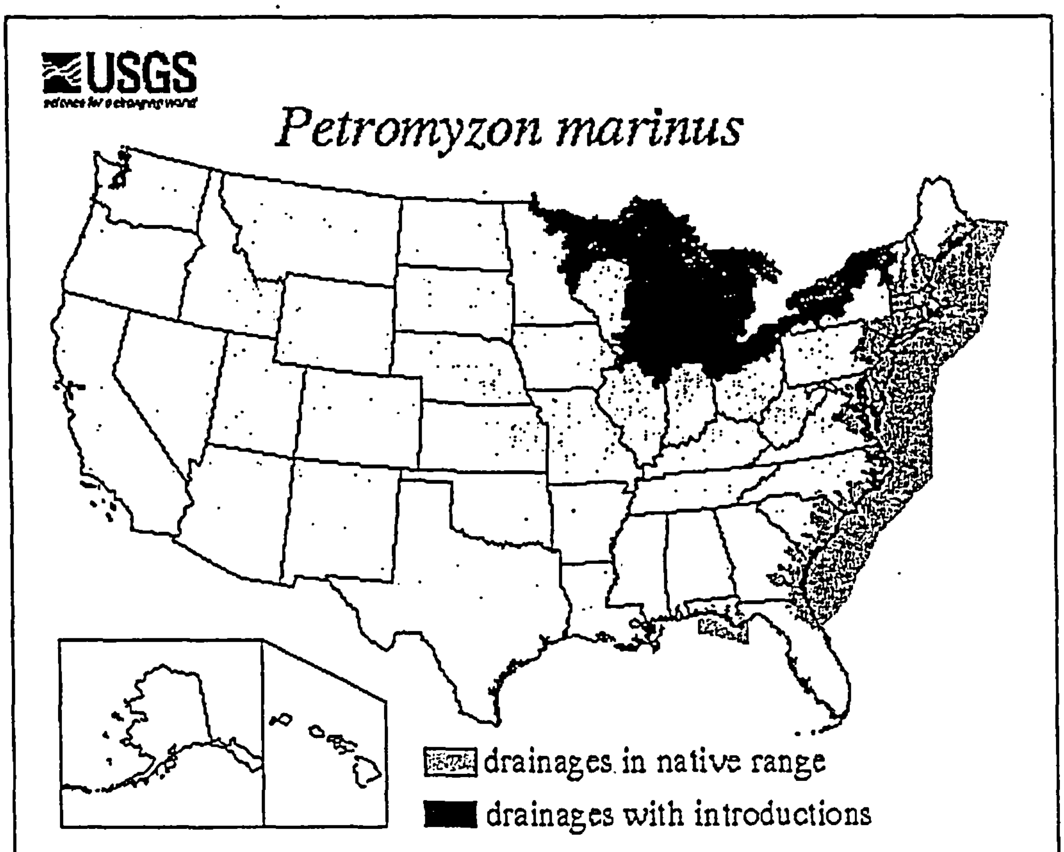
Petromyzon marinus Linnaeus 1758

Common Names: sea lamprey.

Identification: Becker (1983); Page and Burr (1991); Jenkins and Burkhead (1994); Vladykov and Kott (1980) provided a key to the ammocoetes of lampreys found in the Great Lakes region.

Native Range: Generally marine but ascends freshwater rivers to spawn. Atlantic Coast from Labrador to Gulf of Mexico, Florida; landlocked in Great Lakes and several New York lakes. Also along Atlantic coast of Europe and Mediterranean Sea (Page and Burr 1991).

Size: 120 cm anadromous; 64 cm landlocked.



Nonindigenous Occurrences: Lampreys were first discovered in Lake Ontario in 1835, Lake Erie in 1921, Lake Michigan in 1936, Lake Huron in 1937, and Lake Superior in 1946 (Applegate 1950; Lawrie 1970; Smith 1979; Smith and Tibbles 1980; Smith 1985). Its distribution in all five Great Lakes and selected tributaries includes the states **Illinois** (Smith 1979; Emery 1985); **Indiana** (Gerking 1955; Emery 1985); **Michigan** (Applegate 1950; Smith 1979); **Minnesota** (Eddy and Underhill 1974; Phillips et al. 1982; Emery 1985); **New York** (Smith 1985); **Ohio** (Trautman 1981; Emery 1985); **Pennsylvania** (Emery 1985); and **Wisconsin** (Becker 1983; Emery 1985).

Means of Introduction: First reported from Lake Ontario in the 1830s, the lamprey may have entered that lake from its native habitat in the Atlantic drainage by migrating through the Erie Canal after the canal was opened between 1819 and 1825 (Emery 1985), or by hitching rides on boats passing through the Erie and St. Lawrence canal systems (Morman et al. 1980). Previously blocked from Lake Erie and all the upper Great Lakes by Niagara Falls, the sea lamprey apparently gained access to Lake Erie from Lake Ontario via the Welland Canal. It has often been noted that the Welland Canal was originally opened in 1829, but that the sea lamprey was not reported from Lake Erie until 1921, nearly a century later (Applegate 1950). Several reasons have been put forth to explain the 92-year delay. For instance, Morman et al. (1980) indicated that the original Welland Canal was relatively small and may not have allowed sea lampreys easy negotiation; the chance of dispersal was increased with construction of the second Welland Canal, built between 1914 and 1932 for handling larger ships. Similar to its possible passage through the Erie Canal, the sea lamprey may have migrated through the Welland Canal by navigating the locks or by attaching to the hulls of upstream bound ships (Courtenay 1993). Although the available literature does not mention the possibility, lamprey also may have been transported through canals and open lakes by host fish. In the Great Lakes, there are reports of sea lampreys attaching to fish that swim long distances (Scott and Crossman 1973). Morman et al. (1980) provided a map of the Great Lakes basin showing the major waterways of possible importance in the spread of this species. Reproduction was first documented in the Lake Erie drainage in 1932 (Smith 1985). Reproducing populations were found in all of these upper lakes by 1947 (Applegate 1950; Trautman 1981). It also is conceivable that lamprey spread was facilitated because of its use as bait during the 1800s and early 1900s. For instance, several early authors reported that larval lampreys were commonly sold and used as bait in parts of New York (Adams and Hankinson 1928).

Status: Established throughout the Great Lakes region. This species was common in lakes Michigan and Huron by the 1930s and in eastern Lake Superior by the 1940s; it never became abundant in Lake Ontario (Applegate 1950; Emery 1985) or Lake Erie (Smith 1985).

Impact of Introduction: Attack and parasitic feeding on other fishes by adult lampreys often results in death of the prey, either directly from the loss of fluids and tissues or indirectly from secondary infection of the wound (Phillips et al. 1982). Of the fish that survived attacks by lampreys, 85% of various species had been attacked up to five times (Scott and Crossman 1973). The species' introduction to the Great Lakes and its later abundance, combined with water pollution and overfishing, resulted in the decline of several large native species, including several ciscoes *Coregonus* spp., lake trout *Salvelinus namaycush*, and walleye *Stizostedion vitreum*, among others. Consequently, there was a collapse in the commercial fisheries during the 1940s and 1950s in many parts of the Great Lakes, particularly in lakes Huron and Michigan, and in eastern Lake Superior (e.g., Lawrie 1970; Scott and Crossman 1973; Christie 1974; Lee et al. 1980 et seq.; Smith and Tibbles 1980; Becker 1983; Emery 1985; Courtenay 1993). Lake trout catch in Lake Huron fell from 3.4 million pounds in 1937 to virtual failure in 1947. In Lake Michigan, U.S. catch fell from 5.5 million pounds in 1946 to 402 pounds in 1953. In Lake Superior, catch dropped from an average of 4.5 million pounds to 368 thousand pounds in 1961 (Scott and Crossman 1973).

In freshwater, sea lampreys are also known to attack white sucker *Catostomus commersoni*, longnose sucker *Catostomus catostomus*, redhorse *Moxostoma* spp., yellow perch *Perca flavescens*, rainbow trout

Oncorhynchus mykiss, burbot *Lota lota*, channel catfish *Ictalurus punctatus*, northern pike *Esox lucius*, and common carp *Cyprinus carpio* (Scott and Crossman 1973). Sea lamprey predation, in combination with other factors (i.e., overfishing and hybridization with more common cisco species), led to the extinction of three endemics in the Great Lakes; the longjaw cisco *Coregonus alpenae*, the deepwater cisco *C. johannae*, and the blackfin cisco *C. nigripinnis* (Miller et al. 1989). During the late 1940s, the alewife *Alosa pseudoharengus* invaded the Great Lakes from the Atlantic Ocean. Because the sea lamprey had greatly reduced the population of large predators, alewife populations exploded and were followed by tremendous die-offs, resulting in additional changes to fish species composition in the lakes (Smith and Tibbles 1980). Sea lampreys also took a toll on the introduced salmon in the Great Lakes, much to the dismay of anglers and state fish agencies. Although the number of sea lamprey in the Great Lakes has been reduced, they still kill substantial numbers of lake trout in some areas and thus are impeding the rebuilding of established populations (Schneider et al. 1996, and references therein).

Remarks: Controversy exists as to whether the sea lamprey is native to Lake Ontario. Several believe it is native (e.g., Lawrie 1970; Smith 1985), suggesting that sea lampreys found in Lake Ontario and its tributaries, the Finger Lakes, and Lake Champlain represent relict populations from the last Pleistocene glaciation. Those contending that it is not native believe that this species, unknown in Lake Ontario to the 1830s, had most likely entered the inland lake from Atlantic coastal drainages via the artificially created Erie Canal (e.g., Emery 1985). Early methods to control this species included mechanical weirs and electrical barriers (Scott and Crossman 1973; Smith and Tibbles 1980). Beginning in the late 1950s, sea lampreys began to be successfully controlled by use of the lampricide 3-trifluoromethyl-4-nitrophenol (TFM), a chemical agent that kills larval lampreys in their stream habitats (Smith and Tibbles 1980). The lampricide has reduced the population by over 90% of the 1961 peak (Scott and Crossman 1973). As a result, commercial fisheries reportedly have shown some recovery (Smith 1985; Page and Laird 1993) and the sea lamprey's impact on native fishes has been reduced (Page and Laird 1993). However, continued use of TFM is apparently required to keep sea lamprey populations under control (Scott and Crossman 1973; Becker 1983). TFM is sometimes harmful to other fish (e.g., walleye) (Becker 1983), as well as to the larvae of nonparasitic lamprey species. Results of an international symposium on the sea lamprey were published in the Canadian Journal of Fisheries and Aquatic Sciences in 1980. The demise of lake trout led to development of the splake, a hybrid between lake trout and brook trout. It was hoped that the hybrid would better avoid lampreys and mature faster, hence spawn at least once before becoming parasitized (Scott and Crossman 1973). As of 1991, it was estimated that the U.S. and Canada were spending $8 million per year on lamprey control and another $12 million per year on lake trout restoration (Newman 1991).

References

Applegate, V. C. 1950. Natural history of the sea lamprey (*Petromyzon marinus*) in Michigan. U.S. Department of the Interior, Fish and Wildlife Service Special Scientific Report: Fisheries 55. 237 pp.

Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison, WI.

Courtenay, W. R., Jr. 1993. Biological pollution through fish introductions. Pages 35-61 *in* B. N. McKnight, editor. Biological pollution: the control and impact of invasive exotic species. Proceedings of a symposium, Indiana University-Purdue University, Indiana Academy of Science, Indianapolis, IN.

Eddy, S., and J. C. Underhill. 1974. Northern fishes, with special reference to the Upper Mississippi Valley, 3rd edition. University of Minnesota Press, Minneapolis, MN.

Emery, L. 1985. Review of fish introduced into the Great Lakes, 1819-1974. Great Lakes Fishery

Commission Technical Report, volume 45. 31 pp.

Gerking, S. D. 1955. Key to the fishes of Indiana. Investigations of Indiana Lakes and Streams 4:49-86.

Lawrie, A. H. 1970. The sea lamprey in the Great Lakes. Transactions of the American Fisheries Society 99:766-775.

Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980 et seq. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, NC.

Miller, R. R., J. D. Williams, and J. E. Williams. 1989. Extinctions of North American fishes during the past century. Fisheries 14(6):22-38.

Morman, R. H., D. W. Cuddy, and P. C. Rugen. 1980. Factors influencing the distribution of sea lamprey (*Petromyzon marinus*) in the Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences 37(11):1811-1826.

Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of The Peterson Field Guide Series, volume 42. Houghton Mifflin Company, Boston, MA.

Page, L. M., and C. A. Laird. 1993. The identification of the nonnative fishes inhabiting Illinois waters. Report prepared by Center for Biodiversity, Illinois Natural History Survey, Champaign, for Illinois Department of Conservation, Springfield. Center for Biodiversity Technical Report 1993(4). 39 pp.

Phillips, G. L., W. D. Schmid, J. C. Underhill. 1982. Fishes of the Minnesota region. University of Minnesota Press, Minneapolis, MN.

Scott, W. B., and E. J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Bulletin 184. Ottawa. 966 pp.

Smith, B. R., and J. J. Tibbles. 1980. Sea lamprey (*Petromyzon marinus*) in Lakes Huron, Michigan, and Superior: history of invasion and control, 1936-78. Canadian Journal of Fisheries and Aquatic Sciences 37(11):1780-1801.

Smith, C. L. 1985. The inland fishes of New York state. New York State Department of Environmental Conservation, Albany, NY. 522 pp.

Smith, P. W. 1979. The fishes of Illinois. University of Illinois Press, Urbana, IL.

Trautman, M. B. 1981. The fishes of Ohio. Ohio State University Press, Columbus, OH.

Vladykov, V. D., and E. Kott. 1980. Description and key to metamorphosed specimens and ammocoetes of Petromyzonidae found in the Great Lakes region. Canadian Journal of Fisheries and Aquatic Sciences 37(11):1616-1625.

Other Information

Sea Lamprey papers (Sea Grant)

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