Great Lakes Fishery Commission

History, Program, and Progress

by

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GREAT LAKES FISHERY COMMISSION
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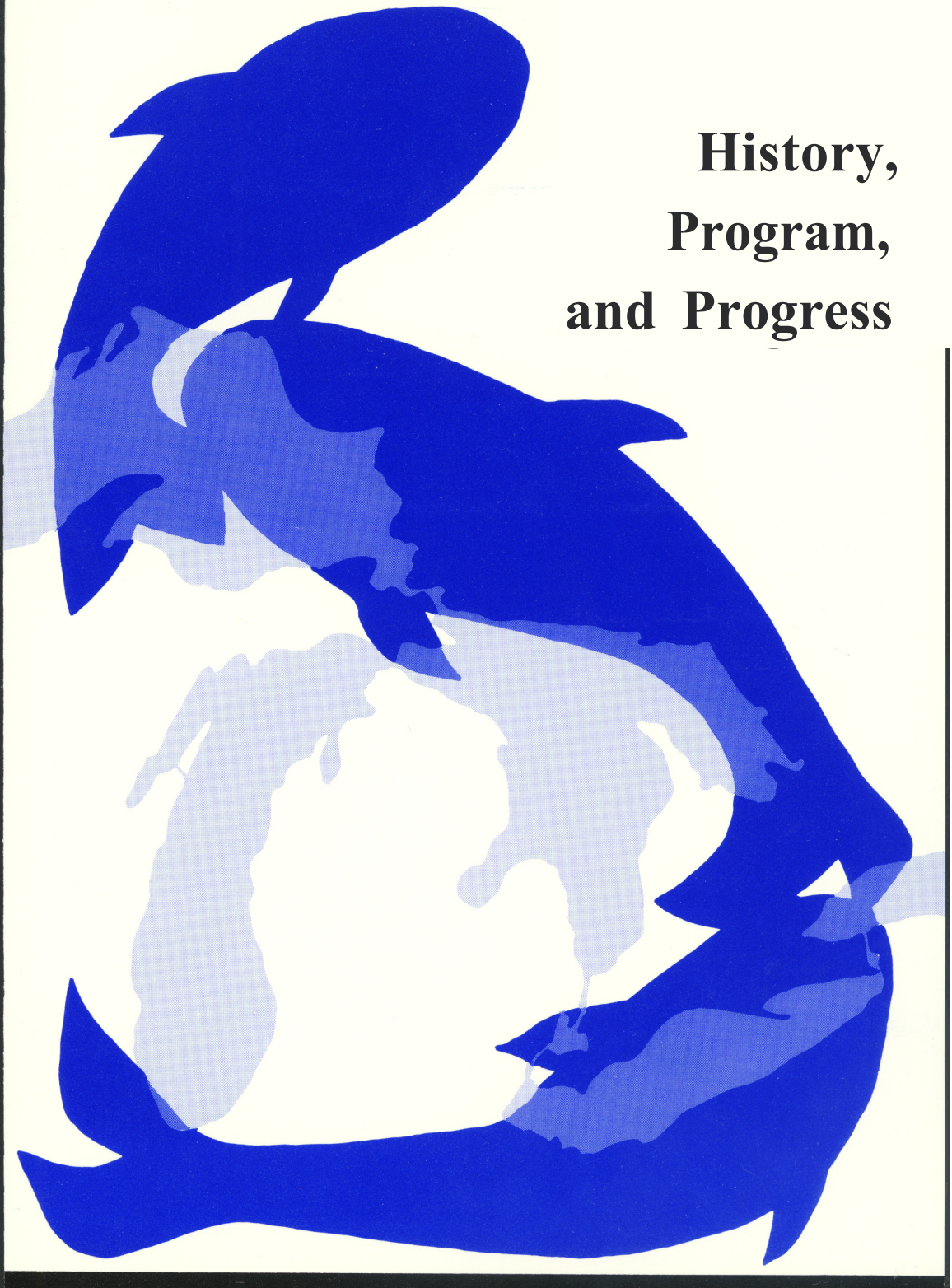
The Great Lakes Fishery Commission was established by the Convention on Great Lakes Fisheries, between Canada and the United States, ratified on October 11, 1955. It was organized in April, 1956 and assumed its duties as set forth in the Convention on July 1, 1956. The Commission has two major responsibilities: the first, to develop co-ordinated programs of research in the Great Lakes and, on the basis of the findings, recommend measures which will permit the maximum sustained productivity of stocks of fish of common concern; the second, to formulate and implement a program to eradicate or minimize sea lamprey populations in the Great Lakes. The Commission is also required to publish or authorize the publication of scientific or other information obtained in the performance of its duties.

History, Program, and Progress



Great Lakes Fishery Commission

History, Program, and Progress

THE NEED for cooperation between the United States and Canada in the solution of problems confronting the fisheries of the Great Lakes has been recognized for many years, Over the past century, several attempts to negotiate a fishery treaty have been made; in 1946 the two countries signed such a treaty, but it was not ratified because of opposition to a provision that would have vested regulatory powers in an international commission.

Renewed interest in the development of an acceptable treaty was stimulated by the invasion of the upper Great Lakes by the parasitic sea lamprey.

This marine invader reached New York's Finger Lakes and Lake Ontario many years ago. The completion of the Welland Canal, in 1829, enabled the sea lamprey to bypass Niagara Falls. Its presence in Lake Erie was recorded in 1921; by the mid 1930's the animal had reached Lakes Huron and Michigan; and by the 1940's it was firmly established in Lake Superior. Its entry into these upper Great Lakes was disastrous.

During a series of meetings in 1952-54, delegates drafted a new Convention on Great Lakes Fisheries between the United States of America and Canada (Contracting Parties), which was signed by representatives of the two countries at Washington, D.C., on September 10, 1954. Instruments of ratification were exchanged at Ottawa, Ontario, Canada on October 11, 1955, on which date the Convention became effective.

The Convention defined the geographic area of concern [1], provided for the establishment of a joint commission to be

1 Lake Ontario (including the St. Lawrence River from Lake Ontario to the forty-fifth parallel of latitude), Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and their connecting waters, hereinafter referred to as "the Convention Area."

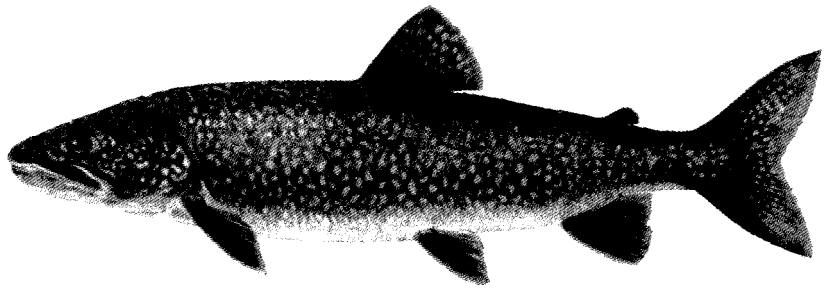


Figure 1. The lake trout *(Salvelinus namaycush)*

Table 1. Summary of requests, allotments, and, expenditures, Great Lakes Fishery Commission, 1958-75 (U. S. Dollars).

Fiscal Year	Request	Allotments			Expenditures		
		U.S.	Canada	Total	Administration	Sea lamprey control	Total
1958	$1,417,197	$914,300	$424,500	$1,338,800	$43,400	$1,288,800	$1,332,200
1959	1,464,749	919,000	426,400	1,345,400	43,900	1,295,300	1,339,200
1960	1,541,700	946,300	438,900	1,385,200	35,800	1,335,200	1,370,500
1961	1,427,200	967,300	437,800	1,405,100	38,200	1,357,500	1,395,700
1962	1,414,500	967,300	447,200	1,414,500	39,900	1,366,000	1,405,900
1963	1,413,400	919,000	425,200	1,344,200	40,800	1,299,600	1,340,400
1964	1,542,200	1,030,700	475,500	1,506,200	41,600	1,458,400	1,500,000
1965	1,673,100	1,030,700	476,600	1,507,300	44,000	1,454,900	1,498,900
1966	1,616,600	1,056,000	488,300	1,544,300	50,600	1,489,100	1,539,700
1967	1,660,300	1,057,000	490,000	1,547,000	57,300	1,488,300	1,545,600
1968	1,841,700	1,001,800	465,600	1,467,400	56,300	1,411,100	1,467,400
1969	1,879,100	1,158,300	502,100	1,660,400	60,000	1,600,400	1,660,400
1970	1,898,100	1,330,600	617,000	1,947,600	68,600	1,879,000	1,947,600
1971	2,540,500	1,388,000	642,400	2,030,400	68,100	1,962,300	2,030,400
1972	2,612,900	1,827,000	835,700	2,662,700	76,900	2,585,800	2,662,700
1973	2,706,600	1,900,100	874,600	2,774,700	84,700	2,690,000	2,774,700
1974	3,346,320	1,972,000	913,900	2,886,000	101,500	2,784,400	2,886,000
19751	3,732,550	2,242,000	1,037,070	3,279,070	110,500	3,104,800	3,215,300

1 Values far 1975 are estimates

known as the Great Lakes Fishery Commission, and prescribed the Commission's duties.

The Commission is composed of Canadian and United States sections, each served by four Commissioners appointed by their respective governments. A Secretariat, appointed by the Commission, assists the Commission in carrying out its duties.

The Commission was charged with developing and coordinating fishery research programs, advising governments on measures to improve the fisheries, and developing and implementing measures to control the sea lamprey. The Convention specified that in the performance of its duties the Commission should, to the greatest extent possible, work through official agencies of the Contracting Parties and their States and the Province of Ontario. Consequently, the Commission relies on numerous individuals and groups from those agencies in the conduct of its business. The Commission's program is divided into two major segments: (1) sea lamprey control, and (2) coordination of fisheries research and management,

FUNDING OF THE COMMISSION

The Commission is funded through the Department of External Affairs[2] in Canada and by legislative appropriation to the Department of State in the United States. The cost of sea lamprey control and research is shared on a 69:31 ratio between the United States and Canada; cost of administration and general research is shared equally. The 69:31 ratio was established on the basis of average annual commercial catches of lake trout in the United States and Canada before the invasion of the sea lamprey into the Great Lakes. Table 1 lists requests, allotments, and expenditures of the Commission since its establishment.

2 Funds provided by the Department of the Environment.

To the present, nearly all Commission funds (Table 1) have been used in the sea lamprey control program, and it appears to be necessary to continue to commit such funds to maintain control. Additional funds will be required for work other than sea lamprey control.

SEA LAMPREY CONTROL METHODS

By the mid 1940's, when fisheries agencies recognized the imperative need for a coordinated program to control the sea lamprey, this parasite had already severely damaged stocks of fish throughout the upper Great Lakes-especially the lake trout. Efforts to control the sea lamprey were initiated as early as 1948, following the establishment of a Great Lakes Sea Lamprey Committee composed of representatives from each of the Great Lakes states, the Province of Ontario, the U. S. Fish and Wildlife Service, and the Canadian Department of Fisheries. Control efforts between 1948 and 1955 were somewhat uncoordinated and experimental, partly because of the multiplicity of agencies involved and also because no assured source of funds was yet established. Initial control efforts were pursued mainly by the U. S. Fish and Wildlife Service in United States waters and by the Ontario Department of Lands and Forests in Canadian waters. During these early years much basic information required to plan and implement a control program was obtained. Important investigations being pursued at the time of the Commission's establishment included: life history and distribution of sea lampreys in the Great Lakes: development and testing of barriers in streams; and screening of chemicals in search of a toxicant that would selectively destroy sea lamprey larvae. These programs were continued, coordinated, and refined under Commission auspices after 1955.

When the Commission assumed responsibility for the sea

Table 2. Numbers of streams and numbers of sea lamprey-producing streams tributary to the Great Lakes.

Lake Province state	Number of Tributaries	Number with Sea lampreys
Lake Superior		
Ontario	690	44
Minnesota	218	3
Wisconsin	287	12
Michigan	475	66
Subtotal	1,670	125
Lake Michigan		
Michigan	380	94
Wisconsin	243	13
Illinois	37	- -
Indiana	6	3
Subtotal	666	110
Lake Huron		
Ontario	1,318	49
Michigan	674	59
Subtotal	1,992	108
Lake St. Clair		
Ontario	23	1
Michigan	22	- -
Subtotal	45	1
Lake Erie		
Ontario	174	6
Michigan	28	- -
Ohio	194	3
Pennsylvania	55	2
New York	143	1
Subtotal	594	12
Lake Ontario		
Ontario	371	23
New York	409	21
Subtotal	780	44
All Lakes		
Ontario	2,576	123
All States	3,171	277
TOTAL	5,747	400

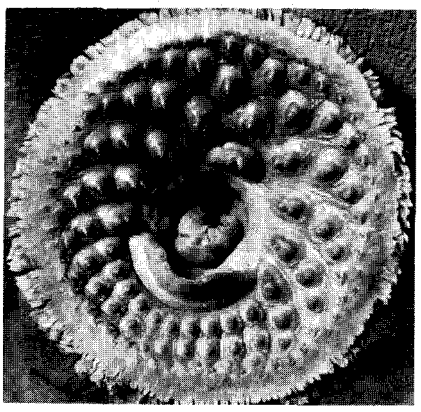
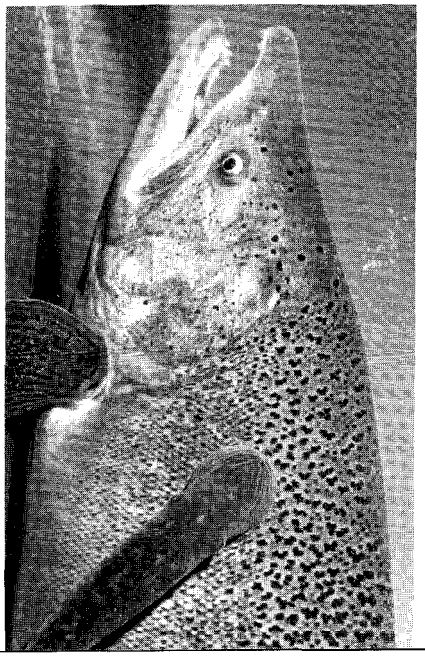


Figure 2. The sea lamprey's mouth is lined with horney teeth surrounding a rasping tongue.

Figure 3. Chinook salmon with sea lamprey attached. (Photo courtesy of Michigan Department of Natural Resources.)



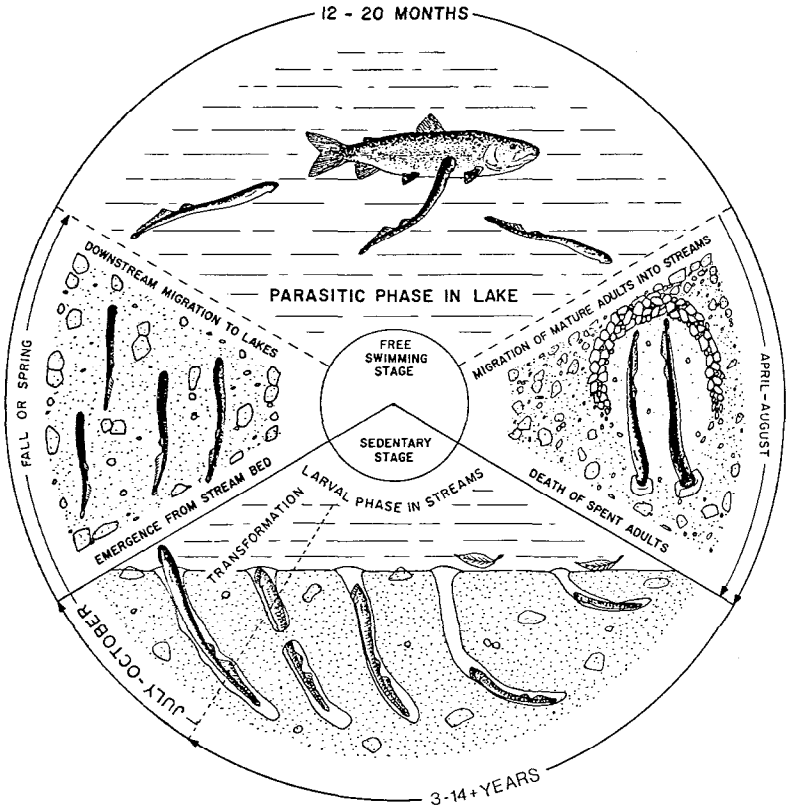
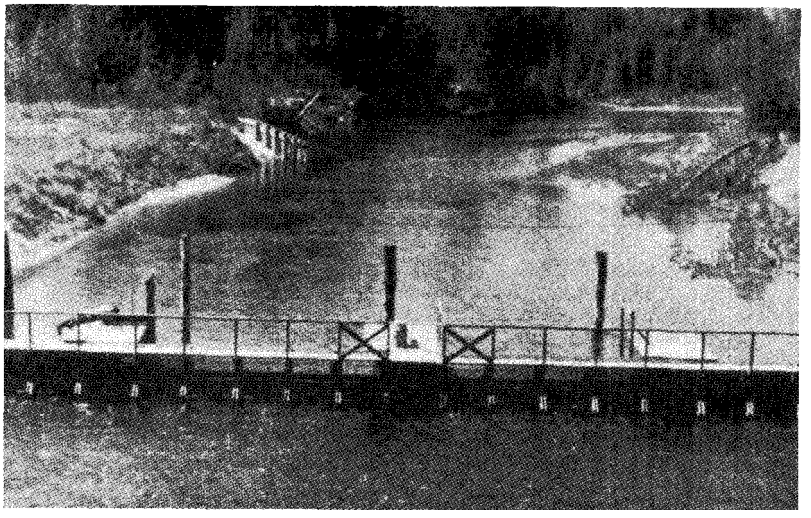


Figure 4. Life cycle of the sea lamprey.

lamprey control program in 1955, it entered into an ongoing contractual agreement with Federal agencies in the United States and Canada to carry out the operational program. In the United States the agent chosen was the U. S. Fish and Wildlife Service, and in Canada, Environment Canada's Fisheries and Marine Service. Both agencies had participated fully in the earlier investigations.



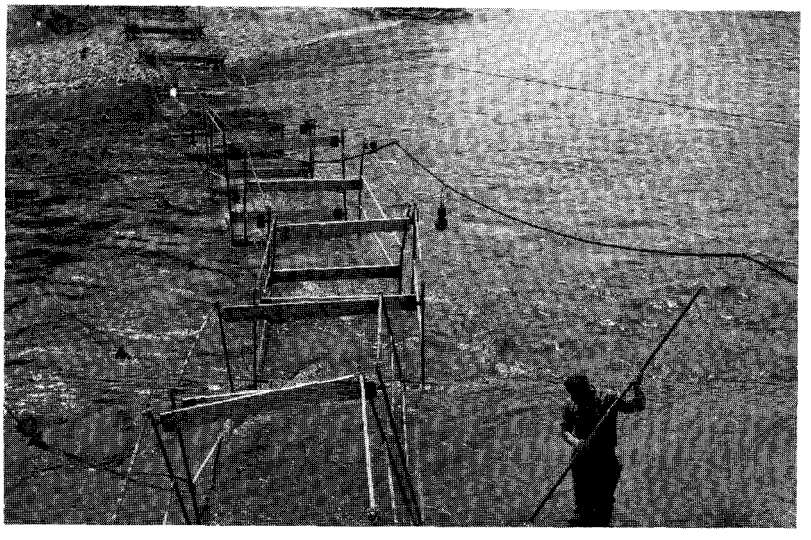


Figure 5. Mechanical weir (above) and electromechanical weir (below) used to capture sea lampreys.

When sea lamprey control was first undertaken, it was apparent that the most logical point of attack was when the animals were concentrated in tributary streams, either as adults on spawning runs or as larvae burrowed in the stream beds. Consequently, a survey of the streams entering the Great Lakes to ascertain which ones supported sea lamprey populations was essential. The survey was initiated in the late 1940's, and since that time all tributaries entering the lakes have been checked (Table 2). In many streams suitable habitat was lacking, or the presence of physical barriers such as dams or falls prevented sea lampreys from reaching suitable habitat. Additional sea lamprey producing streams may yet be found, but the number will assuredly be very small.

Initial efforts to reduce abundance of sea lampreys were carried out by means of mechanical or electromechanical barriers that were installed in sea lamprey producing streams. The barriers were designed to prevent mature sea lampreys from reaching spawning areas. The barrier program was initiated in the late 1940's as a cooperative effort by the U. S. Fish and Wildlife Service and the states. Concurrently, the Ontario Department of Lands and Forests operated a small number of mechanical barriers in streams entering Lakes Huron and Superior; later (early 1950's) mechanical and electromechanical barriers were operated under the sponsorship of a joint federal-provincial committee. After 1955 the program was continued under Commission auspices. At its peak in 1959, the program included about 135 barriers in the United States and Canada. The effectiveness of barriers as a control method was never adequately determined, but there is no doubt that barriers are effective in killing significant numbers of adult sea lampreys. On the other hand, it was recognized that as the main endeavor, the barrier program was fraught with problems. In 1958 the barrier program was discontinued as the major control method, after the initiation of chemical control. Thereafter, electrical barriers were continued in oper-

Figure 6. Adult sea lampreys captured at a barrier.

Table 3. Number of streams treated with lampricide, United States and Canada, 1958-74. [1]

Year	Lake Superior U.S.	Lake Superior Canada	Lake Michigan U.S.	Lake Huron U.S.	Lake Huron Canada	Lake Ontario U.S.	Lake Ontario Canada	Total
1958	10	2	--	--	--	--	--	12
1959	29	9	--	--	--	--	--	38
1960	15	11	7	--	7	--	--	40
1961	9	5	26	1	14	--	--	55
1962	19	13	8	2	--	--	--	42
1963	26	15	22	--	--	--	--	63
1964	25	15	27	--	--	--	--	67
1965	16	6	24	--	--	--	--	46
1966	5	14	12	18	10	--	--	59
1967	17	10	12	14	12	--	--	65
1968	2	7	10	4	11	--	--	34
1969	19	5	12	3	5	--	--	44
1970	10	11	24	27	11	--	--	83
1971	18	7	12	6	9	--	23	87
1972	24	14	18	13	14	20	--	103
1973	22	12	21	11	14	7	3	90
1974	18	5	22	13	9	--	5	72
TOTAL	284	161	269	112	116	27	31	1,000

'Through 1974 no treatments were carried out in Lake Erie, Lake St. Clair, or Finger Lake drainages.

ation only as a means for measuring the abundance and biological characteristics of sea lampreys,

Research into the feasibility of achieving control of sea lampreys with chemical toxicants was going forward during the development of the barrier network. During this period, some 6,000 chemicals were examined. Promising toxicants were field-tested in 1957 and 1958. These successful tests led the Commission, in 1958, to adopt toxicants as the major

Table 4. Numbers of mature sea lampreys captured at barriers on eight tributary rivers of Lake Superior, 1958.74.

Year	Betsey	Two Hearted	Sucker	Chocolay	Iron	Silver	Brule	Amnicon	Total
1958	1,071	3,418	1,727	6,168	401	2,111	22,593	7,584	45,073
1959	1,000	3,990	2,457	3,490	257	773	19,225	980	32,172
1960	686	4,222	4,670	4,167	310	1,261	9,523	1,081	25,920
1961	1,366	7,498	3,209	4,201	2,430	5,052	22,478	4,741	50,975
1962	316	1,757	474	423	1,161	267	2,026	879	7,303
1963	444	2,447	698	358	110	760	3,418	131	8,366
1964	272	1,425	386	445	178	593	6,718	232	10,249
1965	187	1,265	532	563	283	847	6,163	700	10,540
1966	65	878	223	260	491	1,010	226	938	4,091
1967	57	796	166	65	643	339	364	200	2,630
1968	78	2,132	658	122	82	1,032	2,657	148	6,909
1969	120	1,104	494	142	556	1,147	3,374	1,576	8,513
1970	a7	1,132	337	291	713	321	167	1,733	4,781
1971	104	1,035	485	53	1,518	340	1,754	4,324	9,613
1972	146	1,507	642	294	280	2,574	4,121	132	9,696
1973	294	894	468	270	16	495	261	149	2,847
1974	201	489	249	17	1	117	568	270	1,912
TOTAL	6,494	35,989	17,875	21,329	9,430	19,039	105,636	25,798	241,590

method of sea lamprey control. Over the years, two chemicals (3-trifluoromethyl-4-nitrophenol [TFM]) and (2', 5-dichloro-4'-nitrosalicylanilide [Bayer 731) have become established as the primary lampricides. Routine stream treatments are carried out with TFM or with TFM plus a small amount (1-4%) of Bayer 73. The addition of Bayer 73 reduces the amount of TFM required up to one half and thereby greatly reduces the cost of treatments. A granular form of Bayer 73 is also used

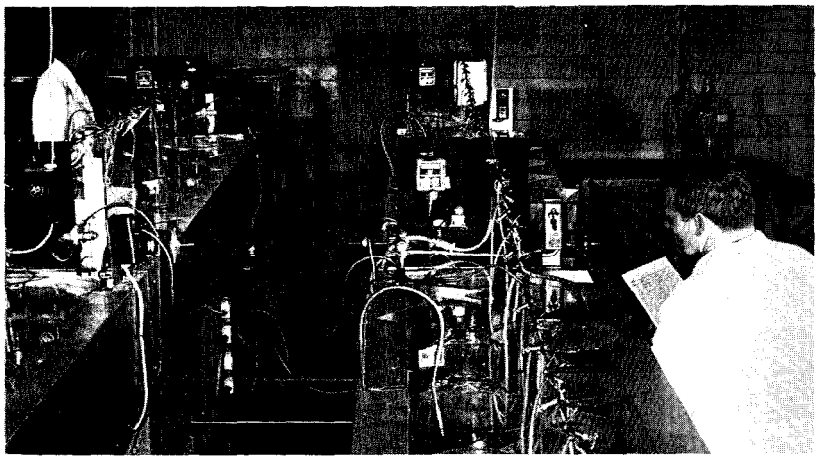


Figure 7. Over 6,000 chemicals were screened during the 7 years of intensive research preceding the discovery of TFM.

in certain areas during treatment with TFM but this formulation of Bayer 73 is more frequently used as a survey tool. Methodology for application of the lampricides has been developed and refined over the years. At proper concentrations TFM destroys sea lamprey larvae without significantly affecting the other fauna or the flora.

Sea lamprey control with lampricides was initiated in Lake Superior in 1958, expanded to Lake Michigan in 1960, to Lake Huron in 1966[3]. and Lake Ontario in 1971.

The first round[4] of treatments was completed in Lake Superior in 1961; in Lake Michigan in 1966; in Lake Huron in 1970; and in Lake Ontario in 1972. Not included in the accompanying summary of chemical treatments of streams in the

3 Chemical control was started in Lake Huron in 1960. It was discontinued in 1962-65 because of insufficient funds, and resumed in 1966.

4 A "round" denotes that all known sea lamprey producing streams tributary to that lake have received one chemical treatment.

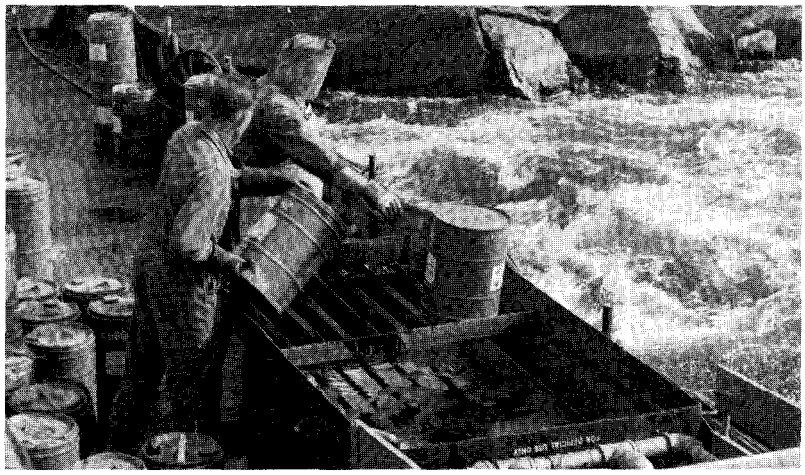


Figure 8. Lampricides being pumped into a stream.

United States and Canada in 1958-74 (Table 3) are several experimental treatments and certain retreatments made when the initial applications were ineffective for a variety of reasons. Thus, the total number of treatments since 1958 exceeds 1,000. Also excluded from the summary are about 160 applications of Bayer 73 in still-water areas within river systems and in areas off river mouths that are inhabited by larval sea lampreys.

RESULTS OF SEA LAMPREY CONTROL

Lampricides have been extremely effective in reducing the abundance of sea lampreys in -the Great Lakes. In Lake Superior, where the control program has been in operation for the greatest number of years and where its effectiveness has been most carefully evaluated, sea lamprey abundance has

Table 5. Salmonids planted in the Great Lakes, 1958-73.

Lake and species	Years	Numbers (thousands)
Lake Superior		
Lake trout	1958-73	34,380
Splake (Lake & brook trout)	1972-73	1 a
Coho Salmon	1966-73	3,395
Chinook salmon	1967-73	1,516
Atlantic salmon	1972-73	40
Subtotal		39,349
Lake Michigan		
Lake trout	1965-73	19,030
coho salmon	1966-73	18,308
Chinook salmon	1967-73	11,506
Atlantic salmon	1972-73	25
Subtotal		48.869
Lake Huron		
Lake trout	1973	629
Splake	1969-73	1,827
Backcross (Splake & lake trout)	1973	486
Coho salmon	1968-73	2,964
Chinook salmon	1968-73	3,548
Atlantic salmon	1972	9
Kokanee	1965-72	13,035 [1]
Subtotal		22,498
Lake Erie		
Coho salmon	1968-73	1,882
chinook salmon.	1970-73.	1,194
Subtotal		3,076
Lake Ontario		
Lake trout	1973	66
Splake.	1972-73.	a7
Coho salmon	1968-73	1,863
Chinook salmon	1969-73	1,762
Kokanee	1965-72	6,122 [2]
Subtotal		9,900
TOTAL		123,692

Total by species		Total by Province or State	
Lake trout	54,105	Ontario	29,744
Splake	1,932	Michigan	66,577
Backcross	486	Wisconsin	16,223
coho salmon	28,412	Minnesota	3,629
Chinook salmon	19,526	New York	2.943
Atlantic salmon	74	Pennsylvania	1,449
Kokanee	19,157 [3]	Indiana	1,201
		Illinois	964
		Ohio	962
	123,692		123,692

1 Includes 10.4 million fry and 1.7 million eggs
2 Includes 5.6 million fry and 0.3 million eggs
3 Includes 16.0 million fry and 2.0 million eggs

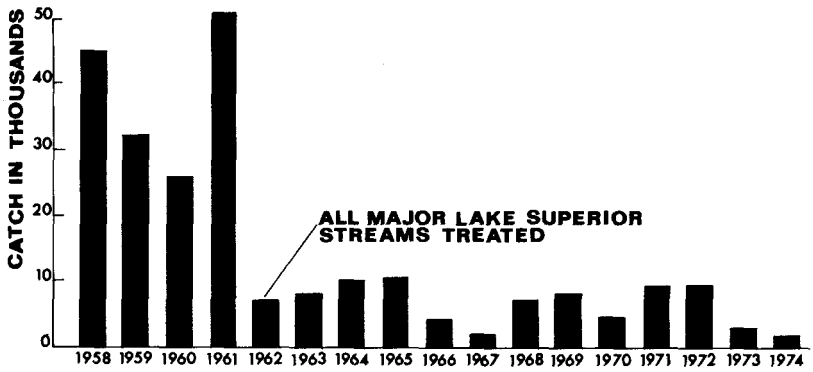


Figure 9. Sea lamprey catch from 8 streams tributary to Lake Superior.

been reduced by about 90 percent. A quantitative measure of sea lamprey abundance has been obtained from counts of mature (spawning run) sea lampreys reaching "index" barriers in selected streams in Lake Superior. Initially such counts were made at 24 barriers (16 in the United States, 8 in Canada); later the number was reduced to 8 in the United States when it became apparent that the runs in these 8 streams would provide adequate information. On the basis of the catch of sea lampreys at these "assessment" barriers [Table 4], the numbers of mature sea lampreys in the spawning runs declined sharply in 1962, the year after the first round of stream treatments had been completed. The decrease in the magnitude of the spawning runs was accompanied by a marked decline in the incidence of fresh sea lamprey wounds on lake trout and later by an improved survival of lake trout to older age and large size. Equivalent quantitative data on sea lamprey control are not available for Lakes Huron[5] and Michigan, but the responses of sea lamprey and fish populations to control

5 Limited quantitative data are available from several barriers on the Canadian side of Lake Huron (in operation since the mid 1960's and the Ocqueoc River in the United States; as in Lake Superior numbers of mature sea lampreys in the spawning runs have declined since the sea lamprey control program was initiated.

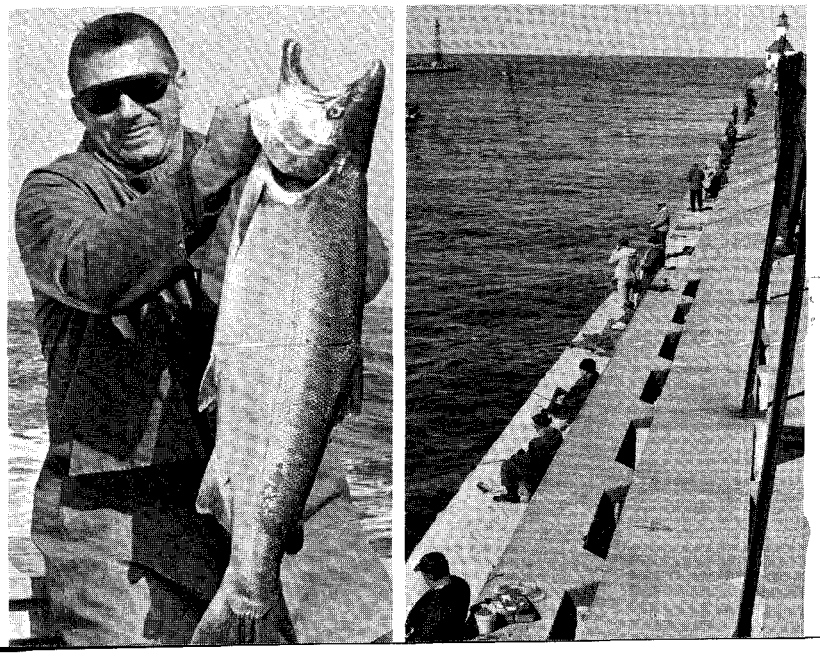
efforts have been similar to those in Lake Superior, and about the same degree of sea lamprey control has been achieved. In Lake Ontario, the sea lamprey control program has been in operation for only a brief time: nevertheless, experience in the other lakes suggests that control efforts will be effective.

The Commission expects that a fully integrated sea lamprey control program will eventually include supplementary or alternative methods such as the construction of permanent barriers on selected streams and the use of biological controls such as chemosterilants.

ENVIRONMENTAL CONSIDERATIONS

In 1971 the Commission's sea lamprey program was broadened to include comprehensive studies of the immediate and

Figure 10. A major sport fishery has become established in the Great Lakes area. (Photo courtesy of Michigan Dept. of Natural Resources.)



long-term effects of lampricides in the environment. Results to date suggest that the effects are very small, that the chemical control program can continue, and that registration of the lampricides by the Environmental Protection Agency will be forthcoming upon completion of the required studies. About $1.2 million were allocated to do this registration-oriented research in 1971-74.

COOPERATIVE FISHERIES MANAGEMENT

Along with its sea lamprey control program, the Commission has cooperated closely with fisheries agencies throughout the

Figure 11. Michigan's Platte River is a popular spot for coho fishing. (Photo courtesy of Michigan Dept. of Natural Resources.)

Convention Area in the planning and implementation of programs to restore and enhance the depleted fish stocks. While the Commission has devoted particular attention to lake trout, the States and the Province of Ontario have pursued complementary programs. Large plantings of hatchery-reared salmonids constitute a major segment of the fisheries restoration program [Table 5).

Sea lamprey control, large plantings of lake trout and other salmonids, and cooperative management programs have been accompanied by the resurgence of several of the indigenous species and the establishment of an outstanding sport fishery in the Great Lakes.

Initially the Commission was obliged to concentrate on sea

Figure 12. The commercial fishery is of international concern. (Photo courtesy of Michigan Department of Natural Resources.)

lamprey control and lake trout restoration, although from the first it was recognized that the effort "to formulate a program to make possible the maximum sustained productivity of any stock of common concern" was a major task. In recent years, with sea lamprey control and lake trout restoration having assumed operational status, the Commission has been able to devote more attention to other problems. Recognizing that ultimately the welfare of the Great Lakes fisheries resource depends upon maintaining an environment of the highest possible quality, the Commission, with the support of other fisheries agencies, is endeavoring, to develop closer liaison with those governmental agencies that have direct responsibility for water quality, pollution abatement, and land use.

Through the years of its existence, the Commission has encouraged close cooperation among state, provincial, and federal fisheries agencies in the Great Lakes region-particularly those of the eight bordering states and the Province of Ontario, who have jurisdiction in their respective waters. Many, and probably most, of the fisheries problems are of concern to all agencies. Inasmuch as the development of integrated and mutually acceptable management programs, supported by adequate biological and statistical information, is vital to all agencies, the Commission has been pleased with the significant progress made in the past few years. The efforts of special interagency groups to summarize, evaluate, and recommend action toward the solution of particular problems have been especially noteworthy. The Commission recognizes that authority for regulation and management is vested in the eight states and the Province of Ontario. Thus, the Commision's most effective actions are to provide guidance, encourage cooperation and negotiation, establish a forum for discussion, disseminate information, and provide documentation. The Commission has found interagency work groups, either permanent or temporary, to be effective in the development and implementation of integrated and mutually acceptable management concepts.

Certain matters that are of particular concern to the Commission are briefly listed here.

1. The development of a fully integrated sea lamprey control program to further reduce sea lamprey abundance. The program will include chemical and biological control methods along with electrical and mechanical barriers.
2. Hatchery-reared lake trout planted in Lakes Superior and Michigan have not yet added substantially to the spawning lake trout population. In Lake Superior, limited recruitment is taking place in certain areas; in Lake Michigan natural reproduction of stocked lake trout has not been confirmed. The Commission supports efforts to accelerate natural reproduction of lake trout.
3. Although sea lamprey control in Lake Ontario was started only recently (1971), certain problems have already appeared; for example, the Finger Lake system, especially the Oneida Lake drainage, may be contributing sea lampreys to Lake Ontario, and may have to be included in the control program.
4. The Commission is concerned that agencies develop mutually compatible programs for fish restoration in Lake Ontario, as well as in the upper Great Lakes.
5. Lake Erie streams have been surveyed for the presence of sea lampreys; about a dozen are potentially suitable for the production of sea lamprey ammocetes. It may, therefore, be necessary to add Lake Erie to the sea lamprey control program.
6. Lake Committees have expressed grave concern over the lack of fisheries interest associated with the agencies responsible for water quality, pollution abatement, and land use. The Commission is continuing its effort to develop closer liaison with agencies such as the International Joint Commission to rectify this problem,

GREAT LAKES FISHERY COMMISSION

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