INTEGRATED MANAGEMENT OF SEA LAMPREYS IN LAKE HURON 2002

Report to
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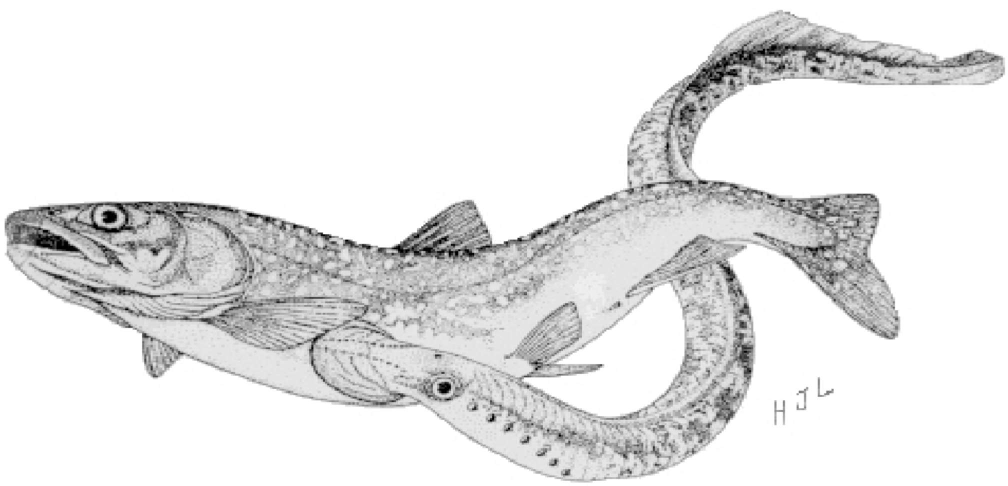

Gerald T. Klar
U.S. Fish and Wildlife Service
Marquette, Michigan
United States

Robert J. Young
Department of Fisheries and Oceans
Sault Ste. Marie, Ontario
Canada

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Gerald T. Klar
United States Fish and Wildlife Service
Marquette, Michigan 49855

Robert J. Young
Department of Fisheries & Oceans
Sault Ste. Marie, Ontario P6A 6W4

INTRODUCTION

Sea lamprey control is a critical fishery management action delivered to support the Fish Community Objectives developed by the Lake Committees as part of the Strategic Plan for Great Lakes Fishery Management. Objectives for acceptable levels of mortality that allow the establishment and maintenance of self-sustaining stocks of lake trout and other salmonids have been established on all of the lakes. In some cases, the lake committees have established specific targets for sea lamprey populations in the Fish Community Objectives or the lake trout rehabilitation plans. The current control program reflects actions by the U.S. Fish and Wildlife Service (Service) and Department of Fisheries and Oceans Canada (Department) as contract agents of the Great Lakes Fishery Commission (Commission) to meet these targets.

The Commission is working in partnership with the Lake Committees through their Lake Technical Committees to refine the current target statements and to develop common target formats for each of the lakes. The Commission and cooperators will consider the costs of control along with the benefits to define an optimum control program. The program must support the Fish Community Objectives, be ecologically and economically sound, and be socially acceptable. The target for each lake will define the abundance of sea lampreys that can be tolerated and the economically viable level of control required to reach the desired suppression.

The cooperation of state, provincial, and tribal agencies continues to be critical to the success of all aspects of the control program. For example, in collaboration with the State of Michigan the agents employed stream treatment methods that provided the best possible suppression of sea lampreys while protecting critical lake sturgeon populations.

This report presents the actions of the Service and Department in the integrated management of sea lampreys in Lake Huron during 2002. Also presented are actions to meet milestones of the Commission vision and trends in sea lamprey abundance as related to Fish Community Objectives.

COMMISSION VISION

The Commission, in its “Strategic Vision for the First Decade of the New Millennium,” identified milestones that included:

Accomplish at least 50% of sea lamprey suppression with alternative technologies while reducing TFM use by 20%.

The pesticide 3-trifluoromethyl-4-nitrophenol (TFM) has been used as a management tool to control larval sea lampreys in the Great Lakes since 1958. In the past decade, the Service and Department have reduced the dependency on TFM through the development and implementation of alternative controls, refinement of assessment procedures, and improvement of application techniques to more efficiently treat tributaries. The use of TFM has decreased 35% from an annual average of 55,169 kg active ingredient from 1986-1990 to an annual average of 35,687 kg active ingredient from 1998-2002.

FISH COMMUNITY OBJECTIVES

In 1995 the Lake Huron Committee established the following specific targets for sea lamprey populations in their Fish Community Objectives:

Reduce sea lamprey abundance to allow the achievement of other fish community objectives; obtain a 75% reduction in parasitic sea lamprey by the year 2000 and a 90% reduction by the year 2010 from present levels.

While the lake-wide abundance has been relatively stable throughout the 1990s, at least twice as many lampreys remain in Lake Huron than in any of the other Great Lakes. Estimated abundance of spawning-phase sea lampreys during 2002 was one of the measures used to determine success of applications of Bayluscide 3.2% Granular Sea Lamprey Larvicide in the St. Marys River during 1998-1999. This sea lamprey target supports the objectives for the other species groups in the fish community including, for example, the salmonine community objective:

Establish a diverse salmonine community which can sustain an annual harvest of 5.3 million pounds, with lake trout the dominant species and anadromous species also having a prominent place.

TRIBUTARY INFORMATION

- Lake Huron has 1,761 (427 United States, 1,334 Canada) tributaries.
- 120 (65 United States, 55 Canada) tributaries have historical records of production of sea lamprey larvae.
- 68 (31 United States, 37 Canada) tributaries have been treated with lampricide at least once during 1993-2002.
- Of these, 48 (22 United States, 26 Canada) tributaries are treated on a regular 3 to 5 year cycle.

LAMPRICIDE CONTROL

Lampricide treatments are systematically scheduled for tributaries harboring larval sea lampreys to eliminate or reduce the populations of larvae before they recruit to the lake as parasitic adults. Service and Department treatment units administer and monitor doses of the lampricide TFM, sometimes augmented with Bayluscide 70% Wettable Powder to scheduled tributaries. Specialized equipment and techniques are employed to provide concentrations of lampricides that eliminate about 95% of the lamprey larvae and minimize the risk to non-target organisms.

The following statements highlight the lampricide control program in Lake Huron during 2002. Table 1 provides details on the application of lampricides to tributaries treated during 2002 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed on 12 Lake Huron tributaries (3 U.S., 9 Canada) scheduled for treatment.

- The interim protocol for application of lampricides to streams with populations of young-of-year lake sturgeon was followed during treatment of the Rifle River. The protocol limits the concentrations of TFM and Bayluscide 70% Wettable Powder to 1.2 times minimum lethal concentration (MLC: concentration required to kill 99.9% of sea lampreys in a 12-hour treatment) to protect young-of-year lake sturgeon. A live young-of-year lake sturgeon (approx. 12–15 cm) was observed in the lower Rifle River after treatment. This was the first observation of lake sturgeon in the Rifle River by Service personnel.

- The Shiawassee River, deferred from treatment last year, was treated successfully. Extreme pH fluctuations which caused the deferral of treatment during 2001 were not encountered during the spring of 2002.

- A Voluntary Adverse Effects 6(a)(2) report was submitted to the Environmental Protection Agency after significant numbers of stonecats were killed during treatment of the Rifle River.

- Numbers of nontarget fish killed in all other treatments were minimal.

- H-267, a small tributary on Manitoulin Island, was treated for the first time during 2002.

- Garden River, treated during 2002, and Brown’s Creek were added to the stream treatment list after quantitative assessments were completed in 2002.

Table 1. Details on the application of lampricides to tributaries of Lake Huron, 2002. (Number in parentheses corresponds to location of stream in Fig. 1.)

Stream	Date	Flow (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1]	Distance Treated (km)
United States					
Saginaw R. (10)					
-Carroll Cr.	May 10	1.6	201.8	0	1.0
-Little Salt Cr.	May 12	3.5	629.5	0	4.2
-Big Salt R./Bluff Cr.	May 13	14.2	2,908.2	0	46.8
-Shiawassee R.	Jun 9	22.1	3,373.9	26.7	73.5
Ocqueoc R. (12)	Jul 18	3.5	862.6	0	43.4
Rifle R. (11)	Sep 28	4.0	1,771.8	4.4	69.8
Total		48.9	9,747.8	31.1	238.7
Canada					
Nottawasaga R. (9)	May 28	11.1	2,263.2	11.8	86.0
Mindemoya R. (8)	Jun 12	1.0	199.1	0	8.5
Spanish R. (5)	Jun 12	78.7	4,161.4	41.7	77.8
H-114 (6)	Jun 13	0.1	0.3	0	0.4
H-267 (7)	Jun 13	0.4	52.7	0	1.2
Watson Cr. (2)	Jun 19	0.2	14.7	0	1.6
Upper Thessalon R. (4)	Jun 25	6.4	293.1	0	42.8
Garden R. (1)	Jul 29	14.6	900.9	0	68.3
Brown's Cr. (3)	Oct 9	0.2	11.6	0	1.3
Total		112.7	7,897.0	53.5	287.9
Grand Total		**161.6**	**17,644.8**	**84.6**	**526.6**

[1]Lampricide quantities are in kg of active ingredient.
[2]Includes a total of 4 TFM bars (0.8 kg of active ingredient) applied in 2 streams.

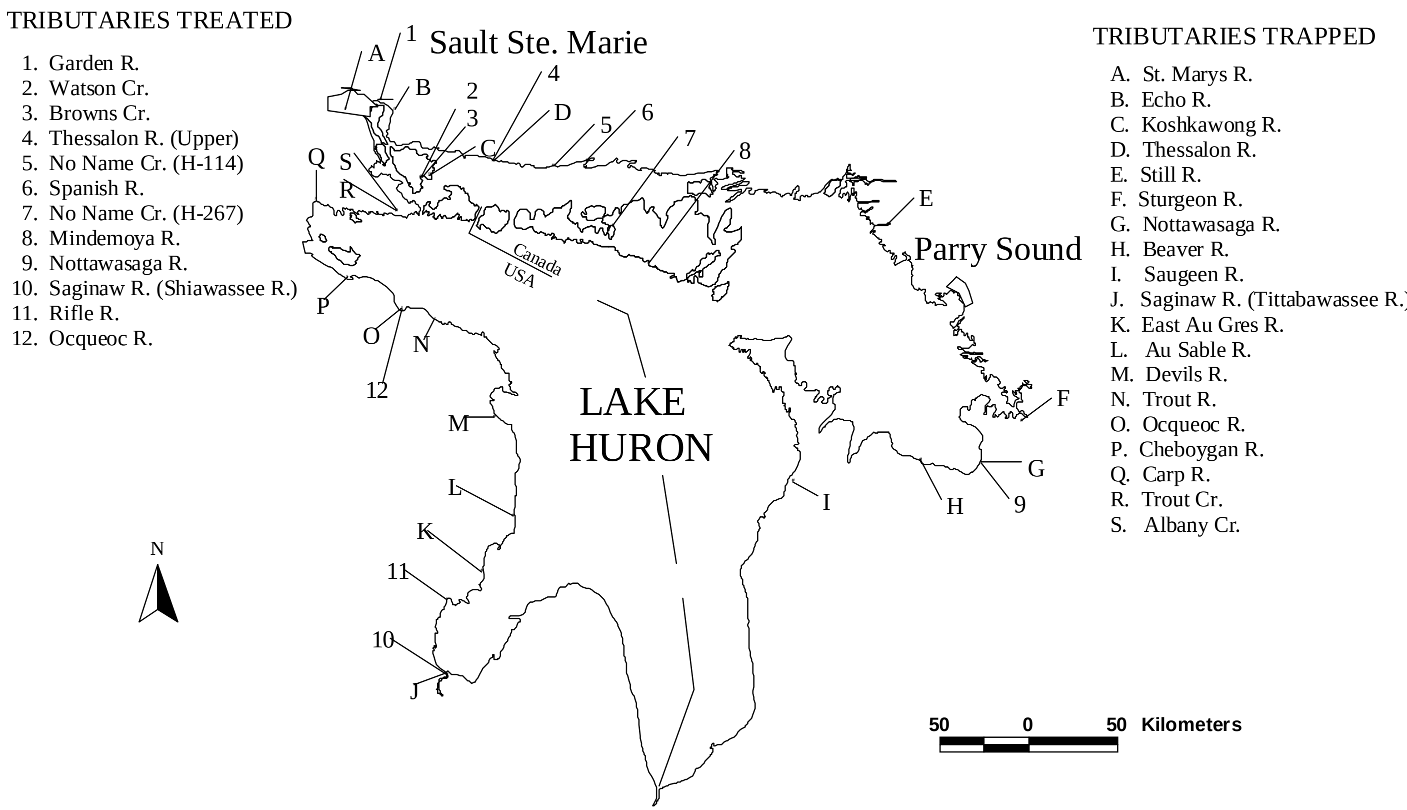

Fig. 1. Locations of Lake Huron tributaries treated with lampricides (Numbers, Table 1) and tributaries where assessment traps were operated during 2002 (Letters, Table 3).

ALTERNATIVE CONTROL

Sterile Male Release Technique

Research into the sterile male release technique (technique) for sea lamprey control began during 1971. The technique was experimentally implemented in Lake Superior and in the St. Marys River during 1991-1996. The technique was refocused for exclusive use in the St. Marys River after 1996.

Male sea lampreys are captured during their spawning migrations in 20 tributaries to lakes Superior, Michigan, Huron, and Ontario, and the St. Marys River and transported to the sterilization facility (facility) at the Hammond Bay Biological Station. At the facility sea lampreys are sterilized with the chemosterilant bisazir, decontaminated, and released into the St. Marys River. Laboratory and field studies have shown that treated male sea lampreys are sterile, sexually competitive, and that the numbers of eggs hatched in nests are reduced.

- A total of 11,593 spawning-phase male sea lampreys were trapped in Lake Huron tributaries and transported to the sterilization facility during May 7 – July 15 for sterilization and release into the St. Marys River. Sources of sterile male lampreys were: Cheboygan River (2,948), Ocqueoc River (609), Trout River (69), Echo River (952), Thessalon River (1,398), Koshkawong River (88), AuSable River (382), East Au Gres River (278), Carp Lake Outlet (358), and St. Marys River (4,511).

- A total of 22,684 sterilized male lampreys from all sources were released in the St. Marys River during May 31 – July 15. The estimated resident population of spawning-phase sea lampreys in the St. Marys River was 13,619 (8,525 males). Assessment traps removed 7,949 sea lampreys (5,007 males). The ratio of sterile male to resident male sea lampreys remaining in the St. Marys River was estimated at 6.4:1 (22,684 sterile: 3,518 estimated untreated males extant).

- The theoretical reduction from trapping and enhanced sterile male release was estimated at 94% during 2002, an increase from an average of 87% during 1997-2001. Prior to enhancement (1991-1996) the theoretical reduction in reproduction averaged 58%.

- The release of sterile males combined with the removal of lampreys by traps, reduced the theoretical number of effective fertile females in the river from about 5,094 to 289 during 2002.

- In the St. Marys River rapids, 5 sterile and 2 untreated males were observed on nests and 101 nests were sampled for eggs. Egg viability was 4% in the nest that produced a sample. Average egg viability (weighted by nests per year) during 1997-2001 was 26%.

Barriers

In its *Strategic Vision for the First Decade of the New Millennium*, the Commission committed to implementation of an integrated control program that relies on alternative control methods to achieve 50 percent of lamprey suppression. Barriers are currently the only proven alternative control method. Presently, there are 18 barriers on Lake Huron tributaries constructed or modified solely to stop the migration of spawning-phase sea lampreys (Fig. 2).

The sea lamprey management program benefits substantially from a number of dams built and operated for other purposes. A Geographic Information System (GIS) inventory of these "de-facto" barriers has been initiated. This will be a useful tool in identifying dams of value to sea lamprey management and tracking a growing number of barrier mitigation proposals that have potentially serious consequences to the Great Lakes fishery. The inventory is complete or nearling completion for Ontario, Michigan, and Wisconsin.

- Schmidt and Black Mallard creeks – U.S. Army Corps of Engineers (ACE) Design Documentation Reports (including hydrology and hydraulics analysis, topographic surveys, real estate, and final PRP) were completed.

- Cheboygan and Au Gres rivers - New barrier projects were accepted by the ACE under Section 1135 of Water Resources Development Act.

- Still River – the barrier continues to deform since an attempt to stabilize it was made in the mid -1990s. Feasibility of rebuilding the barrier is being investigated.

- Beaver River - Numerous discussions were held with the Ontario Ministry of Natural Resources regarding sea lamprey passage concerns at Thornbury Dam. A consultant retained by the Department assisted with structural design of a sea lamprey trap built into a new fishway built at the dam.

- Sturgeon and Still rivers - Retroactive applications under Navigable Waters Protection Act were submitted for sea lamprey barriers.

TRIBUTARIES WITH BARRIERS

1. Echo R.
2. Browns Cr.
3. Koshkawong R.
4. Harris Cr.
5. Blind R.
6. Manitou R.
7. French R.
8. Still R.
9. Sturgeon R.
10. Beaver R.
11. Saugeen R.
12. Saginaw R. (Shiawassee R.)
13. W. Br. Rifle R.
14. East Au Gres R.
15. Trout R.
16. Ocqueoc R.
17. Nuns Cr.
18. Albany Cr.

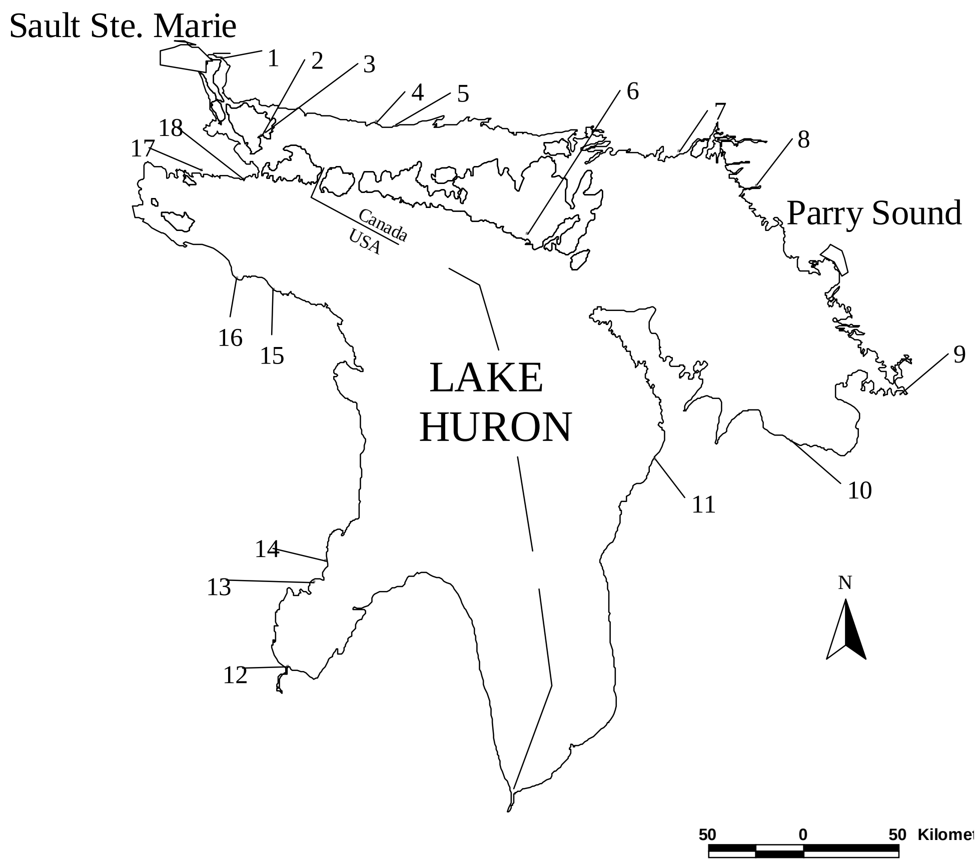

Fig. 2. Locations of Lake Huron tributaries with sea lamprey barriers.

ASSESSMENT

Larval

Tributaries to the Great Lakes are systematically assessed for abundance and distribution of sea lamprey larvae. Quantitative estimates of the numbers of metamorphosing sea lampreys that will leave individual tributaries the following year are used to prioritize streams for lampricide treatment. Qualitative sampling is used to define the distribution of sea lampreys within a stream and to establish the sites for lampricide application.

Tributaries considered for lampricide treatment during 2003 were assessed during 2002 to estimate larval density and amount of suitable larval habitat. Assessments were conducted with backpack electrofishers in waters <1m deep. Waters >1m in depth were surveyed with deepwater electrofishers or Bayluscide 3.2% Granular Sea Lampricide Larvicide. Survey plots were randomly selected in each tributary, catches of larvae were adjusted for gear efficiency, and lengths were standardized to the end of the growing season. Populations of larvae in each tributary were estimated by multiplying the mean density of larvae (number per m^2) by an estimated area of suitable habitat (m^2). The probable number of larvae that would metamorphose into parasitic sea lampreys during 2003 was developed from historical relations of the proportion of metamorphosed sea lampreys to larval sea lampreys collected during previous lampricide applications. After the data was processed, tributaries were ranked for treatment during 2003 based on an estimated cost per kill of metamorphosed sea lampreys.

- Assessments of populations of sea lamprey larvae were conducted in 91 tributaries (45 U.S., 46 Canada). The status of larval sea lamprey populations in tributaries treated within the past 10 years is presented in Table 2.

- A post-treatment quantitative assessment was conducted in one U.S. tributary to determine the effectiveness of lampricide treatments during 2002.

- Larval populations were estimated in 31 tributaries (16 U.S., 15 Canada; Table 2).

- Monitoring of long-term effectiveness and subsequent recruitment after the 1998-2001 granular Bayluscide treatments in the St. Marys River continued during 2002. Approximately 615 sites were sampled with the deepwater electrofisher and an additional 556 adaptively-located sites were sampled in areas of higher larval density, both inside and outside of the treated areas. Surveys were conducted according to a stratified–random design.

Table 2. Status of Lake Huron tributaries that have been treated for sea lamprey larvae during 1993-2002, and sea lamprey population estimates for tributaries surveyed during 2002.

Tributary	Last Treated	Last Surveyed	Residuals Found	Oldest Reestablished Year Class	Estimate of 2002 Larval Population	2003 Metamorphosing Estimate	On 2003 Treatment Schedule
United States							
Little Munuscong R.	Jun-99	2001	Yes	1999	-	-	No
Big Munuscong R.	Jun-99	2001	Yes	1999	-	-	No
Carlton Cr.	Sep-01	2000	No	1998	-	-	No
Caribou Cr.	May-91	2002	-	1999	899	4	No
Albany Cr.	Sep-01	2002	Yes	None	-	-	No
Trout Cr.	May-01	2000	-	-	-	-	No
Beavertail Cr.	Oct-00	2000	-	-	-	-	No
Prentiss Cr.	May-01	2001	Yes	-	-	-	No
McKay Cr.	Sep-01	2002	Yes	None	-	-	No
Ceville R.	Oct-00	2001	No	-	-	-	No
Steeles Cr.[1]	May-84	2002	-	1998	3,090	79	No
Nuns Cr.	Sep-01	2000	-	-	-	-	No
Pine R.	May-98	2002	Yes	1998	222,212	4,106	Yes
Carp R.	Oct-00	2002	Yes	2000	221,324	11,948	Yes
Martineau Cr.	Oct-93	1997	-	-	-	-	No
Cheboygan R. [2]							
Maple R.	Oct-98	2002	Yes	1999	3,855	599	Yes
Pigeon R.	Sep-01	2002	Yes	2002	4,517	1,538	Yes
Little Pigeon R.	Aug-98	2000	No	-	-	-	No
Sturgeon R.	Sep-99	2002	Yes	2000	-	-	No
Laperell Cr.	May-00	2002	No	None	-	-	No
Meyers Cr.	Sep-99	2002	No	None	-	-	No
Elliot Cr.	May-96	2002	-	1998	11,249	53	No
Greene Cr.	Oct-01	2000	-	-	255	91	No
Mulligan Cr.	May-94	2001	-	-	-	-	No
Black Mallard Cr.	Oct-01	2002	Yes	-	2,331	2,059	Yes
Ocqueoc R.	Jul-02	2002	Yes	-	-	-	No
Schmidt Cr.	Sep-98	2002	Yes	1999	2,930	88	No
Trout R.	May-00	2002	Yes	2000	16,054	140	No
Swan R.	May-96	2000	No	1997	-	-	No
Long Lake Cr.[1]	Never	2002	-	1997	9,285	2,843	Yes
Devils R.	May-00	2002	Yes	2000	42,109	83	No
Black R.	Jun-98	2002	Yes	1998	104,568	5,535	Yes
Au Sable R.	Jul-98	2002	Yes	1998	315,842	2,283	Yes
Tawas Lake Outlet	Jul-96	2002	-	1998	26,166	10,503	Yes
Silver Cr.	Jul-00	2002	No	2000	-	-	No
Cold Cr.	Jul-00	2002	Yes	2000	5,770	744	Yes
Sims Cr.	Jul-98	2002	No	2000	-	-	No
East Au Gres R.	Oct-01	2002	No	2002	6,174	0	No
Au Gres R.	Jun-00	2002	No	2000	-	-	No
Rifle R.	Oct-02	2002	-	-	-	-	No

Table 2. Continued

Tributary	Last Treated	Last Surveyed	Residuals Found	Oldest Reestablished Year Class	Estimate of 2002 Larval Population	2003 Metamorphosing Estimate	On 2003 Treatment Schedule
Saginaw R.							
Cass-Juniata Cr.	Sep-98	2000	Yes	-	-	-	No
Chippewa R.	Sep-99	2002	Yes	2000	91,685	66,281	Yes
Little Salt Cr.	Oct-02	2002[3]	-	-	-	-	No
Big Salt Cr.	May-96	2002	-	1996	14,599	230	Yes[4]
Carroll Cr.	May-02	2001	-	-	-	-	No
Big Salt R.	May-02	2001	-	-	-	-	No
Bluff Cr.	May-02	2002	-	-	-	-	No
Shiawassee R.	Jun-03	2001	-	-	-	-	No
Canada							
Root R.	Sep-99	2002	-	2000	141,095	469	Yes
Garden R.	Jul-02	2002	-	-	-	-	No
Echo R.							
Upper	Oct-99	2001	No	-	-	-	No
Lower	Sep-99	-	-	-	-	-	No
Bar/Iron Creek	Jul-98	2001	Yes	1999	-	-	No
Bar R.	Oct-01	2001	-	-	-	-	No
Sucker Cr.	May-00	2002	Yes	2001	-	-	No
Two Tree R.	Oct-01	2000	-	-	-	-	No
Richardson Cr.	Aug-96	2000	No	-	-	-	No
Watson Cr.	Jun-02	2001	-	-	-	-	No
Gordon Cr.	May-01	2000	-	-	-	-	No
Browns Cr.	Sep-02	2002	-	-	-	-	No
Koshkawong R.	May-00	2002	No	-	-	-	No
Thessalon R.							
Upper	Jul-02	2002	-	-	-	-	No
Lower	Jul-01	2000	-	-	-	-	No
Livingstone Cr.	Jun-00	2002	No	-	-	-	No
Mississagi R.							
Main	Aug-00	2001	Yes	1999	-	-	No
Pickerel Cr.	Jun-98	2001	No	-	-	-	No
Blind R.	May-84	2001	No	1999	77	1	No
Lauzon R.	Sep-97	2001	No	1998	-	-	No
Spragge Cr.	Oct-95	2001	No	None	-	-	No
Unnamed (H-114)	Jun-02	2001	-	-	-	-	No
Serpent R.							
Main	Jun-00	2002	No	-	-	-	No
Grassy Cr.	Oct-99	2002	Yes	2000	15,375	819	Yes
Spanish R.	Jun-02	2002	-	-	-	-	No
Unnamed (H-267)	Never	2002	-	-	-	-	No
Silver Cr.	May-94	2001	-	-	-	-	No
Sand Cr.	Oct-01	1999	-	-	-	-	No
Mindemoya R.	Jun-02	2002	-	-	-	-	No

Table 2. Continued

Tributary	Last Treated	Last Surveyed	Residuals Found	Oldest Reestablished Year Class	Estimate of 2002 Larval Population	2003 Metamorphosing Estimate	On 2003 Treatment Schedule
Timber Bay Cr.	May-01	2000	-	-	-	-	No
Manitou R.	Sep-99	2002	No	2000	-	-	No
Blue Jay Cr.	Sep-99	2002	-	2000	32,598	427	Yes
Chikanishing R.	Jun-95	2002	Yes	1997	2,697	253	Yes
French R.							
O.V. Channel	Jun-92	2002	-	-	4,192	1,694	No
Wanapitei R.	Jun-00	2002	No	-	0	0	No
Still R.	Jun-96	2002	No	1999	0	0	No
Magnetawan R.	Jul-99	2002	No	1999	22,694	84	No
Naiscoot R.	Jul-99	2002	Yes	1999	72,515	90	No
Boyne R.	Jun-99	2002	Yes	1999	5,771	128	Yes
Musquash R.	Aug-96	2002	Yes	1998	51,134	3	No
Sturgeon R.	May-99	2002	Yes	1999	3,909	123	Yes
Nottawasaga R.							
Main (inc. Boyne	May-02	2002	-	-	-	-	No
and Bear Creeks)			-	-	-	-	No
Pine R.	May-02	2002	-	-	-	-	No
Bighead R.							
Main	May-00	2002	Yes	2001	108,613	1,895	Yes
Rocklyn Cr.	Never	2002	-	-	249	14	Yes
Sauble R.	Jun-96	2000	No	1996	-	-	No

[1]Not treated during the past 10 years, but quantitative larval surveys were conducted during 2000-2002.
[2]Stream has a known lentic population.
[3]Quantitative assessment conducted prior to treatment during 2002.
[4]Will be treated with the lower Chippewa River.

Spawning-phase

The long-term effectiveness of the control program has been measured by the annual estimation of the lake-wide abundance of spawning-phase sea lampreys. Traps and nets were used to capture migrating spawning-phase sea lampreys during the spring and early summer. Lakewide abundance has been estimated since 1986 from a combination of mark-recapture estimates in streams with traps and model-predicted estimates in streams without traps.

- 22,797 sea lampreys were trapped in 19 tributaries during 2002 (Table 3, Fig. 1).
- The estimated population of spawning-phase sea lampreys in Lake Huron for 2002 was 115,919 (86,292 north, 16,008 south, and 13,619 St. Marys River; $r^2 = 0.82$).
- No significant trend (Fig. 3) was detected from a linear regression of spawner abundance on year during 1983-2002 ($p = 0.425$). Estimates for the period were adjusted using refinements in the spawner discharge model and are different from those reported in previous years.
- Spawning runs were monitored in the Carp River and Albany and Trout creeks through a cooperative agreement with the Chippewa/Ottawa Resource Authority and in the Tittabawassee River through a cooperative agreement with Dow Chemical USA.
- Traps operated in the St. Marys River at the Great Lakes Power facility in Canada and the ACE facility captured 8,133 spawning-phase sea lampreys. The estimated spawning sea lamprey population in the river was 13,619 and trap efficiency was 60%.
- The second year of a two-year bio-telemetry study was conducted in the St. Marys River by a team from the Department, the Service, and the Global Biotelemetry Institute of the University of British Columbia. A total of 126 tagged spawning-phase sea lampreys were tracked from 2 release sites. Initial results support previous plans to enhance the Great Lakes Power plant trap and construct a permanent trap at the Edison Sault power facility.
- The Service completed site rehabilitation required by the U.S. Forest Service at the site of the Carp River temporary electrical barrier that was operated during 1994-1998. This fulfilled the permit and site occupancy requirements and the Service has been released from further responsibility at this site.

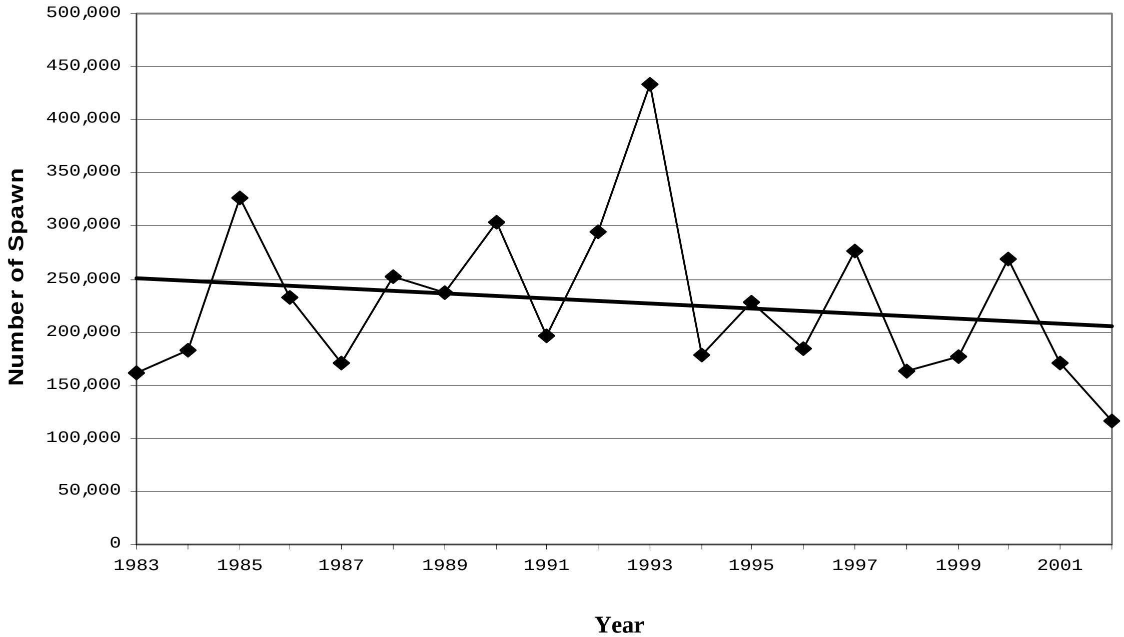

Fig. 3. Trendline of linear regression of spawner abundance for Lake Huron, 1983-2002.

Table 3. Stream, number caught, estimated population, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of Lake Huron, 2002 (Letter in parentheses corresponds to location of stream in Fig. 3).

Stream	Number caught	Spawner estimate	Trap efficiency	Number sampled[1]	Percent males	Mean Length (mm) Males	Mean Length (mm) Females	Mean Weight (g) Males	Mean Weight (g) Females
United States									
Tittabawassee R. (J)	543	---	---	0	---	---	---	---	---
East Au Gres R. (K)	642	1,562	41	42	46	476	467	225	222
Au Sable R. (L)	1,387	6,315	22	76	55	468	472	229	257
Devils R. (M)	25	---	---	2	67	490	550	273	342
Trout R. (N)	202	743	27	0	46	---	---	---	---
Ocqueoc R. (O)	1,244	2,209	56	0	59	---	---	---	---
Cheboygan R. (P)	6,094	10,804	56	0	54	---	---	---	---
Carp R. (Q)	19	---	---	3	---	453	---	363	---
Trout Cr. (R)	36	93	39	3	67	456	427	283	260
Albany Cr. (S)	59	110	54	10	70	444	457	202	243
St. Marys R. (A)	1,460	See Canada	See Canada	---	64	---	---	---	---
Total or Mean (U.S.)	**11,711**	**21,836**		**136**	**56**	**477**	**483**	**236**	**248**
Canada									
St. Marys R. (A)	6,673	13,619	60	0	62	---	---	---	---
Echo R. (B)	1,757	4,954	35	0	62	---	---	---	---
Koshkawong R. (C)	130	---	---	0	65	---	---	---	---
Thessalon R. (D)	13	---	---	0	---	---	---	---	---
Little Thessalon R. (D)	2,513	3,146	80	0	63	---	---	---	---
Still R. (E)	0	---	---	0	---	---	---	---	---
Sturgeon R. (F)	0	---	---	0	---	---	---	---	---
Nottawasaga R. (G)	0	---	---	0	---	---	---	---	---
Beaver R. (H)	0	---	---	0	---	---	---	---	---
Saugeen R. (I)	0	---	---	0	---	---	---	---	---
Total or Mean (Canada)	**11,086**	**21,719**		**0**	**62**	**---**	**---**	**---**	**---**
Total or Mean (for lake)	**22,797**	**43,555**		**136**	**59**	**477**	**483**	**236**	**248**

[1]The number of sea lampreys from which all length and weight measurements were determined.

Parasitic-phase

The Michigan Department of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats during 2002.

- 2,682 sea lampreys (U.S.; sport-580, commercial-183: Canada; commercial-1,919) were collected from 7 management districts (4 U.S.; 3 Canada) during 2002.

- 113 sea lampreys captured in the sports fishery were attached to lake trout and 467 were attached to chinook salmon.

- Lampreys were attached at a rate of 1.5 per 100 lake trout (n = 7,721) and 4.2 per 100 chinook salmon (n = 11,060).

- The recapture of spawning-phase sea lampreys released as metamorphosing juveniles during the spring of 2001 was completed. Of 93 metamorphosing sea lampreys marked with coded wire tags and released, 1 (1%) was recaptured as a spawning adult in Lake Huron during 2002. A total of 21,266 (36,614 U.S.; 11,086 Canada) spawning-phase sea lampreys were scanned for coded wire tags in 13 Lake Huron streams (9 U.S.; 3 Canada; 1 international). The estimated abundance of 794,000 (95% CI 491,000-1,736,000; Table 4) is a measure of the 2001 parasitic cohort.

- A total of 646 metamorphosing sea lampreys were marked with coded wire tags and released into Lake Huron tributaries during November 2002. Of those, 408 were released in streams tributary to the open water of Lake Huron (Pine River-97, Ocqueoc River-98, AuSable River-99, Mindemoya River-114) and 238 were released in streams tributary to the North Channel of Lake Huron (Mississagi River-113, Root River-112, St. Marys River-13) Recapture of these sea lampreys as spawning-phase adults will take place during 2004.

- The recapture of spawning-phase sea lampreys released as parasitic-phase lampreys during 2001 was completed. Of 292 parasitic-phase sea lampreys marked and released in the open water of Lake Huron during 2001, 7 (2%) were recaptured as spawning adults in 2002. The estimated abundance (Table 4) is a measure of the parasitic population during 2001.

- A total of 647 parasitic-phase sea lampreys (captured by commercial fisheries, the Chippewa/Ottawa Resource Authority, and United States Geological Survey (USGS)-Hammond Bay Biological Station) were marked with coded wire tags and released in northern Lake Huron. Of those, 397 were released in the open water of Lake Huron (Hammond Bay-214, Nunns Creek-183) and 250 were release in the North Channel. Recapture of these sea lampreys as spawning-phase adults will take place during 2003.

Table 4. Lake-wide population estimates including 95% confidence intervals (CI) of metamorphosing, parasitic-phase, and spawning-phase sea lampreys in Lake Huron during 1992 – 2002.

Spawning year	Estimate of metamorphosing lampreys (thousands)			Estimate of parasitic-phase lampreys (thousands)			Estimate of spawning-phase lampreys (thousands)
	Population	Lower CI	Upper CI	Population	Lower CI	Upper CI	
Lake Huron							
1992	639	492	907	-----	-----	-----	294
1993	686	459	1,257	-----	-----	-----	434
1994	-----	-----	-----	515	409	688	179
1995	-----	-----	-----	629	518	798	228
1999	803	505	1,737	1,361	788	3,527	176
2000	644	513	865	1,759	1,255	2,848	270
2001	578	491	702	2,302	1,089	14,800	171
2002	1,000[1]	374	7,813	779	442	2,203	116

[1] Estimate derived from a single recaptured sea lamprey.