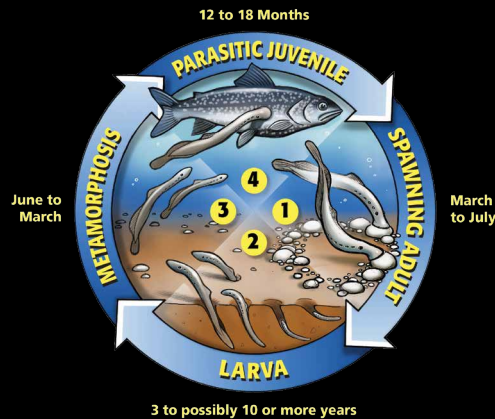


The Sea Lamprey's Life Cycle



Understanding the sea lamprey's life cycle helps scientists deliver an effective control program.

1 adult phase, sea lampreys migrate into streams, build crescent-shaped nests from rocks, spawn, and then die. After the lamprey eggs hatch, **2 larvae** drift to areas of soft sediment and burrow into the river bottom where they live for several years. Larvae then go through **3 metamorphosis**, growing eyes and a suction-cup mouth with barbed teeth, and migrate to the open lake as **4 juveniles** that parasitize fish. After 12-18 months of feeding, sea lampreys return to streams to spawn, and the cycle begins again.

www.sealamprey.org

Working Together to Protect Our Great Lakes Fishery

Government agencies work in consultation with nongovernmental organizations and the fishing public to improve our fishery. In 1955, Canada and the United States created the Great Lakes Fishery Commission to control sea lampreys, coordinate research, and improve the fishery. This cooperative approach has succeeded since 1955.

For More Information

If you would like to learn more about sea lamprey control, contact the **Great Lakes Fishery Commission** or the partner nearest you. Visit the commission online at www.sealamprey.org

GREAT LAKES FISHERY COMMISSION

2200 Commonwealth Blvd., Ste. 100, Ann Arbor, MI 48105
734-662-3209

FISHERIES AND OCEANS CANADA

Sea Lamprey Control Centre
1219 Queen Street East, Sault Sainte Marie, ON, P6A 2E5
705-941-3000

U.S. GEOLOGICAL SURVEY

Hammond Bay Biological Station
11188 Ray Road, Millersburg, MI 49759
989-734-4768
Upper Midwest Science Center
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608-783-6451

U.S. FISH AND WILDLIFE SERVICE

Ludington Biological Station
5050 Commerce Drive, Ludington, MI 49431
231-843-7300
Marquette Biological Station
1095 Cornerstone Drive
Marquette, MI 49855
906-226-6571

This brochure was produced in cooperation with the Ontario Federation of Anglers and Hunters (www.ofah.org) and the Great Lakes Sport Fishing Council (www.great-lakes.org), key partners in protecting our fishery.

Sea Lamprey



The Battle Continues...



Our Great Lakes Fishery:

A Shared Resource

The Great Lakes are a valuable resource shared by Canada and the United States. More than 40 million people depend on the Great Lakes for food, drinking water, and recreation. The fishery alone generates up to \$7 billion for the region annually, offering recreational angling opportunities for five million people and providing 75,000 jobs.

The health of the Great Lakes fishery is under constant threat from habitat loss, pollution, and invasive species including sea lampreys. Through stewardship and cooperation, we are tackling some of our biggest challenges. Sea lamprey control is one area where we are winning the battle.

What are Sea Lampreys?



PHOTO: NYSDEC

Sea lampreys are primitive fish native to the Atlantic Ocean. In the Great Lakes they have no commercial value and fish do not normally feed on them.

Lacking jaws, their round mouths form a sucking disk filled with sharp, horn-shaped teeth that surround a rasping tongue. Unlike most fish, a lamprey's body has cartilage but no bones, scaleless skin, no paired fins, no lateral line, and no swim bladder.

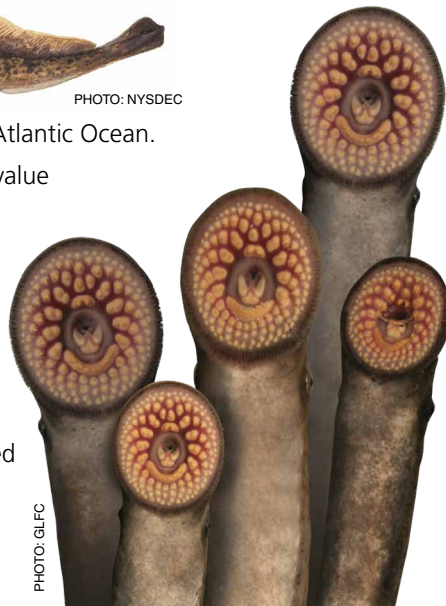


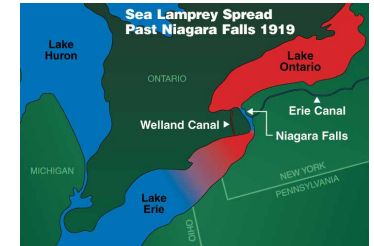
PHOTO: GLFC

Where are Sea Lampreys Found?

Sea lampreys entered the Great Lakes from the Atlantic Ocean through man-made shipping canals and were first observed in Lake Ontario in the 1830s. Niagara Falls acted as a natural barrier preventing sea lamprey movement to Lakes Erie, Huron, Michigan, and Superior. However, when the Welland Canal (constructed to bypass the falls) was deepened in 1919, sea lampreys gained access to the rest of the Great Lakes. By 1938, they had invaded all of the Great Lakes.



PHOTO: VERIDIAN



What Damage Do Sea Lampreys Inflict on the Fishery?

Sea lampreys are parasitic pests. They attach to fish with their suction mouth and teeth, and use their tongue to rasp through a fish's scales and skin so they can feed on its blood and body fluids. A single sea lamprey will destroy up to 18 kgs (40 lbs.) of fish during its adult lifetime. Sea lampreys are so destructive that, under some conditions, only one out of seven fish attacked will survive. Sea lampreys prey on all types of fish, such as lake trout, salmon, rainbow trout (steelhead), brown trout, whitefish, yellow perch, burbot, walleye, catfish, and even sturgeon.

In the 1940s and 1950s, sea lamprey populations exploded as there were no effective control methods and no natural predators. This contributed significantly to the collapse of fish species that were the economic mainstay of a vibrant Great Lakes fishery. For example, before sea lampreys entered the Great Lakes, Canada and the United States harvested about 7 million kgs. (15 million lbs.) of lake trout in lakes Huron and Superior annually. By the early 1960s the catch was only about 136,000 kgs. (300,000 lbs). The fishery was devastated.



PHOTO: M. GADEN and R. BERGSTEDT

How Are Sea Lampreys Controlled in the Great Lakes?

The Great Lakes Fishery Commission, in cooperation with Fisheries and Oceans Canada, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers, carry out sea lamprey control on the Great Lakes. The U.S. Geological Survey conducts critical sea lamprey research. The control program uses several techniques to attack sea lampreys during different stages of the life cycle (see reverse).



Assessment
PHOTO: M. GADEN

Lampricides

Sea lamprey control begins when biologists go into the field and determine which streams contain sea lamprey larvae. This assessment data is then used to help the commission decide which streams to treat with lampricides.

Currently, the primary method to control sea lampreys is a lampricide called TFM. TFM kills sea lamprey larvae in streams with little or no impact on other fish and wildlife.

After extensive testing, which began in the 1950s, scientists determined that TFM is non-toxic or has minimal effects on aquatic plants, invertebrates, fish, and wildlife. It is not harmful to humans or other mammals at the concentration applied. A solid form of lampricide, known as granular Bayluscide, is applied to slow-moving or deep waters. TFM and granular Bayluscide are registered with the U.S. Environmental Protection Agency and with Health Canada.



TFM application
PHOTO: M. MILLAR



Granular Bayluscide application PHOTO: T. LAWRENCE

About 200 Great Lakes streams are treated at regular intervals with lampricides to kill larval sea lampreys. Despite the success of TFM and granular Bayluscide, lampricides are costly and the Great Lakes Fishery Commission is seeking to reduce their use by relying more on the following alternative methods.

Barriers

Barriers have been constructed to block the upstream migration of spawning-phase sea lampreys. Most barriers allow jumping fish to pass with



A typical sea lamprey barrier PHOTO: GLFC

minimal disruption. Some also permit the passage of non-jumping species while blocking sea lampreys. Barriers have reduced or eliminated the need for lampricide treatments on many streams.

Pheromones and Alarm Cues

Sea lampreys have an extremely keen sense of smell, and since the late 1990s, the commission and its research partners have been developing ways

to exploit that sense for sea lamprey control. Pheromones are natural odors organisms emit to affect behavior. Several sea lamprey pheromone components have been identified, which attract spawning females to males. Additional pheromones emitted by larvae inform sea lampreys about which streams have suitable spawning habitat. Pheromones could be used as a “bait” for traps (see “trapping” below) or as a way to manipulate behavior to disrupt reproduction.



Pheromone field trials
PHOTO: USFWS

Alarm cues, which can also be scent-based, caution animals of impending danger. Scientists have discovered that decaying sea lampreys give off an alarm cue that warns sea lampreys to avoid certain areas. Alarm cues could block sea lampreys from certain areas or, in conjunction with attractant pheromones, work in a push-pull technique.

Trapping

Sea lamprey traps are operated throughout the Great Lakes basin, often in



Sea lamprey trap PHOTO: M. GADEN

association with barriers. Traps are designed to catch sea lampreys as they travel upstream to spawn, thus removing individuals from the spawning population. Traps also provide a means to assess spawning lamprey populations and, ultimately, the success of sea lamprey control. Pheromones and alarm cues, along with new trap designs and techniques, could enhance the effectiveness of traps.

Success!

Sea lamprey control in the Great Lakes has been tremendously successful. Ongoing control efforts have resulted in a 90% reduction of sea lamprey populations in most areas, creating a healthy environment for fish survival and spawning.

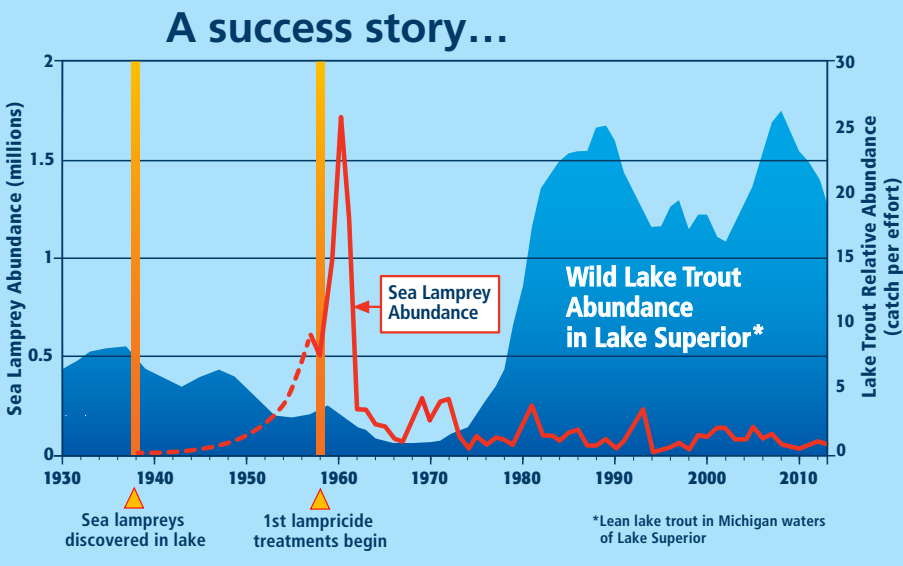
Although it is impossible to completely rid the Great Lakes of sea lampreys, through continued cooperation and support, we can keep their populations at levels that lessen the impact to our fishery.



Sea lamprey control is an investment in our fishery and environment. Success means more quality fish and fishing opportunities for ourselves and for future generations!



PHOTOS: D. KENYON, K. NEIDLINGER, J. GUNDERSON, J. SLADE
COVER PHOTO: T. LAWRENCE



Working Together to Protect Our Great Lakes Fishery



Great Lakes Fishery Commission



U.S. Department of State



U.S. Fish & Wildlife Service



Fisheries & Oceans Canada



Great Lakes Sport Fishing Council



Ontario Federation of Anglers & Hunters



U.S. Geological Survey Biological Resources Division



U.S. Army Corps of Engineers