Congressional Research Service
Informing the legislative debate since 1914

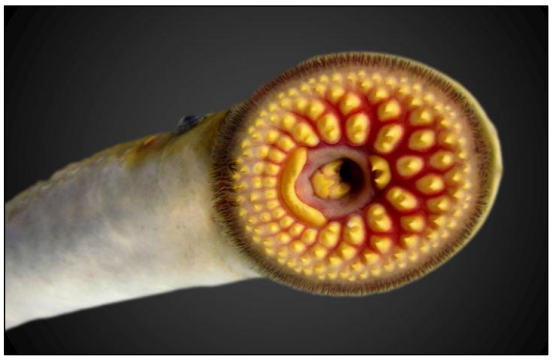
IN FOCUS

September 25, 2023

Federal Management of Sea Lampreys in the Great Lakes and Lake Champlain

The sea lamprey (*Petromyzon marinus*), sometimes known as the *vampire fish* (**Figure 1**), is a parasitic fish species native to the northern Atlantic Ocean and the waters of eastern United States and western Europe. By the early 1900s, sea lampreys had spread throughout the Great Lakes, where they harm economically important fish species such as Atlantic salmon (*Salmo salar*), lake trout (*Salvelinus namaycush*), and lake sturgeon (*Acipenser fulvescens*). According to some estimates, fish wounded by sea lampreys have a mortality rate of 40%-60% and a single lamprey can kill approximately 40 pounds of fish per year. Congress is interested in efforts to control sea lamprey populations and the impacts of these efforts on the health of fisheries, recreation industries, and ecosystems of the Great Lakes and Lake Champlain. This product provides an overview of the biology and spread of sea lamprey, federal sea lamprey control programs, and selected considerations for Congress.

Figure 1. Sea Lamprey Mouth



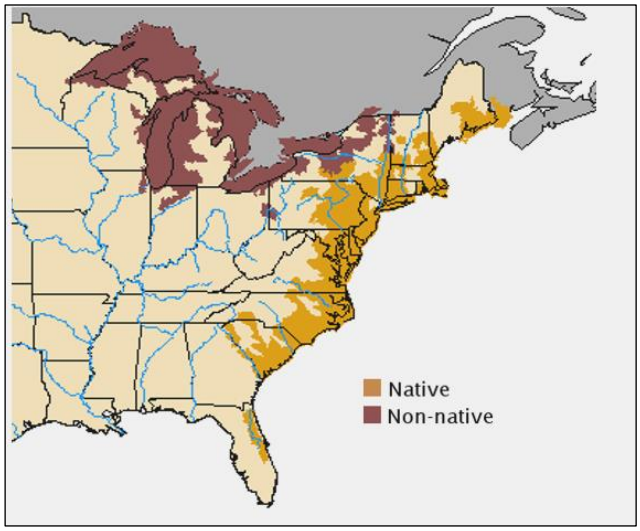
Source: U.S. Geological Survey.

Notes: Injuries and loss of fluids from sea lamprey feeding can cause the death of the host fish.

Geographic Range of the Sea Lamprey

In the United States, sea lampreys occupy offshore, coastal, and inland waters from the Gulf of St. Lawrence to northern Florida and the Great Lakes region (**Figure 2**). Sea lampreys were first observed in the Great Lakes in the 1830s. According to scientists, sea lampreys entered Lake Ontario from the Atlantic Ocean through human-made shipping channels and were found in all of the Great Lakes by 1938. Genetic evidence suggests sea lampreys may be native to Lakes Ontario and Champlain, both of which are accessible from the Atlantic Ocean by water. Some scientists challenge this view, however, stating that there are few records of sea lampreys or fish with lamprey wounds in these lakes prior to the mid-1800s. Regardless of origin, many stakeholders consider sea lampreys to be a nuisance species that threatens native fish populations in the Great Lakes.

Figure 2. Sea Lamprey Range in the United States

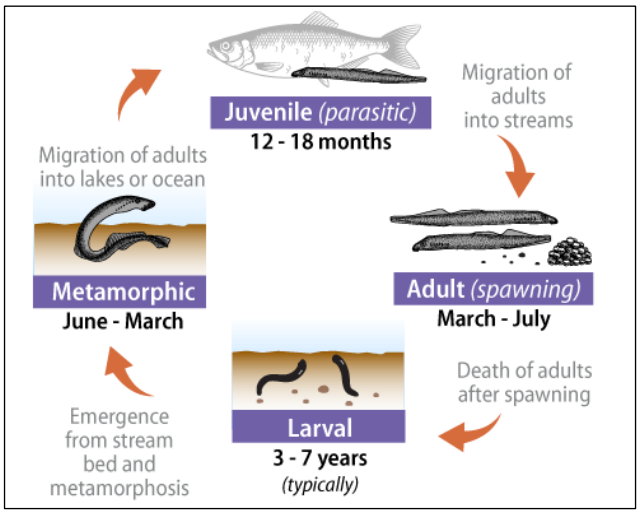


Source: U.S. Geological Survey.

Sea Lamprey Biology

The biology of sea lampreys is relevant to control efforts, many of which are designed to target specific stages of the species' complex life history. Sea lamprey populations from the northern Atlantic are *anadromous*, meaning individuals are born in freshwater, spend a part of their lives in saltwater, and then return to freshwater streams to spawn (**Figure 3**).

Figure 3. Sea Lamprey Lifecycle



Source: Brittney G. Borowiec et al., "Exploiting the Physiology of Lampreys to Refine Methods of Control and Conservation," *Journal of Great Lakes Research*, vol. 47 (2021), pp. S723-S741.

Sea lamprey populations in the Great Lakes and Lake Champlain, however, complete their life cycle within freshwater lakes and streams. After spawning, larval sea lampreys typically remain in the streams where they hatched, referred to as *nursery streams*, for three to seven years. Afterward, larvae metamorphose into juveniles and enter the parasitic life stage, when they start feeding on other fish. Juveniles from the Great Lakes and Lake Champlain populations migrate from their nursery streams to the deeper water of these lakes to feed on host fish. After 12-18 months of feeding, sea lampreys return to streams to develop into adults and spawn. Females can produce up to 100,000 eggs when spawning and both sexes die shortly after the spawning season.

Population Trends

Scientists use indirect methods to estimate sea lamprey populations because of the difficulty of monitoring in deep water. Two commonly used measures are (1) wounding rates on species such as lake trout and Atlantic salmon and (2) the number of individuals trapped in monitored "index" streams. Sea lamprey populations have declined in the Great Lakes and Lake Champlain since the start of control programs in the late 1950s and 1990, respectively. In the Great Lakes, populations have decreased by over 90% since the 1960s. In Lake Champlain, populations have decreased by approximately 50% since the 2000s.

Federal Control Programs

Sea lamprey control and research are implemented by several federal agencies, nonfederal agencies, and other partners. Control and research efforts in the Great Lakes are coordinated by the Great Lakes Fishery Commission (GLFC). The GLFC is a binational entity with Canada established by the United States and Canadian Convention on Great Lakes Fisheries in 1954 and codified by the Great Lakes Fishery Act of 1956 (16 U.S.C. §§931-939). In the United States, the GLFC's control efforts are largely implemented by the U.S. Fish and Wildlife Service (FWS), U.S. Army Corps of Engineers (USACE), and state fish and wildlife agencies. The GLFC's research activities are conducted in cooperation with the U.S. Geological Survey; universities; and state, provincial, and tribal entities. Legislation that addresses aquatic invasive species has typically established that the GLFC retains authority and responsibility to implement a comprehensive sea lamprey control program (e.g., the Great Lakes Fish and Wildlife Restoration Act; 16 U.S.C. §§941-941h).

Sea lamprey control in Lake Champlain is coordinated by the Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC), which was formed in 1973 to coordinate efforts to mitigate the impacts of sea lampreys on Lake Champlain's fisheries. The LCFWMC is a partnership of FWS, the New York State Department of Environmental Conservation, and the Vermont Department of Fish and Wildlife.

Control Methods

Managers use physical, chemical, and biological control methods to reduce sea lamprey populations in the Great Lakes and Lake Champlain. Physical control targets adult sea lampreys before they spawn in the early spring. These methods include barriers to prevent sea lampreys from reaching spawning areas and traps to remove adults from tributaries. Chemical control involves the application of lampricides or pheromones. The U.S. Environmental Protection Agency (EPA) must approve lampricides used in the United States, which are restricted-use pesticides manufactured for designated federal and state agencies. Lampricides are typically applied to streams and deltas to target sea lamprey larvae at nurseries. Application of lampricides follows a procedure that includes conducting pre- and post-assessment of sea lampreys and nontarget species and notifying residents who rely on treated lakes and streams for water. Pheromones are typically used to lure adults and larvae into traps for disposal. Biological control, used less commonly than other methods, involves the release of sterile males during spawning to reduce sea lampreys' reproductive success.

Selected Federal Funding for Control Efforts

Federal funding for sea lamprey control comes from several programs. Congress has on several occasions expanded the scope and scale of programs to meet the goals of federal control efforts for sea lampreys and other aquatic invasive species. The Great Lakes Restoration Initiative (GLRI; 33 U.S.C. §1268(c)(7)) provides funding, allocated by EPA, to federal and state agencies for control of aquatic invasive species, including sea lampreys. In 2021, Congress extended the annual authorization of appropriations for GLRI and provided for an annual increase from $375 million in FY2022 and ending at $475 million in FY2026. Congress also has provided supplementary funds for sea lamprey control through annual appropriations to FWS's Fish and Aquatic Conservation program.

Considerations for Congress

Research from the GLFC and LCFWMC suggests control efforts must be ongoing to prevent the rebound of sea lamprey populations. Recent studies from Lake Champlain also suggest sustained control requires that a large proportion of the larval population receive effective treatment every year. Congress may consider evaluating the

impact of current efforts and the resources needed for long-term control.

Some stakeholders have expressed concern over chemical control of sea lamprey, especially the potential for negative effects on nontarget species, such as the common mudpuppy (*Necturus maculosus*). GLFC and LCFWMC scientists contend that lampricides have minimal effects on non-lamprey species, but some other scientists note that studies may not have addressed all potentially affected species. Additionally, some scientists suggest any negative effects of chemical control on nontarget species are usually short-lived or are not likely to result in mortality. Congress may consider conducting further oversight on EPA procedures for assessing the effect of lampricides on nontarget species, such as those listed under the Endangered Species Act (16 U.S.C. §§1531-1544).

This product was coauthored by Christopher Field, former CRS Analyst in Natural Resources.

Pervaze A. Sheikh, Specialist in Natural Resources Policy

IF12500

Disclaimer