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The Menace of the Sea Lamprey

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The problem of the sea lamprey and its potential threat to the commercial fisheries of our state, especially the lake trout, has grown alarmingly in magnitude within the past decade. Since 1936 the annual commercial catch of lake trout in the United States waters of Lake Huron has taken an unprecedented decline from 1,399,901 pounds in that year to 172,937 pounds in 1945. A slight decrease is evident in northern Lake Michigan where fishermen are beginning to report lake trout more difficult to find. This severe decline in the lake trout catch in Lake Huron has coincided with the spread and increase of the sea lamprey in the Great Lakes and has resulted in placing most of the blame for poor catches on this predator. Whether this action is justified or not is at present uncertain and will remain so until adequate study has been made of the problem.

Very real, however, is the damage the sea lampreys have done in scarring and marking the catches that are made of several of our most prized food fishes. "..... fishermen state that from seventy to ninety percent of the lake trout taken show scars of the sea lamprey, some of the spots being as much as two inches in diameter." "Commercial fishermen are agreed that perhaps as many as 30 percent of their catch are marked by lamprey." These and other reports submitted by conservation officers after a survey made in 1946 attest to the damage this exotic fish parasite may be inflicting upon our lake fisheries, particularly in the northern halves of Lakes Huron and Michigan. This same survey revealed

that lake trout seem to suffer the greatest damage with whitefish, sucker, yellow pike-perch, and carp following in that order. Lamprey-scarred fish, sold in the round, are still marketable except to local purchasers according to the reports received in 1946. However, with a return to normal times and greater freedom of buyer selection, it may prove extremely difficult to market lamprey-scarred catches at full value.

Where did this primitive fish parasite come from and how rapidly did it spread and multiply in the western Great Lakes? D. S. Shetter in a recent report^{1/} has summarized the history of its spread into our

^{1/} Shetter, David S. 1947. A brief history of the sea lamprey problem in Michigan waters. Trans. Amer. Fish. Soc., Vol. 76.

Great Lakes waters^{2/}. The sea lampreys, Petromyzon marinus, originally

^{2/} See also: Hubbs, Carl L. and T. E. B. Pope. 1937. The Spread of the Sea Lamprey through the Great Lakes. Trans. Amer. Fish. Soc., Vol. 66, 1936, pp. 172-176.

lived their adult life in salt water and when sexually mature migrated into the Atlantic coast streams to spawn. A dwarfed form of this species has been known to inhabit Lake Ontario for many years and has now become a native there. In 1921 specimens were captured off Merlin, Ontario, in western Lake Erie. Presumably, sea lampreys had entered the western Great Lakes by way of the Welland Canal. In the years that followed, sea lampreys were captured in Lake Erie near West Sister Island (1927), near

Sandusky, Ohio (1927), and near Rondeau, Ontario (1928); in the St. Clair River, Michigan (1930); in the Huron River, Michigan (1932); in Swan Creek, Ohio (1934); in Lake Michigan 15 miles East of Milwaukee, Wisconsin and near Elk Rapids, Michigan (1936); and in the Ocqueoc River, Michigan (1937). Since 1937, spawning runs were observed in the Clinton River (1938), the Au Gres River (1941), the Platte River (1943), the Ocqueoc River (1944), and the Rifle River (1944) all situated in Michigan. The survey made by Michigan conservation officers in 1946 revealed a total of 68 Michigan streams and rivers which sea lampreys were entering on their spawning migration^{3/}. Most of these streams were in the drainages

^{3/} Shetter, D. S. 1947. (op. cit.)

emptying into the northern halves of Lakes Huron and Michigan. There are undoubtedly many others draining into the Great Lakes in which the lamprey is now reproducing which have not yet been observed or reported. On February 11, 1947, Dr. John Van Oosten of the United States Fish and Wildlife Service received an immature adult sea lamprey taken from a lake trout near Isle Royale in Lake Superior. This record indicates that a spawning run of the sea lamprey was probably established in the Lake Superior drainage several years ago. With this report we now have positive proof that the sea lamprey has successfully invaded all of the Great Lakes. Its success in establishing itself in its new environment is all too apparent in the large spawning runs observed entering such streams as the Ocqueoc and Cheboygan Rivers in recent years.

The sea lamprey should not be confused with our four native species of lampreys which are either non-parasitic (Michigan and American brook

lampreys) or are not dangerously parasitic upon our commercial fish species (Lake and Chestnut lampreys). All lampreys are recognizable by their smooth, scaleless, snake-like bodies, the presence of seven gill openings on each side of the throat, a single nostril on the top of the head, and a round sucking disc instead of a mouth with true jaws. The sea lamprey when a spawning adult may be distinguished from our native species primarily by size and coloration. Adult specimens captured in the Ocqueoc River ranged from 14 to 30 inches in length. Few lampreys of our native species ever attain a length of 14 inches. Sea lampreys characteristically have, upon their backs, a strongly mottled coloration of brown or black blotches upon a gray or yellow background. They possess two separate dorsal fins. The Lake and Chestnut lampreys and the Michigan brook lamprey have a more or less continuous dorsal fin. The American brook lamprey, like the sea lamprey, has two separate fins. However, the large size and the characteristic coloration should make the sea lamprey readily identifiable.

The life history of the sea lamprey in the Great Lakes waters has not been completely worked out. Briefly, what is known or presumed from studies elsewhere may be summarized as follows: Sexually mature adults migrate from the Great Lakes into streams and rivers in the spring to spawn. Active feeding by these parasites stops when the spawning migration commences. The heaviest migration occurs during the hours of darkness. The peak of the spawning run occurs in the latter half of May and in early June when the water temperature is between 50° and 60° F., although migrants begin to enter the streams in mid-April and may still be found moving upstream in mid-July. Males predominate before the peak of the run and females after it. The lampreys travel upstream until

suitable spawning beds are found on a mixed sand, gravel and small rock bottom of rapids and riffles. Moderately fast-flowing water over a gravelly bottom just downstream from pools seems to be particularly preferred by this species. Stream bottom at depths as great as three feet may be utilized. Males and females participate in removing stones from circular areas 12 to 30 inches in diameter which are to be the nests. They transport stones with their sucker-like mouths from the nesting area to the downstream edge of the nest, and continue until a depression 3 to 6 inches deep has been created. A pair will deposit spawn in this nest at short intervals over a period as long as two to four days. There is considerable evidence that the adults deteriorate rapidly and that all die after spawning. Few egg counts have been made but one female lamprey, 20-3/4 inches long, taken from the Great Lakes was reported by Dr. Carl L. Hubbs to have contained 78,762 eggs. This figure may be somewhat below average as other reports from New York state studies indicate that they are capable of depositing more than 236,000 eggs depending on their size at maturity.

The eggs hatch in from one to three weeks and the larvae remain for about a month in the nest until they attain a length of about one-half inch. At this stage they move downstream and burrow into sand and silt banks where they probably remain for three to five years. During this time the larvae, or ammocoetes as they are called, are non-parasitic and sustain themselves on the microscopic organisms that are brought to them by the current. This larval stage may be likened to that of the tadpole whose mode of life and feeding habits are far different from those of the frog into which it develops. Just as the tadpole changes to a frog, so a metamorphosis takes place when the lamprey's larval period is

ended (they are six to eight inches long at this time) and changes come about that fit the lamprey for its adult life of parasitism. The eyes become more highly developed, the mouth becomes circular, and sharp, horny teeth appear within it, as does the file-like tongue. Glands, which secrete a substance that prevents the blood of their prey from coagulating, develop in their mouth. Thus prepared, the transformed sea lamprey leaves its silt or sand bank and migrates downstream to a lake where it begins feeding upon the blood of fish. This it accomplishes by attaching itself to the host by means of its oral sucking disc. Horny teeth within the disc, aided by the rasp-like tongue, soon penetrate the scales and into the flesh. Once the lamprey has started to draw blood from its host, the secretion of the buccal glands prevents coagulation. Feeding continues until the victim is dead or the lamprey is satisfied. How long the adult parasitic stage lasts before the lamprey becomes sexually mature is not known. Estimates by several biologists vary from one and one-half to three and one-half years^{4/}. It is not

^{4/} Gage, Simon Henry. 1928. The lampreys of New York State--Life History and Economics. Biol. Surv. of the Oswego River System, Suppl. to 17th Ann. Rept., New York State Cons. Dept., 1927, pp. 158-191.

unreasonable to assume that the complete life cycle of the sea lamprey is at least five years and may be as much as eight years in duration.

The parasitic habits of maturing adult sea lampreys and the damage they are reportedly inflicting upon the commercial fisheries have caused no little concern to the fishing industry and to conservation officials.

It was recognized early that considerable study and investigation of the lamprey problem and possible control measures were needed but these could not be prosecuted until the termination of the war. In 1946, the Conservation Commission instructed the conservation officers of the Division of Field Administration to interview commercial fishermen for information on the number of known spawning streams, the percent of marked fish taken in their catches, and the marketability of these scarred fish. Some of the findings of this survey are incorporated in this report. In the same year, Congress recognized the urgency of the problem and House Joint Resolution 366 was introduced which directed the United States Fish and Wildlife Service to investigate the sea lamprey problem preparatory to devising the effecting control measures. Funds to subsidize this project were authorized, but no appropriation has yet been made. This resolution was passed by both houses and signed by the President. As a result of this action by Congress, conservation officials from the Great Lakes states and from the Province of Ontario were invited to meet with the Fish and Wildlife Service to form a cooperative program for investigating the sea lamprey problem and devising methods for its control.

Michigan's share of this program of investigation and experimentation is designed to provide the basic information needed in any program of management for control. It must be emphasized that eradication of the sea lamprey from the Great Lakes is impossible, but with a good knowledge of the size and distribution of its spawning populations and a detailed knowledge of its life history, its habits and preferences, effective control measures may be developed. It may be pointed out

here that entomologists do not hope to exterminate most species of harmful insects, and that their efforts are mainly directed toward controlling the numbers to the point where a minimum of damage occurs.

First on the program for this year is a thorough inventory of sea lamprey spawning streams. To obtain an estimate of the cost and practicality of proposed controls we must know the magnitude and distribution of the spawning runs. This spring, sportsmen and other interested groups are asked to report the location of sea lamprey runs observed by them to their local conservation officer, nearest State Fish Hatchery, District Fisheries Biologist, or in writing to the Fish Division of the Conservation Department, Lansing. As far as possible these runs will be checked by the officers or the District Fish Biologists and their size estimated and reported upon to the Department.

In addition to the inventory of spawning streams, studies will be conducted of the lamprey's life history both in streams and in lakes. These studies will include the installation by the U. S. Fish and Wildlife Service (if funds become available) of a permanent weir on the Ocqueoc River in Presque Isle County and the blocking and capture of an entire run in that river. A blocking weir was operated in the Ocqueoc River during the spawning runs in 1944 and 1945 under a cooperative plan between the East Presque Isle County Sportsman's Club and the Department of Conservation. Although the weirs built in those years did not block the migrant lampreys completely, some valuable information was obtained. Until the permanent structure can be built the old weir, replaced in improved forms will be operated by Department personnel with the cooperation of this same sportsmans club.

A survey is being made of the extent of the damage that is being done to our commercial fisheries. Michigan commercial fishermen have been provided with forms on which they may indicate the proportion of their catch bearing lamprey scars. These forms will be submitted with their monthly catch reports until such time as the latter report is reprinted to include space for this information. Field checks of the commercial catch to further assess lamprey damage are also planned.

Investigations to be carried on by the other Great Lakes states follow a pattern similar to ours but are designed to eliminate any unnecessary duplication of work. The Fish and Wildlife Service will study the vitamin D potency of the lamprey and investigate other methods of utilization. Michigan State College will study the Vitamin B content and other food values inherent in the lamprey, its palatability, and possible marketing as food.

These proposed programs of study reflect the realization on the part of the representatives at the sea lamprey conferences that we can never drive the sea lamprey from the Great Lakes. Inherent in their program, however, is a thorough appreciation of the damage the sea lamprey can and may do to our fishing industries and of the need for developing control measures that will reduce or limit the numbers of this pest. The problem is a tremendous one, complicated by the possibility of continual additions to the population from Lake Ontario via the Welland Canal and by the prohibitive cost of all control measures and devices that have been suggested to date. The program will not be concluded in one year or two years or any such short period of time, for much basic knowledge of the sea lamprey and its habits needed for control, is still to be discovered. Furthermore, the efficiency of the initial and most elementary efforts at control may not be apparent for as many as eight years if the sea lamprey's life cycle spans that many years. Regardless

of these obstacles, Michigan has entered upon an active long-range program of investigation and in cooperation with the neighboring Great Lakes states, the Province of Ontario, and the Fish and Wildlife Service it is hoped that methods of exercising some control over the numbers of the sea lamprey in the Great Lakes may be developed.

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Figures which correspond to the following for this report can be seen in MICHIGAN CONSERVATION, May, 1947 (Vol. XVI, No. 4, p 6,7, & 10). (Also reprint 147 of the I. F. R. -- unavailable for distribution.)

Figure 1.--Female sea lamprey, 20-3/4 inches long, showing the characteristically mottled back of a sexually mature adult. Note also the two separate dorsal fins of this species.

Figure 2.--The head of a sea lamprey showing the oral sucking disc with which it attaches itself to its prey and the sharply pointed teeth which rasp through the scales and into the flesh of its victim.

Figure 3.--American Brook lampreys spawning.

Figure 4.--Three adult sea lampreys and a lake trout showing a typical lamprey scar on its side just behind the dorsal fin.