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LAMPREYS IN THE UPPER MANISTEE RIVER, MICHIGAN

By Walter R. Crowe

Introduction

For many years the presence of the chestnut lamprey (Ichthyomyzon castaneus) in the Upper Manistee River has been a source of concern and irritation to anglers. Native parasitic lampreys occur in other waters of the state, but the Manistee River in Crawford and Kalkaska counties is one of the few places where they are numerous enough to worry anglers. Investigations made by the Institute for Fisheries Research in 1939 (I.F.R. Report No. 548) and 1943 (I.F.R. Report No. 931) showed that the chestnut lamprey was in fact fairly abundant, and that trout with lampreys attached, or with fresh scars, were frequently captured. The earlier investigations gave some indication that the chestnut lamprey's abundance fluctuated; the animal was more abundant in some years than in others. Lampreys (parasitic and non-parasitic) have always been a part of the river's fish population; presumably they were there before the trout, and there is little likelihood that the chestnut lamprey will eliminate the trout. From an aesthetic point of view, however, the catching of trout with lampreys attached, or with ugly scars, is unpleasant and such trout seem inferior.

Several methods of control have been suggested, including the planting of many large brown trout in the hope that they would eat the lampreys; collecting and destroying ammocoetes from the muck beds along the stream edges or in mid-channel; dredging to remove muck beds; and the construction of weirs to trap migrating lampreys. These ideas offer little promise.

The U. S. Fish and Wildlife Service, in connection with the sea lamprey control program in the Great Lakes, has recently developed specific toxicants which, at certain concentrations, are lethal to lampreys and do not harm other fishes. If the sea lamprey can be controlled with these chemicals (as now seems likely), presumably the compounds would work equally well in the control of lampreys in the Upper Manistee River. (We do not know if any harm might result from elimination of the non-parasitic brook lampreys but it does not seem probable.) The development of toxic chemicals made it advisable to conduct an inventory to learn, if possible, the distribution and abundance of the chestnut lamprey in the Upper Manistee River system. The inventory was made on September 16-25, 1958.

Methods

Collections were made with a direct-current shocker. All lampreys, and most of the fish collected were preserved. Scale samples were taken from large fish before release. Two parties,[1] each composed of 3 men, made collections at 30 stations between the headwaters in Otsego County (T. 29 N., R. 4 W., Sec. 18) and a point a few miles above the Hodenpyle backwater in Wexford County (T. 23 N., R. 11 W., Sec. 3). A stream survey card and a fish collection record were filled out for each station.[2] The shocker was operated at each station for one hour unless log jams, shallow water, narrow channels, etc. made it impractical. At such stations the shocker was operated for shorter periods of time. At some stations the shocker was used for only 1/2 hour because of the uniform nature of the stream. Collecting was mainly qualitative rather than quantitative, and special effort was devoted to areas

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[1] L. N. Allison, E. H. Andersen, W. R. Crowe, J. R. Hammond, Arnold Hubbell, D. McPhee, D. R. Peterson.

[2] Stream survey cards and fish collection records are on file at the Institute for Fisheries Research.

thought to be good lamprey habitat. Stations were chosen at access points along the stream, and distance between stations was mostly over a mile. Station locations are shown on the accompanying map (Figure 1).

Results

In the field it was noted that the collections contained three species of lampreys: chestnut lamprey (Ichthyomyzon castaneus), northern brook lamprey (Ichthyomyzon fossor), and American brook lamprey (Lampetra lamottei). The presence of the three species was certain because adults or completely transformed specimens of each species were secured. Most of the lampreys in the collections were larvae, or ammocoetes (untransformed individuals). Positive identification of all specimens was desirable so that the distribution of the chestnut lamprey could be determined.

Ammocoetes of the American brook lamprey were distinguished from Ichthyomyzon ammocoetes on the basis of a divided dorsal fin and the number of myomeres or muscle bands (64-70 between anus and posterior gill opening). This species was more abundant than either of the other species and occurred in 27 of the 30 collections.

Ammocoetes of Ichthyomyzon have single, undivided dorsal fins and fewer myomeres (49-58). Separation of the ammocoetes of the chestnut lamprey from those of the northern brook lamprey presented a more difficult problem. Adults and/or fully transformed individuals of one or both species were present in several collections. Careful examination of recently transformed individuals revealed certain differences in pigmentation between castaneus and fossor. These differences could also be observed in ammocoetes. Differences which were used to separate the two species are given below:[3]

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[3] Dr. R. M. Bailey, who also examined many of the lampreys, agreed that the differences were probably valid.

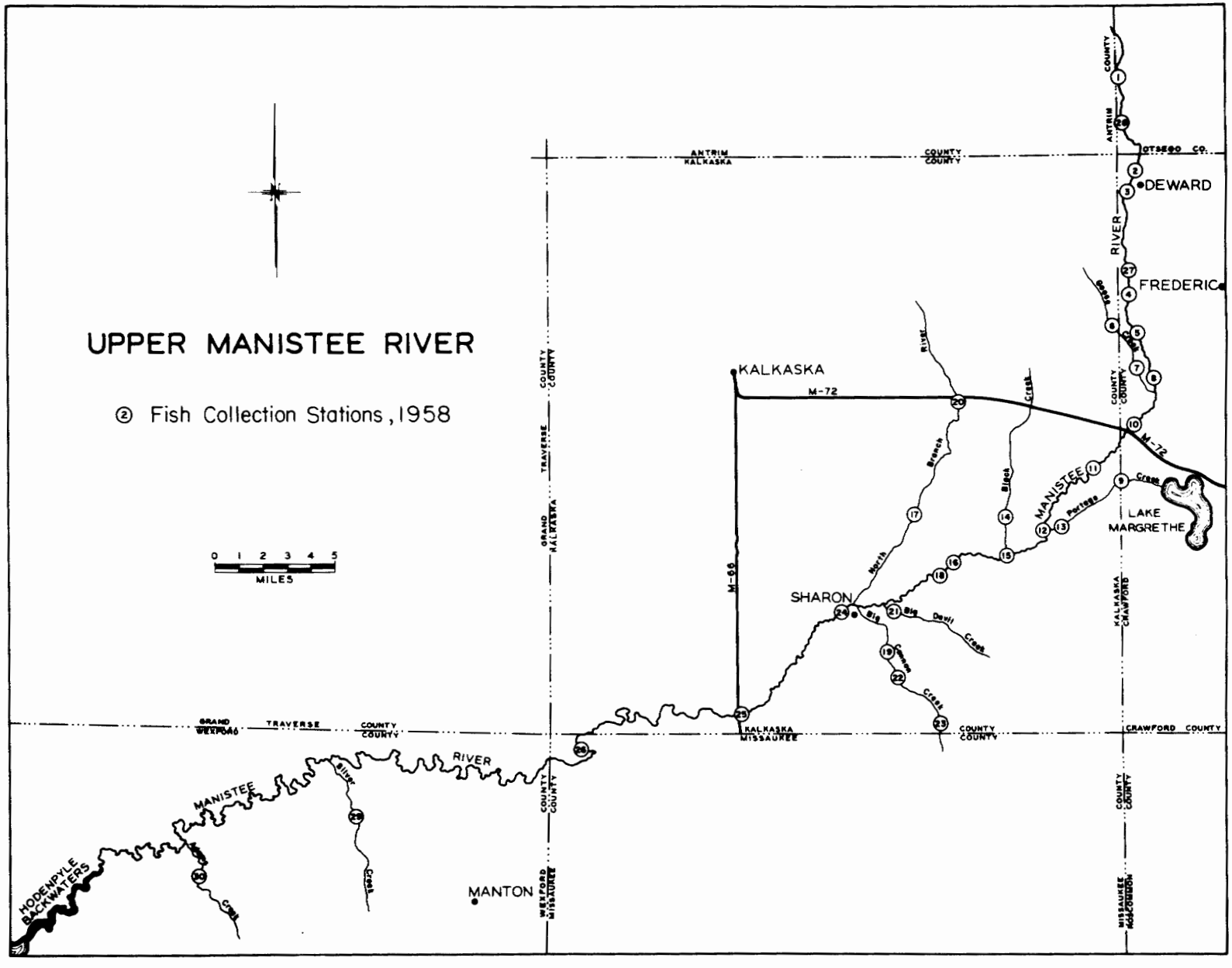

UPPER MANISTEE RIVER
② Fish Collection Stations, 1958
0 1 2 3 4 5
MILES
KALKASKA
M-72
DEWARD
FREDERIC
LAKE MARGRETHE
SHARON
MANTON
M-66
MANISTEE RIVER
HODENPYLE BACKWATERS
ANTRIM COUNTY
KALKASKA COUNTY
TRAVERSE COUNTY
GRAND TRAVERSE COUNTY
CRAWFORD COUNTY
OTSEGO CO.

Figure 1

Northern brook lamprey (Ichthyomyzon fossor)

1. Pigment in tail region dense and usually concentrated near the fin base; outer margin of fin often pale and lacking pigment. Even when most of the fin is pigmented, the pigment is dense and has a blotchy appearance (Figure 2).
2. Lateral line organs (dorsal, lateral, ventral) are unpigmented. These sensory organs, since they are not pigmented, are difficult to see even under high magnification and good light. When visible they appear as small unpigmented pores. In small specimens these sensory organs are seldom visible.
3. General coloration on ventral surface rather pale, not evenly pigmented. General coloration most useful in identifying larger specimens.
4. Myomere count nearly always 50-52 (extremes 47-56). The count is useful only to help confirm identification based on other characters.

Chestnut lamprey (Ichthyomyzon castaneus)

1. Pigment in tail region sparse and diffuse (usually spread over most of the fin); unpigmented area usually confined to a narrow band at the margin. The pigment on dark (heavily pigmented) specimens seldom blotchy.
2. Lateral line organs (dorsal, lateral, ventral) are pigmented. On larger specimens the sensory organs appear as black specks, visible even without magnification (Figure 3).
3. General color dark. Ventral surface rather evenly pigmented. Color useful in identifying larger specimens.

Figure 2.--Pigmentation on tail of larval lampreys

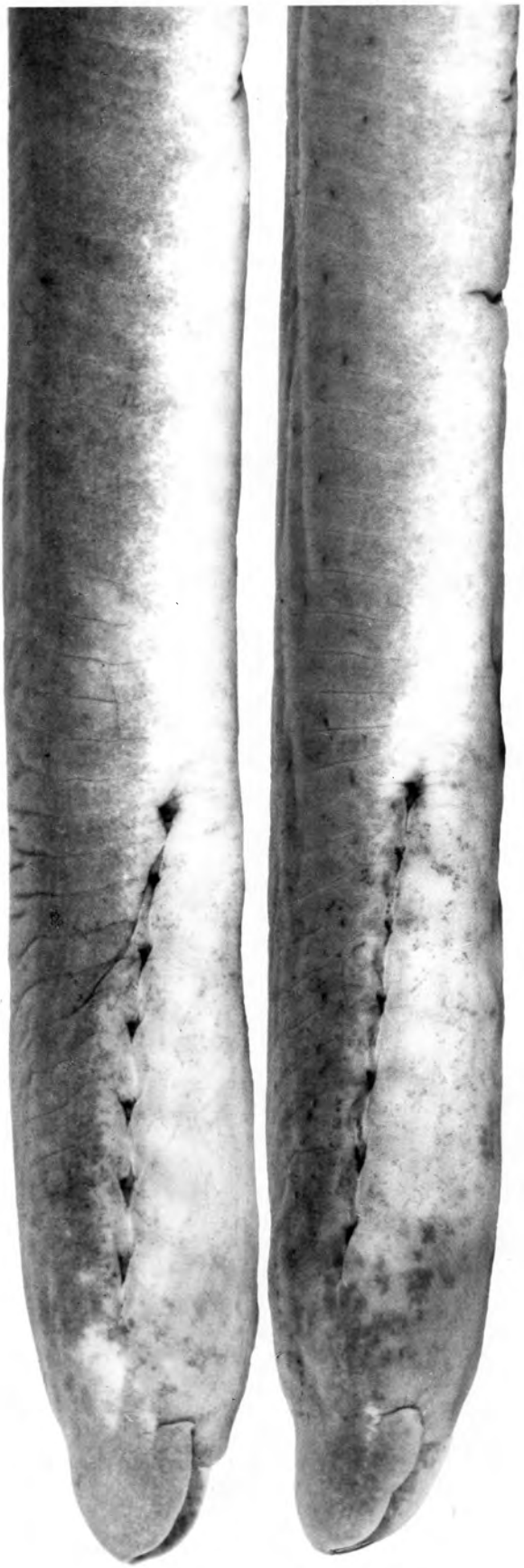
Upper--Ichthyomyzon fossor

Lower--Ichthyomyzon castaneus

Figure 3.--Pigmentation of lateral line organs, larval lampreys

Upper--*Ichthyomyzon fossor*

Lower--*Ichthyomyzon castaneus*



4. Myomere count nearly always 51-54 (extremes 47-56). The two species, fossor and castaneus, cannot be separated by myomere count, but the average difference is of some help as a confirmation of other differences.

Fish and lampreys in the collections were identified in the laboratory. Table 1 lists the locations of the stations shown in Figure 1. Species and numbers of lampreys collected are shown in Table 2 and a list of all fish collected by electrofishing during the survey is given in Table 3. Lampreys were collected at all stations except stations 6 (Goose Creek) and 14 (Black Creek). The American brook lamprey was most numerous in the collections and occurred at 27 of the 30 stations; it was the only species of lamprey collected at 12 stations.

The chestnut lamprey was found at 15 stations (always associated with one or both of the brook lampreys); it occurred most frequently in collections from the main stream between stations 3 and 24 (between Deward and Sharon), and was especially abundant between Station 10 (M-72 bridge) and Station 18 (about midway between Riverview and Sharon). All of the chestnut lampreys were collected in the main stream except for single small specimens from Portage Creek (Station 13) and the North Branch of the Manistee River (Station 17). (Since no adult Ichthyomyzon were obtained at these two stations, identification may be questioned.)

The northern brook lamprey was present at 10 stations. It was associated with both other species except at Station 9 (Portage Creek), where it alone was collected. All other collections of northern brook lampreys came from the main stream, except for a single small specimen secured at Station 13 (Portage Creek, a short distance above its junction with the Manistee River).

Table 1.--Location of stations at which fish collections were made in the Upper Manistee River, September 16-25, 1958

Station number[1]	Stream	County	Town	Range	Section
1	Manistee River	Otsego	29 N.	4 W.	18
28	" "	"	29 N.	4 W.	30
2	" "	Crawford	28 N.	4 W.	6
3	" "	"	28 N.	4 W.	7
27	" "	"	28 N.	4 W.	30
4	" "	"	28 N.	4 W.	31
5	" "	"	27 N.	4 W.	7
8	" "	"	27 N.	4 W.	20
6	Goose Creek	Kalkaska	27 N.	3 W.	12
7	" "	Crawford	27 N.	4 W.	18
10	Manistee River	"	27 N.	4 W.	31
11	" "	Kalkaska	26 N.	5 W.	2
12	" "	"	26 N.	5 W.	21
9	Portage Creek	Crawford	26 N.	4 W.	7
13	" "	Kalkaska	26 N.	5 W.	22
15	Manistee River	"	26 N.	5 W.	29
14	Black Creek	"	26 N.	5 W.	20
16	Manistee River	"	26 N.	6 W.	25
18	" "	"	26 N.	6 W.	35
21	Big Devil Creek	"	25 N.	6 W.	4
23	Cannon Creek	"	25 N.	6 W.	35
22	" "	"	25 N.	6 W.	21
19	" "	"	25 N.	6 W.	16
20	Manistee River, North Branch	"	27 N.	6 W.	24, 25
17	Manistee River, North Branch	"	26 N.	4 W.	15
24	Manistee River	"	25 N.	6 W.	8
25	" "	"	25 N.	7 W.	33
26	" "	Missaukee	24 N.	8 W.	5
29	Silver Creek	Wexford	24 N.	10 W.	23
30	Adams Creek	"	23 N.	11 W.	3

[1] Stations are listed in general downstream sequence in the stream system (See Fig. 1).

Table 2.--Number of lampreys collected at 30 stations in the Upper Manistee River System, September 16-25, 1958

(A = adult, or fully transformed; a = ammocoete)

Station number[1]	Species					
	Ichthyomyzon				Lampetra	
	castaneus		fossor		lamottei	
	A	a	A	a	A	a
1	...	...	...	...	3	63
28	...	...	...	...	1	42
2	...	...	...	...	2	5
3	2	...	...	...	1	48
27	1	...	...	...	...	22
4	...	...	...	...	4	64
5	...	5	...	...	...	128
8	1	1	...	...	...	5
6	...	...	...	...	...	...
7	...	...	...	...	...	2
10	6	11	...	7	2	128
11	1	65	1	35	1	165
12	5	17	1	21	...	58
9	...	...	1	15	...	...
13	...	1	...	1	2	12
15	2	17	...	19	1	90
14	...	...	...	...	...	...
16	1	2	...	2	1	24
18	9	25	2	11	5	108
21	...	...	...	...	...	4
23	...	...	...	...	1	1
22	...	...	...	...	...	3
19	...	...	...	...	1	42
20	...	...	...	...	...	13
17	...	1	...	...	...	50
24	...	3	...	5	3	80
25	1	1	...	2	11	39
26	...	1	...	...	4	61
29	...	...	...	...	...	6
30	...	...	...	...	...	3
Total	29	150	5	118	43	1,266

[1] Stations are listed in general downstream sequence in the stream system (see Fig. 1).

Table 3.--Fish collected at 30 stations in the Upper Manistee River System, September 16-25, 1958

Species[1]	Station number																														Frequency of occurrence in collections
	1	28	2	3	27	4	5	8	6	7	10	11	12	9	13	15	14	16	18	21	23	22	19	20	17	24	25	26	29	30	
Northern brook lamprey											X	X	X	X	X	X		X	X							X	X				10
Chestnut lamprey				X	X		X	X			X	X	X		X	X		X	X						X	X	X	X			15
American brook lamprey	X	X	X	X	X	X	X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	27
Brown trout	X	X	X	X		X	X	X			X											X	X			X			X	X	13
Rainbow trout							X	X				X	X					X	X	X		X	X	X		X	X		X	X	14
Brook trout	X	X	X	X	X	X	X	X	X	X	X	X			X			X	X	X	X	X	X	X	X		X	X		X	24
Mudminnow					X	X	X					X													X						5
White sucker	X			X	X	X	X	X			X			X	X	X	X		X	X					X	X	X	X			17
Creek chub	X				X	X	X	X			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X	23
Creek chub x common shiner								X									X														2
Pearl dace					X	X															X				X						4
Finescale dace																									X						1
Redbelly dace							X	X						X							X		X	X							6
Blacknose dace				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			23
Longnose dace							X	X			X	X				X										X			X		7
Common shiner						X		X					X	X	X		X						X		X	X	X				10
Mimic shiner															X																1
Blacknose shiner																								X							1
Brassy minnow																									X						1
Bluntnose minnow								X						X	X																3
Black bullhead																					X										1
Burbot					X						X				X		X			X		X			X						7
Pumpkinseed																					X		X								2
Blackside darter																											X	X			2
Logperch								X			X	X				X			X						X	X	X	X			9
Johnny darter							X	X			X	X	X	X	X	X		X	X						X	X	X	X			14
Mottled sculpin	X	X	X	X		X	X	X	X	X	X	X	X		X	X		X	X	X			X	X	X	X	X	X			23
Slimy sculpin	X	X	X	X		X	X			X		X			X	X				X		X	X					X	X	X	16
Brook stickleback			X		X	X	X	X																							5
Ninespine stickleback							X			X																					2
Number of species (30)	7	5	6	8	9	12	16	17	3	6	13	13	9	8	14	11	6	9	11	9	8	6	11	8	15	13	13	11	5	6	

[1] For scientific names of fish in this list, see Fish Division Pamphlet No. 22.

Trout and other fish collected were examined for lamprey scars. Relatively few large trout (7 inches or longer) were caught because most of the effort at the different stations was expended in areas where lampreys would be expected. Operation in such shallow-water areas was emphasized both because our primary objective was to learn as much as possible about lamprey distribution and abundance and because the Manistee is a big stream and the shocker could not be operated efficiently in the deep water. Collections were therefore qualitative rather than quantitative and, although many trout were captured, most were small fish from shallow water. Scars were not observed on small trout and usually only on fish more than 8 inches long. Scarred fish were observed at two stations (4, 6) where no chestnut lampreys were caught. Two scars were observed on each of two large brown trout. The amount of scarring among the larger trout (longer than 7 inches) is summarized below (the records include 29 rainbow trout caught by angling on September 24, in addition to the trout collected by shocker):

Species	Number of fish	Number scarred	Percentage scarred
Brook trout	113	4	3.5
Brown trout	58	5	8.6
Rainbow trout	51	8	15.7
Total	222	17	7.7

Ammocoetes and recently transformed individuals of all three species of lampreys were found in similar habitats. Lampreys were seldom collected from "dead" water, although considerable effort was expended in collecting in backwaters, and other quiet areas. Few lampreys were collected from sand in mid channel, or from rubble, hardpan, or gravel bottom. Most lampreys were found

along the stream edge, in areas of moderate current,[4] and where bottom materials were fairly soft (largely a mixture of sand and organic detritus). In some areas the stream bottom in mid channel had submerged hummocks composed of a mixture of sand, muck, and marl. These hummocks usually supported a moderate amount of bottom vegetation. Such areas also produced many lampreys. Few lampreys were collected in areas where gravel was absent, even when habitat appeared otherwise suitable.

Recommendations

We do not know how seriously the chestnut lamprey has affected the trout population of the Manistee River. Neither do we know if destruction of the lamprey population would have an adverse effect on the fish population of the river, but it is unlikely.

There are several possible courses of action. Experiments in hatchery ponds or aquaria could be conducted to determine whether the chestnut lamprey kills trout. Results of such experiments would help to determine the necessity of trying to eliminate lampreys from the river. Before attempting treatment of the river it would be best to wait to observe further the use of the toxicant in controlling the sea lamprey in streams tributary to the Great Lakes. The difference in habits between the migratory sea lamprey and the native lampreys raises an important question. If sea lamprey spawners are prevented from entering a stream and most of the sea lamprey ammocoetes are killed by chemical treatment, control should be permanent, so long as no spawning sea lampreys enter the stream. For native lampreys, effectiveness of the chemical treatment might be of short duration, because of recruitment

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[4] It is important to note that some current was present in areas where ammocoetes were found. Presumably the toxicant (if used) would be distributed by the current. Since ammocoetes apparently live where current is present they would be readily vulnerable to the chemical.

to the treated section by lampreys from above or below. If chemical control seems indicated, sufficient toxicant should be introduced at Deward to eliminate lampreys as far downstream as Sharon. This would be an expensive undertaking at the present market prices of the chemicals being used for lamprey control.

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