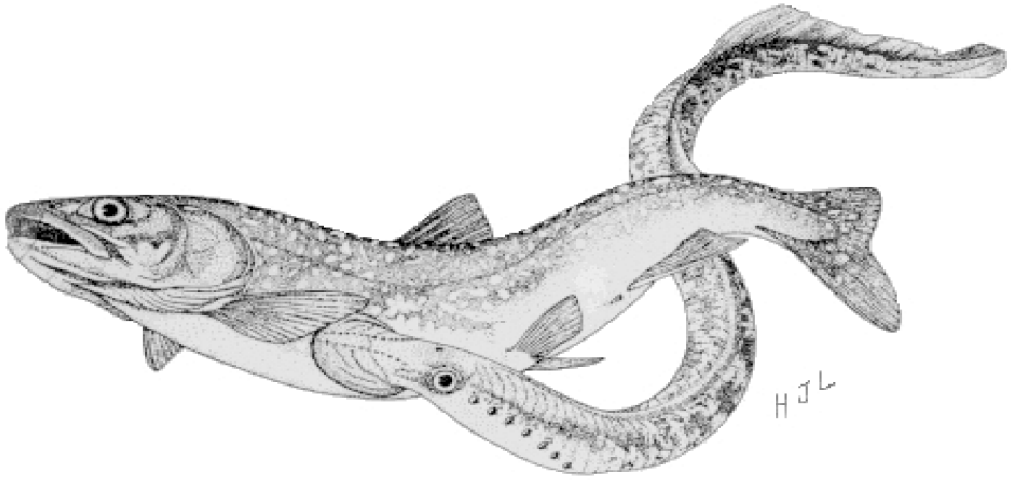
INTEGRATED MANAGEMENT OF SEA LAMPREYS IN THE GREAT LAKES 2005

ANNUAL REPORT TO THE

GREAT LAKES FISHERY COMMISSION



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GLFC Annual Meeting
June 6-7, 2006

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EXECUTIVE SUMMARY

This report summarises activities in the integrated management of sea lampreys conducted by the United States Fish and Wildlife Service (USFWS) and Department of Fisheries and Oceans Canada (DFO) in the Great Lakes during 2005. Lampricide treatments were conducted on 67 tributaries. Larval assessment crews surveyed 337 Great Lakes tributaries and 33 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 68 tributaries to estimate the spawning-phase population in each Great Lake.

We evaluate sea lamprey populations relative to fish community objectives for each of the lakes. In Lake Superior, lamprey abundance (121,000) and wounding (11.6 A1-A3/100 fish) were above targets and rates observed in the mid 1990s. Abundance decreased by 50% in Lake Michigan to 85,000. Both abundance and wounding rates are declining in Lake Huron and approaching fish community objectives. Spawning abundance and wounding rates in Lake Erie have been highly variable over the past five years and are currently above target. In contrast, Lake Ontario spawning populations have been relatively stable during the past 10 years, near the target of 30,000. Currently, sea lamprey-induced mortality in lake trout is estimated as 12% of the annual total. In Lake Michigan the fish community objectives are generally being met despite an increase in lamprey wounding rates on lake trout in northern waters of the lake while populations of parasitic lampreys remain higher than the fish community objective in Lake Huron. The population of larvae in the St. Marys River, lake trout wounding rates, and sea lamprey induced mortality have declined since a St. Marys River treatment strategy was initiated in 1998. Fish Community Objectives of less than 5 marks per 100 fish were met in both Lake Erie and Lake Ontario.

INTRODUCTION

Sea lamprey control is a critical management action used 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 for all of the lakes. In some cases, the lake committees have established specific targets for sea lamprey populations. This report outlines the actions undertaken during 2005 by the USFWS and DFO 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 technical committees to refine the target statements and develop common targets. The targets define the abundance of sea lampreys that can be tolerated and the economically viable level of control required to reach the desired level of suppression. The Commission and co-operators consider the costs of control along with the benefits to define an optimum control program.

COMMISSION VISION

The "Strategic Vision of the Great Lakes Fishery Commission for the First Decade of the New Millennium" contains a *Vision Statement on Integrated Management of Sea Lamprey:*

The Commission will provide an integrated sea lamprey management program that supports the Fish Community Objectives for each of the Great Lakes and that is ecologically and economically sound and socially acceptable.

To achieve this vision, the Commission set the following milestones:

1) *Achieve economic injury levels* - Suppress sea lamprey populations to economic-injury levels (maximize net benefits of sea lamprey and fishery management) by the year 2005.

2) *Control the St. Marys River* – Suppress sea lamprey populations in the St. Marys River to a level that allows rehabilitation of lake trout in northern Lake Huron.

3) *Use alternative control techniques* – Accomplish at least 50% of sea lamprey suppression with alternative technologies while reducing TFM use by 20% through use of at least one new alternative-control method, increased use of current methods such as sterile-male release, trapping and barrier deployment.

4) *Estimate Recruitment* – Estimate recruitment of sea lampreys from all sources, including non-treated rivers, estuaries and connecting channels, by 2005.

FISH COMMUNITY OBJECTIVES

Lake Superior

The Lake Superior Committee established the following goal for sea lamprey management in its 2003 Fish Community Objectives:

Suppress sea lampreys to population levels that cause only insignificant mortality on adult lake trout.

During 2004 the Lake Superior Committee agreed to an explicit target sea lamprey population of 35,000 +/- 18,000 to meet this objective. This target and range were calculated from the abundance of sea lampreys estimated for the 5-year period when marking rates were closest to five marks per 100 fish (1994 - 1998 - 5.2 A1-3 marks per 100 lake trout >21"). The lake-wide abundance of sea lampreys was estimated from a combination of mark-recapture estimates of spawning-phase migrants in streams with traps, and regression model-predicted numbers in streams without traps. Marking rates of less than 5 per 100 fish were found to result in a tolerable annual rate of mortality of less than 5%, based on a relationship between marking rates and the probability of surviving a sea lamprey attack. Target sea lamprey abundances to support the Fish Community Objectives have been estimated for the other lakes through the use of the same methodology and comparable data.

In 2005 sea lamprey abundance was significantly greater than the target abundance with the spawning population estimated to be 121,000 (95% CI; 103,000–151,000). While no overall trend is evident in sea lamprey populations throughout the last 20 years, lake-wide estimates of spawning lamprey abundance has been increasing since 1994. Similarly the 2005 wounding rate was 11.6 wounds per 100 fish which indicates an upward trend since 1994. The increase in wounding rates has been most dramatic in the northwest portion of the lake suggesting the source of additional sea lampreys is originating in this area.

The Commission has addressed the apparent increase in sea lamprey abundance in Lake Superior by significantly increasing assessment and treatment effort. The causes of the increase in sea lamprey numbers during the late 1990s are unclear, with hypotheses ranging from reduced lampricide control effort to increased survival of juvenile lampreys due to changes in the fish community. However, all known and likely sources of sea lampreys have been surveyed during 2004-05. As a result lampricide control effort in streams and lentic habitats was at its highest level in 20 years, especially in the northwest portion of the lake. The effect of the increased control effort will be assessed from the 2006 and 2007 assessment programs.

Lake Michigan

The Lake Michigan Committee established the following goal for sea lamprey management in its 1995 Fish Community Objectives:

Suppress the sea lamprey to allow the achievement of other fish community objectives.

Sea lamprey control has the most direct effect on achieving objectives for lake trout and other salmonines:

Establish a diverse salmonine community capable of sustaining an annual harvest of 2.7 to 6.8 million kilograms (6 to 15 million pounds), of which 20-25% is lake trout.

Establish self-sustaining lake trout populations.

During 2004 the Lake Michigan Committee agreed to an explicit target sea lamprey population of 56,000 +/- 13,000 to support the Fish Community Objectives. Using the method outlined for Lake Superior, this target and range were calculated from the abundance of sea lampreys estimated for the 5-year period when marking rates were closest to five marks per 100 fish (1988-1992 - 4.7 A1-3 marks per 100 lake trout >21").

During 2005, sea lamprey abundance was estimated to be above the target level (85,176, 95% CI: 78,996 – 97,985), but indicated a decrease from abundance in 2004. Sea lamprey abundance was below or within targets prior to the 2000 spawning year, but showed a significant trend upward and has been above the target range since 1999. Similarly, marking rates have indicated an upward trend and have been above target levels since 1995.

Control efforts have targeted all potential sources of sea lampreys in Lake Michigan. The upward trend in sea lamprey abundance over this period may have been caused by immigration from Lake Huron and the St. Marys River, changes in treatment effort, changes in treatment effectiveness, changes in the process used to select streams for treatment, and/or new untreated sources of sea lampreys. Sea lampreys in Lake Huron increased to peak levels of abundance during the mid-1990s and those large populations likely spilled over into Lake Michigan. Successful control of the St. Marys River has reduced sea lamprey abundance and marking rates in Lake Huron during the last five years. The abundance of sea lampreys in Lake Michigan continued to increase during that same period. The numbers of stream treatments declined in Lake Michigan during the late 1990s as the commission focused efforts on the St. Marys River.

The Commission increased the number of treatments in all lakes during 2001 with special emphasis on increasing suppression in Lake Michigan. More stream treatments were carried out on Lake Michigan during 2001 - 2005 than in the previous four years. Stream treatment protocols were changed during the early 1990s to improve their efficiency and to use less TFM. Further changes were enacted during the late 1990s to protect young lake sturgeon. These changes may have reduced the effectiveness of the lampricide treatments. During 2005, the states of Michigan and Wisconsin agreed to relax the reduced concentrations used in streams with lake sturgeon in order to ensure effective treatments. The entire population of larval sea lampreys in the Carp Lake Outlet was not treated due to concerns about the federally listed Hungerfords crawling water beetle. A new barrier has been constructed on the river during 2005 and should eliminate the need for lampricide treatments on this river. A population of larvae that had gone untreated for several years was discovered in the estuary of the Manistique River and was treated during three years beginning in 2001. An increasing population of sea lampreys became established above a dam on the Manistique River. This population, with a distribution covering over 220 km of river, was treated during 2003 and again during 2004 and the decline in abundance of spawning-phase sea lampreys during 2005 corresponds with this treatment. However, marking rates have not shown the same decline. These marking rates may be affected by declines in abundance of large lake trout. Sea lampreys in Lake Michigan are likely to be coming from all of these sources and the targeted control efforts should continue to reduce their abundances.

Lake Huron

The Lake Huron Committee established the following specific goal for sea lamprey management in its 1995 Fish Community Objectives:

Reduce sea lamprey abundance to allow the achievement of other fish community objectives.

Obtain a 75% reduction in parasitic-phase sea lampreys by the year 2000 and a 90% reduction by the year 2010 from present levels.

These sea lamprey objectives support the other Fish Community Objectives, specifically the salmonine objective:

Establish a diverse salmonine community that can sustain an annual harvest of 2.4 million kg, with lake trout the dominant species and anadromous (stream-spawning) species also having a prominent place.

During 2004 the Lake Huron Committee agreed to an explicit target sea lamprey population of 73,000 +/- 20,000 to meet the objective of a 75% reduction and to support the other Fish Community Objectives. Using the method outlined for Lake Superior, this target and range were calculated as 25% of the estimated lake-wide population of sea lampreys during the 5-year period prior to the completion of the Fish Community Objectives (1989 - 1993).

In 2005 sea lamprey abundance was estimated to be above target levels but indicated a downward trend (122,200, 95% CI: 108,300-145,000). Sea lamprey abundance in Lake Huron has been above target levels throughout the last 20 years. During the 1990s there were more sea lampreys in Lake Huron than in all the other Great Lakes combined. The population estimates since 2001 have been significantly lower than estimates from the previous 10 years. The reduction in marking rates observed during the same period is greater than the change in sea lamprey abundance and is also significant.

The abundance of sea lampreys in Lake Huron during the 1980s and 1990s was attributed to production from the St. Marys River, the large connecting channel with Lake Superior. The population of larval sea lampreys in the river was estimated at 5.2 million during the mid 1990s and was considered large enough to be producing the majority of sea lampreys. The volume of the St. Marys River precluded treatment with liquid TFM. An innovative control program was implemented on the river during 1997 that integrated spot treatments with granular Bayluscide (a novel bottom release lampricide) and the alternative control methods of trapping and sterile male release. During 1998-2001 the first full round of approximately 850 ha of spot treatments was completed. These spot treatments have contributed to the decline in sea lamprey abundance and marking rates observed since 2001. This integrated program continued through 2005 with spot treatments of the most densely populated areas to kill larvae (about 80 ha per year) and increased trap capture of migrating adults combined with maximum release of sterilized males.

Lake Erie

The Lake Erie Committee published "Fish Community Goals and Objectives for Lake Erie" during 2003. While the document does not include a specific sea lamprey objective, it does state that effective sea lamprey management is needed to support the fish community objectives for Lake Erie, especially those related to lake trout restoration:

Eastern basin - provide sustainable harvests of walleye, smallmouth bass, yellow perch, whitefish, rainbow smelt, lake trout, rainbow trout, and other salmonids; restore a self-sustaining population of lake trout to historical levels of abundance.

The lake trout management plan for rehabilitation of self-sustaining stocks in the eastern basin of Lake Erie prescribed a maximum annual mortality of less than 40% to permit the establishment and maintenance of suitable stocks of spawning adults. Mortality was to be controlled through management of fishery exploitation and continued suppression of sea lampreys.

During 2004 the Lake Erie Committee agreed to an explicit target sea lamprey population of 3,000 +/- 1,000 to support the Fish Community Objectives. Using the method outlined for Lake Superior, this target and range were calculated from the abundance of sea lampreys estimated for the 5-year period when marking rates were closest to 5 marks per 100 fish (1991-1995 - 4.4 A1-3 marks per 100 lake trout >21").

In 2005 we estimated 17,000 spawning sea lamprey in Lake Erie; significantly greater than the target abundance. The precision of this estimate is low because the sample size for the regression analysis was relatively low. The initial round of stream treatments during 1986 and

suppression during the following eight years resulted in an annual sea lamprey abundance within the target range. During the late 1990s sea lamprey abundance increased to pre-treatment levels, which was probably due to deferral of some treatments, failure to treat all sea lamprey-infested areas in some streams, and sub-optimal treatment efficacy resulting from changes in procedures to protect non-target organisms. Extensive surveys of larval populations (considering all potential sources of sea lampreys) resulted in successful stream treatments and suppression to target levels during three of the past four years. Marking rates show the same pattern with significantly higher rates in 2005 compared to 2004.

Since 2001 the Commission increased treatment effort across the Great Lakes basin to improve suppression, including some treatments planned for Lake Erie in 2006. In response to the increases in spawning phase abundance in 2005, the Commission and its agents are scheduled to treat four additional streams during the 2006 field season.

Lake Ontario

The Lake Ontario Committee established the following goal for sea lamprey management in its 1988 Fish Community Objectives:

Limit the size of the sea lamprey population to a level that will not cause mortality in excess of 90,000 lake trout annually.

The Lake Ontario Committee revised its lake trout rehabilitation plan in 1983. The plan recognized that continued control of sea lampreys is necessary for lake trout rehabilitation and included a specific objective for sea lampreys:

Controlling sea lampreys so that fresh wounding rates (A1) of lake trout larger than 431 mm is less than 2 marks/100 fish.

This objective is meant to maintain an annual survival rate of 60% or greater for lake trout in order to maintain a target spawning stock of 0.5 to 1.0 million adults of multiple year classes. Along with sea lamprey control, angler and commercial exploitation will also be controlled so that annual harvest does not exceed 120,000 fish in the near term.

During 2004 the Lake Ontario Committee agreed to an explicit target sea lamprey population of 30,000 +/- 4,000 to support the Fish Community Objectives. Using the method outlined for Lake Superior, this target and range were calculated from the abundance of sea lampreys estimated for the five year period when marking rates were closest to 5 marks per 100 fish (1999-2003 - 7.0 A1-3 marks per 100 lake trout >21”).

In 2005 sea lamprey abundance was estimated to be above the target range (41,800, 95% CI: 37,200-47,200). However, there is a significant trend downward in abundance of sea lampreys throughout the last 20 years. Sea lamprey abundance has been at or below the target range in eight of 12 years since 1994. However, the spawning population was above the target abundance in 2004 and 2005. The marking rates on lake trout show a similar pattern of decline during the last 20 years. In 2005 the wounding rate increased to 3.9 A1 per 100 fish. The change between 2004 and 2005 was greater for the wounding rate index compared to the spawning abundance index. The difference in the rate of change between these indices may be a function of changes in the predator-prey ratio in Lake Ontario.

Control appears to be effective on Lake Ontario and increases in abundance are hypothesized to be a function of some lampreys surviving treatments and untreated sources of sea lampreys. All cost-effective stream treatments have been carried out on Lake Ontario during recent years. The Commission increased stream treatment effort beginning in 2001 in order to improve suppression across the basin. On average, more lampricide treatments were conducted on Lake Ontario since 2001 than during the previous 4 years. The treatment of the complicated and productive Black River during 2002 is suspected to have been less effective than previous treatments because of flow and stratification patterns. This river was treated during 2004. The Niagara River has a population of larval sea lampreys and contributes parasitic sea lampreys to Lake Ontario. The Commission and its agents are monitoring this population to develop a range of potential management strategies.

LAMPRICIDE CONTROL

Tributaries harboring larval sea lampreys are treated periodically with lampricides to eliminate or reduce larval populations before they recruit to the lake as parasitic adults. USFWS and DFO treatment units administer and monitor doses of the lampricide TFM, sometimes augmented with Bayluscide (70% Wettable Powder or 20% Emulsifiable Concentrate) in streams and 3.2% granular Bayluscide in lentic areas. Specialized equipment and techniques are employed to provide concentrations of lampricides that eliminate about 95% of the sea lamprey larvae and minimize the risk to non-target organisms. During recent years the combination of improved analytical and predictive techniques has allowed treatment personnel to reduce the amount of lampricide use (kg/yr) in the Great Lakes by 35%. Table 1 summarizes 2005 lampricide applications in tributaries of the Great Lakes.

The Lampricide Control Task Force was established during December 1995 with charges to improve the efficiency of lampricide control, maximize sea lampreys killed in stream and lentic treatments (while minimizing lampricide use, costs, and impacts on aquatic ecosystems), and define lampricide control options for near and long-term stream selection and target setting. The report of the progress of this task force for 2005 is presented on page 68.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes, 2005.

Lake	Number of Streams	Discharge (m^3/s)	TFM[1] (kg)	Bayluscide[1] (kg)	Distance (km)
Superior	24	119.1	11,200.1	484.1	723.6
Michigan	12	78.5	15,826.7	102.7	815.9
Huron	19	59.6	8,461.4	739.5	495.4
Erie	2	0.3	75.1	---	14.0
Ontario	10	34.5	3,255.4	---	181.4
Total	**67**	**292.0**	**38,278.7**	**1,326.3**	**2,230.3**

[1]Lampricide quantities are in kg of active ingredient.

Lake Superior

Lake Superior has 1,566 tributaries (833 Canada, 733 United States). One hundred forty-two tributaries (54 Canada, 88 United States) have historical records of larval sea lamprey production. Of these, 67 tributaries (28 Canada, 39 United States) have been treated with lampricides at least once during 1996-2005. Forty-nine tributaries (17 Canada, 32 United States) are treated on a regular 3-5 year cycle.

Table 2 provides details on the application of lampricides to tributaries treated in 2005 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in 19 tributaries (5 Canada, 14 United States) and lentic areas of the Mackenzie, lower Nipigon, Gravel, Cypress and Batchawana rivers.

- The "Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons (*Acipenser fulvescens*)" was followed during treatment of the Sturgeon (72.5 km), Ontonagon (21.6 km), and Bad (30.5 km) rivers. The protocol was applied to 17% (124.6 of 723.6 km) of the total length of all treated streams in the basin. The protocol limits the concentrations of TFM to the minimum lethal concentration (MLC; the concentration required to kill 99.9% of sea lampreys in a 12-hour treatment) or TFM and Bayluscide to 1.2xMLC to protect young-of-year lake sturgeons.

- High discharge affected six lampricide treatments. In the United States, rainfall occurred during treatment of the upper Firesteel River forcing discontinuance of the treatment for two days until discharge decreased to workable levels. Treatment was then restarted near the M-26 crossings of the east and west branches. Near-record high stream discharges occurred during treatments of the Ravine, Silver, and Sturgeon rivers. In Canada, high discharge resulted in TFM treatment deferrals for the Pic and lower Nipigon rivers. This was the second consecutive year for deferral of the Pic River treatment.

- Low discharge also had an affect on treatments. In the United States, discharges were extremely low during treatments of Carpenter Creek and the Laughing Whitefish River. Extremely low discharge resulted in postponement of the Jackfish River treatment from August to November.

Table 2. Details on the application of lampricides to tributaries of Lake Superior, 2005 (number in parentheses corresponds to location of stream in Fig. 1).

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
Canada					
Goulais R. (10)	Jun 21	13.6	1,116.7	---	109.0
Batchawana Bay (9)	Jul 6	---	---	197.6[3]	---
Black Sturgeon R. (2)	Aug 7	12.2	1,038.4	13.3	16.9
Mountain Bay (7)	Aug 8	---	---	96.6[3]	---
Cypress Bay (6)	Aug 9	---	---	2.2[3]	---
Nipigon R.					
lower (3)	Aug 10	---	---	127.5[3]	---
Stillwater Cr. (4)	Aug 10	0.1	16.1	---	1.0
MacKenzie Bay (1)	Aug 12	---	---	11.6[3]	---
White R. (8)	Aug 14	12.9	2,120.2	23.6	5.3
Jackfish R. (5)	Nov 2	4.4	371.3	---	10.4
Total (Canada)		**43.2**	**4,662.7**	**472.4**	**142.6**
United States					
Potato R. (20)	May 6	0.7	74.2	---	20.9
Cranberry R. (21)	May 7	0.3	50.9	---	24.2
Firesteel R. (18)	May 21	4.8	456.6	---	51.5
Iron R. (23)	Jun 28	2.5	183.2	---	4.8
Salmon Trout R. (13)	Jun 29	1.5	163.8	---	12.9
Laughing Whitefish R. (12)	Jul 5	0.1	53.0	---	8.1
Ontonagon R. (19)	Jul 29	14.9	2,004.3	---	191.6
Trap Rock R. (17)	Aug 13	0.4	65.5	---	14.5
Carpenter Cr. (11)	Aug 17	0.1	0.7	---	0.6
Bad R. (22)	Sep 22	11.3	1,524.3	---	144.9
Brule R. (24)	Sep 23	4.8	555.4	---	10.3
Ravine R. (14)	Oct 6	3.1	131.5	---	9.7
Silver R. (15)	Oct 8	4.5	194.1	---	8.1
Sturgeon R. (16)	Oct 11	26.9	1,079.9	11.7	78.9
Total (United States)		**75.9**	**6,537.4**	**11.7**	**581.0**
TOTAL (for lake)		**119.1**	**11,200.1**	**484.1**	**723.6**

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 136 TFM bars (26.2 kg active ingredient) applied in 12 streams.
[3] Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to lentic areas.

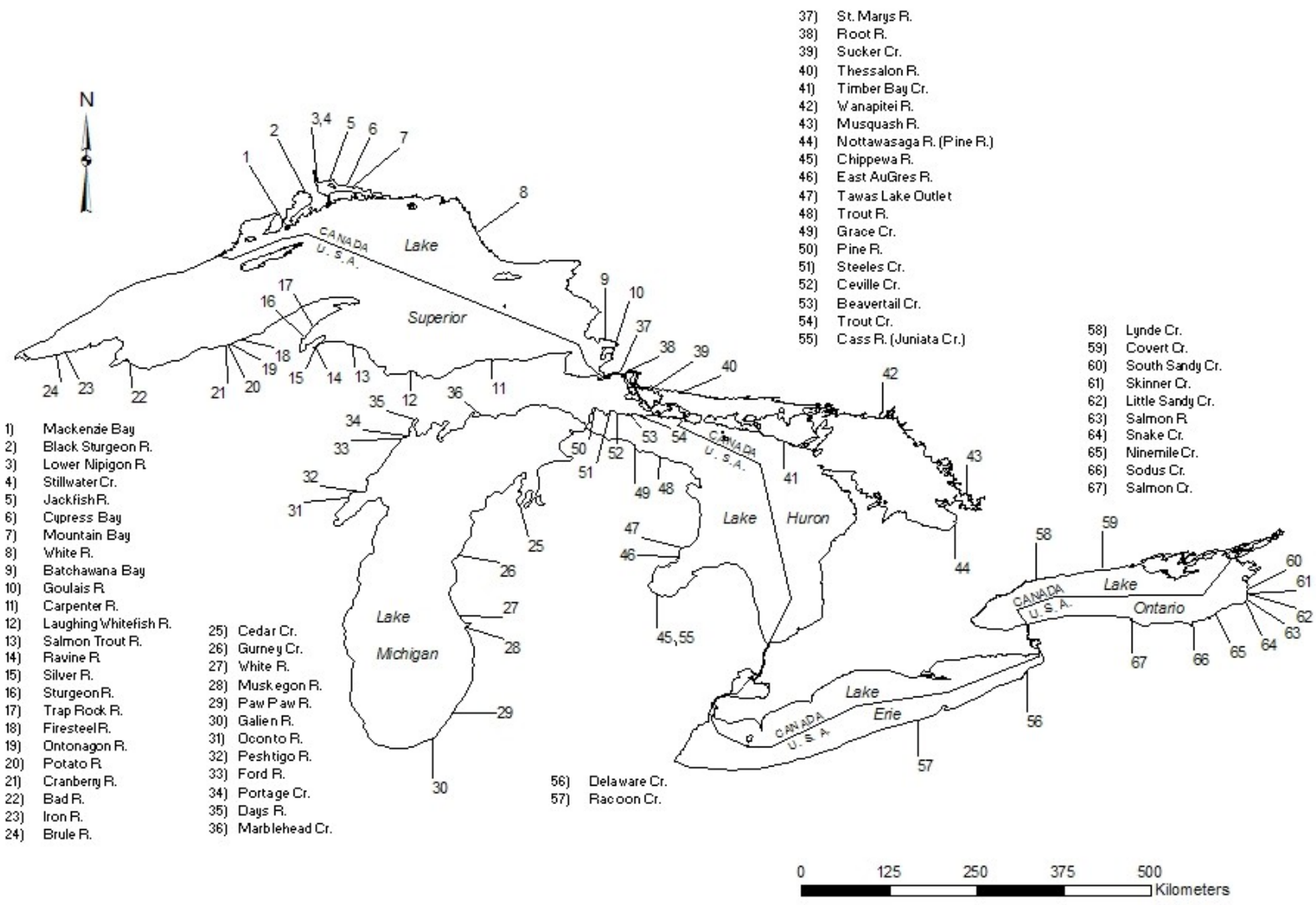

Fig. 1. Location of tributaries treated with lampricides during 2005.

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-two tributaries have historical records of larval sea lamprey production, and of these, 66 tributaries have been treated with lampricides at least once during 1996-2005. Thirty-three tributaries are treated on a regular 3-5 year cycle.

Table 3 provides details on the application of lampricides to tributaries treated in 2005 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in all 12 scheduled tributaries.

- The "Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons (*Acipenser fulvescens*)" was followed during treatment of four large tributaries. The protocol was applied to 20% of the total length of all treated streams in the basin (166 km out of 816 km total). The protocol normally limits the concentrations of TFM and Bayluscide to 1.2 times minimum lethal concentration (MLC; the concentration required to kill 99.9% of sea lampreys in a 12-hour treatment) to protect young-of-year lake sturgeons. Because lamprey numbers in Lake Michigan currently exceed target levels, a modified sturgeon protocol was negotiated with the Michigan and Wisconsin departments of Natural Resources for the 2005 field season. Under the modified protocol, the Muskegon, Peshtigo, and Oconto rivers were treated at no more than 1.3 times MLC and the White River was treated at no more than 1.4 times MLC.

- The Peshtigo River did not rank for treatment under the current protocol for stream selection, but was added to the schedule based on expert judgment. It is difficult to accurately assess lamprey populations in the Peshtigo River, and past experience indicated that lamprey numbers could be much higher than indicated. This was borne out by collections during the passage of the lampricide bank, when large numbers of sea lamprey ammocetes were observed. Unexpected manipulations of the Peshtigo dam resulted in an only partially successful treatment. Stream discharge decreased suddenly from 5.7 m^3/s (already considered low) to 2.3 m^3/s during the primary lampricide application, then increased sharply back to 5.7 m^3/s as the application was concluding.

- Treatments of the Days and Cedar rivers, and Portage Creek were conducted under conditions of extremely low stream discharge.

- A mandatory adverse effects 6(a)(2) report was submitted to the U.S. Environmental Protection Agency after burbot and longnose dace were killed during the Cedar River treatment, the result of a significant, unexpected drop in stream pH apparently caused by the lampricide itself. Numbers of non-target fish killed in other treatments were minimal.

Table 3. Details on the application of lampricides to tributaries of Lake Michigan, 2005 (number in parentheses corresponds to location of stream in Fig. 1).

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1]	Distance Treated (km)
Marblehead Cr. (36)	May 05	0.3	51.5	0.0	7.7
Paw Paw R. (29)	May 06	11.9	3,178.9	19.9	164.2
Ford R. (33)	Jun 02	6.8	1,717.2	7.9	209.3
Gurney Cr. (26)	Jun 07	0.2	35.0	0.0	8.4
Cedar R. (25)	Jun 17	1.4	1,056.7	0.0	111.1
Oconto R. (31)	Jul 14	6.2	742.4	14.5	19.3
Peshtigo R. (32)	Jul 18	4.2	481.7	4.6	9.7
White R. (27)	Aug 01	7.4	1,911.6	18.7	112.7
Muskegon R. (28)	Aug 12	39.2	6,651.9	62.8	141.7
Days R. (35)	Sep 07	0.1	57.4	0.0	6.9
Portage Cr. (34)	Sep 10	0.1	8.8	0.0	2.7
Galien R. (30)	Oct 08	0.7	301.7	0.0	22.2
TOTAL		**78.5**	**16,194.8**	**128.4**	**815.9**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 409 TFM Bars (85.3 kg active ingredient) applied in seven streams.

Lake Huron

Lake Huron has 1,761 tributaries (1,334 Canada, 427 United States). One hundred twenty one tributaries (56 Canada, 65 United States) have historical records of larval sea lamprey production. Of these, 71 tributaries (37 Canada, 34 United States) have been treated with lampricide at least once during 1996 - 2005. Forty-seven tributaries (25 Canada, 22 United States) are treated on a regular 3-5 year cycle.

Table 4 provides details on the application of lampricides to tributaries treated and Fig. 1 shows the locations of the tributaries.

- Treatments were completed in 18 tributaries (8 Canada, 10 United States) and the St. Marys River. The lake sturgeon protocol was not applied to any stream treatment.

- A total of 130 ha (99 Canada, 31 United States) of the St. Marys River was treated with Bayluscide 3.2% Granular Sea Lamprey Larvicide. To maximize efficiency the areas were treated in a "border blind" fashion with the DFO and USFWS sharing application responsibilities on both sides of the border.

- The proposed treatment of the Magnetawan River was deferred due to extremely low discharge.

- The proposed treatment of Sand Creek was deferred to 2006.

- Low stream discharge and two large beaver impoundments reduced the effectiveness of the lampricide block in the lower section of Timber Bay Creek.

- Four miles of the Trout River headwaters were treated to eliminate the 2004 year class of sea lampreys. This was completed to provide a lamprey-free environment for pheromone research.

- The Chippewa River was treated during hot weather in mid-July. Control staff worked closely with owners of three canoe rentals to educate hundreds of canoeists and float-tubers about sea lampreys and lampricide. Treatment of the Chippewa River was planned to minimize lampricide penetration of the Mt. Pleasant water treatment plant's Ranney collection wells. Alternate water sources were used until monitoring showed that the lampricide block had passed.

- The East AuGres River was treated below the sea lamprey barrier for the fifth time. The barrier continues to be effective.

- Treatments of Ceville and Trout creeks were conducted during periods of low stream discharge.

- Tagged larvae, released as part of a larval growth and transformation study, were recovered during the treatment of the Root River and Ceville, Crystal and Juniata creeks.

- During treatment of Juniata Creek a successful mark-recapture study was conducted by Andy Treble, a Michigan State University graduate student.

- Mortality of non-target organisms was negligible in all Lake Huron treatments.

Table 4. Details on the application of lampricides to tributaries of Lake Huron, 2005 (number in parentheses corresponds to location of stream in Fig. 1).

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
Canada					
Sucker Cr. (39)	May 16	0.2	21.0	---	1.0
Nottawasaga R.					
Pine R. (44)	Jun 7	2.3	875.6	---	45.5
Thessalon R. (40)	Jun 27	6.5	417.1	---	31.5
St. Marys R. (37)	Jul 11	---	---	553.0[3]	---
Wanapitei R. (42)	Jul 20	19.8	933.6	10.8	9.7
Musquash R. (43)	Aug 31	12.8	609.6	---	3.2
Root R. (38)	Sep 27	3.9	180.1	---	44.2
Timber Bay Cr. (41)	Oct 12	0.1	18.5	---	3.2
Total (Canada)		**45.6**	**3,055.5**	**563.8**	**138.3**
United States					
Trout R. (48)	Apr 28	2.8	297.0	---	6.4
Steeles Cr. (51)	May 10	0.2	17.5	---	1.9
Pine R. (50)	Jun 02	3.8	1,140.8	---	157.8
Beavertail Cr. (53)	Jun 28	0.1	45.9	---	5.3
Grace Cr. (49)	Jun 29	0.1	2.4	---	2.4
Chippewa R. (45)	Jul 15	4.4	3,244.9	---	117.5
St. Marys R. (37)	Jul 11	---	---	175.7[3]	---
East AuGres R. (46)	Jul 29	1.4	353.3	---	26.6
Cass R.					
Juniata Cr. (55)	Sep 08	0.1	61.9	---	6.4
Tawas Lake Outlet					
Grays Cr. (47)	Sep 09	0.1	26.1	---	4.8
Sims Cr. (47)	Sep 10	0.1	14.9	---	4.8
Silver Cr. (47)	Sep 12	0.7	179.1	---	18.4
Ceville Cr. (52)	Sep 10	0.1	15.5	---	3.2
Trout Cr. (54)	Sep 12	0.1	6.6	---	1.6
Total (United States)		**14.0**	**5,405.9**	**175.6**	**357.1**
TOTAL (for lake)		**59.6**	**8,461.4**	**739.5**	**495.4**

[1] Lampricide quantities are in kg of active ingredient.
[2] Includes a total of 68 TFM Bars (13.1 kg active ingredient) applied in 6 streams.
[3] Includes 728.7 kg Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to the St. Marys River.

Lake Erie

Lake Erie has 842 tributaries (525 Canada, 317 United States). Twenty-one tributaries (11 Canada, 10 United States) have historical records of larval sea lamprey production. Of these, 8 tributaries (3 Canada, 5 United States) have been treated with lampricides at least once during 1996-2005. Four tributaries (2 Canada, 2 United States) are treated on a regular 3-5 year cycle.

Table 5 provides details on the application of lampricides to tributaries treated in 2005 and Fig. 1 shows the locations of the tributaries.

- Treatments with TFM were completed in two tributaries (0 Canada, 2 United States).
- Raccoon Creek was treated in two sections due to low stream discharge and extremely slow flow times.
- Delaware Creek was successfully treated for the second time in 2005; the previous treatment was in 1986.

Table 5. Details on the application of lampricides to tributaries of Lake Erie, 2005 (number in parentheses corresponds to location of stream in Fig. 1).

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1]	Bayluscide (kg)[1,]	Distance Treated (km)
United States					
Delaware Cr. (56)	Sep 24	0.2	43.7	---	10.0
Raccoon Cr. (57)	Sep 24	0.1	31.4	---	4.0
Total		**0.3**	**75.1**	**0.0**	**14.0**

[1] Lampricides are reported in kg of active ingredient.

Lake Ontario

Lake Ontario has 659 tributaries (405 Canada, 254 United States). Sixty-one tributaries (31 Canada, 30 United States) have historical records of larval sea lamprey production, and of these, 41 tributaries (21 Canada, 20 United States) have been treated with lampricides at least once during 1996 - 2005. Twenty-nine tributaries (13 Canada, 16 United States) are treated on a regular 3-5 year cycle.

Table 6 provides details on the application of lampricides to tributaries treated in 2005 and Fig. 1 shows the locations of the tributaries.-

- Treatments were completed in 10 tributaries (2 Canada, 8 United States). The lake sturgeon protocol was not applied to any stream treatment.

- Mark-recapture population studies were performed on Lynde Creek and Trout and Orwell brooks (tributaries to the Salmon River).

- During the treatment of the Salmon River some mudpuppies (< 200) were killed and a 6(a)2 report was filed with the Environment Protection Agency (EPA).

- Little Sandy and Skinner creeks (both treated in 2004) were re-treated in 2005 to reduce the population of residual sea lampreys.

Table 6. Details on the application of lampricides to tributaries of Lake Ontario, 2005 (number in parentheses corresponds to location of stream in Fig. 1).

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
Canada					
Covert Cr. (59)	Sep 14	0.1	21.1	---	2.2
Lynde Cr. (58)	Sep 18	0.3	117.6	---	24.1
Total (Canada)		**0.4**	**138.7**	**0**	**26.3**
United States					
Skinner Cr. (61)	Apr 21	1.5	160.4	---	12.8
Snake Cr. (64)	Apr 22	0.3	101.4	---	15.4
Salmon Cr. (67)	Apr 28	1.7	265.8	---	19.3
South Sandy Cr. (60)	May 3	7.6	793.5	---	14.7
Sodus Cr. (66)	May 4	0.5	114.7	---	2.2
Salmon R. (63)	May 30	20.9	1,256.9	---	28.8
Trout Br. (63)	May 27	0.5	74.6	---	14.1
Orwell Br. (63)	May 29	0.3	95.3	---	10.2
Little Sandy Cr. (62)	June 1	0.4	77.9	---	12.0
Ninemile Cr. (65)	June 2	0.4	176.2	---	25.6
Total (United States)		**34.1**	**3,116.7**	**0**	**155.1**
TOTAL (for lake)		**34.5**	**3,255.4**	**0**	**181.4**

[1] Lampricide quantities are in kg of active ingredient.
[2] Includes a total of 24 TFM Bars (4.6 kg active ingredient) applied in 5 streams.
[3] Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to lentic areas.

ALTERNATIVE CONTROL

Sterile-Male-Release Technique

Research on the use of a sterile-male-release technique (SMRT) in sea lamprey control began during 1971. The SMRT was experimentally implemented in Lake Superior tributaries and the St. Marys River during 1991-1996, and efforts were refocused for exclusive use in the St. Marys River after 1996.

Male sea lampreys have been captured during their spawning migrations in 25 tributaries to lakes Superior, Michigan, Huron, and Ontario for use in the SMRT. Captured males are transported to the sterilization facility at the U.S. Geological Survey Hammond Bay Biological Station. Sea lampreys are sterilized with the chemosterilant bisazir and released into the St. Marys River. Laboratory and field studies have shown that treated male sea lampreys are sterile and sexually competitive (produce mating pheromones and exhibit typical spawning behaviours). Furthermore, studies showed that in areas where sterile males were released the number of eggs hatching in nests had been reduced.

The SMRT Task Force was established in 1984 to refine the long-term strategy for application of the SMRT and to coordinate a large-scale research program in Lake Superior and the St. Marys River. The Reproduction Reduction Task Force assumed these responsibilities in 2003. The report of progress of this task force is presented on page 75.

Highlights of the sterile male release program during 2005 are presented in Table 7 and include the following:

- A total of 32,866 spawning-phase male sea lampreys were delivered to the sterilization facility during 2005 from trapping operations on the Bad River (319), Brule River (4,985), Carp Lake Outlet (307), Cheboygan River (5,039), East Augres River (171), Echo River (1,959), Greene Creek (77), Humber River/Duffins Creek (1,756), Manistee and Pere Marquette rivers (160), Manistique River (10,018), Middle River (8), Ocqueoc River (1,009), Peshtigo River (1,031), St. Marys River (4,876), Thessalon River (1,064), and Tittabawassee River (87).

- A total of 30,581 sterilized male sea lampreys were released in the St. Marys River during May - July 2005 (Table 7). The estimated population of spawning-phase sea lampreys in the St. Marys River during 2005 was 18,790 (12,026 males). Assessment traps removed 8,393 spawning-phase sea lampreys (5,380 males), an estimated reduction of 45% from trapping. The ratio of sterile to fertile males in the St. Marys River was estimated to be 4.6:1 (30,581 sterile: 6,609 fertile).

- The theoretical reduction from trapping and sterile male release was estimated at 90% during 2005. The theoretical reduction from trapping and sterile male release averaged 87% during 1997 - 2005. During 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 6,801 to 673 during 2005.

- In the St. Marys River rapids, one sterile and two untreated males were observed on 13 nests. Egg viability averaged 34.5% in the 14 nests that were excavated. Average egg viability (weighted by nests per year) during 1997-2005 was 23%.

Table 7. Theoretical effects of trapping and sterile-male-release, and theoretical suppression of reproduction in the estimated population of sea lampreys in the St. Marys River during 1991-2005.

	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Population Estimate	35,582	19,508	45,620	10,624	19,608	22,255	8,162	20,235	19,860	38,829	25,311	13,619	27,011	19,864	18,790
Percent males	53	58	56	57	55	63	56	57	60	64	63	63	66	70	64
Percentage of sea lampreys removed by traps	42	39	22	53	44	20	30	35	53	48	45	59	33	27	45
Sterile males Released	7,516	4,508	4,832	2,667	4,238	3,650	17,181	16,743	26,285	43,184	31,459	22,684	27,963	26,472	30,581
Estimated ratio sterile to untreated males	0.7:1	0.7:1	0.2:1	1.0:1	0.7:1	0.3:1	5.4:1	2.2:1	4.7:1	3.3:1	3.6:1	6.4:1	2.3:1	2.6:1	4.6:1
Theoretical percent reduction in reproduction[1]	65	63	38	76	67	39	89	80	92	88	88	94	80	80	90
Theoretical reproducing females[2]	5,805	3,029	12,534	1,091	2,873	4,922	402	1,771	638	1,670	1,113	289	1,860	1,203	673

[1] $\left[f = \frac{1-t}{s{:}n+1} \right]$ Where f is the theoretical reduction in reproduction from sterile males and trapping, t is the proportion of animals trapped and $s{:}n$ is the ratio of sterile to normal males.

[2] Theoretical reproducing females = the theoretical reduction in reproduction (f) x the female population estimate.

Barriers

The "Strategic Vision of the Great Lakes Fishery Commission for the First Decade of the New Millennium" contains a milestone which states that 50% of sea lamprey suppression and a 20% reduction in TFM use will be accomplished through alternative control technologies, including barriers. Ultimately, supression will be measured in terms of reductions in larval sea lamprey production. While estimates of larval production suppression by barriers are developed, an interim measure of preferred (type 1) larval sea lamprey habitat was used as a surrogate. Approximately 1,900 hectares (ha) of type 1 larval habitat was available in Great Lakes tributaries that are regularly treated with lampricide or have sea lamprey barriers. By the end of 2005, the Commission's network of 69 sea lamprey barriers in the Great Lakes had eliminated over 14% of the 1,900 ha of type 1 larval habitat from production.

The revised barrier strategy and implementation plan identifies three sea lamprey barrier program priorities: 1) construction of new, effective sea lamprey barriers; 2) effective operation and maintenance of existing sea lamprey barriers in the Commission's sea lamprey barrier network; and 3) ensured blockage of adult sea lampreys at other barriers. The report on progress of the Sea Lamprey Barrier Task Force is presented on page 80.

Lake Superior

Presently, there are 16 sea lamprey barriers on Lake Superior tributaries (Fig. 2).

New Construction

- New barrier projects in development for the Sucker River and Harlow Creek were on hold during 2005 due to the lack of U.S. Army Corps of Engineers funding.

Operation and Maintenance of Existing Barriers

- Marquette Biological Station (MBS) and DFO personnel performed maintenance and safety inspections on 14 barriers (9 Canada, 5 United States).

- Furnace Creek – The stop-log barrier was operational from March 14 through September 9.

- Lakehead Region Conservation Authority was contracted for supplementary inspections at two barriers near Thunder Bay to enhance level of surveillance at these remote sites. The increased inspection frequency allows early detection of potential problems that could lead to escapement or dam safety issues.

- Miners River - A breach in the barrier on the Miners River was discovered during 2004. Barr Engineering inspected the barrier during 2005 and repair of the footings is scheduled for 2006.

- McIntyre River – The velocity barrier was decommissioned.

- Silver River – The USFWS Ashland Fishery Resource Office (FRO) consulted with the MBS regarding a proposed a fish ladder at a six foot high perched culvert to enhance fish passage in the Bad River system. MBS staff determined that the proposed project may result in sea lamprey infestation upstream and coordinated with the Ashland FRO to incorporate stop logs to block sea lamprey.

- Trout Brook - The USFWS Ashland FRO consulted with the MBS regarding the modification of a culvert to reduce velocities and enhance fish passage in the Bad River system. MBS staff determined that modifications would not affect sea lamprey control efforts.

Lake Michigan

Presently, there are 13 sea lamprey barriers on Lake Michigan tributaries (Fig. 2).

New Construction

- New barrier projects that were in various stages of development for the Paw Paw, Manistee, and Manistique rivers, and Trail and Kids creeks were on hold during 2005 due to the lack of U.S. Army Corps of Engineers funding.

- A steel-sheet pile barrier and permanent sea lamprey trap were constructed on Carp Lake Outlet during October. This replaced an existing barrier that was removed.

- New barrier projects were in various stages of development for the Cedar and Galien rivers.

- Candidate barrier streams will be surveyed to measure fish species richness using the protocol developed by Katherine Smith and Mike Jones (MSU). A study was conducted on the Cedar River to compare efficiency of the Wisconsin AbP-2 (Badger model) backpack electrofisher and two Smith-Root backpack models in sampling species richness following this protocol. All shockers obtained the same number of species; Smith-Root shockers had slightly higher efficiency measured as species collected per hour

Operation and Maintenance of Existing Barriers

- USFWS personnel performed maintenance and safety inspections for eight barriers. Results of the inspections led to repair of a 12-foot section of lip on the crest of the barrier on the West Branch of the Whitefish River.

- Jordan River – The electrical barrier was operational from February 27 through August 2. The barrier was operated with five pulsators for the majority of the season despite repeated attempts by Smith-Root to repair one of the pulsators. Smith-Root believes the barrier decking is not providing sufficient insulation between the electrodes and the streambed, causing the pulsators to fault.

- Pere Marquette River – The electrical barrier was activated from March 3 through August 1. The fishway was operated seven days per week from March 3 through June 24 and during the weekdays only from June 24 through August 1. Fish passed were 7,157 steelhead, 6,683 suckers, 130 brown trout, and 59 chinook salmon. A total of 316 lampreys were captured.

Ensured Blockage at Other Barriers

- Green River – The Fish and Wildlife Service Green Bay Fishery Resource Office, Michigan Department of Natural Resources (MDNR), and Marquette Biological Station (MBS) are coordinating efforts to remove a dam on this Jordan River tributary.

- Boardman River – The Boardman River Dams Settlement Agreement Implementation Team was contacted to ensure that sea lamprey management interests would be considered in removal and modification projects proposed for several dams on the river.

- Stover Creek – The MDNR and the Irish Boat Shop contacted the MBS for input on a barrier reconstruction project. MBS staff requested that sea lamprey remain blocked due to the presence of preferred spawning and larval habitat upstream of the barrier site.

Lake Huron

Presently, there are 19 sea lamprey barriers on Lake Huron tributaries (Fig. 2).

New Construction

- New barrier projects that were in various stages of development for the Black Mallard, Au Gres rivers, and Schmidt Creek were on hold during 2005 due to the lack of U.S. Army Corps of Engineers funding.

- Root River – As a potential candidate for a sea lamprey barrier, the Root River was sampled for species richness. A total of 24 species were found in 0.61 ha of sampling during 2005.

- Thessalon River – As a potential candidate for a sea lamprey barrier, the Thessalon River was sampled for species richness. A total of 29 species were found in 0.34 ha during 2005.

Operation and Maintenance of Existing Barriers

- Marquette Biological Station (MBS) and DFO personnel performed maintenance and safety inspections on 11 barriers (5 U.S. and 6 Canada).

- Albany Creek – The lift gate barrier was operational from March 21 through August 4.

- Greene Creek – The stop-log barrier was operational from April 4 through August 4.

- Ocquoec River - The automatic activation system for the electrical components of the barrier was functional from March 31 through April 30. The electrical barrier was activated during

March 31 through April 6 and April 27 through April 30. After April 30, the activation system was disengaged due to false water level readings. Smith-Root is addressing the problem. Major repairs to the site during 2005 include excavating the jump pool downstream of the barrier to original design elevations, arranging boulders downstream of the barrier to raise tailrace water elevation 6" at the trap entrance, re-grading access roads on both sides of the river and placing new drain tile along the east side trap to drain water from the hillside.

Ensured Blockage at Other Barriers

- Little Ocqueoc River – The Fish and Wildlife Service Alpena Fishery Resource Office consulted the MBS before replacing a perched culvert. It was determined that the replacement would not affect sea lamprey control efforts since it was upstream of the sea lamprey barrier on the Ocqueoc River.

- Noisy River - Nottawasaga Valley Conservation Authority contacted DFO to review a barrier removal project in this tributary to the Nottawasaga River. It was determined that the removal of this barrier would not negatively affect sea lamprey control efforts.

- Sturgeon River - Removal of a barrier in the upper reaches of the Sturgeon River was reported to DFO. It was determined that the removal of this culvert would not negatively affect sea lamprey control efforts since it was upstream of an effective sea lamprey barrier.

Lake Erie

Presently, there are 8 sea lamprey barriers on Lake Erie tributaries (Fig. 2).

New Construction

- A new barrier in the planning stage for Conneaut Creek was terminated due to feasibility of type and size of structure needed, the low cost-benefit analysis, and the withdrawal of support by the Ohio Department of Natural Resources.

- Big Otter River - As a potential candidate for a sea lamprey barrier, Big Otter River was sampled for species richness. A total of 23 species were documented from surveys in 0.44 ha downstream of Tillsonburg.

Operation and Maintenance of Existing Barriers

- DFO personnel performed maintenance and safety inspections on 8 barriers.

- Long Point Region Conservation Authority was contracted for supplementary inspections to enhance the level of surveillance of Lake Erie barriers. The increased inspection frequency allows early detection of potential problems that could lead to escapement or dam safety issues.

- Big Creek - Air bladders were replaced on the inflatable barrier during July and August and successfully tested during November. Upgrades to the control system are underway and will include installation of a backup generator and addition of fault detection software. This should be completed in time for the 2006 season.

Ensured Blockage at Other Barriers

- Grand River (US) – the Ohio Nature Conservancy contacted the Marquette Biological Station (MBS) for their opinion regarding the removal of Harpersfield Dam and the potential for sea lamprey infestation upstream. This project would have a significant negative effect on sea lamprey control and USFWS staff continue to coordinate on the project.

- Grand River (Canada) - The Grand River Conservation Authority (GRCA) has modified the Denil fishway at Dunnville to improve performance. DFO approved the removal of the sea lamprey traps that were of limited function and identified the Caledonia dam as the key defacto barrier in the system. In addition, DFO coordinated with GRCA to lower the Taquanyah dam to allow restoration of coldwater habitat upstream while maintaining a sea lamprey barrier.

- Thames River (Lake St. Clair) - The Upper Thames River Conservation Authority contacted DFO regarding removal of the Dingman Creek weir. Dingman Creek is a tributary to the Thames River downstream of London. Although there had been historic observations of sea lampreys in the vicinity, DFO did not consider the weir in its present state to be a barrier and approved the removal.

Lake Ontario

Presently, there are 14 sea lamprey barriers on Lake Ontario tributaries (Fig. 2).

New Construction

- Bronte Creek – A new barrier is in the planning stage for Bronte Creek. Construction planned for 2006 was postponed because unstable substrate at the proposed site resulted in a doubling of the cost to construct. Alternative options and cost analysis are being pursued.

- Bowmanville Creek – a study was conducted to compare efficiency of the Wisconsin AbP (Badger model) backpack electrofisher against two Smith-Root backpack models in capturing species richness using the protocol developed by Katherine Smith and Mike Jones (MSU). All shockers obtained the same number of species; Smith-Root shockers had slightly higher efficiency (species/hr).

- Oshawa Creek – As a potential candidate for a sea lamprey barrier, Oshawa Creek was sampled for species richness. A total of 18 species were collected while surveying 0.43 hectares during 2005.

- Wilmot Creek - As a potential candidate for a sea lamprey barrier, 15 species were collected while surveying 0.05 hectares during 2005.

Operation and Maintenance of Existing Barriers:

- DFO personnel performed maintenance and safety inspections on 12 barriers in Canada.

- DFO inspected all Canadian Ontario sea lamprey barriers during 2005.

- Port Britain and Cobourg creeks - Bank stabilization was conducted.

- Duffins and Graham creeks - Fences were installed as a public safety and security measure.

Ensured Blockage at Other Barriers

- Shelter Valley Creek - DFO advised a private land owner about mitigation to the dam on their property in Shelter Valley Creek. The DFO determined that removal of the dam would have a negative effect on sea lamprey control and the dam was restored.

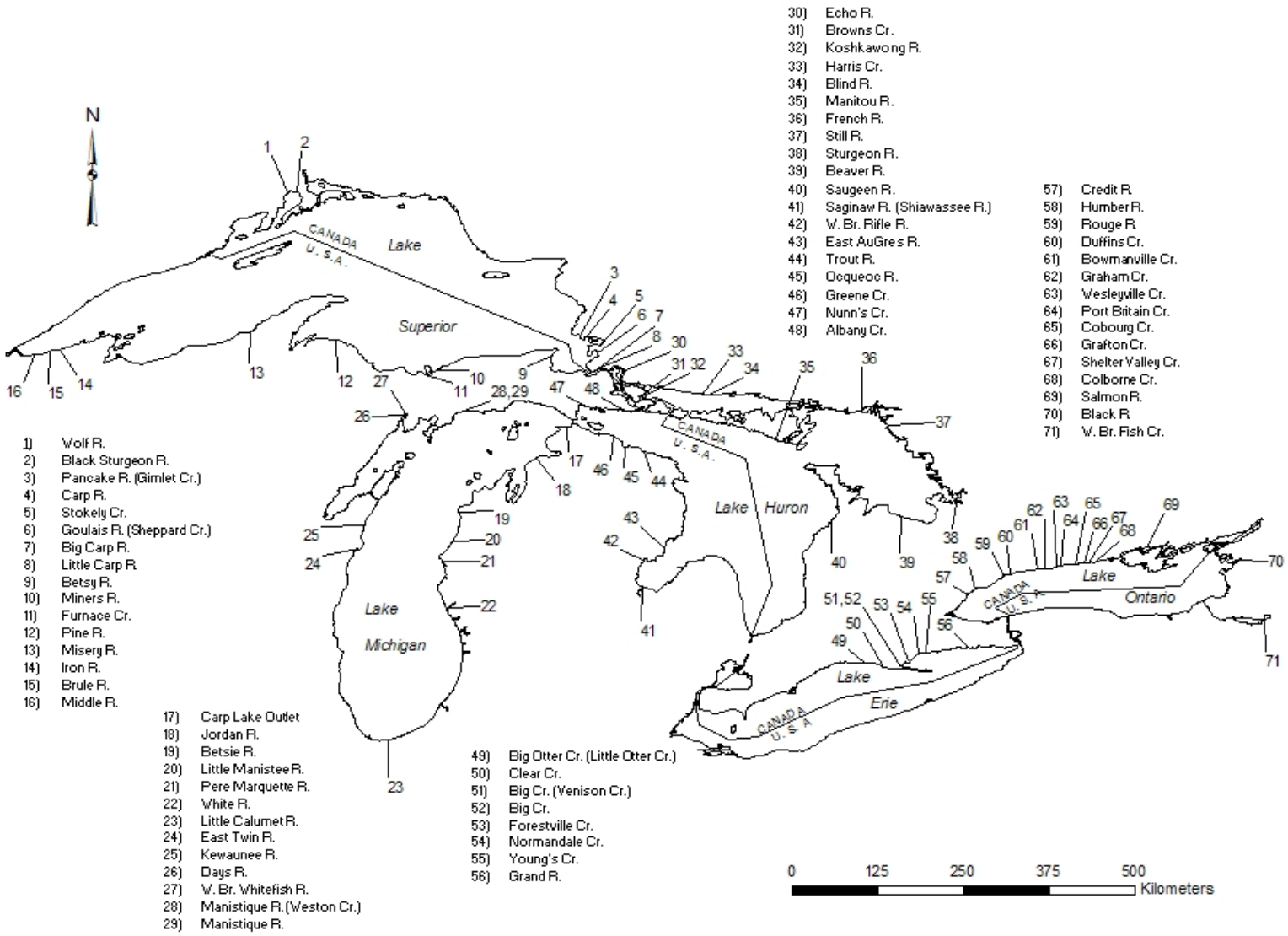

Fig. 2. Locations of tributaries with sea lamprey barriers.

ASSESSMENT

Larval

Tributaries to the Great Lakes are systematically assessed for abundance and distribution of sea lamprey larvae. Quantitative estimates of the number of metamorphosing lampreys that will leave individual tributaries the following year are used to rank 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. Lentic areas are monitored for abundance and distribution of larvae.

Tributaries considered for lampricide treatment in 2006 were assessed during 2005 to estimate larval density and amount of suitable larval habitat. Assessments were conducted with backpack electrofishers in waters <1 m deep. Waters >1 m in depth were surveyed with deepwater electrofishers or Bayluscide 3.2% Granular Sea Lamprey 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 all tributaries 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 in 2006 was developed from the historical ratio of metamorphosed sea lampreys to larval sea lampreys collected during previous lampricide applications. After the data were processed, tributaries were ranked for treatment in 2006 based on the estimated cost per kill of metamorphosed sea lampreys.

Lake Superior

- Assessments of populations of sea lamprey larvae were conducted in 109 tributaries (52 Canada, 57 United States) and offshore of 16 tributaries (7 Canada, 9 United States). The status of larval sea lamprey populations in streams and lentic areas with a history of sea lamprey production is presented in Tables 8 and 9.

- Populations were estimated in 18 tributaries (4 Canada, 14 United States).

- Post-treatment assessments were conducted in 19 tributaries (9 Canada; 10 United States) to determine the effectiveness of lampricide treatments during 2004 and 2005.

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in 37 tributaries (30 Canada; 7 United States). One new population was found in Coldwater Creek, a tributary to Black Bay.

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- A study of paired quantitative assessment sampling and catch-per-unit-effort sampling was conducted in 12 tributaries (4 Canada, 8 United States) as part of a larger project to test a potentially more efficient sampling method for larval assessment.

- Larval sea lampreys were collected from two tributaries for ongoing migratory pheromone research being conducted by researchers at Michigan State University and the University of Minnesota.

- A study of larval density and size distribution in two habitats (preferred and acceptable) and two depth strata (deep and shallow waters) was conducted in the Sucker River (United States) during the fall using a mini-deep water electrofisher. The objective was to measure and compare larval densities and size distributions among all four sampling strata. The analysis is not yet complete.

- A mark-recapture estimate of the larval lamprey population was made in conjunction with the lampricide treatment in the Jackfish River. The estimated population (95% confidence interval) for the Jackfish River was 147,468 (60,822-234,114). No recently-metamorphosed lampreys were collected during the lampricide treatment; consequently, no estimate of metamorphosed lamprey abundance is possible. Population estimates were also made during spot-treatments of areas of the lower Nipigon River in 2005. The estimate of the larval lamprey population for the lower Nipigon River was 11,444 (9,759-13,129) and the estimate of the metamorphosed lamprey population was 472 (293-652).

Table 8. Status of larval sea lampreys in Lake Superior tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed in 2005.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Canada							
East Davignon Cr.	May-72	May-05	No	No	---	---	Unknown
West Davignon Cr.	Jun-04	May-05	Yes	No	---	---	2009
Little Carp R.	Sep-01	Jun-05	Yes	No	---	---	Unknown
Big Carp R.	Sep-01	May-03	Yes	Yes	---	---	2007
Cranberry Cr.	Jun-04	Jul-05	No	No	---	---	2010
Goulais R.	Jun-05	Jul-05	Yes	Yes	---	---	2009
Bostons Cr.	Never	Jul-05	N/A	No	---	---	Unknown
Horseshoe Cr.	Never	Jul-05	N/A	No	---	---	Unknown
Haviland Cr.	Never	Jul-05	N/A	Yes	---	---	Unknown
Stokely Cr.	Sep-00	Oct-05	Yes	Yes	---	---	Unknown
Tier Cr.	Never	Jul-05	N/A	No	---	---	Unknown
Harmony R.	Jun-90	Oct-05	Yes	Yes	307	0	Unknown
Sawmill Cr.	Jun-68	Jul-05	No	No	---	---	Unknown
Jones Landing Cr.	Never	Jun-00	N/A	No	---	---	Unknown
Tiny Cr.	Never	Jul-05	N/A	No	---	---	Unknown
Chippewa R.	Oct-04	Sep-04	---	---	---	---	2010
Unger Cr.	Never	Jun-00	N/A	No	---	---	Unknown
Batchawana R.	Jul-03	Jul-05	Yes	Yes	---	---	2007
Digby Cr.	Never	Jul-05	N/A	No	---	---	Unknown
Carp R.	Sep-00	Jul-03	Yes	Yes	---	---	2007
Pancake R.	Sep-04	Jul-05	Yes	Yes	---	---	2009
Westman Cr.	Never	Sep-04	N/A	Yes	---	---	Unknown
Agawa R.	Jul-01	Aug-04	Yes	Yes	---	---	2007
Sand R.	Sep-71	Jun-03	No	No	---	---	Unknown
Baldhead R.	Never	Jun-03	N/A	Yes	---	---	Unknown
Gargantua R.	Aug-04	Aug-04	---	---	---	---	2009
Michipicoten R.	Aug-04	Oct-04	Yes	Yes	---	---	2009
Dog R.	Aug-63	Jul-02	No	No	---	---	Unknown
White R.	Aug-05	Jul-04	---	---	---	---	2010
Pic R.	Sep-97	Jul-03	Yes	Yes	---	---	2006
Little Pic R.	Sep-94	Aug-05	No	Yes	---	---	2007
Prairie R.	Jul-94	Aug-05	No	No	---	---	Unknown
Steel R.	Aug-04	Aug-05	Yes	No	---	---	2008
Pays Plat R.	Aug-02	Jul-04	Yes	Yes	---	---	2006
Little Pays Plat R.	Never	Jul-04	N/A	Yes	---	---	2006
Gravel R.	Aug-04	Aug-05	Yes	Yes	---	---	2009
Little Gravel R.	Jul-03	Jul-05	Yes	Yes	---	---	2008
Cypress R.	Jul-03	Jul-05	Yes	Yes	---	---	2008
Jackpine R.	Never	Aug-05	N/A	No	---	---	Unknown
Jackfish R.	Nov-05	Aug-05	---	---	---	---	2009

Table 8 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Nipigon R.							
upper	Aug-03	Aug-05	Yes	Yes	---	---	2009
lower	Jul-83	Aug-05	No	Yes	---	---	2006
Cash Cr.	Aug-03	Jul-05	No	Yes	---	---	2009
Polly Cr	Jul-87	Jul-04	No	No	---	---	Unknown
Stillwater Cr.	Aug-05	Jul-04	---	---	---	---	2010
Otter Cove Cr.	Aug-71	Jul-02	No	No	---	---	Unknown
Black Sturgeon R.	Aug-05	Aug-04	---	---	---	---	2011
Big Squaw Cr.	Jun-72	Aug-05	No	No	---	---	Unknown
Wolf R.	Jul-03	Aug-05	Yes	Yes	---	---	2007
Coldwater Cr.	Never	Aug-05	N/A	Yes	---	---	2007
Pearl R.	Aug-04	Aug-04	---	---	---	---	2009
Blende Cr.	Aug-64	Aug-05	No	No	---	---	Unknown
MacKenzie R.	Sep-78	Aug-05	No	Yes	---	---	Unknown
Neebing-McIntrye Floodway	Aug-97	Aug-05	No	Yes	21,825	34	2008
Kaministikwia R.	Aug-02	Aug-05	Yes	Yes	748,191	1,671	2006
Cloud R.	Jul-94	Aug-05	No	Yes	17,908	1,840	2006
Pine R.	Jul-73	Aug-05	No	No	---	---	Unknown
Pigeon R.	Aug-99	Aug-05	No	Yes	---	---	Unknown
United States							
Waiska R.	Aug-01	Sep-05	Yes	Yes	---	---	Unknown
Sec. 11 SW Trib.	Never	Sep-04	---	Yes	---	---	Unknown
Pendills Cr.	Sep-88	Oct-03	---	Yes	---	---	Unknown
Grants Cr.	Jul-63	Sep-05	---	Yes	1,231	4	Unknown
Naomikong Cr.	Jul-63	Jun-04	---	No	---	---	Unknown
Ankodosh Cr.	Jul-73	Jun-04	---	Yes	---	---	Unknown
Roxbury Cr.	Never	Jun-04	---	Yes	---	---	Unknown
Galloway Cr.	Jun-92	Sep-05	---	Yes	889	6	Unknown
Tahquamenon R.	Sep-02	Sep-05	Yes	Yes	58,664	22,968	2006
Betsy R.	Jul-00	Jun-05	No	Yes	---	---	2006
Three Mile Cr.	Jun-62	Jun-04	---	No	---	---	Unknown
Little Two Hearted R.	Sep-04	Jun-05	Yes	---	---	---	2008
Two Hearted R.	Aug-04	Jun-05	Yes	---	---	---	2008
Dead Sucker R.	Jul-75	Jun-03	---	Yes	---	---	Unknown
Sucker R. (Alger)	Sep-02	Oct-05	Yes	Yes	40,167	1,463	2006
Chipmunk Cr.	Sep-62	Jul-04	---	No	---	---	Unknown
Carpenter Cr.	Aug-05	May-05	---	---	---	---	Unknown
Sable Cr.	Sep-89	Jul-05	---	Yes	---	---	Unknown
Hurricane R.	Never	Jul-04	---	No	---	---	Unknown
Sullivans Cr.	Jul-04	Jul-04	---		---	---	Unknown
Seven Mile Cr.	Jul-67	Jun-03	---	No	---	---	Unknown
Beaver Lake Cr. - Lowney Cr.	Sep-87	Oct-05	---	Yes	3,982	19	2006

Table 8 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Mosquito R.	Jun-73	Jul-04	---	No	---	---	Unknown
Miners R.							
barrier downstream	Jun-04	Jun-03	---	---	---	---	2008
barrier to Miners Falls	Sep-77	Jun-05	---	Yes	---	---	Unknown
Munising Falls Cr.	Sep-64	Jun-05	---	No	---	---	Unknown
Anna R.	Sep-65	Jun-01	---	Yes	---	---	Unknown
Furnace Cr.	Sep-93	Oct-05	---	Yes	---	---	2007
Five Mile Cr.	Oct-98	Aug-05	No	Yes	2,818	33	2006
Au Train R.							
upper	Sep-01	Oct-05	Yes	Yes	58,059	737	2006
Buck Bay Cr.	Sep-01	Oct-05	Yes	Yes	35,708	83	2006
lower	Aug-97	Oct-05	---	No	---	---	Unknown
Rock R.	Jul-02	Jun-05	No	No	---	---	Unknown
Deer Lake Cr.	Aug-70	Aug-01	---	No	---	---	Unknown
Laughing Whitefish R.	Jul-05	Oct-05	No	---	---	---	Unknown
Sand R.	Jul-85	Jun-05	---	No	---	---	Unknown
Chocolay R.	Sep-02	Oct-05	Yes	Yes	407,574	1,933	2006
Carp R.	Sep-03	Sep-05	Yes	Yes	23,265	403	2006
Dead R.	Sep-84	Jul-05	---	Yes	149,136	1,307	2006
Harlow Cr.	Jul-02	Oct-05	Yes	Yes	18,680	79	2007
Little Garlic R.	Aug-02	Sep-05	Yes	Yes	---	---	2006
Garlic R. (entire)	Aug-00	Oct-05	Yes	Yes	---	---	2006
Wilson Cr.	Jul-03	Oct-05	Yes	Yes	---	---	2006
Iron R.	Jun-05	Jul-04	---	---	---	---	2010
Salmon Trout R.							
(Marquette)	Jul-05	Oct-05	Yes	Yes	---	---	2009
Pine R.	Jul-04	Oct-03	---	---	---	---	Unknown
Huron R.	Jul-01	Sep-05	Yes	Yes	---	---	2006
Ravine R.[1]	Oct-05	Sep-05	---	---	---	---	2006
Slate R.	Sep-85	Aug-04	---	No	---	---	Unknown
Silver R.[1]	Oct-05	Aug-04	---	---	---	---	2006
Falls R.	Sep-97	Aug-01	No	No	---	---	Unknown
Six Mile Cr.	May-63	Jul-04	---	No	---	---	Unknown
Sturgeon R.							
powerhouse to Otter R.	Aug-05	Aug-04	---	---	---	---	2010
Otter R. to mouth	Aug-05	Jul-04	---	---	---		2010
Pilgrim R.	Aug-62	Sep-04	---	No	---	---	Unknown
Trap Rock R.	Aug-05	Sep-05	No	---	---	---	2009
McCallum Cr.	Aug-63	Sep-05	---	No	---	---	Unknown
Traverse R.	Oct-02	Sep-05	Yes	Yes	137,697	491	2006
Little Gratiot R.	Aug-72	Sep-05	---	No	---	---	Unknown
Eliza Cr.	Oct-77	Aug-04	---	Yes	---	---	Unknown
Gratiot R.	Jun-84	Sep-05	---	Yes	33,647	189	2006
Smiths Cr.	May-64	Jul-04	---	No	---	---	Unknown

Table 8 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Boston-Lily Cr.	Aug-62	Jul-04	---	No	---	---	Unknown
Salmon Trout R. (Houghton)	Aug-92	Aug-05	---	No	---	---	Unknown
Elm R.	Jun-84	Sep-05	---	No	---	---	Unknown
Misery R.							
barrier downstream	Sep-02	Sep-05	Yes	Yes	4,187	143	2006
barrier upstream	Sep-02	Sep-05	Yes	No	---	---	Unknown
East Sleeping R.	Aug-04	Sep-05	No	Yes	---	---	2009
Firesteel R.	May-05	Sep-05	No	---	---	---	2008
Ontonagon R.	Jul-05	Sep-05	Yes	No	---	---	2009
Potato R.	May-05	Sep-05	Yes	No	---	---	2009
Cranberry R.	May-05	Sep-05	Yes	---	---	---	2009
Little Iron R.	Sep-75	Aug-04	---	No	---	---	Unknown
Union R.	May-64	Aug-04	---	No	---	---	Unknown
Black R.	Aug-88	Sep-92	---	No	---	---	Unknown
Montreal R.	Jul-75	Aug-03	---	No	---	---	Unknown
Washington Cr.	Jun-80	Sep-04	---	No	---	---	Unknown
Bad R.	Sep-05	Sep-05	---	---	---	---	2008
Fish Cr.- Eileen Twp.	Sep-80	Aug-05	---	Yes	---	---	Unknown
Red Cliff Cr.	Jun-04	Sep-05	Yes	Yes	2,205	43	2007
Raspberry R.	Jun-63	Jun-04	---	No	---	---	Unknown
Sand R.	Oct-91	Aug-04	---	Yes	---	---	Unknown
Iron R.							
barrier downstream	Never	Aug-04	---	Yes	---	---	Unknown
barrier upstream	Never	Aug-04	---	No	---	---	Unknown
Reefer Cr.	Oct-64	Aug-04	---	No	---	---	Unknown
Fish Cr. – Orienta Twp.	Oct-64	Aug-04	---	No	---	---	Unknown
Brule R.	Sep-05	Aug-05	---	---	---	---	2008
Poplar R.	Aug-03	Aug-02	---	---	---	---	Unknown
Middle R.							
barrier downstream	Jun-02	Aug-05	No	Yes	---	---	Unknown
Amnicon R.	Jun-04	Jul-05	No	Yes	---	---	2008
Nemadji R. (entire)	May-90	Jul-05	---	---	2,398	1,583	2006
mainstream	---	---	---	Yes	---	---	2006
Blackhoof R.	Never	Jul-05	---	Yes	---	---	2006
South Fork	Jun-04	Jul-05	Yes	Yes	---	---	2006
Black R. & Net R.	Jun-04	Jul-05	Yes	Yes	---	---	2006
St. Louis R.	Sep-87	Jul-03	---	Yes	---	---	Unknown
Splitrock R.	Aug-76	Jul-03	---	No	---	---	Unknown
Poplar R.	Jul-77	Jul-03	---	No	---	---	Unknown
Arrowhead R.	Sep-83	Sep-05	---	Yes	---	---	Unknown

Table 9. Status of larval sea lampreys in historically infested lentic areas of Lake Superior, 2005.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Goulais R.	Goulais Bay	Jul-92	Jul-88	Aug-85
Haviland Cr.	Haviland Bay	Aug-90	Aug-90	Never
Stokely Cr.	Haviland Bay	Aug-90	Jul-88	Jul-85
Harmony R.	Batchawana Bay	Jul-01	Jul-01	Aug-87
Chippewa R.	Batchawana Bay	Aug-05	Aug-05	Sep-87
Batchawana R.	Batchawana Bay	Aug-05	Aug-05	Aug-05
Carp R.	Batchawana Bay	Aug-95	Aug-95	Aug-85
Gravel R.	Mountain Bay	Jul-04	Jul-04	Aug-05
Little Gravel R.	Mountain Bay	Jul-04	Jul-04	Aug-05
Little Cypress R.	Nipigon Bay	Aug-78	Aug-78	Never
Cypress R.	Cypress Bay	Aug-05	Aug-05	Aug-05
Jackpine R.	Nipigon Bay	Jul-02	Jul-89	Never
Jackfish R.	Nipigon Bay	Aug-05	Aug-05	Never
Nipigon R.	Lake Helen	Aug-05	Aug-05	Aug-03
Nipigon R.	Nipigon Bay	Jul-03	Jul-03	Aug-05
Nipigon R.	Polly Lake	Aug-05	Jul-90	Jul-87
Black Sturgeon R.	Black Bay	Jul-04	Jul-04	Never
Wolf R.	Black Bay	Jul-04	Jul-04	Never
MacKenzie R.	MacKenzie Bay	Aug-05	Aug-05	Aug-05
Current R.	Thunder Bay	Aug-05	Aug-05	Never
Neebing-McIntyre Floodway	Thunder Bay	Aug-05	Jul-90	Never
Pigeon R.	Pigeon Bay	Aug-76	Aug-76	Never
United States				
Ankodosh Cr.	Tahquamenon Bay	Jun-73	Jun-73	Never
Grants Cr.	Tahquamenon Bay	Sep-05	Never	Never
Galloway Cr.	Tahquamenon Bay	Aug-04	Jul-88	Never
Sucker R.	Grand Marais Harbor	Aug-04	Aug-90	Never
Beaver Lake Outlet	Beaver Lake (Lowney Cr.-offshore)	Sep-05	Sep-05	Never
Anna R.	Munising Bay	Sep-04	Aug-01	Never
Furnace Cr.	Furnace Bay	Sep-04	Sep-04	Never
	Furnace Lake (Hanson Cr.-offshore)	Aug-01	Sep-79	Never
	Furnace Lake (Gongeau Cr.-offshore)	Aug-01	Sep-79	Never
Dead R.	Presque Isle Harbor	Jul-05	Jul-05	Never
Harlow Cr.	Harlow Lake(Bismark Cr.-offshore)	Jun-05	Jun-05	Never
Little Garlic R.	Little Garlic R. (Offshore)	Sep-05	Jul-86	Never
Garlic R.	Garlic R. (Offshore)	Sep-05	Sep-05	Never
Ravine R.	Huron Bay	Sep-05	Sep-05	Never
Slate R.	Huron Bay	Jul-91	Aug-82	Never
Silver R.	Huron Bay	Aug-04	Aug-04	Never
Falls R.	Huron Bay	Aug-04	Jul-03	Never
Trap Rock R.	Torch Lake	Aug-04	Aug-04	Never
Eliza Cr.	Eagle Harbor	Jul-03	Sep-78	Never
Black R.	Black River Harbor	Sep-05	Sep-05	Never
Fish Cr. (Eileen Twp.)	Chequamegon Bay	Aug-04	Sep-80	Never
Red Cliff Cr.	Buffalo Bay	Jul-05	Jun-97	Never

Lake Michigan

- Assessments of sea lamprey larvae were conducted in 91 tributaries and offshore of 11 tributaries. Tables 10 and 11 present the status of larval sea lamprey populations in streams and lentic areas with a history of sea lamprey production.

- Larval populations were estimated in 32 tributaries for potential lampricide treatment during 2006.

- Post-treatment assessments were conducted in 11 tributaries to determine the effectiveness of lampricide treatments completed during 2004 and 2005.

- Assessments to detect the presence of new sea lamprey populations were conducted in 24 tributaries along the east shore and 4 tributaries along the west shore (Escanaba, Manitowoc, Sheboygan, and Milwaukee rivers). One new population was found in Cooper Creek, Mason County, MI.

- Assessments near Marquette, MI did not reveal previously unknown escapement from streams in that area where wounding rates were reportedly high during winter 2004-05.

- The Manistique River lentic area was systematically surveyed using a remote seabed classification device to map likely areas of infestation.

- Sea lamprey larvae were collected from 2 tributaries for ongoing pheromone research being conducted by researchers at Michigan State University and the University of Minnesota, and from 20 tributaries for statolith microchemistry research conducted by personnel from the National Oceanic and Atmospheric Administration, Ann Arbor, Michigan. *Ichthyomyzon* larvae were collected from one tributary for *Ichthyomyzon* species differentiation research conducted by personnel from the University of Windsor, Ontario. Larvae were collected prior to treatment, coded-wire-tagged, and released into two streams following treatment as part of a GLFC-funded research study designed to track transformation of low-density populations of larval sea lampreys following lampricide application.

- A study of paired quantitative assessment sampling compared with catch-per-unit-effort sampling was conducted in 25 streams as part of a larger 3-year project to test a potentially more efficient sampling method for an alternative model of stream selection for lampricide treatments. This is a GLFC-sponsored research project with Dr. Michael Jones of Michigan State University.

Table 10. Status of larval sea lampreys in Lake Michigan tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed in 2005.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Brevort R. (lower)	May-89	Jun-05	---	Yes	407	64	2006
Brevort R. (upper)	Oct-87	Aug-05	---	Yes	4,712	3	2007
Paquin Cr.	Oct-87	Oct-05	---	Yes	---	---	2007
Davenport Cr.	Aug.-83	Aug-05	---	No	---	---	Unknown
Hog Island Cr.	May-04	Oct-05	---	Yes	---	---	2007
Sucker R.	Jun-61	Jun-05	---	Yes	---	---	Unknown
Black R.	May-04	Jun-05	Yes	Yes	123,579	658	2006
Mile Cr.	Sep-72	Sep-05	---	Yes	---	---	2008
Millecoquins R.	Sep-04	Jun-05	Yes	Yes	---	---	2008
Furlong Cr.	Sep-04	Jun-05	Yes	Yes	31,236	1,949	2006
Rock R.	Aug-00	Jun-05	No	Yes	1,160	82	2006
Crow R.	Aug-00	Jun-05	No	Yes	23,782	695	2006
Cataract R.	Aug-04	May-04	---	---	---	---	2008
Pt. Patterson Cr.	Sep-83	Aug-03	---	---	---	---	Unknown
Hudson Cr.	May-98	Jun-05	No	Yes	12,765	12	2007
Swan Cr.	Jul-92	Jun-04	No	No	---	---	Unknown
Seiners Cr.	May-84	Jun-04	No	No	---	---	Unknown
Milakokia R.	Jun-04	Jun-05	Yes	Yes	---	---	2007
Bulldog Cr.	Jun-97	Jul-03	---	No	---	---	Unknown
Gulliver Lake Outlet	May-00	Sep-05	No	Yes	437	14	2008
Marblehead Cr.	May-05	Jun-04	---	---	---	---	2009
Manistique R.							
above dam	Oct-04	Sep-05	Yes	Yes	---	---	2008
below dam	Oct-04	Sep-05	Yes	Yes	---	---	2008
estuary	Oct-04	Aug-05	Yes	Yes	---	---	2008
Southtown Cr.	Jun-77	Jun-04	---	Yes	---	---	2007
Johnson Cr.	Aug-81	Jun-04	No	Yes	---	---	2007
Deadhorse Cr.	Jul-04	Jun-03	---	---	---	---	2008
Gierke Cr.	Never	Jun-04	---	Yes	---	---	2008
Bursaw Cr.	Jul-04	Jun-05	Yes	Yes	---	---	2008
Parent Cr.	Jun-91	Jun-05	---	Yes	---	---	2008
Poodle Pete Cr.	Aug-01	Jun-05	---	No	---	---	Unknown
Valentine Cr.	Jun-97	Jun-05	No	Yes	---	---	2008
Little Fishdam R.	May-01	Jul-04	No	No	---	---	Unknown
Big Fishdam R.	Aug-04	Jun-04	---	---	---	---	2008
Sturgeon R.	Jun-03	Oct-05	Yes	Yes	261,868	---	2006
Ogontz R.	Jul-03	Jun-05	Yes	Yes	---	---	2008
Squaw Cr.	Aug-00	Jun-04	---	---	---	---	Unknown
Hock Cr.	May-81	May-03	---	---	---	---	Unknown
Whitefish R.	Aug-04	Oct-05	Yes	Yes	218,965	2,478	2006

Table 10 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Rapid R.	May-03	Oct-05	Yes	Yes	319,319	28,461	2006
Tacoosh R.	Jun-04	Aug-04	Yes	Yes	---	---	2007
Days R.	Sep-05	Jul-05	Yes	Yes	---	---	2006
Portage Cr.	Sep-05	Jun-05	Yes	No	---	---	2008
Ford R.	Jun-05	May-05	---	---	---	---	2008
Sunnybrook Cr.	May-71	May-05	---	No	---	---	Unknown
Bark R.	Oct-03	Aug-05	Yes	Yes	9,567	86	2007
Cedar R.	Jun-05	May-05	---	---	---	---	2008
Sugar Cr.	Aug-77	Jun-05	---	Yes	---	---	2008
Arthur Bay Cr.	Apr-70	May-05	---	No	---	---	Unknown
Rochereau Cr.	Apr-63	Jul-04	---	No	---	---	Unknown
Johnson Cr.	Apr-63	Jul-04	---	No	---	---	Unknown
Bailey Cr.	May-02	Aug-04	No	Yes	---	---	2007
Beattie Cr.	Oct-01	Jul-04	No	Yes	---	---	2007
Springer Cr.	May-99	Jul-05	No	Yes	---	---	2007
Menominee R.	Aug-88	Jul-05	---	Yes	10,152	4,666	2006
Little R.	Aug-77	Sep-04	---	No	---	---	Unknown
Peshtigo R.	Jul-05	Sep-04	---	---	21,420	9	2006
Oconto R.	Jul-05	Sep-05	Yes	Yes	---	---	2008
Pensaukee R.	Nov-77	Jun-03	---	No	---	---	Unknown
Suamico R.	Never	Oct-05	---	No	---	---	Unknown
Ephraim Cr.	Apr-63	May-03	---	No	---	---	Unknown
Hibbards Cr.	May-02	Sep-05	No	Yes	12,561	105	2007
Whitefishbay Cr.	May-87	Sep-05	---	Yes	0	0	Unknown
Lilly Bay Cr.	Apr-63	May-03	---	No	---	---	Unknown
Bear Cr.	May-75	May-03	---	No	---	---	Unknown
Door Co. 23 Cr.	May-79	Jul-05	---	Yes	0	20	Unknown
Ahnapee R.	Apr-64	Sep-04	---	No	---	---	Unknown
Three Mile Cr.	May-75	Sep-05	---	Yes	---	---	Unknown
Kewaunee R.							
Casco Cr.	May-75	Oct-05	---	Yes	1,714	81	2006
East Twin R.	May-04	Sep-04	---	---	---	---	2007
Fischer Cr.	May-87	Sep-04	---	No	---	---	Unknown
Carp Lake R.	Oct-04	Aug-05	Yes	No	---	---	Unknown
Big Stone Cr.	May-97	Aug-05	No	Yes	3,220	44	2007
Big Sucker R.	May-89	Aug-05	No	Yes	10,323	10	2007
Wycamp Lake Outlet	May-00	Jun-05	No	No	---	---	Unknown
Horton Cr.	Oct-04	Oct-05	No	Yes	---	---	2006
Boyne R.	Sep-02	Sep-05	Yes	Yes	114,767	59	2006
Porter Cr.	Oct-04	Oct-05	Yes	Yes	---	---	2006
Jordan R.	Jul-02	Sep-05	Yes	Yes	139,858	665	2007
Monroe Cr.	Oct-72	Oct-05	No	Yes	528	---	2006

Table 10 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Loeb Cr.	Oct-04	Aug-04	---	---	---	---	Unknown
McGeach Cr.	Oct-99	Jun-05	No	No	---	---	Unknown
Elk Lake Outlet	Sep-04	Sep-04	No	---	---	---	Unknown
Yuba Cr.	Aug-64	Aug-05	No	Yes	4,435	79	2006
Acme Cr.	Aug-63	Jun-03	No	No	---	---	Unknown
Mitchell Cr.	Sep-03	Jun-02	---	---	---	---	2007
Boardman R.	Aug-01	May-05	Yes	Yes	83,851	12,178	2006
Leo Cr.	Never	May-04	N/A	No	---	---	Unknown
Goodharbor Cr.	Oct-01	Aug-05	No	Yes	28,646	1	2007
Crystal R.	Oct-72	May-04	No	No	---	---	Unknown
Platte R. (upper)	Jul-03	Oct-05	Yes	Yes	---	---	2007
Platte R. (middle)	Jul-01	Oct-05	Yes	Yes	50,281	158	2007
Platte R. (lower)	Sep-04	Oct-04	No	---	---	---	Unknown
Betsie R.	Jul-02	Oct-05	Yes	Yes	157,020	234	2006
Bowen Cr.		Jul-04	---	No	---	---	Unknown
Big Manistee R.	Aug-03	Oct-05	Yes	Yes	1,699,601	121,395	2006
L. Manistee R.	Jul-04	Jun-04	---	---	---	---	Unknown
Gurney Cr.	Jan-05	Sep-05	Yes	Yes	---	---	Unknown
Cooper Cr.		Jun-05	---	Yes	---	---	Unknown
Lincoln R.	Jun-02	Aug-05	No	Yes	13,431	1,086	2006
Pere Marquette R.	Aug-02	Oct-05	Yes	Yes	145,960	3,860	2006
Bass Lake Outlet	Aug-78	Jul-04	No	No	---	---	Unknown
Pentwater R.							
North Br.	Jul-03	Oct-02	---	---	---	---	2008
Lambricks Cr.	Sep-84	Jun-05	No	No	---	---	Unknown
Stony Cr.	Jul-87	Jun-05	No	Yes	---	---	Unknown
Flower Cr.	Sep-81	Sep-05	No	No	---	---	Unknown
White R.	Aug-05	Oct-05	Yes	No	---	---	Unknown
Duck Cr.	Jul-84	May-03	No	No	---	---	Unknown
Muskegon R.	Aug-05	Sep-05	Yes	No	19,025	39	2009
Brooks Cr.	Aug-05	Jul-05	---	---	---	---	2009
Cedar Cr.	Aug-05	Jul-05	---	---	---	---	2009
Bridgeton Cr.	Jul-04	Aug-03	---	---	---	---	2008
Minnie Cr.	Aug-04	Aug-04	---	---	---	---	2008
Bigelow Cr.	Aug-05	May-05	---	---	---	---	2009
Black Cr.	Aug-70	Jun-04	No	Yes	---	---	Unknown
Grand R.	Never	Sep-03	---	No	---	---	Unknown
Norris Cr.	Jun-00	Oct-05	No	Yes	198	61	Unknown
Lowell Cr	Sep-65	Aug-05	No	No	---	---	Unknown
Buck Cr.	Sep-65	Aug-05	No	No	---	---	Unknown
Rush Cr.	Sep-65	Aug-05	No	No	---	---	Unknown
Sand Cr.	Sep-96	Oct-05	No	Yes	303	50	Unknown

Table 10 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Crockery Cr.	Sep-04	Sep-04	No	---	---	---	Unknown
Bass R.	Aug-04	Sep-03	---	---	---	---	Unknown
Pigeon R.	Oct-64	Jun-04	No	No	---	---	Unknown
Pine Cr.	Oct-64	Jun-04	No	No	---	---	Unknown
Gibson Cr.	Jul-84	Sep-04	No	No	---	---	Unknown
Kalamazoo R.	Never	Jul-02	No	No	---	---	Unknown
Bear Cr.	Aug-04	Sep-04	No	---	---	---	Unknown
Sand Cr.	Aug-04	Sep-04	Yes	---	---	---	Unknown
Mann Cr.	Jul-02	Jun-04	No	Yes	---	---	Unknown
Rabbit R.	Jul-81	Oct-05	No	Yes	---	---	Unknown
Swan Cr.	Jul-77	Oct-05	No	Yes	---	---	Unknown
Allegan 3 Cr.	Sep-65	Jun-04	No	No	---	---	Unknown
Allegan 4 Cr.	Oct-78	Sep-03	No	No	---	---	Unknown
Allegan 5 Cr.	Never	Jun-04	---	No	---	---	Unknown
Black R.	Jun-01	Jun-04	No	No	---	---	Unknown
Brandywine Cr.	Aug-85	Jul-02	No	Yes	---	---	Unknown
Rogers Cr.	May-98	Sep-03	No	No	---	---	Unknown
St. Joseph R.	Never	Jul-02	---	Yes	---	---	Unknown
Lemon Cr.	Oct-65	May-03	No	No	---	---	Unknown
Pipestone Cr.	Aug-03	Sep-02	No	No	---	---	Unknown
Meadow Dr.	Oct-65	May-03	No	No	---	---	Unknown
Hickory Cr.	Oct-65	May-03	No	No	---	---	Unknown
Paw Paw R.	May-05	Oct-05	No	No	---	---	Unknown
Blue Cr.	May-01	May-03	No	No	---	---	Unknown
Mill Cr.	May-05	Oct-05	No	No	---	---	Unknown
Brandywine Cr.	May-05	Oct-05	No	No	---	---	Unknown
Brush Cr.	May-05	Oct-05	No	No	---	---	Unknown
Galien R.							
north branch	May-02	Oct-05	Yes	Yes	207	132	2007
east branch & Dowling Cr.	May-02	Jul-04	No	Yes	---	---	2007
south branch & Galina Cr.	Oct-05	Aug-05	---	---	---	---	2009
Spring Cr.	Oct-05	Aug-05	---	---	---	---	2009
south branch Spring Cr.	Oct-05	Aug-05	---	---	---	---	2009
State Cr.	May-86	Jul-04	No	No	---	---	Unknown
Trail Cr.	Apr-00	Oct-05	No	Yes	5,084	986	2006
Donns Cr.	May-66	Jul-03	No	No	---	---	Unknown
Burns Ditch	Jul-99	Jul-04	No	No	---	---	Unknown

Table 11. Status of larval sea lampreys in historically infested lentic areas of Lake Michigan, 2005.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Hog Island Cr.	Hog Island Cr. (Offshore)	Aug-05	Aug-05	Never
Black R.	Black R. (Offshore)	Aug-05	Aug-05	Never
Milakokia R.	Seul Choix Bay	Jul-86	Aug-80	Never
Manistique R.	Manistique R. (Offshore)	Jun-05	Jun-05	Aug-03
Bursaw Cr.	Bursaw Cr. (Offshore)	Jul-86	Jul-76	Never
Ogontz R.	Ogontz R. (Offshore)	Aug-05	Aug-05	Never
Whitefish R.	Big Bay De Noc	Jul-97	Aug-93	Never
Rapid R.	Little Bay De Noc	Aug-88	Jul-80	Never
Days R.	Little Bay De Noc	Aug-05	Aug-05	Never
Portage Cr.	Portage Bay	Jul-84	Jul-77	Never
Ford R.	Green Bay	Jun-87	Jun-84	Never
Cedar R.	Green Bay	Jul-85	Jun-84	Never
Beattie Cr.	Green Bay	Jul-85	Jul-85	Never
Menominee R.	Green Bay	Jul-86	Jun-77	Never
Carp Lake R.	Cecil Bay	Aug-05	Aug-05	Never
Bear R.	Little Traverse Bay	May-05	May-05	Never
Horton Cr.	Horton Bay (Lake Charlevoix)	Jun-04	Jun-04	Never
Boyne R.	Boyne Harbor (Lake Charlevoix)	May-04	May-04	May-04
Porter Cr.	Lake Charlevoix	Jun-04	Jun-04	Never
Jordan R.	Lake Charlevoix	Jun-05	Jun-05	Never
Monroe Cr.	Lake Charlevoix	Jun-05	Jun-05	Never
Mitchell Cr.	Grand Traverse Bay (East Arm)	May-04	May-04	Never
Boardman R.	Grand Traverse Bay (West Arm)	May-04	May-04	Never
Leland R.	Leland R. (Offshore)	Oct-05	Oct-05	Never
Platte R.	Loon Lake	Sep-00	Aug-96	Never
	Platte Lake	Jul-03	Jul-03	Never
Betsie R.	Betsie Lake	Aug-83	Aug-83	Never
Big Manistee R.	Manistee Lake	May-04	Aug-90	Never

Lake Huron

- Assessments of populations of sea lamprey larvae were conducted in 72 tributaries (39 Canada, 33 United States) and offshore of four U.S. tributaries. The status of larval sea lamprey populations in streams and lentic areas with a history of sea lamprey production is presented in Tables 12 and 13.

- Larval sea lamprey populations were estimated in 20 tributaries (10 Canada, 10 United States; Table 12).

- Post-treatment assessments were conducted in 13 tributaries (7 Canada, 6 United States) to determine the effectiveness of lampricide treatments during 2004 and 2005.

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in 21 tributaries (11 Canada; 10 United States). One new population was found in Nagels Creek, Presque Isle County, Michigan.

- A mark-recapture estimate of larval sea lamprey populations was made in conjunction with the lampricide treatment in the Thessalon River. The estimated population for the main branch of the river was 141,286 (95% CI; 44,540-238,032) and for Bridgeland Creek, a sea lamprey-producing tributary to the Thessalon River, the estimated larval population was 26,110 (95% CI; 20,069-32,152). The lampricide treatment occurred in June of 2005, before signs of transformation. Consequently, an estimation of the population of transforming sea lampreys was not possible.

- Larval sea lampreys were collected from one tributary for ongoing migratory pheromone research being conducted by Michigan State University and the University of Minnesota. Larval sea lampreys were also collected from 24 tributaries (11 Canada, 13 United States) for statolith microchemistry research being conducted by the National Oceanic and Atmospheric Administration, Ann Arbor, Michigan.

- A study of paired quantitative assessment sampling and catch-per-unit-effort sampling was conducted in 12 stream reaches (4 Canada, 8 United States) as part of a larger project to test a potentially more efficient sampling method for larval assessment.

- Monitoring of larval sea lampreys in the St. Marys River continued during 2005. Approximately 900 sites were sampled using the deepwater electrofisher. Surveys were conducted according to a stratified, systematic, adaptive cluster sampling design. The larval sea lamprey population in the St. Marys River was estimated to be 2.4 million (95%; confidence limits (1.1–3.7million).

Table 12. Status of larval sea lampreys in Lake Huron tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed in 2005.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals present	Recruitment evident			
Canada							
Root R.							
main	Oct-05	Sep-05	---	---	---	---	2009
west Root	Oct-05	Sep-05	---	---	---	---	2009
Garden R.	Aug-02	Aug-05	Yes	Yes	641,883	1,281	2006
Echo R.							
upper	Oct-99	Aug-05	No	No	---	---	Unknown
lower	Oct-99	Oct-05	Yes	Yes	111	1	2007
Bar/Iron Cr.	Oct-04	Jun-05	No	No	---	---	2010
Bar R.	Oct-01	Jul-04	Yes	Yes	---	---	Unknown
Sucker Cr.	May-05	May-04	---	---	---	---	2010
Twotree R.	Oct-01	Jul-05	No	No	---	---	Unknown
Richardson Cr.	May-04	Jul-05	No	No	---	---	Unknown
Watson Cr.	Jun-02	Jul-05	Yes	Yes	---	---	2006
Gordon Cr.	May-01	Aug-05	Yes	Yes	---	---	2009
Browns Cr.	Oct-03	Aug-05	Yes	No	---	---	Unknown
Koshkawong R.	May-00	Aug-05	Yes	Yes	2,488	224	2006
No Name	Aug-75	Jul-05	No	Yes	---	---	Unknown
No Name	Sep-75	Jul-05	No	Yes	---	---	Unknown
MacBeth Cr.	Jun-67	Aug-05	No	No	---	---	Unknown
Thessalon R.							
upper	Jul-02	Jun-05	Yes	Yes	2,189	224	2006
lower	Jun-05	Aug-05	Yes	Yes	---	---	2009
Livingstone Cr.	Jun-00	Jul-04	No	No	---	---	Unknown
Mississagi R.							
main	Aug-04	Jun-05	Yes	Yes	---	---	2008
Pickerel Cr.	Jun-98	Jun-03	No	No	---	---	Unknown
Blind R.	May-84	Jun-05	No	Yes	---	---	Unknown
Lauzon R.	Jul-04	Jun-03	---	---	---	---	2009
Spragge Cr.	Oct-95	May-03	No	No	---	---	Unknown
No Name	Jun-02	May-05	Yes	Yes	248	59	2006
Serpent R.							
main	Jun-00	Jun-05	Yes	Yes	---	---	2007
Grassy Cr.	Oct-03	Jun-05	Yes	Yes	3,023	290	2006
Spanish R.	Sep-02	Jun-05	Yes	Yes	1,243	1	2007
Kagawong R.	Aug-67	May-01	No	No	---	---	Unknown
Unnamed	Jun-02	May-05	No	Yes	---	---	2009
Silver Cr.	Jul-04	May-05	Yes	Yes	---	---	2010
Sand Cr.	Oct-01	Jun-04	Yes	No	---	---	2006
Mindemoya R.	Jun-02	Oct-05	Yes	Yes	31,215	280	2006
Timber Bay Cr.	Oct-05	Oct-05	---	---	---	---	---
Manitou R.	Sep-99	May-05	Yes	Yes	4,566	22	2007

Table 12 continued.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals present	Recruitment evident			
Blue Jay Cr.	Jun-03	May-05	Yes	Yes	---	---	2007
Kaboni Cr.	Oct-78	May-05	No	No	---	---	Unknown
Chikanishing R.	Jul-03	May-05	No	No	---	---	Unknown
French R. System							
O.V. Channel	Jun-92	Jul-05	No	Yes	788	475	2006
Wanapitei R.	Jul-05	Jun-04	---	---	---	---	2010
Key R. (Nesbit Cr.)	Sep-72	Jul-05	No	No	---	---	Unknown
Still R.	Jun-96	Jul-05	No	Yes	---	---	Unknown
Magnetawan R.	Jul-99	Jun-04	Yes	Yes	---	---	2006
Naiscoot R.	Jun-04	May-05	Yes	Yes	---	---	2009
Shebeshekong R.	Never	Jul-04	N/A	No	---	---	Unknown
Boyne R.	Jun-03	May-05	Yes	Yes	---	---	2007
Musquash R.	Sep-05	Jun-04	---	---	---	---	Unknown
McDonald Cr.	Never	Jun-99	N/A	No	---	---	Unknown
Simcoe/Severn System	Never	Jun-03	N/A	Yes	---	---	Unknown
Coldwater R.	Never	May-04	N/A	No	---	---	Unknown
Sturgeon R.	Jun-03	May-05	No	No	---	---	2009
Hog Cr.	Sep-78	May-04	No	No	---	---	Unknown
Lafontaine Cr.	Jun-68	May-04	No	No	---	---	Unknown
Nottawasaga R.							
main (incl. Boyne & Bear creeks)	May-02	Jun-04	No	No	---	---	2009
Pine R.	Jun-05	May-05	---	---	---	---	2009
Pretty R.	May-72	May-04	No	No	---	---	Unknown
Silver Cr.	Sep-82	Jun-04	No	No	---	---	Unknown
Bighead R.	Jun-03	May-05	Yes	Yes	---	---	2007
Bothwells Cr.	Jun-79	May-04	No	No	---	---	Unknown
Sydenham R.	Jun-72	May-04	No	No	---	---	Unknown
Sauble R.	Jun-04	Jul-05	No	Yes	---	---	2010
Saugeen R.	Jun-71	May-04	Yes	No	---	---	Unknown
Bayfield R.	Jun-70	May-01	No	No	---	---	Unknown
United States							
Mission Cr.	Never	Aug-04	---	Yes	---	---	2009
Charlotte R.	Oct-81	Aug-04	No	No	---	---	Unknown
Little Munuscong R.	May-04	Sep-05	Yes	Yes	49,137	1,018	2006
Big Munuscong R.							
Mainstream	Jun-99	Aug-04	No	No	---	---	Unknown
Taylor Cr.	May-04	Aug-04	Yes	Yes	14,583	514	2006
Carlton Cr.	Sep-01	Jun-05	No	No	---	---	2009
Canoe Lake Outlet	May-70	Jul-04	No	No	---	---	Unknown
Caribou Cr.	Jun-04	May-04	---	---	---	---	2009
Bear Lake Outlet	Jun-77	Jun-04	No	No	---	---	Unknown

Table 12 continued.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals present	Recruitment evident			
Carr Cr.	May-78	May-03	---	Yes	---	---	2008
Joe Straw Cr.	May-75	Jun-05	No	No	---	---	Unknown
Albany Cr.	Sep-01	Aug-05	Yes	Yes	2,166	26	2006
Trout Cr.	Oct-05	Sep-04	---	---	---	---	2009
Beavertail Cr.	Jun-05	Jul-05	Yes	---	---	---	2009
Prentiss Cr.	May-01	May-04	No	No	---	---	Unknown
McKay Cr.	Sep-01	Oct-05	Yes	Yes	10,714	49	2007
Flowers Cr.	Sep-83	May-02	No	No	---	---	Unknown
Ceville Cr.	Sep-05	Sep-04	---	---	---	---	2009
Hessel Cr.	Jun-04	May-03	---	---	---	---	2008
Steeles Cr.	May-05	Oct-04	---	---	---	---	2009
Nuns Cr.	Sep-01	Jul-04	No	No	---	---	Unknown
Pine R.	Jun-05	Aug-05	No	No	---	---	2009
McCloud Cr.	Oct-72	Sep-03	No	No	---	---	Unknown
Carp R.	Sep-03	Jun-05	No	Yes	---	---	2007
Martineau Cr.	Oct-93	Oct-05	---	Yes	2,262	20	2007
266-20 Cr.	Aug-76	Jun-04	No	No	---	---	Unknown
Beaugrand Cr.	Never	May-02	---	No	---	---	Unknown
Little Black R.	May-67	Sep-04	No	No	---	---	Unknown
Cheboygan R.	Oct-83	Aug-05	No	Yes	---	---	Unknown
Laperell Cr.	May-00	Jun-05	No	No	---	---	Unknown
Meyers Cr.	Sep-99	Jun-05	No	No	---	---	Unknown
Maple R.	Sep-03	Aug-02	---	---	---	---	2007
Pigeon R.	Sep-03	Aug-03	---	---	---	---	2007
Little Pigeon R.	Aug-98	Aug-03	No	No	---	---	Unknown
Sturgeon R.	Aug-04	May-04	---	---	---	---	2008
Elliot Cr.	May-04	Jun-04	No	---	---	---	2008
Greene Cr.	Oct-01	Oct-04	No	Yes	---	---	Unknown
Grass Cr.	May-78	May-03	No	No	---	---	Unknown
Mulligan Cr.	May-94	Jun-04	No	No	---	---	Unknown
Grace Cr.	Jun-05	Jun-04	---	---	---	---	Unknown
Black Mallard Cr.	May-03	Oct-05	Yes	Yes	46,124	44	2006
Seventeen Cr.	May-67	May-03	No	No	---	---	Unknown
Ocqueoc R.	Jul-02	Oct-05	Yes	Yes	---	---	2006
Johnny Cr.	Sep-70	May-03	No	No	---	---	Unknown
Schmidt Cr.	Jun-04	May-04	---	---	---	---	2008
Trout R.	May-04	Aug-05	Yes	Yes	4,390	7	2007
Swan R.	May-96	Aug-05	No	Yes	---	---	Unknown
Middle Lake Outlet	Jun-67	Sep-04	No	No	---	---	Unknown
Grand Lake Outlet	Never	Jun-05	---	No	---	---	Unknown
Long Lake Cr.	Jun-04	Jun-05	Yes	Yes	---	---	2007
Squaw Cr.	Jun-67	May-03	No	No	---	---	Unknown
Devils R.	Jun-04	May-04	---	---	---	---	2008
Black R.	May-03	Aug-05	Yes	Yes	142,137	19	2007

Table 12 continued.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals present	Recruitment evident			
Au Sable R.	Aug-03	Jul-04	Yes	---	---	---	2008
Pine R.	May-87	May-03	No	No	---	---	Unknown
Tawas Lake Outlet	Jun-03	May-03	---	---	---	---	2007
Cold Cr.	Jun-03	May-02	---	---	---	---	2007
Sims Cr.	Sep-05	Oct-05	No	No	---	---	2009
Grays Cr.	Sep-05	Oct-05	Yes	No	---	---	2009
Silver Cr.	Sep-05	Oct-05	Yes	No	---	---	2009
East Au Gres R.	Aug-05	Oct-05	Yes	No	---	---	2009
Au Gres R.	Jun-04	May-05	No	Yes	---	---	2008
Rifle R.	Sep-02	Oct-05	Yes	Yes	1,406,306	178,373	2006
Saginaw R.							
Cass R.	Oct-84	Jul-05	No	Yes	1,172	1	Unknown
Juniata Cr.	Sep-05	Oct-05	No	No	---	---	Unknown
Tittabawasse R.	Never	Jul-03	---	No	---	---	Unknown
Chippewa R. (upper)	Jul-05	Sep-05	No	No	28	2	2008
Coldwater R.	Jul-05	Sep-04	---	---	---	---	Unknown
Chippewa R. (lower)	Jul-05	Sep-05	Yes	No	---	---	2008
Pine R.	Jun-03	Oct-05	No	Yes	5,369	505	Unknown
Little Salt Cr.	May-02	Jun-05	No	Yes	---	---	Unknown
Big Salt Cr.	Jul-05	Jun-05	---	---	---	---	2008
North Br.	Never	Jun-05	---	No	---	---	Unknown
Carroll Cr.	May-02	Jun-04	No	Yes	---	---	Unknown
Big Salt R.	May-02	Sep-05	No	Yes	58,153	1,279	2006
Bluff Cr.	May-02	Oct-05	No	Yes	---	---	2006
Shiawassee R.	Jun-02	Sep-05	No	Yes	10,462	2,053	2006
Rock Falls Cr.	Never	May-01	---	No	---	---	Unknown
Sucker Cr.	Never	Jul-02	---	No	---	---	Unknown
Cherry Cr.	Never	May-01	---	No	---	---	Unknown
Mill Cr.	May-85	May-01	No	No	---	---	Unknown

Table 13. Status of larval sea lampreys in historically infested areas of Lake Huron, 2005.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Echo R.	Solar Lake	Jul-99	Sep-93	Jul-87
	Stuart Lake	May-90	May-90	Jul-80
Two Tree R.	North Channel	Aug-81	Aug-81	Never
Gordon's Cr.	North Channel	Aug-91	Aug-91	Jul-84
Brown's Cr.	North Channel	Aug-91	Aug-91	Aug-87
Koshkawong R.	North Channel	Aug-91	Aug-91	Never
No Name	North Channel	Sep-71	Sep-71	Never
Mississagi R.	North Channel	Aug-90	Aug-90	Jul-81
Kagawong R.	Mudge Bay	Jul-90	Jul-90	Aug-87
Mindemoya R.	Providence Bay	Jul-88	Jul-88	Jul-81
Manitou R.	Michael's Bay	Jul-90	Jul-90	Aug-87
Magnetawan R.	Byng Inlet	Jul-04	Jul-04	Jul-99
United States				
Albany Cr.	Albany Bay (offshore)	Aug-05	Aug-05	
Trout Cr.	Trout Cr. (offshore)	Aug-05	Aug-05	
McKay Cr.	McKay Bay	Jul-05	Jul-05	
Flowers Cr.	Flowers Bay	Jul-81	Jul-80	
Nuns Cr.	St. Martin Bay	Aug-87	Aug-87	
Pine R.	St. Martin Bay	Jul-97	Jul-97	
Carp R.	St. Martin Bay	Aug-05	Aug-05	
Cheboygan R.	Straits of Mackinac	Sep-03	Aug-93	
	Burt Lake (Sturgeon R.)	Aug-03	Aug-98	
Elliot Cr.	Duncan Bay	Jun-04	Aug-86	
Mulligan Cr.	Mulligan Cr. (offshore)	Sep-84	Aug-73	
Ocqueoc R.	Hammond Bay	Jun-04	Sep-86	
Devils R.	Thunder Bay	Oct-04	Aug-76	
Au Sable R.	Au Sable R. (offshore)	Jul-04	Jul-04	
East Au Gres R.	East Au Gres R. (offshore)	Aug-88	Jun-86	

Lake Erie

- Qualitative assessments of larval sea lamprey populations were conducted in 23 tributaries (4 Canada, 19 United States) and offshore of two U.S. tributaries. The status of larval sea lamprey populations in historically infested Lake Erie tributaries and lentic areas are presented in Tables 14 and 15.

- Populations of larval sea lampreys were estimated in five tributaries (1 Canada, 4 United States).

- Post-treatment assessments were conducted in two tributaries (1 Canada, 1 United States) to determine the effectiveness of lampricide treatments during 2004 and 2005.

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in nine tributaries (3 Canada, 6 United States). One new population was found in the Chagrin River, Lake County, Ohio.

- In accordance with the Control Integrated with Assessment Optimally (CIAO) initiative, five tributaries (1 Canada, 4 United States) were surveyed using both Quantitative Assessment Survey (QAS; area-based survey) and a Rapid Assessment technique (time-based survey). CIAO is Commission-sponsored research with the objective of developing an alternative model for selecting streams for lampricide application. The Rapid Assessment technique is designed to use about 1/3 of the sampling effort of QAS.

Table 14. Status of larval sea lampreys in Lake Erie tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed in 2005.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
Canada							
St. Clair R.	Never	Jul-04	---	Yes	---	---	Unknown
Thames R.	Never	Jul-04	---	No	---	---	Unknown
Detroit R.	Never	Sep-00	---	No	---	---	Unknown
East Cr.	Jun-87	May-04	No	No	---	---	Unknown
Catfish Cr.	Jun-87	May-04	No	No	---	---	Unknown
Silver Cr.	Never	May-05	---	Yes	---	---	Unknown
Big Otter Cr.	Jun-04	May-05	No	Yes	---	---	2007
South Otter Cr.	Oct-86	May-05	No	No	---	---	Unknown
Clear Cr.	May-91	Sep-01	No	No	---	---	Unknown
Big Cr.	May-03	Sep-05	Yes	Yes	74,764	180	2006
Forestville Cr.	May-89	May-04	No	No	---	---	Unknown
Normandale Cr.	Jun-87	May-04	No	No	---	---	Unknown
Fishers Cr.	Jun-87	May-04	No	Yes	---	---	Unknown
Young's Cr.	May-01	May-05	Yes	Yes	---	---	2006
Grand R.	Never	Sep-03	---	No	---	---	Unknown
Welland R.	Never	Aug-00	---	No	---	---	Unknown
United States						---	
Buffalo R.	Never	Aug-04	No	Yes	---	---	Unknown
Delaware Cr.	Sep-05	Aug-05	---	---	---	---	2008
Cattaraugus Cr.							
mainstream	Sep-04	Aug-05	Yes	Yes	---	---	2007
Clear Cr.	May-04	Sep-05	Yes	Yes	49,647	85	2007
Halfway Brook	Oct-86	Jun-03	---	No	---	---	Unknown
Canadaway Cr.	Oct-86	Aug-05	No	No	---	---	Unknown
Crooked Cr.	Oct-02	Aug-05	Yes	Yes	1,171	105	2006
Raccoon Cr.	Sep-05	Aug-05	---	---	---	---	2008
Conneaut Cr.	Apr-03	Aug-05	Yes	Yes	3,512	287	2006
Grand R.	Apr-03	Aug-05	Yes	Yes	---	---	2006
Black R.	Never	Jun-05	---	Yes	---	---	Unknown
Pine R.	Apr-88	Jun-05	No	No	---	---	Unknown
Belle R.	Never	Jun-05	---	No	---	---	Unknown
Clinton R.	Never	Oct-05	---	No	---	---	Unknown
St. Clair R.	Never	Jul-05	---	No	---	---	Unknown

Table 15. Status of larval sea lampreys in historically infested lentic areas of Lake Erie, 2005.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Cattaraugus Cr.	Sunset Bay	Aug-92	July-85	Never
Conneaut Cr.	Conneaut Harbor	Aug-05	Aug-05	Never
Grand R.	Fairport Harbor	Aug-05	Jun-87	Never

Lake Ontario

- Qualitative assessments of larval sea lamprey populations were conducted in 42 tributaries (25 Canada, 17 United States). The status of larval sea lamprey populations in streams with a history of sea lamprey production is presented in Tables 16 and 17.

- Populations of larval sea lampreys were estimated in 14 tributaries (8 Canada, 6 United States).

- Post-treatment assessments were conducted in 16 tributaries (6 Canada, 10 United States) to determine the effectiveness of lampricide treatments during 2004 and 2005.

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in 26 tributaries (23 Canada, 3 United States). One new small population was found in Grindstone Creek, Burlington, Ontario.

- Five tributaries (3 Canada, 2 United States) were surveyed using both the Quantitative Assessment Survey (QAS; area-based survey) and a Rapid Assessment technique (time-based survey). This new protocol is aiming to develop an alternative, less intensive survey effort for selecting streams for lampricide application.

- Mark-recapture estimates were made for three tributaries (1 Canada, 2 United States), including : - Lynde Creek (Ont.) 22,769 larvae (95% C.I. of 13,943-31,415)
  - Trout Brook (Salmon R., NY) 16,316 larvae (95% C.I. of 11,915-20,717)
  - Orwell Brook (Salmon R., NY) 38,295 larvae (95% C.I. of 29,482-49,107)

Table 16. Status of larval sea lampreys in Lake Ontario tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed in 2005.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Canada							
Niagara R.	Never	Jun-03	---	Yes	---	---	Unknown
Ancaster Cr.	May-03	May-05	No	No	---	---	Unknown
Grindstone Cr.	Never	May-05	---	Yes	---	---	Unknown
Bronte Cr.	May-04	Sep-04	No	Yes	---	---	2007
Sixteen Mile Cr.	Jun-82	May-05	No	Yes	---	---	Unknown
Credit R.	May-02	Sep-05	No	Yes	---	---	Unknown
Rouge R.	May-04	Jun-05	Yes	Yes	---	---	2007
Petticoat Cr.	Sep-04	Jun-05	Yes	No	---	---	Unknown
Duffins Cr.	Jun-03	Oct-05	Yes	Yes	6,213	1,844	2006
Carruthers Cr.	Sep-76	May-04	No	No	---	---	Unknown
Lynde Cr.	Sep-05	Sep-05	---	No	---	---	2009
Oshawa Cr.	Jun-03	Oct-05	Yes	Yes	47,339	19,791	2006
Farewell Cr.	Sep-03	Jun-05	Yes	Yes	---	---	2007
Bowmanville Cr.	Sep-04	Jun-05	Yes	Yes	---	---	2008
Wilmot Cr.	May-03	Oct-05	No	Yes	16,057	1,006	2006
Graham Cr.	May-96	Jun-05	No	No	---	---	Unknown
Wesleyville Cr.	Oct-02	May-04	Yes	No	---	---	Unknown
Port Britain Cr.	Oct-02	Jun-05	Yes	Yes	---	---	2007
Gage Cr.	May-71	May-03	No	No	---	---	Unknown
Cobourg Br.	Oct-96	Jun-05	No	Yes	---	---	Unknown
Covert Cr.	Sep-05	Sep-05	---	---	---	---	2009
Grafton Cr.	Oct-02	Jun-05	Yes	Yes	---	---	Unknown
Shelter Valley Cr.	Sep-03	Jun-05	No	No	---	---	Unknown
Colborne Cr.	Sep-03	Jun-05	No	No	---	---	Unknown
Salem Cr.	Oct-02	Sep-05	Yes	Yes	46,537	634	2006
Proctor Cr.	Aug-98	Jun-05	No	No	---	---	Unknown
Smithfield Cr.	Sep-86	May-04	No	No	---	---	Unknown
Trent R. (Canal System)	Never	Sep-05	---	Yes	10,458	2,437	2006
Mayhew Cr.	Jun-00	Sep-05	No	Yes	27,796	910	2006
Moira R.	Never	Jun-05	---	Yes	---	---	Unknown
Salmon R.	Jun-00	Sep-05	Yes	Yes	1,808	9	Unknown
Napanee R.	Never	Sep-05	---	Yes	---	---	Unknown
United States							
Black R.	Jul-04	Jul-05	Yes	Yes	---	---	2007
Stony Cr.	Sep-82	Jun-04	No	No	---	---	Unknown
Sandy Cr.	Never	Jul-05	---	Yes	---	---	Unknown
South Sandy Cr.	May-05	Jul-05	Yes	Yes	---	---	2008
Skinner Cr.	Apr-05	Apr-05	No	---	---	---	2008
Lindsey Cr.	Apr-04	Oct-05	Yes	Yes	7,306	323	2006
Blind Cr.	May-76	Jun-04	No	No	---	---	Unknown
Little Sandy Cr.	Jun-05	May-05	---	Unknown	77	22	2008

Table 16 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment)		Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Expected Year of Next Treatment
			Residuals Present	Recruitment Evident			
Deer Cr.	Apr-04	Jul-05	Yes	No	150	149	2007
Salmon R.	May-05	Jul-05	Yes	Yes	---	---	2008
Grindstone Cr.	Apr-04	Jul-05	Yes	Yes	---	---	2007
Snake Cr.	Apr-05	Jul-05	No	---	---	---	2008
Sage Cr.	May-78	Jun-04	No	No	---	---	Unknown
Little Salmon R.	May-03	Oct-05	Yes	Yes	139,301	6,970	2006
Butterfly Cr.	Never	Jun-04	---	No	---	---	Unknown
Catfish Cr.	May-03	Jul-05	Yes	Yes	328,703	2,238	2006
Oswego R.							
Black Cr.	May-81	Jun-04	No	No	---	---	Unknown
Big Bay Cr.	Sep-93	Jul-03	No	No	---	---	Unknown
Scriba Cr.	May-84	Apr-05	No	Yes	207	51	Unknown
Fish Cr.	Jun-04	Apr-05	Yes	Yes	---	---	2007
Carpenter Br.	May-94	Jul-03	No	No	---	---	Unknown
Putnam Br. / Coldsprings Cr.	May-96	Apr-05	No	Yes	---	---	Unknown
Hall Br.	Never	Apr-05	---	No	---	---	Unknown
Crane Br.	Never	Jun-04	---	No	---	---	Unknown
Skaneateles Cr.	Never	Jul-05	---	No	---	---	Unknown
Rice Cr.	Never	Jun-04	---	No	---	---	Unknown
Eight Mile Cr.	Apr-04	Jun-04	Yes	---	---	---	2007
Nine Mile Cr.	Jun-05	Jul-05	No	---	---	---	2008
Sterling Cr.	Apr-03	Oct-05	Yes	Yes	28,295	4,589	2006
Blind Sodus Cr.	May-78	Jun-04	No	No	---	---	Unknown
Red Cr.	Apr-03	Jul-05	No	No	---	---	Unknown
Wolcott Cr.	May-79	Oct-05	No	No	---	---	Unknown
Sodus Cr.	May-05	Oct-05	No	No	---	---	2008
Irondequoit Cr.	Never	Aug-04	---	Yes	---	---	Unknown
Northrup Cr.	Never	Sep-00	---	No	---	---	Unknown
Salmon Cr.	Apr-05	Sep-04	---	---	---	---	Unknown
Oak Orchard Cr.	May-88	Aug-04	No	Yes	---	---	Unknown
Third Cr.	Never	May-00	---	No	---	---	Unknown
First Cr.	May-95	Oct-05	No	No	---	---	Unknown

Table 17. Status of larval sea lampreys in historically infested areas of Lake Ontario, 2005.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Duffins Cr.	Duffins Cr. - lentic	Oct-81	Oct-81	Never
Oshawa Cr.	Oshawa Cr. - lentic	Oct-81	Oct-81	Never
Wilmot Cr.	Wilmot Cr. - lentic	Oct-81	Oct-81	Never
United States				
Black River	Black River Bay	Jul-01	Jul-01	Never

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. Lake-wide 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.

Table 18. Summary of the number and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of the Great Lakes, 2005.

Lake	Number of Streams	Total Captured	Number Sampled	Percent Males	Mean Length (mm)		Mean Weight (g)	
					Males	Females	Males	Females
Superior	20	13,173	1,127	57	435	431	193	191
Michigan	15	30,974	2,205	48	502	502	264	273
Huron	20	28,255	973	57	472	476	231	233
Erie	4	596	24	52	482	475	344	313
Ontario	9	8,436	985	55	484	481	250	254
Total	**68**	**81,434**	**5,314**	**---**	**---**	**---**	**---**	**---**

Lake Superior

- A total of 13,173 sea lampreys was trapped from 20 sites in 19 tributaries in 2005 (Fig. 3; Table 19).

- The estimated population of spawning-phase sea lampreys for 2005 was 121,034 (62,213 western United States and 58,821 eastern United States and Canada; $r^2 = 0.50$).

- No significant trend (Fig. 4) was detected from a linear regression of spawner abundance during 1986-2005 ($p=0.396$; $r^2=0.04$).

- Spawning runs were monitored in the Amnicon, Middle, Bad, Firesteel, Misery, and Silver rivers through cooperative agreements with the Great Lakes Indian Fish and Wildlife Commission, in Red Cliff Creek with the Red Cliff Band of Lake Superior Chippewas, in the Miners River with the National Park Service, Pictured Rocks National Lakeshore, and in the Big Carp River with the Great Lakes Laboratory for Fisheries & Aquatic Sciences.

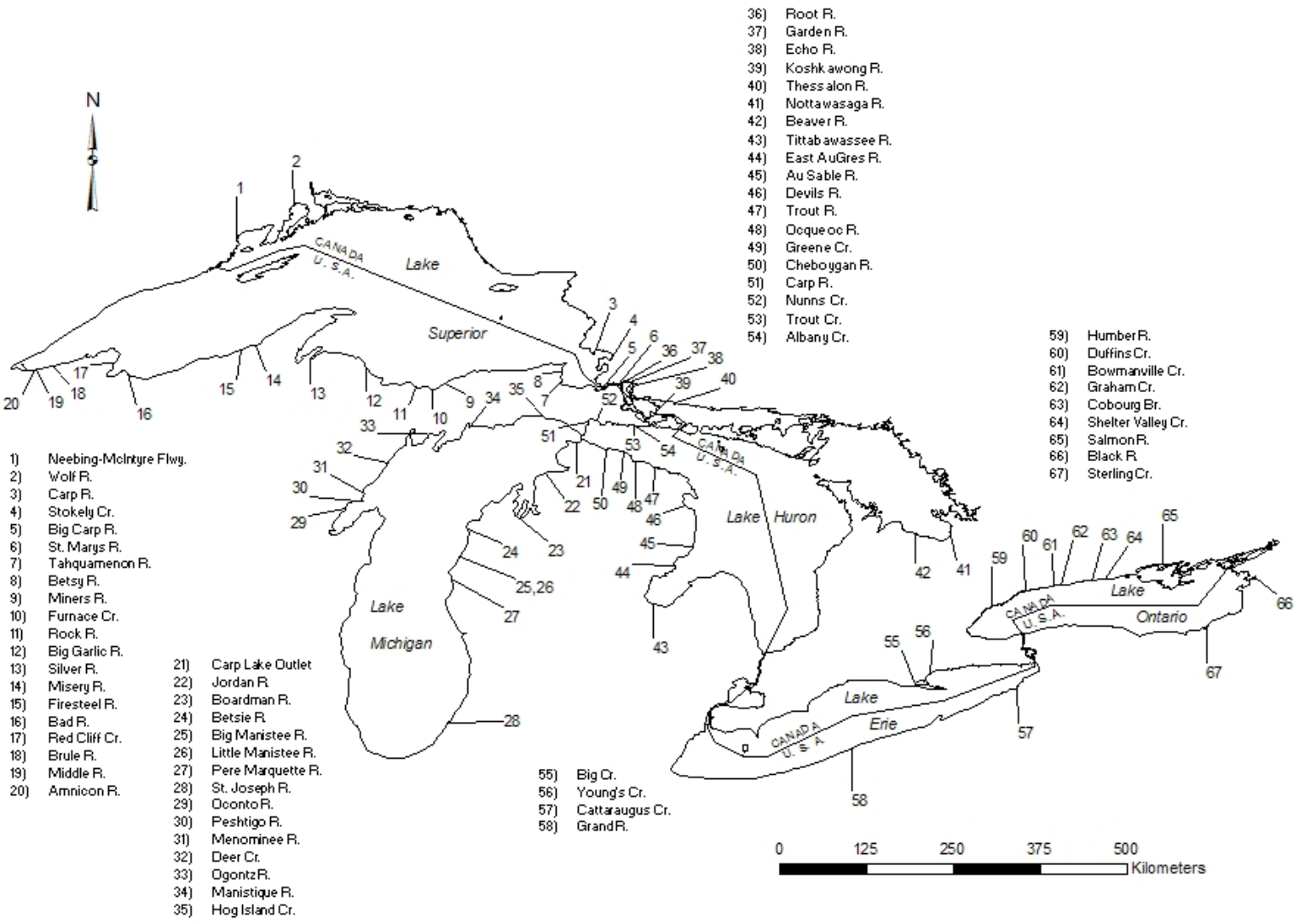

Fig. 3. Locations of tributaries where assessment traps were operated during 2005.

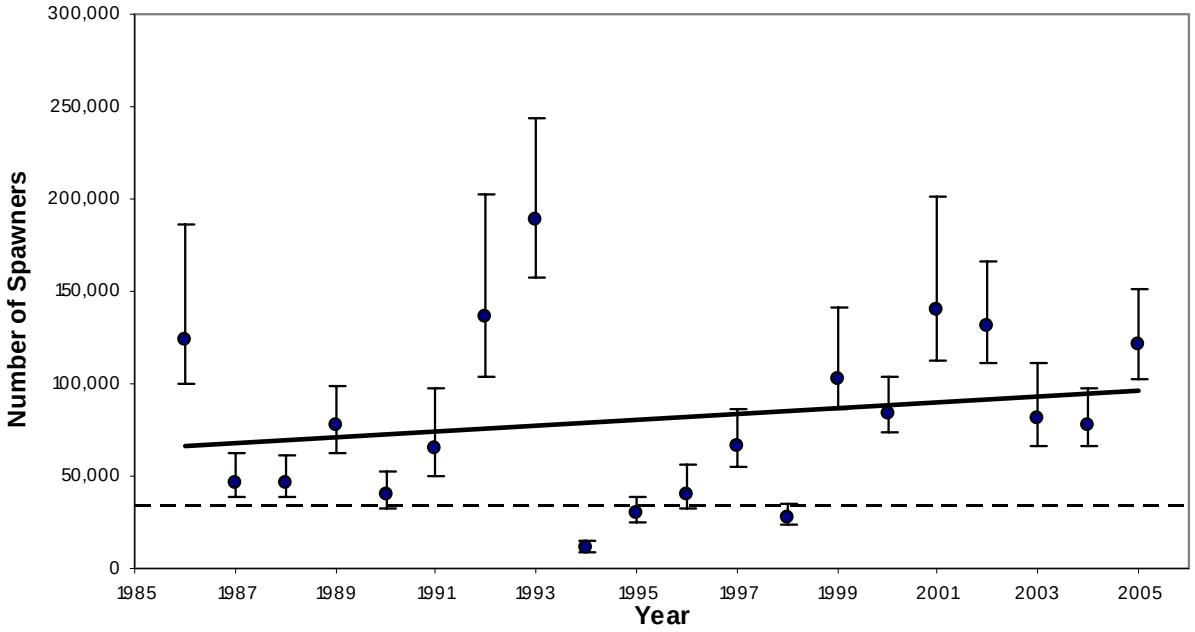

Fig. 4. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Superior during 1986 – 2005 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 19. Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Superior, 2005 (number in parentheses corresponds to location of stream in Fig. 3).

Tributary	Number Caught	Spawner Estimate	Trap Efficiency	Number Sampled[1]	Percent Males	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Canada									
Neebing-McIntyre Floodway									
Neebing R. (1)	297	885	34	0	---	---	---	---	---
McIntyre R. (1)	184	665	28	0	---	---	---	---	---
Wolf R. (2)	0	---	---	0	---	---	---	---	---
Carp R. (3)	148	183	81	0	59	---	---	---	---
Stokely Cr. (4)	10	---	---	0	78	---	---	---	---
Big Carp R. (5)	21	23	91	0	73	---	---	---	---
Total or Mean (CAN)	**660**	**---**	**---**	**0**	**62**	**---**	**---**	**---**	**---**
United States									
Tahquamenon R. (7)	626	2,811	22	67	61	457	457	216	232
Betsy R. (8)	137	313	44	37	70	448	438	211	185
Miners R. (9)	79	231	34	16	69	403	390	149	152
Furnace Cr. (10)	39	152	26	3	33	410	415	142	219
Rock R. (11)	297	602	49	142	47	420	418	170	173
Big Garlic R. (12)	35	---	---	2	---	---	435	---	191
Silver R. (13)	12	---	---	0	---	---	---	---	---
Misery R. (14)	31	---	---	2	50	402	474	143	216
Firesteel R. (15)	27	---	---	0	---	---	---	---	---
Bad R. (16)	1,090	12,383	9	73	26	426	418	188	183
Red Cliff Cr. (17)	22	---	---	22	77	440	435	198	165
Brule R. (18)	9,478	13,556	70	605	52	439	440	195	196
Middle R. (19)	482	1,049	46	138	54	424	415	192	178
Amnicon R. (20)	158	594	27	20	42	482	455	239	229
Total or Mean (US)	**12,513**			**1,127**	**52**	**435**	**431**	**193**	**191**
TOTAL or MEAN (for lake)	**13,173**			**1,127**	**57**	**435**	**431**	**193**	**191**

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

Lake Michigan

- 30,974 sea lampreys were trapped at 15 sites in 13 tributaries during 2005 (Fig. 3; Table 20).

- The estimated population of spawning-phase sea lampreys in Lake Michigan for 2005 was 85,176 (52,386 north and 32,790 south; $r^2 = 0.78$).

- Spawning runs were monitored in the Boardman and Betsie rivers through a cooperative agreement with the Grand Traverse Band of Ottawa and Chippewa Indians, and in the Carp Lake Outlet with the Little Traverse Bay Bands of Odawa Indians.

- A significant positive trend (Fig. 5) was detected from a linear regression of spawner abundance on year during 1986 – 2005 ($p=0.00004$; $r^2=0.62$).

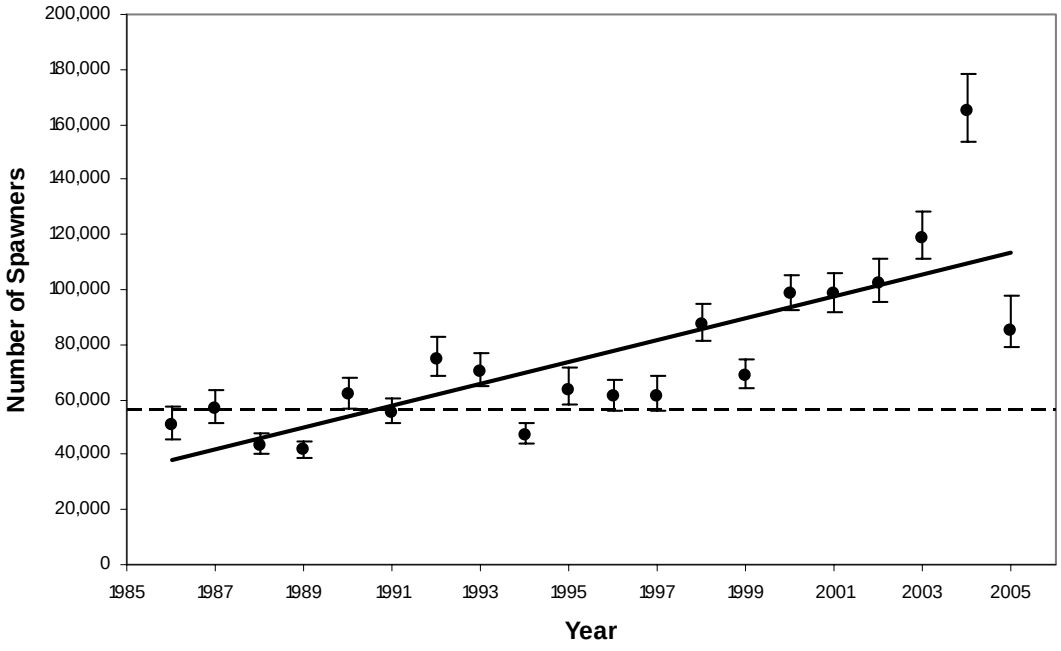

Fig. 5. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Michigan during 1986 – 2005 with trend line (solid line), 95% confidence intervals (vertical lines), and target level (dashed line).

Table 20. Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of Lake Michigan, 2005 (number in parentheses corresponds to location of stream in Fig. 3).

Tributary	Number Caught	Spawner Estimate	Trap Efficiency	Number Sampled[1]	Percent Males	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Carp Lake Outlet (21)	1,099	1,890	58	179	34	475	472	205	214
Jordan R. (22)	14	---	---	0	---	---	---	---	---
Deer Cr. (32)	97	301	32	20	50	504	488	287	245
Boardman R. (23)	400	788	51	122	48	480	477	247	246
Betsie R. (24)	694	2,224	31	117	57	494	502	266	283
Big Manistee R. (25)	440	4,100	11	5	20	470	493	236	252
Little Manistee R. (26)	215	372	58	20	45	496	490	274	284
Pere Marquette R. (27)	316	732	43	30	27	519	492	278	270
St. Joseph R. (28)	473	1,095	43	117	45	506	504	263	258
Oconto R. (29)	187	1,168	16	22	64	506	499	248	257
Peshtigo R. (30)	3,692	4,353	85	496	50	515	515	275	295
Menominee R. (31)	173	1,427	12	3	67	526	510	263	285
Ogontz R. (33)	5	---	---	0	---	---	---	---	---
Manistique R. (34)	23,102	34,385	67	1,059	49	505	508	267	283
Hog Island Cr. (35)	67	252	27	15	---	---	---	---	---
TOTAL or MEAN	**30,974**	**53,087**		**2,205**	**48**	**502**	**502**	**264**	**273**

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

Lake Huron

- A total of 28,255 sea lampreys was trapped from 21 sites in 20 tributaries in 2005 (Fig. 3; Table 21).

- Estimated population of spawning-phase sea lampreys in Lake Huron for 2005 was 122,195 (106,655 north and 15,540 south).

- Spawning runs were monitored in the Carp River and Albany, Trout, and Nunns 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 U.S. Army Corps of Engineers facilities in the U.S. captured 8,940 spawning-phase sea lampreys. The estimated spawning lamprey population in the river was 18,790 and trap efficiency was 48%.

- No significant trend (Fig. 6) was detected from a linear regression of spawner abundance on year during 1986 – 2005 ($p = 0.076$; $r^2 = 0.16$).

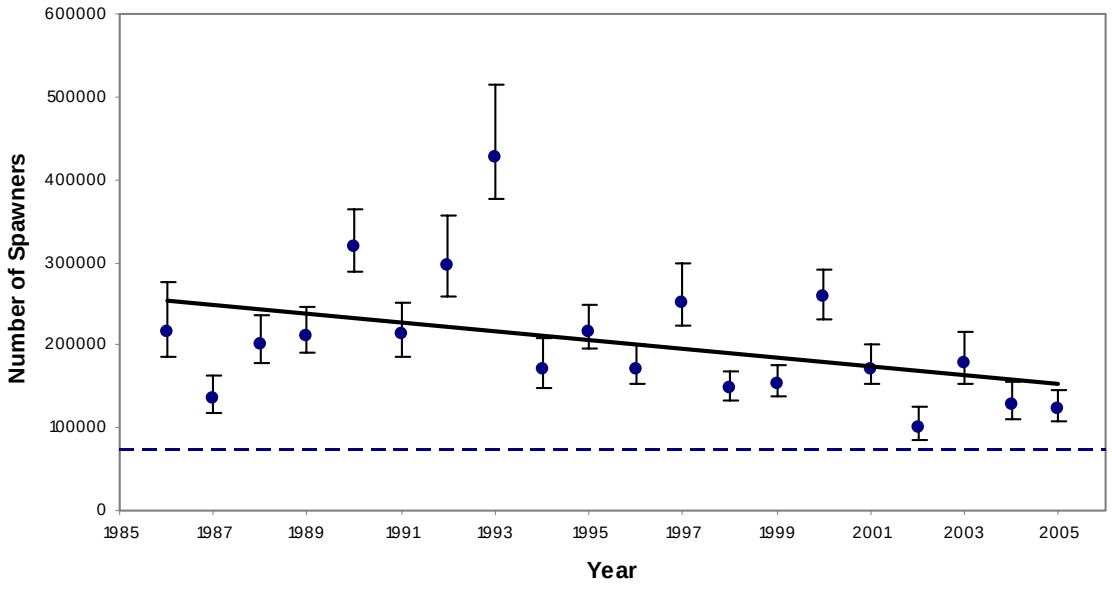

Fig. 6. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Huron during 1986–2005 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 21. Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Huron, 2005 (number in parentheses corresponds to location of stream in Fig. 3).

Tributary	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
Canada									
St. Marys River (6)	6,612	18,790	48	0	63	---	---	---	---
Root R. (36)	61	192	32	0	72	---	---	---	---
Garden R. (37)	169	2,721	6	0	71	---	---	---	---
Echo R. (38)	2,949	19,461	15	0	60	---	---	---	---
Koshkawong R. (39)	56	---	---	0	54	---	---	---	---
Thessalon R. (40)	41	331	12	0	---	---	---	---	---
Little Thessalon R.	3,388	4,087	83	0	61	---	---	---	---
Nottawasaga R. (41)									
Pine R.	46	---	---	0	72	---	---	---	---
Beaver R. (42)	0	---	---	0	---	---	---	---	---
Total or Mean (CAN)	**13,322**	**---**	**---**	**0**	**62**	**---**	**---**	**---**	**---**
United States									
Saginaw R.									
Tittabawassee R. (43)	328	---	---	0	---	---	---	---	---
East AuGres R. (44)	593	6,345	9	12	50	495	483	245	285
Au Sable R. (45)	168	---	---	0	---	---	---	---	---
Devils R. (46)	17	---	---	0	---	---	---	---	---
Trout R. (47)	0	---	---	0	---	---	---	---	---
Ocqueoc R. (48)	1,957	6,162	32	124	57	462	454	229	212
Greene Cr. (49)	154	199	77	6	67	465	510	213	224
Cheboygan R. (50)	9,229	11,638	79	818	50	474	480	233	234
Carp R. (51)	46	---	---	1	---	---	520	---	275
Nunns Cr. (52)	6	---	---	0	---	---	---	---	---
Trout Cr. (53)	37	168	22	3	33	510	464	215	245
Albany Cr. (54)	70	210	33	9	78	431	438	206	245
St. Marys R. (6)	2,328	See Canada	See Canada	---	See Canada	---	---	---	---
Total or Mean (US)	**14,933**			**973**	**52**	**472**	**476**	**231**	**233**
TOTAL OR MEAN (for lake)	**28,255**			**973**	**57**	**472**	**476**	**231**	**233**

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

Lake Erie

- A total of 596 sea lampreys was trapped from five sites in four tributaries in 2005 (Fig. 3; Table 22).

- Estimated population of spawning-phase sea lampreys was 17,475.

- No significant trend (Fig. 7) was detected from a linear regression of spawner abundance on year during 1986–2005 ($p=0.785$; $r^2=0.004$).

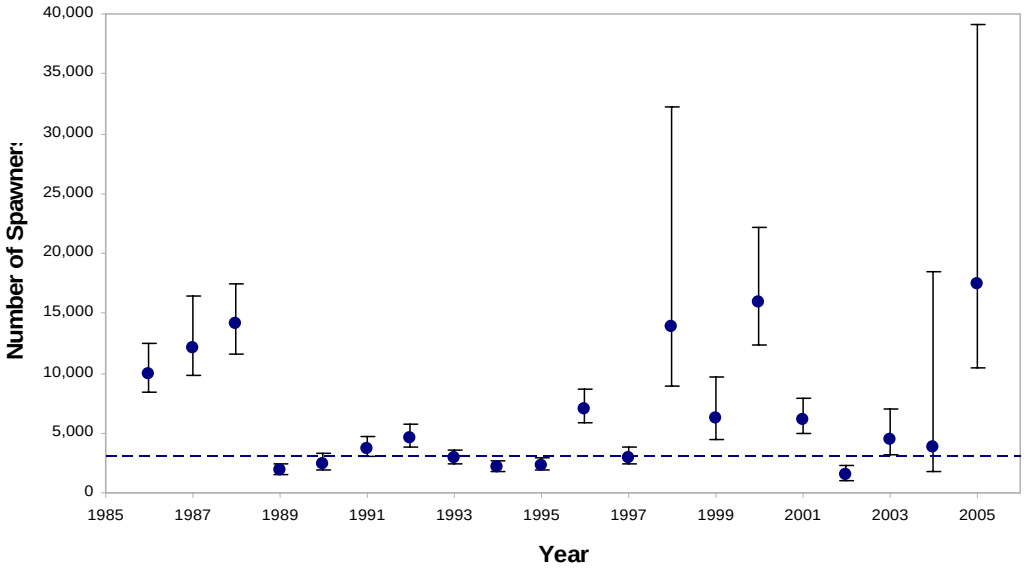

Fig. 7. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Erie during 1986–2005 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 22. Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Erie, 2005 (number in parentheses corresponds to location of stream in Fig. 3).

Tributary	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
Canada									
Big Cr. (55)	5	---	---	0	---	---	---	---	---
Young's Cr. (56)	34	---	---	0	---	---	---	---	---
Total or Mean (CAN)	**39**			**0**					
United States									
Cattaraugus Cr. (57)	78	---	---	0	---	---	---	---	---
Spooner Cr.	6	---	---	0	---	---	---	---	---
Grand R. (58)	473	9108	5	24	52	482	475	344	313
Total or Mean (US)	**557**			**24**	**52**	**482**	**475**	**344**	**313**
TOTAL OR MEAN (for lake)	**596**			**24**	**52**	**482**	**475**	**344**	**313**

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

Lake Ontario

- A total of 8,436 sea lampreys was trapped from ten sites at nine tributaries (Fig. 3; Table 23).
- Estimated population of spawning-phase sea lampreys was 41,814.
- A significant negative trend (Fig. 8) was detected from a linear regression of spawner abundance on year during 1986–2005 ($p=0.016$; $r^2=0.28$).
- The spawning run of Cobourg Brook was monitored in large part through a cooperative agreement with the Great Lakes Laboratory for Fisheries & Aquatic Sciences.

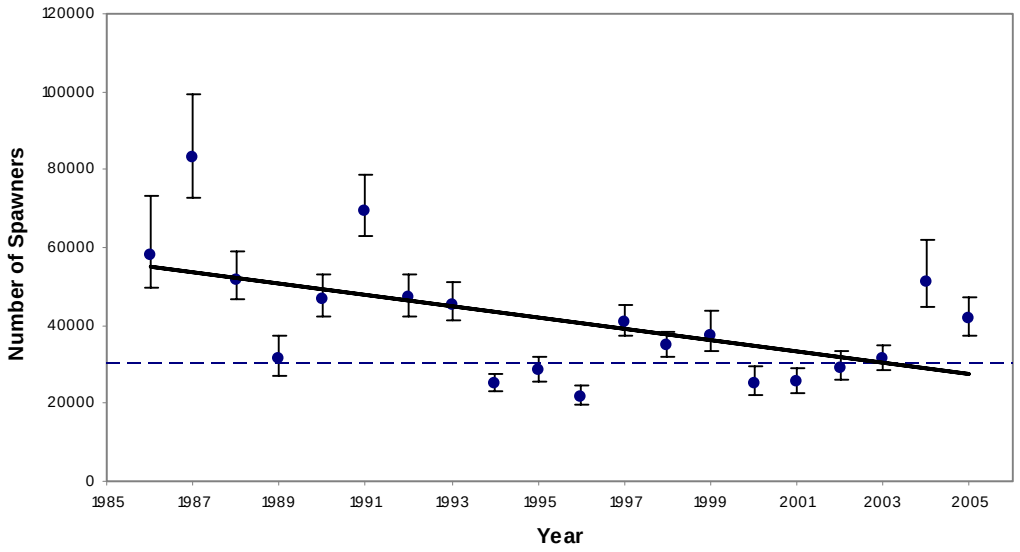

Fig. 8. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Ontario during 1986–2005 with trend line (solid line), 95% confidence intervals (vertical lines) and target level (dashed line).

Table 23. Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Ontario, 2005 (number in parentheses corresponds to location of stream in Fig. 3).

Tributary	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
Canada									
Humber R. (59)	5,077	9,922	51	530	54	478	475	253	253
Duffins Cr. (60)	1,261	4,120	31	122	61	491	489	248	248
Bowmanville Cr. (61)	299	922	32	91	59	498	495	262	268
Graham Cr. (62)	56	93	60	17	47	506	513	283	294
Cobourg Br. (63)	161	328	49	52	38	460	465	207	232
Shelter Valley Cr. (64)	340	495	69	88	60	499	502	247	260
Salmon R. (65)	83	---	---	22	45	494	503	278	276
Total or Mean (CAN)	**7,277**			**922**	**55**	**485**	**482**	**252**	**254**
United States									
Black R. (66)	1,048	10,547	10	56	58	462	469	214	251
Sterling Cr. (67)	87	749	12	6	33	453	495	210	285
Sterling Valley Cr.	24	285	10	1	0	---	510	---	311
Total or Mean (US)	**1,159**			**63**	**55**	**462**	**474**	**214**	**258**
TOTAL OR MEAN (for lake)	**8,436**			**985**	**55**	**484**	**481**	**250**	**254**

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

Parasitic Phase

Lake Superior

The Michigan Department of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats in 2005.

- A total of 53 sea lampreys attached to lake trout was collected from 4 lake trout management districts.

- Parasitic-phase sea lampreys were attached at a rate of 1.17 per 100 lake trout (n = 4,524).

- The recapture of spawning-phase sea lampreys that were released as metamorphosing sea lampreys during 2003 was completed. Of 1,332 metamorphosing sea lampreys marked with coded wire tags and released, 21 (1.6%) were recaptured as spawning adults during 2005. A total of 12,739 (660 Canada, 12,079 United States) spawning-phase sea lampreys was scanned for coded wire tags in 15 (4 Canada, 11 United States) Lake Superior streams in 2005. The estimated abundance of the 2005 metamorphosing cohort is 771,927 (Table 234. This ends the transforming-phase mark-recapture study that commenced in Lake Superior in the fall of 1998.

Lake Huron

- A total of 1,798 parasitic-phase sea lampreys (Canada: commercial-1,499; United States: sport-299) was collected from eight statistical districts (4 Canada, 4 United States) in 2005.

- A total of 137 parasitic-phase sea lampreys captured by the sport fishery was attached to lake trout and 162 to chinook salmon.

- Parasitic-phase sea lampreys were attached at a rate of 1.13 per 100 lake trout (n =12,023) and 6.38 per 100 chinook salmon (n = 2,537).

- A total of 768 metamorphosing sea lampreys was marked with coded wire tags and released into ten Lake Huron tributaries during September and October 2005 to estimate the 2006 parasitic-phase cohort. Recapture of these sea lampreys as spawning-phase adults will take place in 2007.

- The recapture of spawning-phase sea lampreys released as parasites during 2004 was completed. Of 138 parasitic-phase sea lampreys marked and released in the open water of Lake Huron during 2004, 4 (2.9%) were recaptured as spawning-phase adults in 2005. A total of 27,602 (13,247 Canada, 14,355 United States) spawning-phase sea lampreys was scanned for coded wire tags in 18 (6 Canada, 11 United States; joint St. Marys) Lake Huron streams in 2005. The estimated abundance of the parasitic population is 610,543 (Table 25).

- A total of 233 parasitic-phase sea lampreys (captured by commercial fisheries) was marked with coded wire tags and released in the North Channel of Lake Huron. Recapture of these sea lampreys as spawning-phase adults will take place in 2006.

Table 25. Lake-wide population estimates (PE) and 95% confidence intervals (CI) of metamorphosing, parasitic-phase, and spawning-phase sea lampreys in Lake Huron during 1992-2005.

Spawning Year	Estimate of metamorphosing lampreys (thousands)		Estimate of parasitic-phase lampreys (thousands)		Estimate of spawning-phase lampreys (thousands)	
	PE	95% CI	PE	95% CI	PE	95% CI
1992	639	492-907	---	---	296	260-371
1993	686	459-1,257	---	---	429	374-511
1994	---	---	515	409-688	171	147-206
1995	---	---	629	518-798	217	197-247
1999	803	505-1,737	1,361	788-3,527	154	140-181
2000	644	513-865	1,759	1,255-2,848	259	234-297
2001	578	491-702	2,302	1,089-14,800	171	152-204
2002	1,000[1]	374-7,813	779	442-2,203	102	87-127
2003	630	443-1,032	1,909	958-8,715	180	153-221
2004	1,100	701-2,301	687	451-1,337	129	113-157
2005	---	---	611	305-2766	122	108-145

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

RISK ASSESSMENT

Risk assessment addresses the environmental issues related to the implementation of sea lamprey management activities. Priority projects included participating in sea lamprey related environmental risk management discussions with state, tribal, and Federal regulatory agencies to obtain lampricide application permits, assuring the protection of Federal- and state-listed species, and working with others to minimize the risk to non-target organisms.

Permits

Issues concerning management of environmental risk during lampricide applications were addressed to fulfill regulatory agency permit requirements for the Indiana Department of Natural Resources, Michigan Department of Environmental Quality, Minnesota Department of Natural Resources, New York Department of Environmental Conservation, Ohio Environmental Protection Agency, Pennsylvania Fish and Boat Commission, Wisconsin Department of Natural Resources, and Bad River Band of Lake Superior Tribe of Chippewa Indians.

Reports were prepared to comply with the U.S. Environmental Protection Agency (EPA) June 16, 1998, ruling of Section 6(a)(2) of the Federal Insecticide, Fungicide, and Rodenticide Act. This section of the Act requires pesticide registrants to report to the EPA information concerning unreasonable adverse effects of their products. The USFWS is the registrant for lampricides and must report unreasonable adverse effects on humans, domestic animals, fish or wildlife, plants, other non-target organisms, and water, and property damage. Incident reports are required if the death of a single organism of a Federally-listed endangered, threatened, or candidate species, or more than 50 individuals of any species or taxa is observed during a lampricide application. Reports filed during 2005 included observed mortalities of 79 burbot (*Lota lota*) and 88 longnose dace (*Rhinichthys cataractae*) in the Cedar River (Lake Michigan) and about 150 mudpuppies (*Necturus maculosus*) in the Salmon River (Lake Ontario).

Federal and State Endangered Species

Consultations with USFWS offices and state agencies were held to discuss proposed lampricide applications to assess the risk to Federal- (endangered, threatened, and candidate) and state-listed (endangered, threatened, and special concern) species, and determine procedures that protect or avoid disturbance to each listed species. The State of Michigan issued a Threatened/ Endangered Species Permit to allow the incidental take of state-listed species.

The following protocols were implemented to protect and avoid disturbance to Federal and state-listed species:

- Protocol to protect and avoid disturbance to Federal- and/or state-listed endangered, threatened, candidate, proposed, or special concern species and critical or proposed critical habitats in or near Great Lakes streams scheduled for lampricide treatments in the United States during 2005; and

- Protocol to protect and avoid disturbance to Federal- and/or state-listed endangered, threatened, candidate, proposed, or special concern species and critical or proposed critical habitats in or near Great Lakes streams scheduled for granular Bayluscide assessments in the United States during 2005.

These protocols provided field personnel a list of protected Federal- and state-listed species, known locations, and steps to assure protection and avoidance. No mortality or disturbance was observed for the 27 Federal- or state-listed species and 1 natural feature listed in the protocols.

Hungerford's Crawling Water Beetle

The Hungerford's crawling water beetle (*Brychius hungerfordi*, Coleoptera:Haliplidae) a Federal- and state-listed endangered species was found in the Carp Lake River (Lake Michigan) in Emmet County, Michigan during 1998. After consensus was reached with representatives of the East Lansing Field Office (Ecological Services) a strategy was designed which allowed control agents to treat about 96% of the population of larval sea lampreys in the Carp Lake River during 2004.

To again comply with the Endangered Species Act of 1973, an Intra-Service Biological Evaluation review was completed with personnel of the East Lansing Field Office (Ecological Services) with terms and conditions for a post treatment larval sea lamprey electrofishing assessment during 2005. Consensus was achieved on a strategy designed to assess up to 84% of the stream and to minimize adverse effects on the Hungerford's crawling water beetle.

Lake Sturgeon

During 1982, the lake sturgeon (*Acipenser fulvescens*) was being considered for threatened or endangered status in the United States and was listed in the Federal Notices of Review Register as a category 2 (C2) candidate species. The C2 classification was removed within the USFWS during 1995 and for the public during 1996. The lake sturgeon now has no formal Federal designation.

During 2005, the lake sturgeon was listed as state endangered in Illinois, Indiana, Ohio, and Pennsylvania, threatened in Michigan and New York, and as a special concern species in Minnesota and Wisconsin. Tributaries in these states where lake sturgeon recently have been documented include the Bad, Ontonagon, Sturgeon, and St. Louis rivers (Lake Superior); Fox, Grand, Kalamazoo, Manistee, Manistique, Manitowoc, Menominee, Millecoquins, Milwaukee, Muskegon, Oconto, Peshtigo, and St. Joseph rivers (Lake Michigan); Carp, Cheboygan, Rifle, Saginaw, and St. Marys rivers (Lake Huron); Detroit and St. Clair rivers (Lake Erie); and Black, Genesee, and Niagara rivers (Lake Ontario).

Consensus was achieved with the Michigan and Wisconsin Departments of Natural Resources and Bad River Band of Lake Superior Tribe of Chippewa Indians to manage lampricide treatments to control sea lampreys and minimize the mortality of lake sturgeons in the Bad, Ontonagon, and Sturgeon rivers (Lake Superior) and Muskegon, Oconto, Peshtigo, and White rivers (Lake Michigan). Assessments during and immediately after treatments of these rivers

found no dead lake sturgeons. Some of the assessments were completed to fulfill requirements specified in the 2005 Certifications of Approval issued for lampricide treatments by the Michigan Department of Environmental Quality.

Northern Brook Lamprey

Concurrence was achieved with the Indiana Department of Natural Resources to control sea lampreys in the Indiana portions of tributaries to the Galien River and to minimize the risk to the state endangered northern brook lamprey (*Ichthyomyzon fossor*). Pretreatment electrofishing assessments and collections following the treatment found no northern brook lampreys in the treated portion of the Galien River system in Indiana.

During the permitting process, we also provided records of sea lampreys and native lampreys found in Indiana streams during 1960 to 2004 and scheduled a cooperative electrofishing assessment in the St. Joseph River system in Indiana to look for the northern brook lamprey. The assessment documented the presence of northern brook lampreys in the Indiana portions of two tributaries to the St. Joseph River during 2005.

TASK FORCE REPORTS

The Commission, through its Sea Lamprey Integration Committee (SLIC), has established task forces to recommend direction and coordinate actions in several focus areas: Lampricide Control, Sterile-Male-Release Technique, Sea Lamprey Barriers, Pheromone and Trapping, and Assessment. The progress and major actions of the task forces for 2005 are outlined below.

Lampricide Control Task Force

The Lampricide Control Task Force was established during December 1995.

Purpose:

To improve the efficiency of lampricide control to maximize the number of sea lampreys killed in stream and lentic area treatments while minimizing lampricide use, costs, and impacts on stream and lake ecosystems; and to define control options for near- and long-term stream selection and target setting.

2005 Membership:

Terry Morse (Chair), Dorance Brege, David Johnson, Dennis Lavis, Alex Gonzalez, Ellie Koon, Jeff Slade and John Weisser (USFWS); Rob Young, Brian Stephens and Paul Sullivan (DFO); Gavin Christie and Dale Burkett, Great Lakes Fishery Commission Secretariat; Jean Adams, Cindy Kolar, Mike Boorgaard and Ron Scholefield, U.S. Geological Survey.

Progress:

1. ***Achieve economic injury levels by suppressing sea lamprey populations to economic-injury levels (maximize net benefits of sea lamprey and fishery management) by the year 2005.***

2. ***Through enhanced treatment effort over the past 7 years the Lampricide Treatment Program has brought the numbers of sea lampreys and marking rates in lakes Erie, Ontario, and Huron to near target levels.*** Enhanced and focused effort in Lake Michigan resulted in over a 50% drop in sea lampreys in the lake in 2005, and a corresponding reduction in marking is anticipated in 2006, as well as an additional drop in spawning sea lampreys. Although Lake Superior has a small increase in spawning sea lampreys in 2005, it was well within the numbers noted through the history of the program in Lake Superior and is expected to drop after the normal 2-year lag period associated with intensive treatment efforts. The amount of treatment effort on Lake Superior in 2005 has been unequalled since 1980.

3. ***Control the St. Marys River by suppressing sea lamprey populations in the St. Marys River to a level that allows rehabilitation of lake trout in northern Lake Huron.***

4. ***Lampricide control efforts continued in the St. Marys River in 2005 where 143.9 hectares were treated with granular Bayluscide.*** Portions of the river have been treated annually since 1999 when over 2,000 acres were treated and resulted in an estimated 50% reduction in the larval population. The lampricide effort, combined with successful trapping and release of sterilized male sea lampreys continues to reduce reproduction potential in the river and the contribution of transformed sea lampreys to Lake Huron. Fish assessment in Lake Huron has documented young-of-the-year lake trout in 2004 and 2005, and for the first time, yearlings in 2005 at several locations in the lake which implies natural reproduction. Expectations are that by maintaining at least the current level of control in the St. Marys River, the population of naturally produced lake trout in Lake Huron will continue to increase.

Tactical/Operational Planning:

- Base control program included 4,370 staff days plus an added 384 staff day;
- A total of 65 streams were treated (57-streams selected as a result of the ESTR process; 50 – base, 7 – with added effort);
- Eight streams (5-Lake Michigan, 2-Lake Huron, 1-Lake Erie) were treated as a result of flexibility associated with the additional effort for U.S. crews (4 persons). A 10 percent increase in efficiency resulted from treatment of these geographically convenient streams (streams treated due to their proximity to other ranked streams) which were not included in the original 2005 budget allocation. High numbers of large (>120mm) sea lamprey larvae and transformers were present in all of the geographic streams;
- Four streams in Canada were deferred due to high water, logistics, and a lack of flexibility to re-schedule during the 2005 season;
- Recommended the continuation of the additional U.S. effort (4 person add) plus an additional 8 person crew on the Canadian side in order to further move toward targets;
- Lampricide use was about 10 percent less than projected (43,630 kg projected, 39,390 kg used).

Long-term Planning:

- A combined session of the Lampricide Control Task Force and the Control Ranking and Evaluation Task Force was convened to develop strategies to maximize suppression and to evaluate results of additional control efforts. Additional treatment effectiveness measures (higher TFM concentrations, longer banks, increased use of secondary treatment staff, etc.) will be employed beginning in 2006 (52 streams) to move closer to reaching targets in all lakes. A plan to evaluate the change in treatment measures is under development during 2006.
- A study of issues related to stream pH and lampricide toxicity will continue in 2006.
- Task Force continues to pursue registration for H&S TFM in Canada and to investigate potential of dual-labelled lampricide products to increase the efficiency of transportation and application of lampricides between the U.S. and Canada.

Control Ranking and Evaluation Task Force

Purpose:

The purpose of the Control Ranking and Evaluation Task Force (CRETF) is to rank streams and lentic areas for sea lamprey control options, and to optimize the evaluation of the success of the sea lamprey control program.

2005 Membership:

Doug Cuddy (Chair), Rod McDonald, Fraser Neave and Mike Steeves (DFO); Michael Fodale, Katherine Mullett, Jessica Richards and Jeffrey Slade (USFWS); Roger Bergstedt, Bill Swink and Jean Adams, U.S. Geological Survey, Biological Resources Division; Bill Mattes, Great Lakes Indian Fish and Wildlife Commission; Michael Jones, Michigan State University; Gavin Christie and Dale Burkett, Great Lakes Fishery Commission Secretariat.

The Task Force met twice – during February and September, 2005. The larval workgroup also met twice. CRETF continues to work closely with all of the other SLIC task forces.

Progress:

1. ***Annually rank streams and lentic areas for lampricide control through use of the ESTR model***. In cooperation with the Secretariat and IMSL contractor, CRETF used transformer production estimates and treatment costs generated by the Empirical Stream Treatment Ranking model (ESTR) to rank all producing streams in the basin for treatment in 2006. Included in this ranking were the St. Marys River and lentic areas off the mouths of producing streams in Lake Superior.

2. ***Upon receiving sea lamprey abundance targets from the Sea Lamprey Target Setting Work Group, to annually activate the targets into the control ranking that uses the ESTR model.*** Additional treatment effort for 2006 is being weighted towards those lakes that are exhibiting higher sea lamprey wounding rates. The additional effort is being strategically allocated in the order of lakes Huron, Erie, Michigan, Superior, and Ontario. All lakes are receiving some level of additional treatment effort in 2006.

3. ***Annually rank streams for selection for sea lamprey barriers***. CRETF continues to work with the Barrier task force and the Secretariat on the ranking of streams for barriers. Larval production estimates, quantity of habitat and treatment effectiveness are being incorporated into the ranking.

4. ***Refine and implement the recommendations of the larval assessment review of 2002.*** The Task Force continues to implement recommendations of the review panel. Activities in 2005 included ranking streams for treatment using "expert judgment" and validation of QAS estimates using mark-recapture during treatment. In addition, the field work in support of the second phase of the review got underway in 2005. This second phase will look at optimizing the resources spent on assessing and controlling larval lamprey populations. The current

research is designed to develop a rapid assessment methodology that will replace the labour intensive QAS methodology.

5. ***Annually refine the parameters of the ESTR model for sea lamprey population biology and habitat, effort and costs, and control effectiveness.*** Model refinement is an ongoing process. In 2005 lake specific spawner abundance, wounding rates and fish community objectives were incorporated into the model and were used in allocating some of the control effort for 2006.

6. ***Optimize the assessments of abundance of adult sea lampreys, fish abundance, and fish survival into the best long-term measure(s) of sea lamprey control success.*** This work is being done by the Sea Lamprey Damage and Target Work Group. This group is attempting to rationalize long- and short-term lamprey abundance and damage in each of the lakes to better allocate control effort among all lakes.

7. ***Refine and implement the recommendations of the adult assessment review of 1997.*** Lake-wide spawner estimates are made each year. Rationalization of which streams to trap is on-going using a value-added approach. Informational gaps including trapping more large rivers and assessment of Georgian Bay continue to be worked on by the task force and the trap work group of the Reducing Reproduction Task Force.

8. ***Develop annual border-blind schedules that maximize efficiency.*** Border blind larval assessment schedules are the norm on the lower lakes. Cost efficiencies are also being realized by Canada doing almost all larval assessment work on the St. Marys River in 2006. Cost benefit analyses are being done on other aspects of the assessment programs on the upper lakes in an attempt to improve border efficiencies.

9. ***Annually update SOPs.*** Larval assessment SOPs are reviewed annually and updated as changes are made. In order to compare the results of the rapid assessment technique study a three year moratorium has been implemented on changes to the QAS field protocol.

10. ***Annually develop estimates of costs for effort for upcoming fiscal year.*** Assessment cost estimates are developed annually for submission to the Program Integration Working Group prior to its fall budget meeting.

11. ***Assist in the development and refinement of the assessment research theme paper.*** The task force continues to review the Theme paper for relevancy to current and future needs.

12. ***Working with internal and external researchers, develop proposals and participate in field research of studies consistent with the assessment research theme paper.*** The task force regularly reviews progress on research priorities and encourages members and colleagues to submit proposals in areas of need. Currently, task force members are actively involved in several research projects.

13. ***Annually review research proposals for relevance to the assessment research theme paper.*** Research pre-proposals are reviewed and their relevance to the Task Force needs is evaluated. This evaluation is then passed on to the Sea Lamprey Research Board.

Connecting Channel and Lentic Area Task Force

The Connecting Channel and Lentic Area Task Force continued to coordinate with other task forces regarding the combined activities conducted on the St. Marys River and plans for lentic area investigations of Lakes Michigan and Superior in 2005. The TF submitted budget recommendations for continued assessment and control actions for 2006.

The Connecting Channel and Lentic Area Task Force was established in June 2003.

Purpose:

Integrate estimates of contribution of sea lamprey transformers from connecting channels and lentic areas into the annual treatment ranking process by development of assessment and control strategies appropriate for those areas.

2005 Membership:

Denny Lavis (Chair), Mike Twohey, Mike Fodale, Jeff Slade, Terry Morse, and Kasia Mullett (USFWS); Doug Cuddy, Paul Sullivan and Mike Steeves (DFO); Jean Adams and Roger Bergstedt (U.S. Geological Survey, Biological Resources Division); Michael Jones (Michigan State University); Gavin Christie and Dale Burkett (Great Lakes Fishery Commission Secretariat). Chair passes to Mike Fodale in October 2005.

Task force meetings were held on March 7-8 and September 9, 2005.

Progress:

1. ***Coordinate St. Marys control and assessment strategies, provide summary reports and ensure all tasks are appropriately addressed.*** Report of 2005 activities and results were provided at SLIC and summarized for GLFC annual report. Assessment and alternate control activities for 2006 were planned and are detailed in respective task force reports. Lampricide treatment plans include treating 135 hectares. Trap work group under Reducing Reproduction Task Force (RRTF) to experimentally examine physical conditions as they may relate to trap efficiency historically. Soo Edison and GLP trap construction projects proceeding under auspices of the RRTF

2. ***Address assessment precision levels needed for the St. Clair, Detroit, and Niagara rivers.*** Limited discussion to date. The more immediate focus is upon lentic areas in Lakes Michigan and Superior.

3. ***Using existing data, inventory infested lentic areas and estimate contribution of transformers; where needed, coordinate the development of proposals for consistent, comparable, and efficient assessment of their contribution.*** Inventories completed and

estimates of potential larval production based upon historical data compiled during 2004. Plan developed and implementation began in 2005 for systematic sampling of lentic areas based upon the above using RoxAnn and granular Bayluscide (Table 26).

4. ***Identify specific research questions or hypothesis on population dynamics to define the contribution to recruitment of lentic areas and connecting channels; advance specific proposals to refine knowledge relating to control of sea lampreys in connecting channels and lentic areas.*** Ongoing discussion in task force; specific pre-proposal by Swink to determine lentic parasitic contribution to lakes supported for full proposal solicitation by the SLRB.

5. ***Evaluate current assessment methodologies/technologies toward the development of a "rapid" assessment technique.*** Draft sampling protocol deployed during 2005 uses published information to allow "rapid" assessment of lentic area habitat with RoxAnn.

6. ***Identify treatment options and costs.*** Lentic area habitat and production estimates continue to be budgeted as an add-on for 2006 and include a total about 400 staff days and $197,200 for the upper and lower Great Lakes and the Niagara River based upon historical inventories of infested lentic areas, potential for production and assessments completed in 2005. Investigations in 2005 provided data to consider 6 Lake Superior lentic areas for granular bayluscide treatment, 3 of which (114 ha) will be treated in 2006. St. Marys River 2006 funding recommended at an estimated cost of $1,515,000 that includes:
    - Larval Assessment and Lampricide Control activities included in respective program targets provides for about 130 staff days (@~$700/da, $91,000) of larval assessment effort to estimate population and delineate necessary treatment areas and 120 hectares (@~$4,800/ha, $576,000) of granular bayluscide treatment effort.
    - SMRT and Trap activities included in respective program targets of SMRT ($478,800) and Pheromone and Trapping ($251,200 - trapping for SMRT in and outside of St. Marys River and Trapping for Control) provides for collection and release of sterile males, spawning run estimate and removal of female lampreys.
    - Cheboygan River trap improvements attributable to trapping for SMRT is estimated to be $118,000 based upon 2004 percentage males collected for sterilization. This is a one time cost.

7. ***Coordinate with other task forces prior to proposing field actions to SLIC.*** Chairs of Control Ranking and Evaluation Task Force, Lampricide Control Task Force, Reducing Reproduction Task Force, as well as members from the Research Priorities Working Group, Trap Work Group, Larval Work Group and Program Integration Working Group are part of CCLATF and assist in formulation of proposed field actions and reporting to SLIC.

Table 26. Results of lentic area surveys using RoxAnn and granular Bayluscide in areas of lakes Superior and Michigan, 2005.

Lake	Source Stream	Lentic Area (ha)	Transformers Killed (est)	Treatment Cost	Cost/Kill
Superior	Batchawana	330	12,225	$ 1,728,148	$ 141
Superior	Carp R. (CDN)	154	0	804,561	---
Superior	Chippewa R.	21	6,205	111,995	18
Superior	Cypress R.	137	1,827	716,203	392
Superior	Gravel R.	81	2,293	425,102	185
Superior	Harmony R.	23	0	121,996	---
Superior	Haviland R.	14	0	71,933	---
Superior	Jackfish R.	34	795	179,324	225
Superior	Lake Helen	659	736	3,447,387	4,686
Superior	MacKenzie R.	4	23	20,194	872
Superior	Magnetawan R.	94	0	492,739	---
Michigan	Manistique R.	16	256	83,079	324
Superior	Neebing-MacIntyre	67	0	348,684	---
Superior	Stokely Cr.	45	0	237,495	---

Table 27. Lentic area and connecting channel investigations planned for 2006 at the recommended funding level of $197.2K.

Lake	Source Stream	Lentic Area	Potential Infested Area (ha)	RoxAnn Complete	GB Sampling Complete
Huron	Carp R.	Carp R.	13	No	No
Huron	Mindemoya R.	Providence Bay	20	No	No
Huron	Manitou R.	Michael's Bay	5	No	No
Ontario – Canada	Duffins Cr.	Duffins Cr. (lentic)	8	No	No
Ontario - NY	Black R.	Black R. Bay	14	No	No
Ontario	Niagara R.	Upper	4,231	No	No
Ontario	Niagara R.	Lower	761	No	No
Superior	Goulais R.	Goulais Bay	310	No	No
Superior	Steel R.	Santoy Bay	14	No	No
Superior	Black Sturgeon R.	Black Bay	54	No	No
Superior	Wolf R.	Black Bay	68	No	No
Huron	Mississagi R.	North Channel	129	Yes	No
Huron	Magnetawan R.	Bying Inlet	103	Yes	No
Superior	Haviland Cr.	Haviland Bay	18	Yes	No
Superior	Stokely Cr.	Haviland Bay	22	Yes	No
Superior	Harmony R.	Batchawana Bay	23	Yes	No
Superior	Carp R.	Batchawana Bay	165	Yes	No

Reproduction Reduction Task Force

The task force was established in 2003 and incorporated the former sterile-male-release technique (SMRT) task force, and pheromone and trapping task force.

Purpose:

Coordinate and optimize the pheromone, sterile-male release, and trapping strategies in an integrated program of sea lamprey control.

Supporting Great Lakes Fishery Commission Strategic Vision Milestones:

- Achieve economic-injury levels: Suppress sea lamprey populations to economic-injury levels (maximize net benefits of sea lamprey and fishery management) by the year 2005.
- Control the St. Marys River lamprey population: Suppress sea lamprey populations in the St. Marys River to a level that allows rehabilitation of lake trout in northern Lake Huron.
- Use alternative control technologies: Accomplish at least 50% of sea lamprey suppression with alternative technologies while reducing TFM use by 20% through use of at least one new alternative-control method, increased use of current methods such as sterile-male release, trapping, and barrier deployment.

2005 Membership:

Michael Twohey (chair), Gary Klar, Kasia Mullett, and Jessica Richards, (USFWS); Weiming Li, Mike Jones, Mike Wagner and Larry Gut, Michigan State University; Gavin Christie and Dale Burkett, Great Lakes Fishery Commission; Doug Cuddy and Rod McDonald (DFO); Cindy Kolar, Jane Rivera and Roger Bergstedt, U.S. Geological Survey; Rob McLaughlin, University of Guelph; Greg Wright, Chippewa/Ottawa Resource Management Authority; Ellen Marsden, University of Vermont; and Peter Sorensen, University of Minnesota.

Progress:

1. ***Develop and periodically refine the pheromone, sterility, and trapping for control research theme papers.*** Themes for SMRT, Pheromones, and Trapping (in the Barrier theme) have been published on the GLFC website.

2. ***Identify application strategies. Solicit or develop field evaluation of the most promising strategies.*** The task force and pheromone work group have identified potential pheromone strategies to advance for implementation by 2010. Broad strategies have been prioritized based on cost, probability of success, degree of complexity and time to implement. Research questions were included in the research theme. The task force was working with Dr. Michael Wagner to incorporate costs and expected outputs along with specifics pertaining to: which tests will be conducted; where tests will be conducted; need for controls and replicates of tests and how replicate tests will be made; and, how much of each pheromone compound will be needed to complete all aspects of testing.

The Wagner lab led field studies that built on the proof of concept studies of the previous year. Migratory pheromone field trials in 2005 were designed to develop an understanding of how lampreys discriminate concentrations in a background odour. Migratory pheromone studies were interrupted after a promising start. Low temperatures and low flows prevented the movement of lampreys, even in the presence of pheromone. With an increased supply of migratory pheromone, studies will be moved to a larger tributary in 2006 where conditions will be more dependable. Mating pheromone studies faired better. More ovulating females interacted and were captured in traps baited with more males (similar results were observed by other researchers on Lake Champlain). Further, the Wagner lab conducted additional treatments where background odours were introduced. Results showed that the behavioural patterns of ovulating females did not change but trapping efficiency was reduced because females spent less time at a trap. In other experiments, there was not strong evidence to show that mate choice was important. More pheromone was more important than more sources of pheromone.

The Li lab (Nick Johnson lead) conducted tests using synthetic mating pheromones. Traps baited with 3kPZS captured more females than un-baited traps while 3kACA baited traps did not capture more females than un-baited traps. A mix of 3kPZS and 3kACA (3kPZS at 10^{-12} M) was able to lure females from 0.5 miles downstream to within 1 meter of the odour introduction. A direct comparison of 3kPZS versus a mixture showed that 3kACA is not important in attracting females from a distance, but may be important in inducing spawning behaviours (a short-range cue). A laboratory was contracted to scale up synthesis of these compounds for future field trials.

The Sorensen lab published the structures of three migratory pheromone components [Petromyzonamine disulfate (PADS), Petromyzosterol disulfate (PSDS), Petromyzonol sulfate (PS)] in Nature Chemical Biology. A laboratory was contracted to synthesize these compounds for field trials planned through 2010.

Recommendations by the sterile-male-release technique expert panel and a publication by Klassen et al. (2004) suggest that the release of sterile female sea lampreys could be an effective way to suppress sea lamprey populations. A proposal for a field trial in 2006 was deferred to 2007 in order to allow lampricide treatment of the study site in the year prior to the trial.

3. ***Evaluate the role of trapping as an alternate control technique.*** Assessment of larval populations in the St. Marys River, simulation modeling by Jones et al. and economic effects investigated in Jones' decision analysis project all indicate that trapping is an integral element of the integrated control strategy in the St. Marys River, and that the strategy is effectively reducing production of larvae. The task force was monitoring effectiveness of trapping for control in some Lake Champlain tributaries.

   New traps were scheduled for completion in 2006. Construction of traps in the St. Marys River progressed with construction initiated at the Edison Sault hydro plant, and planning and permitting continued for a trap on the south side of the Great Lakes Power - Francis H. Clergue hydro plant. Traps should be complete by June 1, 2006. Plans for evaluation and

operation of these traps were underway. A pilot trapping project was being planned for the Mississagi River, a large river in the North Channel of Lake Huron with potential to provide thousands of males for SMRT.

The task force continued to evaluate variables that affected trap efficiencies with evaluations of new and existing trapping technologies undertaken. Experimental manipulations of individual traps were conducted in the St. Marys River that included evaluation of nigh-checks and video observations of lampreys at traps with retention devices (fingers). Also, an experimental fish-wheel was tested in the Cheboygan River. Results of these evaluations were being analyzed and plans formulated for additional investigations during 2006.

4. ***Evaluate results of laboratory and field research and revise application strategies accordingly.*** The task force, in cooperation with Dr. Michael Wagner, was documenting a plan of research and development for implementation of a pheromone control technique by 2010 that incorporated recent results of laboratory and field studies.

   An expert panel reviewed the sterile-male-release technique during 2003 and noted that implementation and evaluation of the technique was proceeding in a highly effective and efficient manner, that there was compelling evidence the technique had reduced recruitment of sea lampreys in the St. Marys River, and that it was a vital part of the integrated control strategy. Planning continues to maximize trapping efficiencies and the number of males available for sterilization.

   The task force was working with the Fish Health Committee and lake committees to establish effective protocols for screening and moving sea lampreys from the lower to upper Great Lakes. Lampreys from Lake Ontario were screened for *Heterosporis*, and for the presence of emergency and restricted diseases. No diseases were found that would curtail releases. The task force was pursuing low or no cost screening, and was working with the FHC on a formal risk assessment for inter-lake transfers of lampreys.

   Trapping technologies were evaluated in the Cheboygan and St. Marys River and results were being used to optimize operations for 2006. Results of St. Marys River telemetry studies in 2001-2002 were used to identify additional trapping sites on the St. Marys River.

   Results of sterile-male releases and trapping in the St. Marys River during 1991–2005 are presented in Table 7.

5. ***Mediate a collaborative link between control agencies and research institutions, such that the best available resources are used and the transition from laboratory to field is adequately facilitated.*** Pheromone field experiments continued during 2005 with investigators from three universities, both control agents, and other collaborators. The control agent's expertise in trapping was integral to the field studies. Good Laboratory Practices training was provided by the Upper Mississippi Environmental Sciences Center (UMESC). Extraction of larval (migratory) pheromone was occurring at Hammond Bay with support from Peter Sorensen (University of Minnesota) and both control agents. This approach

provided a strong interdisciplinary team and built critical expertise for future implementation of a pheromone control strategy.

The task force was collaborating with agents, and internal and external researchers to advance strategies for suppression of reproduction. A workshop was scheduled to occur in 2006 that would advance innovation in trap design and operation. The task force continued to collaborate with Jones on compensatory mechanism studies. The Hammond Bay Biological Station continued to provide support for SMRT related field activities.

6. ***Identify chemical/biochemical registration requirements, coordinate appropriate registration research, and facilitate the registration process with U.S. Environmental Protection Agency and Health Canada through appropriate Commission and U.S. Geological Survey personnel.*** Experimental use permits for migratory and sex pheromones were renewed for the 2005 field experiments, and were being amended for the 2006 field experiments. Good Laboratory Practices training was coordinated by UMESC for field trial workers to support registration requirements, and past data was reviewed for compliance with GLP. A report on field trial results was drafted for the State of Michigan. Future registration strategies continue to be evaluated by UMESC, including simultaneous registration in the U.S. and Canada. Timelines and cost projections were updated.

7. ***Work with control ranking task force on issues of compensatory response of sea lampreys to reduced abundance and behavioural responses to pheromones, sterile-male release, and trapping.*** Results of compensatory mechanisms investigations and subsequent modeling exercises suggested that strategies to reduce reproduction could be effective in an integrated strategy that aggressively reduces recruitment to very low larval densities. The task force continued to monitor progress of Dr. Jones compensatory mechanism studies.

8. ***Develop annual border-blind schedules that maximize efficiency.*** The US and Canadian agents worked on both sides of the boarder to facilitate effective trapping, processing, and transport of sea lampreys. The US and Canadian agents both provided staffing for pheromone field experiments near Hammond Bay. The task force was refining effective protocols for screening and moving sea lampreys from the lower to upper Great Lakes using facilities on both sides of the boarder.

9. ***Annually update standard operating procedures.*** Field operations were conducted under current protocols. Standard operating procedures for critical sterilization activities were developed, externally peer reviewed, and incorporated into a manual of standard operating procedures. Additional procedures were being reviewed for incorporation in 2006. Transfers of lampreys from Lake Ontario were conducted under a protocol that was reviewed by the Fish Health Committee and lake committees. The task force developed methods and schedules for trap operation on the St. Marys River. Procedures were detailed in the agents' annual work plans. Pheromone field trials were conducted under peer reviewed study plans.

10. ***Annually develop estimates of costs for effort for upcoming fiscal year.*** Budgets were proposed for control trapping, sterilization, and pheromones and presented to the Sea Lamprey Integration Committee.

11. ***Working with internal and external researchers, develop proposals and participate in field research consistent with pheromone, sterility, and trapping for control research theme papers.*** Task force members were engaged in development of research proposals for trapping, SMRT and pheromones. The task force continued to refine a research strategy to support implementation of a pheromone control technique by 2010. Control agents, internal research and external research collaborated on pheromone field trials through 2005 and proposed additional studies through 2010. New applications of technology were being investigated to improve trapping efficiencies. A workshop was planned to synthesize trapping information (formal and informal), identify information needs, design experiments, and to identify new technologies and strategies that may help in such areas as trapping in unconventional locations, improving trap retention, and optimizing traps for use with pheromones. Efficacy of sterilization, Q/A, and potential for sterile female release continued to be investigated with help from agents, internal research, and external research. The task force continued to consider recommendations of the SMRT Expert Review Panel in formulating research plans.

12. ***Annually review pheromone, sterility, and trapping for control research proposals for relevance to pheromone, sterility, and trapping for control research theme papers.*** Task force input into research priorities was provided through the research themes and reliance on task force members who attend the Research Priorities Working Group core meeting.

Sea Lamprey Barrier Task Force

Purpose:

The Barrier Task Force was established during April 1991 to coordinate efforts of the DFO, USFWS and the U.S. Army Corps of Engineers (Corps) on the construction, operation and maintenance of sea lamprey barriers.

Supporting GLFC Strategic Vision Milestones:

- *Achieve economic injury levels.* Suppress sea lamprey populations to economic-injury levels (maximize net benefits of sea lamprey and fishery management) by the year 2005.
- *Use alternative control technologies.* Accomplish at least 50% of sea lamprey suppression with alternative technologies while reducing TFM use by 20% through increased use of current methods such as sterile-male-release, trapping, and barrier deployment.

To contribute toward this milestone, the barrier program focuses on three priorities: 1) construction of new sea lamprey barriers; 2) operation and maintenance of existing sea lamprey barriers; and 3) ensured blockage of sea lampreys at other dams (defacto) not specifically built for sea lamprey control but serve that purpose.

2005 Membership:

Kasia Mullett (Chair), (USFWS); Andrew Hallett, Paul Sullivan, Jerry Weise (DFO); David Gesl, Corps; Sharon Hanshue, Michigan Department of Natural Resources; Bill Swink, U.S. Geological Survey; Rob McLaughlin, University of Guelph; and Dale Burkett, Gavin Christie, Commission.

Progress:

1. ***Coordinate the construction of new sea lamprey barriers that annually eliminates 1% of available habitat for sea lamprey larvae.*** During 2005, construction was completed on the Carp Lake River barrier and St. Marys Edison Sault Electric trap. The Carp Lake River barrier contributed 0.1% of the total type 1 habitat available for sea lamprey larvae in regularly treated streams. Progress continued toward replacing the measures of type 1 larval habitat with production estimates of larval and transforming sea lampreys to gauge barrier performance and progress toward targets/milestones. The barrier work plan was modified to reflect the termination of the Conneaut and Bad river sea lamprey barriers and construction of Bronte Creek barrier was delayed due to geotechnical difficulties. The Corps experienced funding constraints that only allowed enough resources to complete the Carp Lake River barrier and St. Marys trap. Progress on the remaining 12 Corps projects (10 barrier, 2 traps) was postponed for the duration of 2005.

2. ***Coordinate the operation of all existing barriers so that they are 100 % effective in blocking spawning-phase sea lampreys.*** The list of barriers that are *operated* each year consists of those barriers that have adjustable components that need to be set/removed/adjusted at the beginning/end of the sea lamprey migration periods or that have permanent traps or fishways associated with them that require regular servicing. During 2005, 11 barriers were operated (5 Canada, 6 United States). A preliminary assessment of the effectiveness of existing barriers that were constructed or modified to block sea lampreys indicated that 54 of 70 are effective at eliminating treatment upstream of the barrier.

3. ***Coordinate the maintenance of all existing barriers so that they are safe and always in sound condition by the expected arrival of spawning-phase sea lampreys.*** During 2005, maintenance inspections were conducted at 53 sites (35 in Canada, 18 in the United States). The results of inspections led to immediate minor repairs or an engineered inspection and remediation plan for major repairs. Progress continued in 2005 to repair a breach in the Miners River barrier and is scheduled to be completed during 2006. The McIntyre River barrier was decommissioned. Funds were requested in the FY06 budget for major maintenance projects including repairs to Gimlet, Stokely and Big barriers, decommissioning of Shelter Valley barrier and an escapement study on Duffins. The Stokely and Big were funded for FY06.

4. ***In consultation with the control ranking task force, annually select new construction projects from the ranked barrier list.*** No new projects were selected in 2005. The need to rebuild the de facto barrier on the Manistique was discussed and elevated as a high priority. The project was submitted to the Corps under Section 1135, but has been delayed due to funding issues. The task force recommended it be pursued as a FWS project until the Corps obtained funds to commit to it, but funds were not provided in the FY06 budget to initiate the process.

5. ***Coordinate to ensure that other barriers either remain complete blocks to adult sea lampreys or if they are proposed for removal then some form of sea lamprey block remains in place.*** During 2005, agent staffs consulted and provided mitigation advice on fish passage or dam/perched culvert removal projects for 13 de facto barriers (5 Canada, 8 United States).

6. ***Develop protocol to identify and recommend withdrawal of existing non-functional barriers from the Commission barrier network.*** The criteria for considering withdrawal of existing non-functional barriers will determined after the completion (interim meeting 2006) of the Barrier Strategy and Implementation Plan. The definition of a successful barrier in the Plan will guide the decision making process for barrier removal.

7. ***Coordinate the development and maintenance of a GIS data base for all barriers that are relevant to sea lamprey control.*** Progress toward the inventory and GIS data base for de facto barriers continued.

8. ***Develop annual border-blind schedules that maximize efficiency.*** Annual border-blind schedules continued to be developed during 2005. The potential for the Canadian Barrier Coordinator to conduct initial planning work in U.S. Lake Ontario streams was discussed. A new situation arose on Pekin Brook (tributary to Orwell Brook in Lake Ontario) where the ability to effectively treat in the future is compromised. While it is a U.S. stream, the Canadian barrier coordinator could initiate the site visit, partner coordination and conceptual design processes depending on the priority of this stream in the revised ranked list.
9. ***Annually develop estimates of costs for effort and construction for upcoming fiscal year.*** Developed and recommended a fiscal year 2006 budget of $1,621,600 for barrier coordinators and technical staff support, operational cost increase, barrier operations, Big Creek back-up system, Stokely Creek repair, Cedar River barrier construction, additional fish assessment in U.S. for Cedar.

10. ***Annually update the cost information for the barrier rank model and provide the information to the Control Ranking and Evaluation Task Force.*** A Barrier Policy Team was established in 2003 to handle policy issues related to the sea lamprey barrier program. Policy team consisted of Dale Burkett (chair), Gavin Christie, Rob Young and John Heinrich and was charged with revising both the Barrier Strategy and Implementation Plan and the Ranked List of Barrier Candidate Streams. Kasia Mullett replaced John Heinrich on the team in 2005. The April 2004 version of the ranked list of candidate barrier streams was in the process of being revised. The Barrier Task Force coordinated with the Control Ranking and Evaluation and the Lampricide Control task forces to replace the type 1 larval habitat estimates with estimates of larval/transformer production, estimate downstream spawning habitat, and determine post-barrier control costs. The barrier teams have consulted with state agencies in Michigan and Wisconsin tribes to incorporate consideration of individual watershed management plans into the revised ranked list. Further coordination is in progress with the Province of Ontario and the states of New York. Pending completion of the data revisions, the SLIC recommended applying weights, conducting AHP analysis, alternative ranking analysis, and incorporating the results of decision analysis research.

11. ***Annually update SOPs.*** Several of the protocols in the Barrier Life Cycle and Operational Protocols document continue to be in need of revision. There is no schedule to complete these revisions until the Barrier Strategy document is revised.

12. ***Assist in the development and refinement of the barrier research theme paper.*** Task force provided feedback and comments that contributed toward the completion of the barrier theme paper, "Innovation and Assessment Supporting Sea Lamprey Control in the Laurentian Great Lakes Using Barriers, Traps and Fishways".

13. ***Work with internal and external researchers to develop proposals and participate in field research of studies consistent with barrier research theme paper.*** The task force continued to work with researchers via the task force and to develop proposals consistent with barrier research theme paper. Rob McLaughlin continued progress on the FishMAP database and Mike Jones/Katherine Smith were solicited for help in addressing fish assessment concerns with collection gear and sampling methods.

14. ***Annually review barrier research proposals for relevance to barrier research theme paper.*** Research proposal summaries were reviewed and ranked by priority.

OUTREACH 2005

Activity or Event	Number of Occurrences		Staff Days	
	Canada	US	Canada	US
School Presentations	1	32	.5	23.5
Sports Shows	7	10	58	43
Youth Fishing	-	-	-	-
Civic Groups	1	4	.5	2.5
Media Interviews	12	16	4	3.5
Media Mailings/E-mail	90	1,233	2	13.75
Station Public Displays	-	29	-	52
SLCC Public Aquarium	210	1	12	.5
Landowner Notification	500	95	20	2
Employment Outreach	-	4	-	3.5
Total Outreach	**821**	**1,329**	**97**	**144.25**

PERMANENT EMPLOYEES OF THE SEA LAMPREY MANAGEMENT PROGRAM 2005

DEPARTMENT OF FISHERIES AND OCEANS CANADA

Sea Lamprey Control Centre – Sault Ste. Marie, Ontario Canada
Robert J. Young, Division Manager

Section Head, Control: W. Paul Sullivan
Fisheries Biologist, Control:
Control Supervisor: Brian Stephens
Control Technician:
Randy Stewart
Barry Scotland
Chris Sierzputowski
Peter Grey
Jamie Smith
Jamie Storozuk
Mike MacKenna
Shawn Robertson
Charlie Boudreau
Glenn Goulay
John Tibbles
Jerome Keen
Administration Support:
A/Property & Contract Manager: Lisa Vine
Clerk-Receptionist: Christine Reid
Accounts Clerk: Melanie McCaig
Maintenance Supervisor: Brian Greene
Maintenance Assistant: Chad Hill

Section Head, Assessment: Douglas Cuddy
Fisheries Biologist, Assessment:
Adult Supervisor: Rod McDonald
Larval Supervisor (upper lakes) Todd Steeves
Larval Supervisor (lower lakes): Fraser Neave
Assessment Technologist:
Ed Achtemichuk
Gale Bravener
Chris Cowper
Scott Cressey
Richard Middaugh
Sean Morrison
Jeff Rantamaki
James Richard
Kevin Tallon
Andy Treble
Thomas Voigt
Environmental Studies: Jerry Weise
Barrier Coordinator: Andrew Hallett
Barrier Technologist: Joseph Hodgson
Informatics: John Graham

U. S. FISH AND WILDLIFE SERVICE

Marquette Biological Station
Gerald T. Klar, Field Supervisor

Control Supervisor: Terry Morse
Chemist: David Johnson
Fishery Biologist, Control:
Treatment Supervisor: Dorance Brege
Darrian Davis
Joseph Genovese
Physical Science Technician:
Lead Technician: Robert Wootke
Timothy Peiffer
Michael St. Ours
Kelley Stanley
Administration Support:
Supervisor: Nadine Seeke
Mary Jo Buckett
Steven Dagenais
Pauline Hogan
Gloria Hoog
Betty L'Huillier
Barbara Poirier
Automated Data Processing:
Supervisor: Larry Carmack
Robert Kahl
Deborah Larson

Assessment Supervisor: Katherine Mullett
Fishery Biologist, Assessment:
Larval Supervisor: Mike Fodale
Adult Supervisor: Jessica Richards
Sterile Male Supervisor: Michael Twohey
Risk Management Supervisor: John Weisser
Barrier Supervisor: Cheryl Kaye
Mary Henson
Gregory Klingler
Shawn Nowicki
Dale Ollila
Michael Siefkes
Biological Science Technician:
Gregg Baldwin
Robert Katona
Daniel Kochanski
Kyle Krysiak
Dennis Smith
Mary Wilson
Deborah Winkler

Ludington Biological Station
Dennis Lavis, Station Supervisor

Lead Treatment Biologist: Ellie Koon
Fishery Biologist, Control:
Treatment Supervisor: Alex Gonzales
Kathy Hahka
Physical Science Technician:
Lead Technician: Jeffrey Sartor
Kevin Butterfield
Ken Chaltry
Tim Sullivan

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