture, mining, forestry, housing and shopping developments, highways, powerlines, and other human activities are altering aquatic habitats and aquatic life each day.

Thousands of miles of streams and rivers were lost to dams or straightened (channelized). Over 75,000 high dams and thousands of low dams block 600,000 miles of rivers (17 percent of all river miles) in the United States.

Dams isolate upstream and downstream populations of fish, mussels, crayfish, snails, and other aquatic animals. They also alter water quality and flows, changing rivers into reservoirs and sediment basins that will not support native stream life.

Our natural biodiversity is lost through many careless human activities including: the large-scale cutting of streamside forests, the overharvest of native plants and animals, the indiscriminate use of pesticides, draining and filling of wetlands, mining, stream gravel dredging, water pollution, flood control, dams, irrigation and water diversions, road construction, and the conversion of wetlands to agricultural and city development.

Preventing habitat loss is the first important step to take in protecting our native species, and restoring important degraded habitat is the second step. By protecting critical habitats and restoring degraded ones, by insisting on smart development and restricting urban sprawl, especially in sensitive riparian (streamside) areas, river corridors, and wetlands, we assure our native aquatic biodiversity will be sustained.

Introduced Species (Aquatic Exotics)



Alien species (nonnative, introduced, or non-indigenous species) are animals or plants that have been accidentally moved or intentionally introduced into areas beyond their native, natural geographical range.

Zebra mussels, for example, are native to Europe, but have been accidental hitchhikers transported into the United States where they are not native and, therefore, are an exotic species. In fact, nearly 30,000 species of exotic water plants (water milfoil), shellfish (zebra mussel), fish (snakehead), and disease microbes (West Nile Virus) have arrived in the United States.

How did they get here? Ballast water used in ships to maintain stability (added weight) on the open ocean often is pumped (along with aquatic animals and plants) on board in the home port and discharged at the destination port. About 3,000 aquatic species are moving around the globe in the ballast tanks of ships daily. Ships and airplanes serve as global conveyor belts rapidly distributing large numbers of plants and animals to areas where they are not found naturally .

Global transport and exchange systems have dramatically altered the biodiversity of our world's waters. An estimated 300 alien species now inhabit the San Francisco Bay area, and 100 more have invaded the Chesapeake Bay.

Although many of the introductions of exotic plants and animals are accidental, some are intentional imports as aquarium pets or for use on fish farms. Aliens such as the Asian snakehead fish and African walking catfish, the Asian clam, the Chinese mitten crab, and South American aquatic plants that were introduced intentionally for the aquarium trade are causing problems.



The snakehead fish, an aggressive predator with sharp teeth native to Asia, has recently been found in the wild in ponds in Maryland, Florida, North Carolina, and Hawaii. These fish, sold in pet stores and later released into natural waters, destroy native fish species. Their sale is now banned in pet stores in many states and a federal law was enacted to ban them from distribution and sale in the United States.

The ruffe is a European fish in the perch family that was introduced into Wisconsin waters and can displace native fishes.

The European zebra mussel, a small striped freshwater mussel, is an environmental and economic disaster in the United States where it was accidentally introduced. Zebra mussels were transported into the Great Lakes and have spread throughout the United States. In waters infested with the exotic zebra mussel, rapid

declines in the species and numbers of our native freshwater mussels have occurred, and large blooms of toxic blue-green algae may result. In high densities, zebra mussel colonies can outcompete our native fish and mussels for food and habitat.

Large colonies of zebra mussels have clogged water pipes and water intakes at power plants, dams, and waterworks in cities in Canada and the Great Lakes states, costing taxpayers hundreds of millions of dollars for pipe replacement, cleaning, and higher water and electric bills for millions of consumers. Zebra mussels foul motors, nets, pumps, boats, navigational bouys, and other submerged equipment resulting in expensive repairs and replacement.

Another shellfish, the Asian clam, was imported for food and the aquarium trade, and has now spread into rivers and lakes throughout the United States where it competes with native mussels.

The aggressive rusty crayfish preys on native aquatic plants, fish, and fish eggs and outcompetes native crayfishes. Sometimes used as fish bait, they have been spread around the country.

Eurasian water milfoil, purple loosestrife, and other alien aquatic plants outgrow our native water plants and are becoming widely established.

Why are invasions of exotic species a problem for native aquatic life forms? Introduced aquatic plant and animal species can disrupt the balance of natural ecosystems. Exotic species threaten to outcompete (for food or space) native species, lowering biodiversity and the abundance of our native species.

In their new habitats, these exotics have no natural predators, and can eliminate native species directly or indirectly. They may carry diseases and parasites that can infect native plants and animals. Invasive organisms can potentially reproduce with native species and alter the gene pool, leading to hybridization and homogeneity, and reducing genetic diversity. In many places, native species are on the brink of extinction because of competition with exotic species.

Introduced nonnative species cause widespread destruction by reducing or eliminating economically-important native species. Exotic species may cause economic damage by

- reproducing with valuable species and producing worthless hybrids and crossbreeds;
- carrying or supporting harmful pests;
- reducing recreational boating, swimming, commercial fishing; and
- importing diseases that affect related native plants, animals, and even humans.

To protect our native fish and shellfish populations, we must prevent the import of nonnatives into the United States and stop the further spread of exotic fish, shellfish, and other aquatic animals into waters nationwide.

To limit the import of nonnative species into our country, we need to more strictly enforce our quarantine regulations, and more completely inspect animals and plants at ports of entry. We especially need to prevent the import of exotics through the pet trade and by requiring that ships discharge ballast water at sea before entering port. To conserve our native aquatic biodiversity, please do not release exotic pets into the wild.

Water Pollution

Air and water pollution are widespread threats that can directly poison threatened and endangered species, reduce their numbers, and diminish their available habitat. Acid rain is poisoning and global warming is heating our surface waters, resulting in dramatic declines in aquatic biodiversity.

Web Links to More Information

Exotic, Invasive Species

- Protect Your Waters and Stop Aquatic Hitchhikers: <http://www.protectyourwaters.net/>
- Exotic Aquatics: <http://www.invasivespecies.gov/>
- USDA Invasive Species: <http://www.invasivespecies.gov/>
- Florida Center For Invasive and Aquatic Plants: <http://aquat1.ifas.ufl.edu/welcome.html>
- Costly Interlopers: <http://www.sciam.com/article.cfm?articleID=0002DE3A-E57F-1CD1-B4A8809EC588EEDF&pageNumber=1&catID=4>
- World Resources Institute, Resources at Risk: Bioinvasions: Stemming the Tide of Exotic Species: <http://www.wri.org/wri/wri/wr-98-99/bioinva2.htm>

- New England Chapter of the Society for Conservation Biology, marine bioinvasions: <http://www.massscb.org/links/aquabiodiversity.html>
- Nonnative Wildlife in Oregon: http://www.dfw.state.or.us/south_willamette/nonnative.html
- Sea Grant National Aquatic Nuisance Species (Invasive Species) Clearinghouse: http://www.cce.cornell.edu/aquaticinvaders/nan_ld.cfm
- Aquatic Nuisance Species Task Force: <http://www.anstaskforce.gov/>
- *Zebra Mussels Pose a Threat to Virginia's Waters*, Virginia Cooperative Extension publication 420-900: <http://www.ext.vt.edu/pubs/fisheries/420-900/420-900.html>

Endangered Animals

- U.S. Fish and Wildlife Service: <http://ecos.fws.gov/>
- Science NetLinks for information on rare, threatened, and endangered mammals: <http://www.animalinfo.org/>
- Red List of Threatened Species: <http://www.redlist.org/>
- U.S. Fish and Wildlife Service Teacher's Packet contains activities, fact sheets, coloring books: <http://endangered.fws.gov/kids/Heyteach.htm>
- U.S. Fish and Wildlife Service animal pictures and graphics: <http://pictures.fws.gov/>
- NatureServe: <http://www.natureserve.org/>
- Environmental Defense: <http://www.environmentaldefense.org/system/templates/page/focus.cfm?focus=1>

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