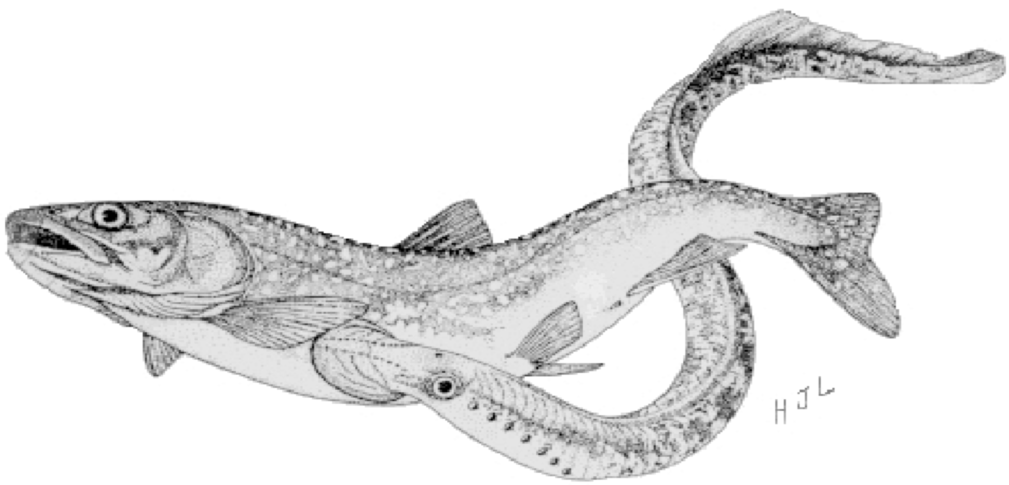
INTEGRATED MANAGEMENT OF SEA LAMPREYS IN THE GREAT LAKES 2004

ANNUAL REPORT TO THE

GREAT LAKES FISHERY COMMISSION



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EXECUTIVE SUMMARY

This report summarizes activities in the integrated management of sea lampreys conducted by the U.S. Fish and Wildlife Service and the Department of Fisheries and Oceans Canada in the Great Lakes during 2004. Lampricide treatments were conducted in 77 tributaries. Larval assessment crews surveyed 333 tributaries and 36 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 84 tributaries to estimate the spawning-phase abundance in each Great Lake.

Sea lamprey populations are evaluated relative to fish community objectives for each of the lakes. In Lake Superior the management objective for sea lampreys is a level of sea lamprey abundance that accounts for less than 5% of the annual lake trout mortality. Currently, sea lamprey induced mortality in lake trout is estimated as 12% of the annual mortality. Populations of parasitic sea lampreys remain higher than the fish community objective targets in Lakes Huron and Michigan. The population of larvae in the St. Marys River, lake trout wounding rates, and sea lamprey induced mortality in Lake Huron has declined since a St Marys River treatment strategy was initiated in 1998. Fish community objectives of less than five 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 2004 by the U.S. Fish and Wildlife Service (Service) and Department of Fisheries and Oceans Canada (Department) as contract agents of the Great Lakes Fishery Commission (Commission) to meet these targets.

The Commission is working in partnership with the lake committees through their technical committees to refine the current target statements and to 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 suppression. The Commission and cooperators 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 34,000 +/- 17,000 in order to meet this objective. This target and range were calculated from the abundance of sea lampreys estimated for the 5-year period (1994 - 1998) when marking rates were closest to five marks per 100 fish (5.2 A1-3 marks per 100 lake trout >21"). The lake-wide abundances of sea lampreys were 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 five 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 using the same methodology and comparable data.

During 2004, sea lamprey abundance was estimated to be above the target level (74,500, 95% CI: 63,900 - 89,300) (see Fig. 4). While no overall trend is evident in sea lamprey populations during the past 20 years, the numbers showed an increasing trend between 1994 and 2002 with a decline during the last 2 years. The estimated abundance has been above target since 1999. Similarly marking rates indicate an upward trend since 1994 and remain at levels above the target five per 100 fish. Sea lamprey induced mortality on lake trout was estimated to be 12% during 2004.

The causes of the increase in sea lamprey numbers during the late 1990s are unclear. Efforts to reduce sea lampreys to the target level included increased stream treatments across the Great Lakes basin during 2001 - 2004. During 2004, this additional stream treatment effort was directed to the lakes with marking rates furthest from targets, including Lake Superior. During 2004, two streams on the north shore were deferred because of high water conditions; they will be treated during 2005. During 2005, the most lampricide treatments in 20 years are planned for Lake Superior. All streams considered likely to produce sea lampreys in the northwest portion of the lake have been treated during the last four years or are planned for 2005, including the entire Nipigon system. The northwest portion of the lake has had the highest reported marking rates during recent years.

Lentic areas off stream mouths contribute sea lampreys to Lake Superior. During 2004, assessments identified four lentic areas that were ranked and targeted for treatment with granular Bayluscide (a novel bottom-release lampricide) during 2005. During 2005, an inventory of the lentic areas with the greatest potential to produce sea lampreys will be completed and additional treatments may result in the future.

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. This target and range were calculated from the abundance of sea lampreys estimated for the 5-year period (1988 - 1992) when marking rates were closest to five marks per 100 fish (4.7 A1-3 marks per 100 lake trout >21”). The lake-wide abundances of sea lampreys were 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 five 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 using the same methodology and comparable data.

During 2004, sea lamprey abundance was estimated to be above the target level (158,100, 95% CI: 147,500 - 171,500) (see Fig. 5). Sea lamprey abundance shows a significant trend upward during the past 20 years. The abundance has been above the target range since 1999. Similarly, marking rates have indicated an upward trend and have been above target levels since 1995.

Potential factors contributing to the increase in sea lamprey abundance in Lake Michigan during the period of observation include immigration from Lake Huron during the 1980s and early 1990s, changes in treatment effort or efficacy on the lake, and untreated sources during the more recent period. Sea lamprey abundances and marking rates have declined on Lake Huron during the last three years in response to the St. Marys River control effort. The population in Lake Michigan continued to increase during the same period. The Commission increased treatments across the Great Lakes basin beginning during 2001. This additional treatment effort was allocated to lakes furthest from their marking targets, including Lake Michigan. More stream treatments were carried out on Lake Michigan during 2001 - 2004 than in the previous four years. All 32 tributaries that are treated on a regular 3 – 5 year cycle and 32 of the remaining 36 streams treated over the past decade have been treated during the last 4 years or are planned for 2005. The larval population in the estuary of the Manistique River was identified and treated during three years beginning during 2001. The population of sea lampreys upstream of the deteriorating dam on the Manistique River expanded in the early 2000’s. This population, which extended over 220 km of river, was treated during 2003 and again during 2004. Another untreated population of sea lampreys in the Carp Lake Outlet was treated in 2004. The 2004 fall marking observations in northern sections of Lake Michigan, which are the first indicators of the effects of the 2003 and 2004 treatments were down slightly from 2003 marking (Mark Ebener, personal communication). This observation however, was confounded by an increase in marking observed in the southern portion of the lake. The effects of these treatments will be observed in the 2005 and 2006 spawning-phase abundance estimates and in the 2005 marking assessments. The Carp Lake Outlet barrier is scheduled for construction during 2005 and will eliminate the need for lampricide controls on this river.

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. This target and range were calculated as 25% of the estimated lake-wide population of sea lampreys during the 5-year period (1989 - 1993) prior to the completion of the Fish Community Objectives. Estimates of the number of spawning-phase sea lampreys were used as an indicator of parasitic-phase abundance in Lake Huron. The lake-wide abundances of spawning-phase sea lampreys were estimated from a combination of mark-recapture estimates of migrants in streams with traps and regression model-predicted numbers in streams without traps. The other Great Lakes do not have explicit targets for sea lamprey abundance in their Fish Community Objectives. Instead, targets have been estimated in the other lakes based on observations of marking rates that were low enough to affect insignificant mortality on lake trout.

During 2004, sea lamprey abundance was estimated to be above target levels, but indicated a downward trend over the past decade (128,900, 95% CI: 113,000 - 156,700) (see Fig. 6). Sea lamprey abundance in Lake Huron has been above target levels during 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 to be 5.2 million during the mid 1990s and was considered large enough to be producing the majority of sea lampreys feeding in the lake. The volume of the St. Marys River precluded treatment with liquid TFM. An innovative control program was begun on the river during 1997 that integrated spot treatments with granular Bayluscide and the alternative control methods of trapping and sterile male release. During 1998 - 2001, the first full round of approximately 850 ha acres of spot treatments were completed. These spot treatments were thought to have contributed to the decline in sea lamprey abundance and marking rates observed since 2001. This integrated program continues through 2005 with spot treatments of the most densely populated areas to kill larvae (about 80 ha per year) and maximum 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. This target and range were calculated from the abundance of sea lampreys estimated for the 5-year period (1991 - 1995) when marking rates were closest to five marks per 100 fish (4.4 A1-3 marks per 100 lake trout >21”). The lake-wide abundances of sea lampreys were 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 five 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 using the same methodology and comparable data.

During 2004, sea lamprey abundance was estimated as not being significantly different than the target range and was relatively stable (5,100, 95% CI: 2,200 - 26,900) (see Fig. 7). The confidence bounds on this estimate are very large because traps did not function effectively in some streams. The initial round of stream treatments during 1986 and suppression during the following eight years resulted in sea lamprey abundances 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 modifications of procedures to protect nontarget organisms. Extensive surveys of larval populations (considering all potential sources of sea lampreys) resulted in successful stream treatments and suppression to target levels during the past 3 years. Marking rates show the same pattern of increase during the late 1990s followed by a return to the target levels during the most recent years.

All streams considered likely to produce sea lampreys have been treated during the last four years. Since 2001, the Commission increased treatment effort across the Great Lakes basin to improve suppression, including some treatments planned for Lake Erie during 2005.

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 two 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. This target and range were calculated from the abundance of sea lampreys estimated for the 5-year period (1999 - 2003) when marking rates were closest to five marks per 100 fish (7.0 A1-3 marks per 100 lake trout >21”). The lake-wide abundances of sea lampreys were 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 five 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 abundance to support the Fish Community Objectives has been estimated for the other lakes using the same methodology and comparable data.

During 2004, sea lamprey abundance was estimated to be above the target range (51,000, 95% CI: 44,100 - 65,300) (see Fig. 8). There has been a significant trend downward in abundance of sea lampreys during the last 20 years. Sea lamprey abundance has been within the target range during 1994 - 2004. The marking rates on lake trout show a similar pattern of decline during the last 20 years. In contrast to the estimate of sea lamprey abundance during 2004, the marking that would have been caused by those sea lampreys was 2.9 A1-3 marks per 100 fish and below the target level. The marking rate observed during fall 2004 was 15.5 marks per 100 fish; a rate that was above target and the highest observation since 1997. Biologists on the lake have noted that their observations of A1 marks, which have been found to be correlated with mortality of lake trout, remain at target levels and do not show the same increase during 2004.

Control appears to be effective on Lake Ontario and any increases in abundance are thought to be because of ineffective treatment or 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 during 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 produces sea lampreys to Lake Ontario. Plans are being developed to monitor this population to determine whether it has increased during recent years.

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. Service and Department treatment units administer and monitor doses of the lampricide TFM, sometimes augmented with Bayluscide (70% wettable Powder or 20% emulsifiable concentrate) to scheduled tributaries and 3.2% Granular Bayluscide to scheduled 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 2004 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 progress on the charges during 2004 is presented on pages 70.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes, 2004

Lake	Number of Streams	Discharge (m^3/s)	TFM[1] (kg)	Bayluscide[1] (kg)	Distance (km)
Superior	20	74.7	4,823.8	22.8	266.9
Michigan	28	80.7	9,953.0	45.1	888.1
Huron	19	93.1	7,715.2	547.7	280.0
Erie	2	21.1	4,074.0	27.5	152.2
Ontario	12	76.4	7,564.8	38.4	235.4
Total	**81**	**346**	**34,130.8**	**681.5**	**1822.6**

[1]Lampricide quantities are in kg of active ingredients

Lake Superior

Lake Superior has 1,566 tributaries (733 U.S., 833 Canada). One hundred thirty-nine tributaries (92 U.S., 47 Canada) have historical records of larval sea lamprey production, and of these, 68 tributaries (39 U.S., 29 Canada) have been treated with lampricides at least once during 1995-2004. Forty-nine tributaries (32 U.S., 17 Canada) are treated on a regular 3-5 year cycle.

The following statements highlight the lampricide control program for Lake Superior during 2004. Table 2 provides details on the application of lampricides to tributaries treated during 2004 and Fig. 1 shows the locations of the tributaries.

- Treatments with TFM were completed in 20 tributaries (11 U.S., 9 Canada). The lake sturgeon protocol was not applied to any stream treatment.

- Treatments of the East Sleeping and Ravine rivers, and Red Cliff Creek were completed in mid-summer with low stream discharges.

- Treatment of the Two Hearted River was interrupted by a heavy rainstorm. The South and West branches were completed under high discharge conditions; the mainstream was treated one day later after water levels had receded.

- Treatment of Dawson Creek (Two Hearted River) was delayed until October to accommodate requirements of a study on transformation rates. The delay was coordinated with study personnel to allow collection of larvae from the study area during the treatment.

- Treatments of all Canadian tributaries were considered successful with the exception of the Gargantua River. Heavy rains may have reduced treatment effectiveness in the lower river.

- The Pancake River was treated later in the season to accommodate a sea lamprey transformation study as part of a MS thesis project.

- Mortality of nontarget organisms was insignificant.

- Treatments of the Pic and White rivers were deferred until 2005 due to high discharge.

Table 2. Details on the application of lampricides to tributaries of Lake Superior, 2004 (Number in parentheses corresponds to location of stream in Fig. 1).

Stream	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1]	Distance Treated (km)
United States					
Amnicon R. (19)	Jun 17	1.7	152.3	0	12.9
Nemadji R. (20)					
Net R.	Jun 18	0.7	47.5	0	9.7
Black R.	Jun 21	0.9	53.3	0	10.5
Red Cliff Cr. (18)	Jun 22	0.1	32.2	0	5.0
Miners R. (13)	Jun 29	1.1	165.2	0	1.6
Pine R. (14)	Jul 6	1.7	130.8	0	6.4
East Sleeping R. (17)	Jul 20	0.3	108.5	0	22.5
Sullivans Cr. (12)	Jul 29	0.1	8.6	0	1.9
Two Hearted R. (11)	Aug 1	5.4	636.6	0	93.4
Silver R. (16)	Aug 26	0.7	74.3	0	8.1
Ravine R. (15)	Aug 28	0.1	12.2	0	7.1
L. Two Hearted R. (10)	Sep 10	0.6	61.8	0	22.5
Total		13.4	1,483.4	0	201.6
Canada					
Cranberry Cr. (8)	Jun 1	1.1	33.2	0	4.7
W. Davignon Cr. (9)	Jun 3	0.6	30.7	0	5.5
Gargantua R. (5)	Aug 18	0.3	19.5	0	1.6
Michipicoten R. (4)	Aug 21	42.0	1,784.0	19.2	17.4
Gravel R. (2)	Aug 25	4.0	276.2	3.6	13.3
Pearl R. (1)	Aug 26	0.4	93.3	0	3.6
Steel R. (3)	Aug 28	8.8	875.2	0	6.7
Pancake R. (6)	Sep 1	1.5	66.3	0	8.4
Chippewa R. (7)	Sep 30	2.6	162.0	0	4.1
Total		61.3	3,340.4	22.8	65.3
Grand Total		**74.7**	**4,823.8**	**22.8**	**266.9**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 17 TFM bars (3.5 kg active ingredient) applied in five streams.

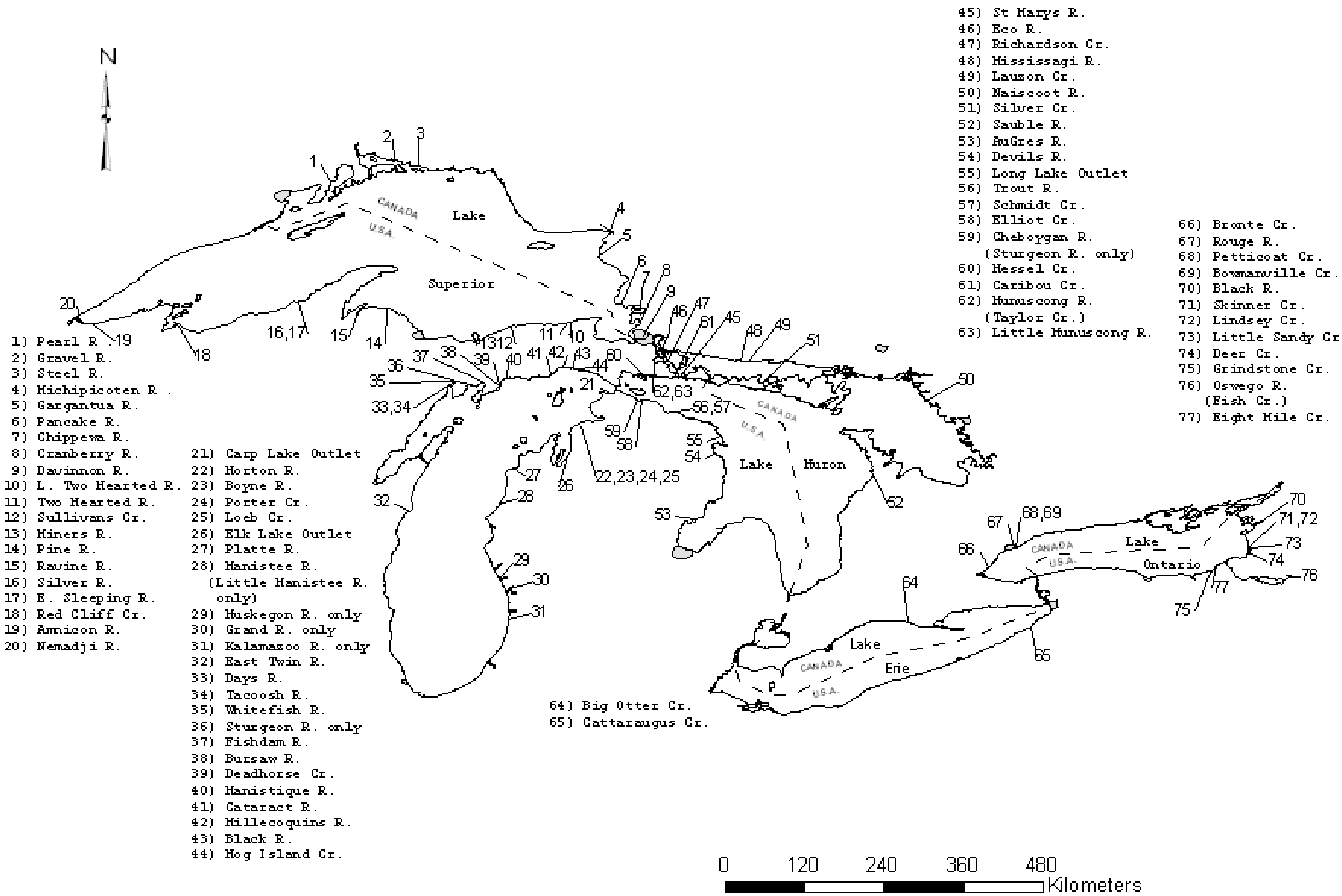

Fig. 1. Location of tributaries treated with lampricides during 2004.

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-one tributaries have historical records of larval sea lamprey production, and of these, 63 tributaries have been treated with lampricides at least once during 1995 - 2004. Thirty-two tributaries are treated on a regular 3 - 5 year cycle.

The following statements highlight the lampricide control program for Lake Michigan during 2004. Table 3 provides details on the application of lampricides to tributaries treated during 2004 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed successfully in all 23 scheduled tributaries. Loeb Creek, a tributary of Lake Charlevoix, was added to the schedule in mid-season.

- The "Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons (*Acipenser fulvescens*)" was followed during treatment of the lower Platte (4.2 km), Manistique (123.9 km), Millecoquins (15.5 km), and Whitefish (8.6 km) rivers. The protocol was applied to 17.1% (152.2 of 888.1 km) of the total length of all treated streams in the basin. The protocol limits the concentrations of TFM and Bayluscide to 1.2 times minimum lethal concentration (the concentration required to kill 99.9% of sea lampreys in a 12-hour treatment) to protect young-of-year lake sturgeons.

- The Whitefish River was treated in two phases. Bills, Casey, Haymeadow, and Pole creeks were treated early in the year when stream discharges were adequate. The mainstream was treated at low discharge, which made it difficult to maintain minimum lethal concentration in some upstream sections.

- The Manistique River was treated for the second consecutive year. The 2003 treatment was successful in killing large numbers of larval sea lampreys, but enough survived to warrant another treatment.

- A mandatory adverse effects 6(a)(2) report was submitted to the U.S. Environmental Protection Agency after significant numbers of mottled sculpins were killed during the Little Manistee River treatment. Numbers of nontarget fish killed in other treatments were minimal.

- Mortality of nontarget organisms was insignificant for the remainder of the treatments.

- Bayluscide 20% Emulsifiable Concentrate was applied successfully during the treatments of the Black, Whitefish, Millecoquins, and lower Platte rivers. This new formulation is a valuable tool for the treatment of medium sized streams.

- Stream discharges were problematic during many treatments. Discharge was high during treatments of the Whitefish River tributaries and the Little Manistee, Tacoosh, and Manistique rivers. Low discharge hindered treatments of the Whitefish River mainstream and Millecoquins River.

- The Little Manistee River was treated to eliminate residual larval sea lampreys upstream of the Michigan Department of Natural Resource's weir, a seasonal sea lamprey barrier.

- Carp Lake Outlet was treated for the first time in 10 years under an agreement with endangered species personnel from the Service's East Lansing Ecological Services Field Office to protect the federally endangered Hungerford's crawling water beetle.

Table 3. Details on the application of lampricides to tributaries of Lake Michigan during 2004 (Number in parentheses corresponds to location of stream in Fig. 1).

Stream	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1]	Distance treated (km)
Black R. (43)	May 7	2.4	138	0.6	22.5
Boyne R. (23)	May 11	n/a	0	13.8[3]	n/a
Hog Island Cr. (44)	May 11	0.2	55	0.0	6.4
Tacoosh R. (34)	Jun 03	4.0	274	0.0	14.5
Whitefish R. tributaries (35)	Jun 05	4.1	301	0.0	37.0
East Twin R. (32)	Jun 08	3.3	517	0.0	8.1
Muskegon R.					
Bridgeton Cr. (29)	Jul 07	0.3	74	0.0	6.6
Sturgeon R.					
Eighteen Mile Cr. (36)	Jul 17	0.6	119	0.0	12.1
Big Manistee R.					
Little Manistee R. (28)	Jul 19	7.9	1,271	5.9	53.9
Deadhorse Cr. (39)	Jul 19	0.1	10	0.0	2.7
Bursaw Cr. (38)	Jul 30	0.2	31	0.0	6.4
Cataract R. (41)	Aug 01	0.2	26	0.0	3.7
Kalamazoo R.					
Sand Cr. (31)	Aug 13	0.1	12	0.0	3.2
Whitefish R. (35)	Aug 14	4.0	1,089	0.0	96.6
Grand R.					
Bass Cr. (30)	Aug 14	0.4	68	0.0	8.1
Kalamazoo R.					
Bear Cr. (31)	Aug 16	0.2	43	0.0	4.8
Muskegon R.					
Minnie Cr. (29)	Aug 27	0.1	21	0.0	5.1
Days R. (33)	Aug 28	0.4	78	0.0	6.4
Grand R.					
Crockery Cr. (30)	Aug 29	2.0	651	0.0	57.3
Fishdam R. (37)	Aug 30	1.0	194	0.0	27.4
Elk Lake Outlet (26)	Sep 10	1.4	382	0.0	0.5
Platte R. (lower) (27)	Sep 11	5.0	619	7.6	4.2
Millecoquins R. (42)	Sep 12	4.0	661	3.3	48.3
Manistique R. (40)	Oct 07	36.8	2,969	13.9	434.7
Loeb Cr. (25)	Oct 22	0.3	55	0.0	3.2
Porter Cr. (24)	Oct 23	0.6	82	0.0	1.6
Horton Cr. (22)	Oct 25	0.6	121	0.0	6.4
Carp Lake Outlet (21)	Oct 25	0.5	92	0.0	6.4
Total		80.7	9,953	45.1	888.1

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 136 TFM Bars (28.3 kg active ingredient) applied in five streams.
[3]Applied as Bayluscide 3.2% Granular Sea Lamprey Larvicide to 2.5 ha.

Lake Huron

Lake Huron has 1,761 tributaries (427 U.S., 1,334 Canada). One hundred twenty tributaries (65 U.S., 55 Canada) have historical records of larval sea lamprey production, and of these, 68 tributaries (31 U.S., 37 Canada) have been treated with lampricide at least once during 1995 - 2004. Forty-seven tributaries (22 U.S., 25 Canada) are treated on a regular 3 - 5 year cycle.

The following statements highlight the lampricide control program for Lake Huron during 2004. Table 4 provides details on the application of lampricides to tributaries treated during 2004 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in 18 tributaries (11 U.S., 7 Canada) and the St. Marys River.

- Long Lake Outlet in Alpena County, Michigan was treated for the second time in two years. An infested section of the stream was not treated during 2003 because of landowner issues. This resulted in re-treatment during 2004.

- The "Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons (*Acipenser fulvescens*)" was followed during treatment of the Mississagi (45.5 km) and Sturgeon (24.1 km below Wolverine, Michigan) rivers. The protocol was applied to 24.9% (69.6 of 280.0 km) of the total length of all treated streams in the basin. The protocol limits the concentrations of TFM and Bayluscide to 1.2 times minimum lethal concentration (the concentration required to kill 99.9% of sea lampreys in a 12-hour treatment) to protect young-of-year lake sturgeons.

- A total of 88 ha (42 U.S., 46 Canada) of the St. Marys River were treated with Bayluscide 3.2% Granular Sea Lamprey Larvicide. To maximize efficiency the areas were treated in a "border blind" fashion with the Department and Service sharing application responsibilities on both sides of the border.

- The treatment of Bar Creek (tributary to the Echo River) was initiated on July 28, however the treatment was terminated because of low flows that compromised treatment effectiveness. The tributary was treated in its entirety October 19.

- Treatments of all tributaries were considered successful with the exception of the Mississagi River. High on-shore winds prevented the lampricide from reaching minimum lethal concentrations in the western mouths of the river (~7% of the stream distance treated).

- Mortality of nontarget organisms was insignificant.

Table 4. Details on the application of lampricides to tributaries of Lake Huron during 2004 (Number in parentheses corresponds to location of stream in Fig. 1).

Stream	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
United States					
Elliot Cr. (58)	May 7	0.2	58.2	0	3.2
Munuscong R. (62)	May 8	0.8	136.5	0	8.5
Taylor Cr.					
Trout R. (56)	May 10	0.8	211.2	0	6.4
L. Munuscong R. (63)	May 11	2.5	103.9	0	19.3
AuGres R. (53)	Jun 4	5.3	1,129.5	0	95.0
Hessel Cr. (60)	Jun 18	0.1	14.4	0	0.8
Caribou Cr. (61)	Jun 19	0.1	5.0	0	1.0
Long Lake Outlet (55)	Jun 20	1.2	229.9	0	3.2
Devils R. (54)	Jun 23	1.2	228.5	0	8.7
Schmidt Cr. (57)	Jun 29	0.2	68.3	0	4.0
St. Marys R. (45)	Jul 14			233.9	
Sturgeon R. (59)	Aug 1	8.5	1,012.7	10.6	46.9
Total		20.9	3,198.1	244.5	197.0
Canada					
Richardson Cr. (47)	May 27	0.5	35.3	0	2.6
Naiscoot R. (50)	Jun 20	1.4	88.3	0	18.3
Sauble R. (52)	Jun 23	8.0	1,198.8	14.7	3.2
St. Marys R. (45)	Jul 6			257.6	
Lauzon Cr. (49)	Jul 20	1.0	26.4	0	0.3
Silver Cr. (51)	Jul 20	0.4	62.0	0	3.0
Mississagi R. (48)	Aug 6	60.6	3,061.1	30.9	45.5
Echo R. (46)	Oct 19	0.3	45.2	0	10.1
Bar - Iron Cr.					
Total		72.2	4,517.1	303.2	83.0
Grand Total		**93.1**	**7,715.2**	**547.7**	**280.0**

[1]Lampricides are reported in kg of active ingredient.
[2]Includes a total of 40.5 TFM bars (8.4 kg active ingredient) applied in six streams.
[3]Includes 491.5 kg Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to the St. Marys River.

Lake Erie

Lake Erie has 842 tributaries (317 U.S., 525 Canada). Twenty-one tributaries (10 U.S., 11 Canada) have historical records of larval sea lamprey production, and of these, eight tributaries (5 U.S., 3 Canada) have been treated with lampricide at least once during 1995 - 2004. Four tributaries (2 U.S., 2 Canada) are treated on a regular 3 - 5 year cycle.

The following statements highlight the lampricide control program for Lake Erie during 2004. Table 5 provides details on the application of lampricides to tributaries treated during 2004 and Fig. 1 shows the locations of the tributaries.

- Treatments with TFM were completed in two tributaries (1 U.S., 1 Canada). The lake sturgeon protocol was not applied to either stream treatment.

- Completion of treatment of Cattaraugus Creek, scheduled for May, was delayed by rain after the treatment of one tributary, Clear Creek. Treatment of Cattaraugus Creek was successfully completed during September. The New York State Department of Environmental Conservation Bureau of Pesticides Management conducted two pesticide application inspections during the treatment.

- Heavy rains may have compromised treatment effectiveness of the lower portion (approximately 23% of the treated distance) of Big Otter Creek. However, the significance of the larval sea lamprey population in this portion of the river is uncertain; historically very few larvae have been observed during treatments.

- Mortality of nontarget organisms was insignificant.

Table 5. Details on the application of lampricides to tributaries of Lake Erie during 2004 (Number in parentheses corresponds to location of stream in Fig. 1).

Stream	Date	Discharge (m^3/s)	TFM (kg)[1]	Bayluscide (kg)[1]	Distance Treated (km)
United States					
Cattaraugus Cr. (65)	Sep 25	15.5	2,664.2	27.0	79.7
Canada					
Big Otter Cr. (64)	Jun 15	5.6	1,409.8	0.5	72.5
Grand Total		**21.1**	**4,074.0**	**27.5**	**152.2**

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

Lake Ontario

Lake Ontario has 659 tributaries (254 U.S., 405 Canada). Sixty-two tributaries (31 U.S., 31 Canada) have historical records of larval sea lamprey production, and of these, forty-three tributaries (22 U.S., 21 Canada) have been treated with lampricide at least once during 1995 - 2004. Twenty-nine tributaries (15 U.S., 14 Canada) are treated on a regular 3 - 5 year cycle.

The following statements highlight the lampricide control program for Lake Ontario during 2004. Table 6 provides details on the application of lampricides to tributaries treated during 2004 and Fig. 1 shows the locations of the tributaries.

- Treatments with TFM were completed in 12 tributaries (8 U.S., 4 Canada). The lake sturgeon protocol was not applied to any stream treatment.

- Petticoat Creek was treated for the first time, however, low flows compromised treatment effectiveness. Treatment collections confirmed the presence of a single age class of larval sea lampreys.

- Little Sandy and Bowmanville creeks were treated later in the season to accommodate a sea lamprey transformation study as part of a MS thesis project.

- Low pH levels in the upper reaches of the Rouge River resulted in mortality of approximately 500 stonecats. The mortality was limited to the uppermost 2 km of treated stream.

- Mortality of other nontarget organisms was insignificant for the remainder of the treatments.

Table 6. Details on the application of lampricides to tributaries of Lake Ontario during 2004 (Number in parentheses corresponds to location of stream in Fig. 1).

Stream	Date	Discharge (m^3/s)	TFM (kg)[1]	Bayluscide (kg)[1]	Distance Treated (km)
United States					
Skinner Cr. (71)	Apr 16	1.8	201.0	0	12.4
Deer Cr. (74)	Apr 18	1.5	102.4	0	11.2
Lindsey Cr. (72)	Apr 20	1.5	139.9	0	21.9
Grindstone Cr. (75)	Apr 23	2.4	259.9	0	35.5
Eight Mile Cr. (77)	Apr 27	0.7	77.9	0	7.6
Oswego R.	Jun 10	15.4	1,309.8	0	47.7
Fish Cr. (76)					
Black R. (70)	Jul 16	45.4	3,463.0	38.4	9.3
Little Sandy Cr. (73)	Sep 21	0.5	71.0	0	10.3
Total		69.2	5,624.9	38.4	155.9
Canada					
Bronte Cr. (66)	May 16	4.2	1,198.5	0	36.5
Rouge R. (67)	May 19	1.5	328.4	0	23.5
Petticoat Cr. (68)	Sep 17	0.2	12.6	0	3.2
Bowmanville Cr. (69)	Sep 18	1.3	400.4	0	16.3
Total		7.2	1,939.9	0	79.5
Grand Total		**76.4**	**7,564.8**	**38.4**	**235.4**

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

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 behaviors). 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 the Task Force is presented on pages 79.

Highlights of the sterile male release program during 2004 are presented in Table 7 and include the following:

- A total of 28,437 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Betsie River (259), Brule River (1,521), Carp Lake Outlet (1,568), Cheboygan River (4,043), Echo River (1,409), Humber River/Duffins Creek (600), Koshkawong River (111), Manistique River (11,771), Ocqueoc River (453), Pere Marquette River (100), Peshtigo River (650), St. Marys River (3,809), and Thessalon River (2,143).

- A total of 26,472 sterilized male sea lampreys were released in the St Marys River during May 20 - July 20 (Table 7). The estimated resident population of spawning-phase sea lampreys in the St Marys River was 19,864 (13,858 males). Assessment traps removed 5,656 sea lampreys (3,946 males), an estimated reduction of 27% from trapping. The ratio of sterile to resident male sea lampreys remaining in the St Marys River was estimated at 2.6:1 (26,472 sterile: 10,055 estimated resident).

- The theoretical reduction from trapping and sterile male release was estimated at 80% during 2004. The theoretical reduction from trapping and sterile male release averaged 87% during 1997 - 2003. 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 6,006 to 1,203 during 2004.

- In the St. Marys River rapids, five sterile and seven untreated males were observed on 13 nests. Egg viability averaged 16% in the 13 nests excavated. Average egg viability (weighted by nests per year) during 1997-2003 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 1991-2004.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
Percent males	53	58	56	57	55	63	56	57	60	64	63	63	66	70
Percentage of sea lampreys removed by traps	42	39	22	53	44	20	30	35	53	48	45	59	33	27
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
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
Theoretical percent reduction in reproduction[1]	65	63	38	76	67	39	89	80	92	88	88	94	80	80
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

[1]Combination of trapping and sterile male release.

[2] $\left[f = \frac{1-t}{s{:}n+1} \right]$ where *t* is the proportion of animals trapped and *s:n* is the ratio of sterile to normal males.

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 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 2004, 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 76.

Lake Superior

Presently, there are 17 sea lamprey barriers on Lake Superior tributaries (Fig. 2).

New Construction

- New barrier projects are in development for the Sucker River and Harlow Creek.

Operation and Maintenance of Existing Barriers

- Big Carp River - Inflatable barrier was operational from April 30 through August 10 (crest height was lost on June 10 during a power failure and 10 sea lampreys were caught in the fishway the preceding day).

- Little Carp River - Stop-log barrier was operational from April 30 through August 6.

- Furnace Creek - Stop-log barrier was operational from March 3 through September 3.

- Service and Department personnel performed maintenance and safety inspections on 12 barriers (7 U.S., 5 Canada). The Department also contracted with the Lakehead Conservation Authority to supplement maintenance and inspections at the McIntyre and Wolf River barriers. Results of the inspections led to the following actions:

    Miners River - A breach in the dam on the Miners River was located and is scheduled for repair in 2005.

- A portage was installed in the Wolf River to meet requirements of the Navigable Waters Protection Act.

- Water level data recorders were installed at most of the existing sea lamprey barriers as a new initiative to monitor barrier performance.

Ensured Blockage at Other Barriers

- Vaughn Creek - A perched culvert was proposed for removal by the Ashland Fishery Resource Office to enhance fish passage in the Bad River system. Service staff determined that the proposed project would not negatively affect sea lamprey control.

- Ontonagon River - The U.S. Forest Service suggested removing stop logs on the East Branch at M-28. Service staff determined that the stop logs currently block sea lamprey spawning migration and removal would negatively affect sea lamprey control.

- Black Sturgeon River - Preliminary discussions with the Ontario Ministry of Natural Resources (OMNR) Northwestern Region engineering staff led to an OMNR commitment to work with Department staff during 2005 to review the barrier on the Black Sturgeon River, review dam safety results, deficiencies and required repairs, and develop a long-term strategy for the de facto barrier. Dam removal and construction of a fishway in the draft Black Bay Walleye Restoration Plan.

- To improve barrier communications, Department personnel presented the value of de facto barriers in controlling sea lampreys in the Great Lakes to OMNR Northwestern Region managers and requested that the Department be consulted in barrier mitigation projects.

Lake Michigan

Presently, there are 12 sea lamprey barriers on Lake Michigan tributaries (Fig. 2).

New Construction

- New barrier projects are in various stages of development for the Cedar, Paw Paw, Galien, and Manistique rivers, Trail and Kids creeks, and Carp Lake Outlet. A permanent trap project is in the early stages of planning for the Manistee River.

Operation and Maintenance of Existing Barriers

- Jordan River - Electrical barrier was operational from March 9 through July 22. The weir was activated with five of six pulsators working. The integrity of the electrical field was not compromised.

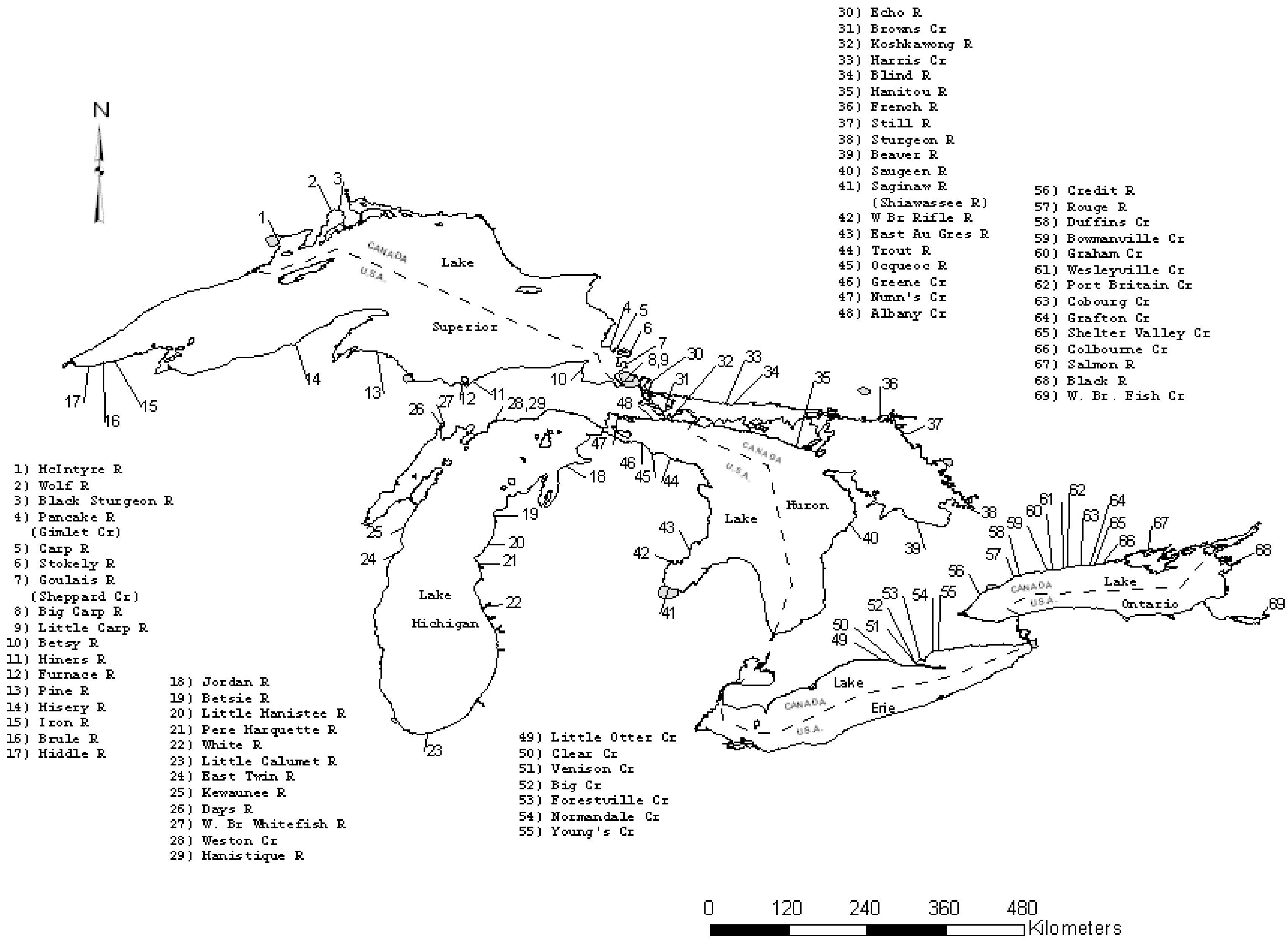

Fig. 2. Locations of tributaries with sea lamprey barriers.

- Pere Marquette River - Electrical barrier on the Pere Marquette River was operational from March 6 through July 21. On May 13, the water level in the fishway was four inches above the highest jump in the fishway. Three lampreys were captured on video attempting to migrate upstream of the barrier through the fishway during this period of high water and one was successful. The fishway was shut down to avoid further escapement of lampreys past the barrier until June 22 when water levels receded enough to resume operation of the ladder. In addition, there was a power outage on May 30 caused by heavy rain and winds. The pulsators were inoperative several times during a five-hour period. Lampreys may have migrated upstream pass the barrier during these power outages.

- Service personnel performed maintenance and safety inspections and on eight barriers. Results of the inspections led to the following actions:

  Pere Marquette River – Repairs were made to fishway pumps and a preventive maintenance program was implemented to monitor vibration and electrical current draw of the pumps. The entire site was re-wired to counter further electrical problems and a new back-up generator was installed.

  Jordan River - The electrode platform on the barrier is warped and the banks need stabilization. Proposals for significant repairs will be pursued.

  Kewaunee River - New screens were constructed and installed to repair several gaps that were found.

- Water level data recorders were installed at most of the existing sea lamprey barriers as a new initiative to monitor barrier performance.

Ensured Blockage at Other Barriers

- Tannery Creek - Removal of a perched culvert was proposed by Tip of the Mitt Watershed Council and the Service's Alpena Fishery Resource Office to enhance fish passage. Service personnel determined that the proposed project had the potential to negatively affect sea lamprey control. The culvert was removed and a seasonal stop-log barrier was placed on a culvert located near the mouth.

- Pike River - The Service proposed a dam removal project in the Pike River near Kenosha, WI. The dam was not blocking sea lamprey and removal would not negatively affect sea lamprey control.

- Underwood Creek - The U.S. Army Corps of Engineers requested that the Service comment on the removal of a concrete lined channel and associated drop structures to enhance fish passage in the Milwaukee River. Service personnel determined that the proposed project would not adversely affect sea lamprey control. Removal of these structures will open approximately 5 miles of stream.

- Paw Paw River - Berrien County requested that the Service comment on a dam removal project in Watervliet, Michigan. Service staff determined that the proposed project would not interfere with construction of the proposed sea lamprey barrier further downstream.

- Cedar River - New stop-logs were constructed and installed at Veterans Park dam.

Lake Huron

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

New Construction

- New construction projects are in various stages of development for the Black Mallard and Au Gres rivers, and Schmidt Creek.

Operation and Maintenance of Existing Barriers

- Albany Creek - Lift gate barrier was operational from March 16 through September 2.

- Greene Creek - Stoplog barrier was operational from March 15 through September 2.

- Ocqueoc River – Electrical components of the barrier became operational on March 5.

- Service and Department personnel performed safety inspections and maintenance on 10 barriers (5 U.S., 5 Canada). Results of the inspections led to the following actions:

  Ocqueoc River - The automatic activation system was not operational due to a failed heating system. Repair work to the access roads is scheduled for 2005.

  Nunns Creek – Repairs were made to stop-log portions of the barrier.

- Portages were installed in the Still and Sturgeon rivers to meet the requirements of the Navigable Waters Protection Act.

- Water level data recorders were installed at most of the existing sea lamprey barriers as a new initiative to monitor barrier performance.

Ensured Blockage at Other Barriers

- Beaver River - The Ontario Ministry of Natural Resources restored the Thornbury Dam on the Beaver River. The Department identified the Thornbury Dam as a barrier to sea lamprey migration. A fishway was installed as part of the project during 2003 and an adjustable sea lamprey barrier was included at the base of the fishway. An attractant water sea lamprey trap was installed during 2004.

- Bass Creek - The Department was advised of a fishway being installed at the Bass Creek dam on Manitoulin Island as part of the re-build of a deteriorated dam. The Department determined that there were no significant sea lamprey control concerns on this stream.

- Cass River - Service personnel coordinated with Public Sector Consultants to incorporate a sea lamprey trap into the dam removal project proposed at the Frankenmuth dam.

- Cheboygan River - Operational components of the lock in the river were discussed with Michigan Department of Natural Resources personnel to decrease the potential for sea lamprey escapement upstream.

Lake Erie

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

New Construction

- A new barrier is in development for Conneaut Creek.

Operation and Maintenance of Existing Barriers

- Big Creek - Inflatable barrier was operational for only 10 days (March 28 through April 7) due to a large air leak and high water that impeded repair. The fishway remained operational for the balance of the season in an attempt to trap sea lampreys for assessment.

- Department personnel performed safety inspections and maintenance on all barriers. The Long Point Region Conservation Authority was contracted to provide cost-effective assistance with safety inspections. Results of the inspections led to the following actions:

  Big Creek - Crest gate modules were removed following rupture of one of the bladders early in the season (possible causes were identified and repairs are planned for 2005). The barrier was stabilized with rip rap stone.

  Clear Creek (Canada) - Additional steel sheet pile was installed to repair seepage around the barrier.

- Water level data recorders were installed at most of the existing sea lamprey barriers as a new initiative to monitor barrier performance.

Ensured Blockage at Other Barriers

- Rouge River - The Service reviewed a grant proposal submitted by Environmental Consulting & Technology to the Great Lakes Fishery Trust for a feasibility study of a fish passage project at the Henry Ford Estate Dam. The Service determined that the proposed project had the potential to result in sea lamprey infestation. The grant was not funded for reasons unrelated to sea lamprey control.

- Sandusky River - The Ashland Fishery Resource Office requested comment on the removal of the Ballville Dam in Ohio to enhance fish passage. Service staff determined that the proposed project posed little risk to sea lamprey control.

- Grand River - The Grand River Conservation Authority (GRCA) is in the process of mitigating effects of the Taquanyah dam in Ontario by removing the stop-logs in the ~5-m high dam, removing the head pond, and restoring a unique cold-water stream. The Department advised the GRCA on the status of the dam as a de facto barrier, and it was agreed that a minimum number of stop-logs would remain in place to assure the barrier's effectiveness. The Department provided water level monitoring equipment to help determine final barrier elevation with a hydraulics study during reservoir drawdown.

- Thames River - The Thames Conservation Authority, the City of London, and the Ontario Ministry of Natural Resources plan to modify the Springbank dam and possibly install a fishway for non-jumping fish by replacing the stop-logs with mechanically actuated crest gates to be lowered in the fall and raised after spring walleye migration. The Department determined the project posed a low risk to sea lamprey control.

- To improve barrier communications, Department personnel presented the value of de facto barriers in controlling sea lampreys in the Great Lakes to Ontario Ministry of Natural Resources Southern Region managers and requested that the Department be consulted in barrier mitigation projects.

Lake Ontario

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

New Construction

- A feasibility study is in progress for Bronte Creek and an environmental assessment was drafted and circulated for comment. Construction of a barrier and fishway is scheduled for 2005.

Operation and Maintenance of Existing Barriers

- Cobourg Brook - Fishway was operational from March 24 through July 5.

- Wesleyville Creek – Stop-log barrier was operational from March 25 through July 9.

- Department personnel performed maintenance and safety inspections on 10 barriers (Toronto and Ganaraska Conservation Authorities were contracted to augment the safety inspections).

- Planning/permitting for a Navigable Waters Protection Act approval for the Duffins Creek barrier continued (final approval and installation of a portage are expected during 2005).

- Water level data recorders were installed at most of the existing sea lamprey barriers as a new initiative to monitor barrier performance.

Ensured Blockage at Other Barriers

- Credit River - Reid's Mill Dam in Mississauga was restored under a cooperative agreement between Kraft Canada, the dam owner, the Department (who provided funding), and the Ontario Ministry of Natural Resources (who operate and maintain the existing dam and fishway). The downstream side of the barrier was re-configured to provide a consistent drop across the length of the spillway and deteriorated abutments were repaired. This will complement recent improvements to the fishway and is expected to eliminate approximately 45 km of potential sea lamprey infestation upstream of the dam.

- Bowmanville Creek - Department personnel continued to consult with the Central Lake Ontario Conservation Authority and others regarding the installation of a "nature-like" fishway at the Goodyear dam. The proposed type of fishway would not block sea lampreys and would negatively affect sea lamprey control.

- Oshawa Creek - The Department continued to consult with the Central Lake Ontario Conservation Authority regarding a proposed fish passage project at the Camp Samac Dam.

- Coyle Creek - The Niagara River Restoration Council notified the Department of their plans to remove a small barrier. Department personnel determined that the removal would not adversely affect sea lamprey control.

- Humber River - The Ontario Ministry of Natural Resources and Ontario Streams initiated an environmental assessment for the installation of a rocky ramp bypass fishway at the Old Mill dam (and six subsequent barriers) with funds granted from Environment Canada under the Great Lakes Sustainability Fund. The dam is owned by the Toronto Region Conservation Authority. Department personnel responded to the Ministry of Natural Resources as part of the public consultation phase of the environmental assessment, and advised that maintaining a sea lamprey barrier and trap facility is a very high priority for the Sea Lamprey Control Program. Trapping at the site provides essential adult sea lamprey assessment data and spawning-phase males for the sterile-male-release technique. In addition, the barrier has prevented the establishment of larval sea lamprey populations in this large and complex watershed which would otherwise require treatment.

- Department personnel presented the value of de facto barriers in controlling sea lampreys in the Great Lakes to Ontario Ministry of Natural Resources Southern Region managers and requested that the Department be consulted in barrier mitigation projects.

ASSESSMENT

Larval

Tributaries to the Great Lakes are systematically assessed for abundance and distribution of larval sea lampreys. Quantitative estimates of metamorphosing sea lampreys are used to prioritize streams for lampricide treatment. Qualitative sampling is used to define the distribution of sea lampreys within a stream and to establish the sites for lampricide application. Lentic areas are monitored for abundance and distribution of larvae in deepwater areas.

Tributaries considered for lampricide treatment during 2005 were assessed during 2004 to estimate larval sea lamprey density and amount of suitable larval habitat. Assessments were conducted with backpack electrofishers in waters <1m deep. Waters >1m in depth were surveyed with deepwater electrofishers or Bayluscide 3.2% Granular Sea 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. Larval populations in each tributary were estimated by multiplying the mean density of larvae (number per m^2) by an estimated area of suitable habitat (m^2). The proportion of metamorphosing larvae during 2005 was developed from historical relations of the proportion of metamorphosed to larval sea lampreys collected during previous lampricide applications. Tributaries were ranked for treatment during 2005 based on an estimated cost per kill of metamorphosed sea lampreys.

The Assessment Task Force was established during 1996. The task force was later divided into the Control Ranking and Evaluation Task Force and Connecting Channel and Lentic Area Task Force. Reports on progress of these Task Forces are presented on pages 72 and 75.

Lake Superior

- Qualitative assessments of larval sea lamprey populations were conducted in 99 tributaries (62 U.S., 37 Canada) and offshore of 19 tributaries (11 U.S., 8 Canada). The status of larval lampreys in historically infested tributaries and lentic areas are presented in Tables 8 and 9.

- Populations of larvae were estimated in 34 tributaries (23 U.S., 11 Canada; Table 8).

- Post-treatment assessments were conducted in three tributaries (2 U.S., 1 Canada) to determine the effectiveness of lampricide treatments during 2003 and 2004.

- Larval sea lampreys were collected from two tributaries for ongoing migratory pheromone research being conducted by Michigan State University and the University of Minnesota and *Ichthyomyzon* larvae were collected from three tributaries for species differentiation research conducted by the University of Windsor, Ontario Canada.

- Concurrent with lampricide application, collections of larval and recently metamorphosed sea lampreys were made in four tributaries in Canada using fixed sampling intervals, in an effort to verify estimates of each life stage at the time of treatment.

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 during 2004.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Waiska R.	Sep-01	Aug-04	No	-	-	No
Sec. 11 SW Trib.	Never	Sep-04	No	-	-	No
Pendills Cr.	Sep-88	Oct-03	Yes	-	-	No
Grants Cr.	Jul-63	Jun-04	Yes	-	-	No
Naomikong Cr.	Jul-63	Jun-04	No	-	-	No
Ankodosh Cr.	Jul-73	Jun-04	Yes	-	-	No
Roxbury Cr.	Never	Jun-04	Yes	-	-	No
Galloway Cr.	Jun-92	Aug-04	Yes	3,636	30	No
Tahquamenon R.	Sep-02	Oct-00	-	-	-	No
Betsy R.	Jul-00	Jun-04	Yes	1,511	278	No
Three Mile Cr.	Jun-62	Jun-04	No	-	-	No
Little Two Hearted R.	Sep-04	Jun-04	Yes	-	-	No
Two Hearted R.	Sep-04	Sep-04	Yes	-	-	No
Dead Sucker R.	Jul-75	Jun-03	Yes	-	-	No
Sucker R. (Alger)	Sep-02	Oct-04	Yes	16,018	448	No
Chipmunk Cr.	Sep-62	Jul-04	No	-	-	No
Carpenter Cr.	Sep-60	Jul-04	Yes	1,153	211	Yes
Sable Cr.	Sep-89	Jun-03	Yes	-	-	No
Hurricane R.	Never	Jul-04	No	-	-	No
Sullivans Cr.	Jul-04	Jul-04	No	-	-	No
Seven Mile Cr.	Jul-67	Jun-03	No	-	-	No
Beaver Lake Cr. – Lowney Cr.	Sep-87	Sep-04	Yes	5,865	25	No
Mosquito R.	Jun-73	Jul-04	No	-	-	No
Miners R. (barrier Downstream)	Jun-04	Jul-03	Yes	-	-	No
Miners R. (barrier to Miners Lake)	Sep-77	Sep-04	Yes	1,253	1	No
Munising Falls Cr.	Sep-64	Aug-01	No	-	-	No
Anna R.	Sep-65	Jun-01	No	-	-	No
Furnace Cr.	Sep-93	Sep-04	Yes	3,869	87	No
Five Mile Cr.	Oct-98	Jun-04	Yes	1,101	26	No
Au Train R.	Sep-01	Sep-01	Yes	-	-	No
Rock R.	Jul-02	Aug-01	No	-	-	No
Deer Lake Cr.	Aug-70	Aug-01	No	-	-	No
Laughing Whitefish R.	Jun-98	Sep-04	Yes	26,800	1,387	Yes
Chocolay R.	Sep-02	Jul-03	Yes	-	-	No
Carp R.	Sep-03	Aug-04	Yes	18,355	54	No
Dead R.	Sep-84	Sep-04	Yes	-	-	No
Harlow Cr.	Jul-02	Jul-04	Yes	-	-	No
Little Garlic R.	Aug-02	Aug-02	Yes	-	-	No
Garlic R. (entire)	Aug-00	Aug-03	Yes	-	-	No
Garlic R. (Wilson Cr.)	Jul-03	Aug-03	No	-	-	No
Iron R.	Jul-01	Jul-04	Yes	79,660	593	Yes
Salmon Trout R. (Marquette)	Jul-00	Jun-04	Yes	-	-	Yes
Pine R.	Jul-04	Oct-03	-	-	-	No
Huron R.	Jul-01	Jul-04	Yes	72,242	736	No
Ravine R.	Aug-04	Sep-03	Yes	-	-	Yes
Silver R.	Aug-04	Jul-02	Yes	-	-	Yes
Falls R.	Sep-97	Aug-01	No	-	-	No
Six Mile Cr.	May-63	Jul-04	No	-	-	No

Table 8. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Sturgeon R. (powerhouse to Otter R.)	Aug-01	Aug-04	Yes	373,679	1,732	Yes
Sturgeon R. (Otter R. to mouth)	Aug-01	Jul-04	No	-	-	No
Pilgrim R.	Aug-62	Sep-04	No	-	-	No
Trap Rock R.	Oct-02	Aug-04	Yes	17,375	820	Yes
Traverse R.	Oct-02	Aug-01	-	-	-	No
Little Gratiot R.	Aug-72	Aug-01	No	-	-	No
Eliza Cr.	Oct-77	Aug-04	Yes	7,338	0	No
Gratiot R.	Jun-84	Jul-04	Yes	23,421	112	No
Smiths Cr.	May-64	Jul-04	No	-	-	No
Boston-Lily Cr.	Aug-62	Jul-04	No	-	-	No
Salmon Trout R. (Houghton)	Aug-92	Aug-04	Yes	-	-	No
Elm R.	Jun-84	Sep-01	No	-	-	No
Misery R. (barrier downstream)	Sep-02	Jun-03	Yes	-	-	No
Misery R. (barrier upstream)	Sep-02	Sep-04	No	-	-	No
East Sleeping R.	Aug-04	Sep-03	-	-	-	No
Firesteel R.	Jun-02	Sep-04	Yes	-	-	Yes
Ontonagon R.	May-01	Sep-04	Yes	-	-	Yes
Potato R.	Jun-01	Aug-04	Yes	46,901	503	Yes
Cranberry R.	Jun-01	Aug-04	Yes	61,780	871	Yes
Little Iron R.	Sep-75	Aug-04	No	-	-	No
Union R.	May-64	Aug-04	No	-	-	No
Black R.	Aug-81	Aug-04	Yes	-	-	No
Montreal R.	Jul-75	Aug-03	No	-	-	No
Washington Cr.	Jun-80	Sep-04	No	-	-	No
Bad R.	Sep-01	Aug-04	Yes	1,250,850	10,821	Yes
Fish Cr.- Eileen Twp.	Sep-80	Aug-04	Yes	1,441	7	No
Red Cliff Cr.	Jun-04	Aug-04	No	-	-	No
Raspberry R.	Jun-63	Aug-04	No	-	-	No
Sand R.	Oct-91	Aug-04	Yes	-	-	No
Iron R. (barrier downstream)	Never	Aug-03	Yes	-	-	No
Iron R. (barrier upstream)	Never	Aug-04	No	-	-	No
Reefer Cr.	Oct-64	Aug-04	No	-	-	No
Fish Cr. – Orienta Twp.	Oct-64	Aug-04	No	-	-	No
Brule R.	Jun-01	Jun-04	Yes	-	-	Yes
Poplar R.	Aug-03	Aug-02	-	-	-	No
Middle R. (barrier downstream)	Jun-02	Sep-04	Yes	10,541	0	No
Amnicon R.	Jun-04	Sep-03	-	-	-	No
Nemadji R.						
Mainstream	Sep-00	Aug-04	Yes	-	-	No
Blackhoof R.	Sep-00	Aug-04	Yes	1,701	117	No
South Fork	Sep-00	Aug-04	Yes	-	-	No
Black R. & Net R.	Jun-04	Aug-03	-	-	-	No
St. Louis R.	Sep-87	Jul-03	Yes	-	-	No
Splitrock R.	Aug-76	Jul-03	No	-	-	No
Poplar R.	Jul-77	Jul-03	No	-	-	No
Arrowhead R.	Sep-83	Aug-03	Yes	-	-	No

Table 8. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Canada						
East Davignon Cr.	May-72	May-03	No	-	-	No
West Davignon Cr.	Jun-04	Jul-04	Yes	-	-	No
Little Carp R.	Sep-01	May-03	Yes	-	-	No
Big Carp R.	Sep-01	May-03	Yes	-	-	No
Cranberry Cr.	Jun-04	Jun-04	-	-	-	No
Goulais R.	Jul-02	Sep-04	Yes	634,465	14,863	Yes
Bostons Cr.	Never	May-01	No	-	-	No
Horseshoe Cr.	Never	Jun-00	No	-	-	No
Haviland Cr.	Never	May-03	Yes	-	-	No
Stokely Cr.	Sep-00	May-03	Yes	-	-	No
Tier Cr.	Never	Jun-00	No	-	-	No
Harmony R.	Jun-90	May-03	Yes	-	-	No
Sawmill Cr.	Jun-68	Jun-00	No	-	-	No
Jones Landing Cr.	Never	Jun-00	No	-	-	No
Tiny Cr.	Never	Jun-00	No	-	-	No
Chippewa R.	Oct-04	Sep-04	-	-	-	No
Unger Cr.	Never	Jun-00	No	-	-	No
Batchawana R.	Jul-03	Jul-04	Yes	-	-	No
Digby Cr.	Never	Jun-00	Yes	-	-	No
Carp R.	Sep-00	Jul-03	Yes	-	-	No
Pancake R.	Sep-04	Jun-03	-	-	-	No
Westman Cr.	Never	Sep-04	Yes	-	-	No
Agawa R.	Jul-01	Aug-04	Yes	-	-	No
Sand R.	Sep-71	Jun-03	No	-	-	No
Baldhead R.	Never	Jun-03	No	-	-	No
Gargantua R.	Aug-04	Aug-04	-	-	-	No
Michipicoten R.	Aug-04	Oct-04	Yes	-	-	No
Dog R.	Aug-63	Jul-02	No	-	-	No
White R.	Sep-88	Jul-04	Yes	25,083	93	Yes
Pic R.	Sep-97	Jul-03	Yes	116,431	11,301	Yes
Little Pic R.	Sep-94	Jul-04	Yes	19,821	14	No
Prairie R.	Jul-94	Jul-04	No	-	-	No
Steel R.	Aug-04	Jul-03	-	-	-	No
Pays Plat R.	Aug-02	Jul-04	Yes	7,055	229	No
Little Pays Plat Cr.	Never	Jul-04	Yes	32,415	174	No
Gravel R.	Aug-04	Aug-04	-	-	-	No
Little Gravel R.	Jul-03	Jul-04	Yes	-	-	No
Cypress R.	Jul-03	Jul-04	Yes	271	32	No
Jackpine R.	Never	Jul-02	No	-	-	No
Jackfish R.	Jul-00	Jul-04	Yes	43,554	1,934	Yes
Nipigon R.						
Upper Nipigon R.	Aug-03	Jul-03	-	-	-	No
Lower Nipigon R.	Jul-83	Jul-03	Yes	38,597	9,729	Yes
Cash Cr.	Aug-03	Jul-04	No	-	-	No
Polly Cr.	Jul-87	Jul-04	No	-	-	No
Stillwater Cr.	Jul-96	Jul-04	Yes	7,737	205	Yes
Otter Cove Cr.	Aug-71	Jul-02	No	-	-	No
Black Sturgeon R.	Aug-99	Aug-04	Yes	17,060	555	Yes
Big Squaw Cr.	Jun-72	Aug-99	No	-	-	No
Wolf R.	Jul-03	Jul-04	Yes	-	-	No
Pearl R.	Aug-04	Aug-04	-	-	-	No
Blende Cr.	Aug-64	Jul-03	No	-	-	No
MacKenzie R.	Sep-78	Aug-04	Yes	-	-	No
Current R.	Never	Jul-04	No	-	-	No
Neebing-McIntyre Floodway	Aug-97	Jul-04	Yes	-	-	No

Table 8. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Canada						
Kaministikwia R.	Aug-02	Jul-04	Yes	-	-	No
Cloud R.	Jul-94	Jul-03	No	-	-	No
Pine R.	Jul-73	Jul-99	No	-	-	No
Pigeon R.	Aug-99	Jul-04	No	-	-	No

[1]Applies only to streams surveyed since last lampricide treatment.

Table 9. Status of larval sea lampreys in historically infested lentic areas of Lake Superior during 2004.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Ankodosh Cr.	Tahquamenon Bay	Jun-73	Jun-73	-
Galloway Cr.	Tahquamenon Bay	Aug-04	Jul-88	-
Sucker R.	Grand Marais Harbor	Aug-04	Aug-90	-
Anna R.	Munising Bay	Sep-04	Aug-01	-
Furnace Cr.	Furnace Bay	Sep-04	Sep-04	-
	Furnace Lake (Hanson Cr. - offshore)	Aug-01	Sep-79	-
	Furnace Lake (Gongeau Cr.- offshore)	Aug-01	Sep-79	-
Harlow Cr.	Harlow Lake (Bismark Cr.- offshore)	Jul-04	Jul-04	-
Little Garlic R.	Little Garlic R. (Offshore)	Jun-89	Jul-86	-
Garlic R.	Garlic R. (Offshore)	Jul-85	Jul-85	-
Ravine R.	Huron Bay	Aug-04	Aug-04	-
Slate R.	Huron Bay	Jul-91	Aug-82	-
Silver R.	Huron Bay	Aug-04	Aug-04	-
Falls R.	Huron Bay	Aug-04	Jul-03	-
Trap Rock R.	Torch Lake	Aug-04	Aug-04	-
Eliza Cr.	Eagle Harbor	Jul-03	Sep-78	-
Black R.	Black River Harbor	Aug-04	Aug-04	-
Fish Cr. (Eileen Twp.)	Chequamegon Bay	Aug-04	Sep-80	-
Red Cliff Cr.	Buffalo Bay	Aug-03	Jun-97	-
Canada				
Goulais R.	Goulais Bay	Jul-92	Jul-88	-
Haviland Cr.	Haviland Bay	Aug-90	Aug-90	-
Stokely Cr.	Haviland Bay	Aug-90	Jul-88	-
Harmony R.	Batchawana Bay	Jul-01	Jul-01	-
Chippewa R.	Batchawana Bay	Aug-95	Aug-95	-
Batchawana R.	Batchawana Bay	Aug-04	Aug-04	Aug-01
Carp R.	Batchawana Bay	Aug-95	Aug-95	-
Steel R.	Santoy Bay	Jul-91	Never	-
Gravel R.	Mountain Bay	Jul-04	Jul-04	Sep-00
Little Gravel R.	Mountain Bay	Jul-04	Jul-04	Sep-00
Little Cypress R.	Nipigon Bay	Aug-78	Aug-78	-
Cypress R.	Cypress Bay	Jul-04	Jul-04	-
Jackpine R.	Nipigon Bay	Jul-02	Jul-89	-
Jackfish R.	Nipigon Bay	Jul-90	Jul-90	-
Nipigon R.	Lake Helen	Jul-02	Jul-02	Aug-03
Nipigon R.	Nipigon Bay	Jul-03	Jul-03	-
Nipigon R.	Polly Lake	Jul-90	Jul-90	-
Black Sturgeon R.	Black Bay	Jul-04	Jul-04	-
Wolf R.	Black Bay	Jul-04	Jul-04	-
MacKenzie R.	MacKenzie Bay	Jul-04	Jul-04	-
Current R.	Thunder Bay	Jul-04	Jul-04	-
Neebing-McIntyre Floodway	Thunder Bay	Jul-90	Jul-90	-
Pigeon R.	Pigeon Bay	Aug-76	Aug-76	-

Lake Michigan

- Assessments of larval sea lamprey populations were conducted in 79 tributaries and offshore of nine tributaries. The status of larval sea lampreys in historically infested Lake Michigan tributaries and lentic areas are presented in Table 10 and Table 11.

- Populations of larval sea lampreys were estimated in 24 tributaries (Table 10).

- Post-treatment assessments were conducted in eight tributaries to determine the effectiveness of lampricide treatments during 2003 and 2004.

- During 2003, samples of larval sea lamprey density were allocated to type 1 and acceptable (type 2) habitat based on estimates of the area of each type of habitat and the variance in larval density from previous sampling in a subset of Lake Michigan streams. To evaluate the success of this optimization strategy and determine if it should be applied to future quantitative sampling, equal samples of larval density from both type 1 and type 2 habitats were collected in three Lake Michigan streams during 2004. The information collected during 2004 will be used to make further recommendations regarding the implementation of this optimization procedure throughout the Great Lakes.

- Larval sea lampreys were collected from nine tributaries for ongoing migratory pheromone research being conducted by Michigan State University and the University of Minnesota, and from 16 tributaries for statolith microchemistry research conducted by the National Oceanic and Atmospheric Administration, Ann Arbor, Michigan. *Ichthyomyzon* larvae were collected from one tributary for species differentiation research conducted by the University of Windsor, Ontario Canada.

Table 10. Status of larval sea lampreys in Lake Michigan tributaries with a history of sea lamprey production and abundance estimates in tributaries surveyed during 2004.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Brevort R. (lower)	May-89	Oct-04	Yes	3,755	1,361	No
Brevort R. (upper)	Oct-87	Oct-04	Yes	6,621	0	No
Paquin Cr.	Oct-87	Aug-04	Yes	-	-	No
Davenport Cr.	Aug-83	Jun-03	Yes	-	-	No
Hog Island Cr.	May-04	Oct-03	-	-	-	No
Black R.	May-04	Oct-04	Yes	-	-	No
Mile Cr.	Sep-72	Sep-04	Yes	-	-	No
Millecoquins R.	Sep-04	May-04	-	-	-	No
Rock R.	Aug-00	Sep-03	Yes	-	-	No
Crow R.	Aug-00	Sep-03	Yes	-	-	No
Cataract R.	Sep-04	May-04	-	-	-	No
Point Patterson Cr.	Sep-83	Aug-03	No	-	-	No
Hudson Cr.	May-88	Sep-04	Yes	19,160	11	No
Swan Creek	Jul-92	Jun-04	No	-	-	No
Seiners Creek	May-84	Jun-04	No	-	-	No
Milakokia R.	Jun-04	Jun-03	-	-	-	No
Bulldog Cr.	Jun-97	Jul-03	No	-	-	No
Gulliver Lake Outlet	May-00	Jun-04	Yes	2,105	94	No
Marblehead Cr.	May-00	Jun-04	Yes	6,382	468	Yes
Manistique R.						
Above dam	Oct-04	Sep-04	-	-	-	No
Below dam	Oct-04	Jul-04	-	-	-	No
Estuary	Sep-03	Jul-99	-	-	-	No
Southtown Cr.	Jun-77	Jun-04	Yes	-	-	No
Johnson Cr.	Aug-81	Jun-04	Yes	379	0	No
Deadhorse Cr.	Jul-04	Jun-02	-	-	-	No
Gierke Cr.	Never	Jun-04	Yes	-	-	No
Bursaw Cr.	Jul-04	Jun-04	-	-	-	No
Parent Cr.	Jun-91	Jun-04	Yes	619	35	No
Poodle Pete Cr.	Aug-01	Jun-04	No	-	-	No
Valentine Cr.	Jun-97	Jul-03	No	-	-	No
Little Fishdam R.	May-01	Jul-04	No	12	12	No
Big Fishdam R.	Jun-04	Jun-04	-	-	-	No
Sturgeon R.	Jun-03	May-04	Yes	-	-	No
Ogontz R.	Jul-03	Oct-03	No	-	-	No
Squaw Cr.	Aug-00	Jun-04	Yes	-	-	No
Hock Cr.	May-81	May-03	No	-	-	No
Whitefish R.	Jul-04	Jul-04	Yes	-	-	No
Rapid R.	May-03	Sep-03	No	-	-	No
Tacoosh R.	Jun-04	Aug-04	No	-	-	No
Days R.	Sep-04	Jul-04	-	-	-	Yes
Portage Cr.	May-97	Jul-04	Yes	5,699	149	Yes
Ford R.	May-02	Oct-04	Yes	3,210,444	5,627	Yes
Sunnybrook Cr.	May-71	May-02	No	-	-	No
Bark R.	Oct-03	Sep-03	-	-	-	No
Cedar R.	Oct-01	Oct-04	Yes	-	-	Yes
Sugar Cr.	Aug-77	May-02	No	-	-	No
Arthur Bay Cr.	Apr-70	May-02	No	-	-	No
Rochereau Cr.	Apr-63	Jul-04	No	-	-	No
Johnson Cr.	Apr-63	Jul-04	No	-	-	No
Bailey Cr.	May-02	Aug-04	Yes	-	-	No
Beattie Cr.	Oct-01	Jul-04	Yes	-	-	No
Springer Cr.	May-99	Sep-02	No	-	-	No
Menominee R.	Aug-88	Sep-03	Yes	-	-	No
Little R.	Aug-77	Sep-04	No	-	-	No

Table 10. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Peshtigo R.	Jul-01	Sep-04	Yes	56,594	3	Yes
Oconto R.	Jul-01	Sep-04	Yes	175,047	2,568	Yes
Pensaukee R.	Nov-77	Jun-03	No	-	-	No
Suamico R.	Never	Sep-04	No	-	-	No
Ephraim Cr.	Apr-63	May-03	No	-	-	No
Hibbards Cr.	May-02	May-03	Yes	-	-	No
Whitefish Bay Cr.	May-87	May-00	No	-	-	No
Lilly Bay Cr.	Apr-63	May-03	No	-	-	No
Bear Cr.	May-75	May-03	No	-	-	No
Door Co. 23 Cr.	May-79	May-03	Yes	-	-	No
Ahnapee R.	Apr-64	Sep-04	No	-	-	No
Three Mile Cr.	May-75	Sep-04	Yes	285	2	No
Kewaunee R.	May-75	Sep-04	Yes	-	-	No
East Twin R.	May-04	Sep-04	No	-	-	No
Fischer Cr.	May-87	Sep-04	No	-	-	No
Pike R.	Never	Sep-04	No	-	-	No
Carp Lake R.	Oct-04	Sep-03	-	-	-	No
Big Stone Cr.	May-97	Jun-04	Yes	-	-	No
Big Sucker R.	May-89	Jun-03	Yes	-	-	No
Wycamp Lake Outlet	May-00	Jun-02	No	-	-	No
Horton Cr.	Oct-04	Sep-04	-	-	-	No
Boyne R.	Sep-02	Sep-02	No	-	-	No
Porter Cr.	Oct-04	Aug-04	-	-	-	No
Jordan R.	Jul-02	Oct-04	Yes	-	-	No
Monroe Cr.	Oct-72	Sep-04	Yes	2,736	12	No
Loeb Cr.	Oct-04	Aug-04	-	-	-	No
McGeach Cr.	Oct-99	Jun-02	No	-	-	No
Elk Lake Outlet	Sep-04	Sep-04	No	-	-	No
Yuba Cr.	Aug-64	Jul-04	Yes	2,827	18	No
Acme Cr.	Aug-64	Jun-03	No	-	-	No
Mitchell Cr.	Sep-03	Jun-02	-	-	-	No
Boardman R.	Aug-01	May-04	Yes	-	-	No
Hospital Cr.	Aug-01	May-04	Yes	13,205	151	No
Leo Cr.	Never	May-04	No	-	-	No
Goodharbor Cr.	Oct-01	May-04	Yes	-	-	No
Crystal R.	Oct-72	May-04	No	-	-	No
Platte R. (upper)	Jul-03	Sep-03	Yes	-	-	No
Platte R. (middle)	Jul-01	Jul-04	Yes	8,663	48	No
Platte R. (lower)	Sep-04	Oct-04	No	-	-	No
Betsie R.	Jul-02	Sep-04	Yes	147,293	17	No
Bowen Cr.	Never	Jul-04	No	-	-	No
Big Manistee R.	Aug-03	Sep-04	Yes	581,732	1,672	No
Bear Cr.	Sep-02	Sep-02	Yes	-	-	No
Pine Cr.	Aug-03	Aug-03	-	-	-	No
L. Manistee R.	Jul-04	Jun-04	-	-	-	No
Gurney Cr.	Jul-01	Sep-04	Yes	2,599	32	Yes
Lincoln R.	Jun-02	Jul-04	Yes	-	-	No
Pere Marquette R.	Aug-02	Oct-04	Yes	-	-	No
Bass Lake Outlet	Aug-78	Jul-04	No	-	-	No
Pentwater R.	Jul-03	May-03	-	-	-	No
Stony Cr.	Jul-87	Jun-04	Yes	-	-	No
Flower Cr.	Sep-81	Jul-01	No	-	-	No
White R.	Aug-01	Sep-04	Yes	-	-	Yes
Duck Cr.	Jul-84	May-03	No	-	-	No

Table 10. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Muskegon R.	Aug-02	Sep-04	Yes	4,934,959	98,178	Yes
Brooks Cr.	Aug-00	Sep-04	Yes	645	102	Yes
Cedar Cr.	Aug-00	Sep-04	Yes	5,562	74	Yes
Bridgeton Cr.	Jul-04	Aug-03	-	-	-	No
Minnie Cr.	Sep-04	Aug-04	-	-	-	No
Bigelow Cr.	Aug-02	Jun-02	-	-	-	No
Black Cr.	Aug-70	Jun-04	No	-	-	No
Grand R.	Never	Sep-03	No	-	-	No
Norris Cr.	Jun-00	Jun-02	No	-	-	No
Lowell Cr	Sep-65	Jun-87	No	-	-	No
Buck Cr.	Sep-65	Jun-03	No	-	-	No
Rush Cr.	Sep-65	Aug-98	No	-	-	No
Sand Cr.	Sep-96	Jun-02	No	-	-	No
Crockery Cr.	Aug-04	Sep-04	No	0	0	No
Bass R.	Aug-04	Sep-03	-	-	-	No
Pigeon R.	Oct-64	Jun-04	No	-	-	No
Pine Cr.	Oct-64	Jun-04	No	-	-	No
Gibson Cr.	Jul-84	Sep-04	No	-	-	No
Kalamazoo R.	Sep-65	Jul-02	No	-	-	
Bear Cr.	Aug-04	Sep-04	No	-	-	No
Sand Cr.	Aug-04	Sep-04	Yes	-	-	No
Mann Cr.	Jul-02	Jun-04	Yes	-	-	No
Rabbit R.	Jul-81	Oct-02	Yes	-	-	No
Swan Cr.	Jul-77	Sep-02	No	-	-	No
Allegan 3 Cr.	Sep-65	Jun-04	No	-	-	No
Allegan 4 Cr.	Oct-78	Sep-03	No	-	-	No
Allegan 5 Cr.	Never	Jun-04	No	-	-	No
Black R.	Jun-01	Jun-04	No	-	-	No
Brandywine Cr.	Oct-85	Jul-02	Yes	-	-	No
Rogers Cr.	May-98	Sep-03	No	-	-	No
St. Joseph R.	Never	Jul-02	Yes	-	-	No
Lemon Cr.	Oct-65	May-03	No	-	-	No
Pipestone Cr.	Aug-03	Sep-02	-	-	-	No
Meadow Dr.	Oct-65	May-03	No	-	-	No
Hickory Cr.	Oct-65	May-03	No	-	-	No
Paw Paw R.	May-01	Sep-04	Yes	87,998	12,016	Yes
Blue Cr.	May-01	May-03	No	-	-	No
Mill Cr.	May-01	Sep-04	Yes	4,645	724	Yes
Brandywine Cr.	May-97	Aug-04	Yes	9,748	13	Yes
Brush Cr.	May-01	Sep-04	Yes	4,083	185	Yes
Galien R. (N. Br.)	May-02	Jul-04	Yes	-	-	No
E. Br. Galien & Dowling Cr.	May-02	Jul-04	Yes	-	-	No
S. Br. Galien & Galina Cr.	Jun-99	Jul-04	Yes	459	195	Yes
Spring Cr.	Jun-99	Jul-03	No	-	-	No
South Br. Spring Cr.	May-02	Jul-04	Yes	-	-	Yes
State Cr.	May-86	Jul-04	No	-	-	No
Trail Cr.	Apr-00	Jul-04	Yes	1296	55	No
Donns Cr.	May-66	Jul-03	No	-	-	No
Burns Ditch	Jul-99	Jul-04	No	-	-	No

[1]Applies only to streams surveyed since last lampricide treatment

Table 11. Status of larval sea lampreys in historically infested lentic areas of Lake Michigan during 2004.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Hog Island Cr.	Hog Island Cr. (Offshore)	Jul-84	Jul-81	-
Black R.	Black R. (Offshore)	Jul-86	Jul-84	-
Milakokia R.	Seul Choix Bay	Jul-86	Aug-80	-
Bursaw Cr.	Bursaw Cr. (Offshore)	Jul-86	Jul-76	-
Ogontz R.	Ogontz R. (Offshore)	Jul-87	Jul-87	-
Whitefish R.	Big Bay De Noc	Jul-97	Aug-93	-
Rapid R.	Little Bay De Noc	Aug-88	Jul-80	-
Days R.	Little Bay De Noc	Jul-04	Jul-04	-
Portage Cr.	Portage Bay	Jul-84	Jul-77	-
Ford R.	Green Bay	Jun-87	Jun-84	-
Cedar R.	Green Bay	Jul-85	Jun-84	-
Beattie Cr.	Green Bay	Jul-85	Jul-85	-
Menominee R.	Green Bay	Jul-86	Jun-77	-
Carp Lake R.	Cecil Bay	Sep-03	Sep-03	-
Bear R.	Little Traverse Bay	Jun-04	Jun-04	-
Horton Cr.	Horton Bay (Lake Charlevoix)	Jun-04	Jun-04	-
Boyne R.	Boyne Harbor (Lake Charlevoix)	May-04	May-04	May-04
Porter Cr.	Lake Charlevoix	Jun-04	Jun-04	-
Jordan R.	Lake Charlevoix	Jun-03	Jun-03	-
Monroe Cr.	Lake Charlevoix	Jun-03	Jun-03	-
Mitchell Cr.	Grand Traverse Bay (East Arm)	May-04	May-04	-
Boardman R.	Grand Traverse Bay (West Arm)	May-04	May-04	-
Leland R.	Leland R. (Offshore)	May-04	May-04	-
Platte R.	Loon Lake	Sep-00	Aug-96	-
	Platte Lake	Jul-03	Jul-03	-
Betsie R.	Betsie Lake	Aug-83	Aug-83	-
Big Manistee R.	Manistee Lake	May-04	Aug-90	-

Lake Huron

- Qualitative assessments of larval sea lamprey populations were conducted in 92 tributaries (40 U.S., 52 Canada) and offshore of eight tributaries (7 U.S., 1 Canada). The status of larval sea lampreys in historically infested Lake Huron tributaries and lentic areas are presented in Table 12 and Table 13.

- Populations of larval sea lampreys were estimated in 31 tributaries (20 U.S., 11 Canada; Table 12).

- Post-treatment assessments were conducted in 10 U.S. tributaries to determine the effectiveness of lampricide treatments during 2003 and 2004.

- During 2003, samples of larval sea lamprey density were allocated to type 1 and acceptable (type 2) habitats based on estimates of the area of each type of habitat and the variance in larval density from previous sampling in a subset of Lake Michigan streams. To evaluate the success of this optimization strategy and determine if it should be applied to future quantitative sampling, we collected equal samples of larval density from both type 1 and type 2 habitats in three (2 U.S., 1 Canada) Lake Huron streams during 2004. The information collected during 2004 will be used to make further recommendations regarding the implementation of this optimization procedure throughout the Great Lakes.

- Concurrent with lampricide application, collections of larval and recently metamorphosed sea lampreys were made in three tributaries in Canada using fixed sampling intervals, in an effort to verify estimates of each life stage at time of treatment.

- Larval sea lampreys were collected from 11 tributaries for ongoing migratory pheromone research being conducted by Michigan State University and the University of Minnesota, and from 25 tributaries (11 U.S., 14 Canada) for statolith microchemistry research being conducted by the National Oceanic and Atmospheric Administration, Ann Arbor, Michigan. *Ichthyomyzon* larvae were collected from one tributary for species differentiation research conducted by the University of Windsor, Ontario Canada.

- Monitoring of larval sea lampreys in the St. Marys River continued during 2004. 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 2.1 million with 95% confidence limits (1.3 - 2.9).

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 during 2004.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Mission Cr.	Never	Aug-04	Yes	-	-	No
Charlotte R.	Oct-81	Aug-04	No	-	-	No
Little Munuscong R.	May-04	Sep-04	Yes	-	-	No
Big Munuscong R. (Mainstream)	Jun-99	Aug-04	No	-	-	No
Big Munuscong R. (Taylor Cr.)	May-04	Aug-04	Yes	-	-	No
Carlton Cr.	Sep-01	Oct-03	No	-	-	No
Canoe Lake Outlet	May-70	Jul-04	No	-	-	No
Caribou Cr.	Jun-04	May-03	Yes	-	-	No
Bear Lake Outlet	Jun-77	Jun-04	No	-	-	No
Joe Straw Cr.	May-75	May-03	Yes	-	-	No
Albany Cr.	Sep-01	Aug-04	Yes	-	-	No
Trout Cr.	May-01	Sep-04	Yes	6,367	10	Yes
Beavertail Cr.	Oct-00	Jul-04	Yes	37,436	884	Yes
Prentiss Cr.	May-01	May-04	No	-	-	No
McKay Cr.	Sep-01	Sep-04	Yes	21,478	54	No
Flowers Cr.	Sep-83	May-02	No	-	-	No
Ceville R.	Oct-00	Sep-04	Yes	12,517	83	Yes
Hessel Cr.	Jun-04	May-03	-	-	-	No
Steeles Cr.	May-84	Jul-04	Yes	4,620	234	Yes
Nuns Cr.	Sep-01	Jul-04	No	-	-	No
Pine R.	May-03	Aug-04	Yes	59,796	2,318	Yes
McCloud Cr.	Oct-72	Sep-03	No	-	-	No
Carp R.	Sep-03	Sep-04	Yes	-	-	No
Martineau Cr.	Oct-93	Aug-04	Yes	-	-	No
266-20 Cr.	Aug-76	Jun-04	No	-	-	No
Beaugrand Cr.	Never	May-02	No	-	-	No
Little Black R.	May-67	Sep-04	No	-	-	No
Cheboygan R.	Oct-83	Sep-04	Yes	-	-	No
Laperell Cr.	May-00	May-02	No	-	-	No
Meyers Cr.	Sep-99	May-02	No	-	-	No
Maple R.	Sep-03	Aug-02	-	-	-	No
Pigeon R.	Sep-03	Aug-02	-	-	-	No
Little Pigeon R.	Aug-98	Aug-03	No	-	-	No
Sturgeon R.	Aug-04	Sep-03	-	-	-	No
Elliot Cr.	May-04	Jun-04	No	-	-	No
Greene Cr.	Oct-01	Oct-04	Yes	-	-	No
Grass Cr.	May-78	May-03	No	-	-	No
Mulligan Cr.	May-94	Jun-04	No	-	-	No
Grace Cr.	Sep-77	Jun-04	Yes	11,250	162	Yes
Black Mallard Cr.	May-03	Jun-04	Yes	-	-	No
Seventeen Cr.	May-67	May-03	No	-	-	No
Ocqueoc R.	Jul-02	Oct-04	Yes	-	-	No
Johnny Cr.	Sep-70	May-03	No	-	-	No
Schmidt Cr.	Jun-04	May-04	-	-	-	No
Trout R.	May-04	Oct-04	Yes	44	0	No
Swan R.	May-96	Jul-04	Yes	1,004	32	No
Middle Lake Outlet	Jun-67	Sep-04	No	-	-	No
Grand Lake Outlet	Never	Sep-03	Yes	-	-	No
Long Lake Cr.	Jun-04	Jul-04	No	-	-	No
Squaw Cr.	Jun-67	May-03	No	-	-	No
Devils R.	Jun-04	Jul-04	No	0	0	No
Black R.	May-03	Jun-04	Yes	152,917	4	No

Table 12. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Au Sable R.	Aug-03	Jul-04	Yes	257	18	No
Pine R.	May-87	May-03	No	-	-	No
Tawas Lake Outlet	Jun-03	May-03	-	-	-	No
Cold Cr.	Jun-03	May-02	-	-	-	No
Sims Cr.	Jul-98	Jul-04	Yes	1,062	26	Yes
Grays Cr.	Never	Jul-04	Yes	1,477	38	Yes
Silver Cr.	Jul-00	Sep-04	Yes	674,041	870	Yes
East Au Gres R.	Oct-01	Sep-04	Yes	-	-	Yes
Au Gres R.	Jun-04	Jun-04	-	-	-	No
Rifle R.	Oct-02	Jul-04	Yes	-	-	No
Saginaw R.						
Cass R.	Oct-84	Aug-03	Yes	-	-	No
Juniata Cr.	Sep-98	Sep-04	Yes	677	128	Yes
Tittabawasse R.	Never	Jul-03	No	-	-	No
Chippewa R. (upper)	Sep-99	Oct-04	Yes	34,510	263	Yes
Coldwater R.	Sep-95	Oct-04	Yes	1,868	93	Yes
Chippewa R. (lower)	Jun-03	Oct-04	Yes	106,160	1,439	Yes
Pine R.	Jun-03	Aug-02	-	-	-	No
Little Salt Cr.	Oct-02	Sep-04	No	-	-	No
Big Salt Cr.	Jun-03	Sep-04	Yes	-	-	No
North Br.	Never	Jul-03	No	-	-	No
Carroll Cr.	May-02	Jun-04	Yes	-	-	No
Big Salt R.	May-02	Sep-04	Yes	300	25	No
Bluff Cr.	May-02	Sep-04	Yes	-	-	No
Shiawassee R.	Jun-02	Sep-04	Yes	-	-	No
Rock Falls Cr.	Never	May-01	No	-	-	No
Sucker Cr.	Never	Jul-02	No	-	-	No
Cherry Cr.	Never	May-01	No	-	-	No
Mill Cr.	May-85	May-01	No	-	-	No
Canada						
Root R.						
Main	Sep-99	Jul-04	Yes	-	-	Yes
West Root	Oct-03	Jul-04	Yes	-	-	No
Garden R.	Aug-02	Jul-03	Yes	-	-	No
Echo R.						
Upper	Oct-99	Jul-04	Yes	-	-	No
Lower	Oct-99	Jul-04	Yes	26	0	No
Bar/Iron Cr.	Oct-04	Jul-04	-	-	-	No
Bar R.	Oct-01	Jul-04	No	-	-	No
Sucker Cr.	May-00	May-04	Yes	-	-	Yes
Twotree R.	Oct-01	May-04	No	-	-	No
Richardson Cr.	May-04	May-04	-	-	-	No
Watson Cr.	Jun-02	May-01	-	-	-	No
Gordon Cr.	May-01	May-04	No	-	-	No
Browns Cr.	Oct-03	May-04	Yes	-	-	No
Koshkawong R.	May-00	Jun-04	Yes	-	-	No
No Name	Sep-75	May-03	Yes	-	-	No
MacBeth Cr.	Jun-67	Jun-00	No	-	-	No
Thessalon R.						
Upper	Jul-02	Sep-04	Yes	-	-	No
Lower	Jul-01	Aug-04	Yes	69,684	1,692	Yes
Livingstone Cr.	Jun-00	Jul-04	No	0	0	No

Table 12. Continued.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Canada						
Mississagi R.						
Main	Aug-04	Jul-04	-	-	-	No
Pickerel Cr.	Jun-98	Jun-03	No	-	-	No
Blind R.	May-92	Jun-01	Yes	-	-	No
Lauzon R.	Jul-04	Jun-03	-	-	-	No
Spragge Cr.	Oct-95	May-03	No	-	-	No
No Name	Jun-02	May-01	-	-	-	No
Serpent R.						
Main	Jun-00	Jun-02	No	-	-	No
Grassy Cr.	Oct-03	May-03	-	-	-	No
Spanish R.	Sep-02	Aug-04	Yes	-	-	No
Kagawong R.	May-93	May-01	No	-	-	No
No Name	Jun-02	Jun-04	No	-	-	No
Silver Cr.	Jul-04	Jun-04	-	-	-	No
Sand Cr.	Oct-01	Jun-04	Yes	259	108	Yes
Mindemoya R.	Jun-02	Jun-04	Yes	28,744	17	No
Timber Bay Cr.	May-01	Jun-04	Yes	27,205	332	Yes
Manitou R.	Sep-99	Jun-04	Yes	6,770	32	No
Blue Jay Cr.	Jun-03	Jun-04	Yes	-	-	No
Kaboni Cr.	Oct-78	May-02	No	-	-	No
Chikanishing R.	Jul-03	May-02	-	-	-	No
French R. System						
O.V. Channel	Jun-92	Jun-02	Yes	-	-	No
Wanapitei R.	Jun-00	Jun-04	Yes	32,599	4,256	Yes
Key R. (Nesbit Cr.)	Sep-72	Jun-99	No	-	-	No
Still R.	Jun-96	Jun-04	No	-	-	No
Magnetawan R.	Jul-99	Jun-04	Yes	66,542	847	Yes
Naiscoot R.	Jun-04	Jun-04	-	-	-	No
Shebeshekong R.	Never	Jul-04	No	-	-	No
Boyne R.	Jun-03	Jun-04	Yes	-	-	No
Musquash R.	Aug-96	Jun-04	Yes	14,370	826	Yes
McDonald Cr.	Never	Jun-99	No	-	-	No
Simcoe/Severn System	Never	Jun-03	Yes	-	-	No
Coldwater R.	Never	May-04	No	-	-	No
Sturgeon R.	Jun-03	May-04	No	-	-	No
Hog Cr.	Sep-78	May-04	No	-	-	No
Lafontaine Cr.	Jun-68	May-04	No	-	-	No
Nottawassaga R.						
Main (Including Boyne & Bear Cr.)	May-02	Jun-04	No	-	-	No
Pine R.	May-02	Jun-04	Yes	56,941	28,049	Yes
Pretty R.	May-72	May-04	No	-	-	No
Silver Cr.	Sep-82	Jun-04	No	-	-	No
Bighead R.	Jun-03	May-04	Yes	-	-	No
Bothwells Cr.	Jun-79	May-04	No	-	-	No
Sydenham R.	Jun-72	May-04	No	-	-	No
Sauble R.	Jun-04	Jun-04	Yes	-	-	No
Saugeen R.	Jun-71	May-04	No	-	-	No
Bayfield R.	May-70	May-01	No	-	-	No

[1]Applies only to streams surveyed since last lampricide treatment.

Table 13. Status of larval sea lampreys in historically infested lentic areas of Lake Huron during 2004.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Albany Cr.	Albany Bay (Offshore)	Aug-04	Aug-04	-
Trout Cr.	Trout Cr. (Offshore)	Jun-98	Jul-81	-
McKay Cr.	McKay Bay	Sep-04	Sep-04	-
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-04	Aug-04	-
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	-
Canada				
Echo R.	Solar Lake	Jul-99	Sep-93	-
	Stuart Lake	May-90	May-90	-
Two Tree R.	North Channel	Aug-81	Aug-81	-
Gordon's Cr.	North Channel	Aug-91	Aug-91	-
Brown's Cr.	North Channel	Aug-91	Aug-91	-
Koshkawong	North Channel	Aug-91	Aug-91	-
No Name	North Channel	Sep-71	Sep-71	-
Mississagi R.	North Channel	Aug-90	Aug-90	-
Kagawong R.	Mudge Bay	Jul-90	Jul-90	-
Mindemoya	Providence Bay	Jul-88	Jul-88	-
Manitou R.	Michael's Bay	Jul-90	Jul-90	-
Magnetawan R.	Byng Inlet	Jul-04	Jul-04	Jul-99

Lake Erie

- Qualitative assessments of larval sea lamprey populations were conducted in 25 tributaries (18 U.S., 7 Canada). The status of larval sea lamprey populations in historically infested Lake Erie tributaries and lentic areas are presented in Table 14 and Table 15.

- Populations of larval sea lampreys were estimated in three U.S. tributaries (Table 14).

- Post-treatment assessments were conducted in one U.S. tributary to determine the effectiveness of lampricide treatments during 2003 and 2004.

- Larval sea lamprey surveys conducted on the St. Clair River indicate that sea lamprey production may be increasing from this uncontrolled source.

  Eighteen 500 m^2 plots were surveyed with granular Bayluscide on the Canadian side of the river, resulting in a catch of 48 sea lampreys (ranging in size from 36-176mm), 86 *Ichthyomyzon* spp., 55 American brook lamprey, and two silver lamprey transformers.

  The current density estimate of 0.0055 larvae/m^2 is considerably higher than in previous sampling years (0.0008 larvae/m^2 in 1998; 0.0031 larvae/m^2 in 1992).

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 during 2004.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Buffalo R.	Never	Aug-04	Yes	-	-	No
Delaware Cr.	Oct-86	Aug-04	Yes	140	17	Yes
Cattaraugus Cr. (Mainstream)	Sep-04	Apr-04	-	-	-	No
Cattaraugus Cr. (Clear Cr.)	May-04	Aug-04	Yes	-	-	No
Halfway Br.	Oct-86	Jun-03	No	-	-	No
Canadaway Cr.	Oct-86	Aug-04	Yes	-	-	No
Crooked Cr.	Oct-02	Aug-04	Yes	281	2	No
Raccoon Cr.	May-01	Aug-04	Yes	1,008	246	Yes
Conneaut Cr.	Apr-03	Nov-03	Yes	-	-	No
Grand R.	Apr-03	Sep-03	Yes	-	-	No
Black R.	Never	Jul-04	No	-	-	No
Vermillion R.	Never	Jul-04	No	-	-	No
Huron R.	Never	Jul-04	No	-	-	No
Sandusky R.	Never	Jul-04	No	-	-	No
Portage R.	Never	Jul-04	No	-	-	No
Toussaint Cr.	Never	Jul-04	No	-	-	No
Maumee R.	Never	Jul-04	No	-	-	No
Flat Cr.	Never	Jul-04	No	-	-	No
Little Lake Cr.	Never	Jul-04	No	-	-	No
La Plaisance Cr.	Never	Jul-04	No	-	-	No
Sandy Cr.	Never	Jul-04	No	-	-	No
Swan Cr.	Never	Jul-04	No	-	-	No
Black R.	Never	Jun-98	Yes	-	-	No
Pine R.	Apr-88	May-02	No	-	-	No
Belle R.	Never	May-02	No	-	-	No
Clinton R.	Never	May-02	No	-	-	No
St. Clair R.	Never	Jun-98	Yes	-	-	No
Canada						
St. Clair R.	Never	Jul-04	Yes	-	-	No
Thames R.	Never	Jul-04	No	-	-	No
Detroit R.	Never	Sep-00	No	-	-	No
East Cr.	Jun-87	May-04	No	-	-	No
Catfish Cr.	Jun-87	May-04	No	-	-	No
Silver Cr.	Never	May-02	Yes	-	-	No
Big Otter Cr.	Jun-04	May-02	-	-	-	No
South Otter Cr.	Oct-86	Jun-01	No	-	-	No
Clear Cr.	May-91	Sep-01	No	-	-	No
Big Cr.	May-03	Jun-03	No	-	-	No
Forestville Cr.	May-89	May-04	No	-	-	No
Normandale Cr.	Jun-87	May-04	No	-	-	No
Fishers Cr.	Jun-87	May-04	Yes	-	-	No
Youngs Cr.	May-01	Sep-03	-	-	-	No
Grand R.	Never	Sep-03	No	-	-	No
Welland R.	Never	Aug-00	No	-	-	No

[1]Applies only to streams surveyed since last lampricide treatment.

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

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Cattaraugus Cr.	Sunset Bay	Aug-92	Jul-85	-
Conneaut Cr.	Conneaut Harbor	Sep-86	Sep-86	-
Grand R.	Fairport Harbor	Jun-87	Jun-87	-

Lake Ontario

- Qualitative assessments for larval sea lamprey populations were conducted in 38 tributaries (26 U.S., 12 Canada). The status of larval sea lampreys in historically infested Lake Ontario tributaries and lentic areas are presented in Table 16 and Table 17.

- Populations of larval sea lampreys were estimated in nine tributaries (7 U.S., 2 Canada; Table 16).

- Routine assessment found new populations of larval sea lampreys in three separate tributaries. After quantitative assessment, Petticoat Creek was treated during 2004. Sandy Creek was quantitatively assessed, but transformer estimates did not necessitate a treatment for 2005. One larval sea lamprey was found in Irondequoit Creek.

- Concurrent with lampricide application, collections of larval and recently metamorphosed sea lampreys were made in three tributaries using fixed sampling intervals in an effort to verify estimates of each life stage at time of treatment.

- During 2003, samples of larval sea lamprey density were allocated to type 1 and acceptable (type 2) habitat based on estimates of the area of each type of habitat and the variance in larval density from previous sampling in a subset of Lake Michigan streams. To evaluate the success of this optimization strategy and determine if it should be applied to future quantitative sampling, we collected equal samples of larval density from both type 1 and type 2 habitats in one Lake Ontario stream during 2004. The information collected during 2004 will be used to make further recommendations regarding the implementation of this optimization procedure throughout the Great Lakes.

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 during 2004.

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
United States						
Black R.	Jul-04	Jun-03	-	-	-	No
Stony Cr.	Sep-82	Jun-04	No	-	-	No
North Sandy Cr.	Never	Sep-04	Yes	2,392	102	No
South Sandy Cr.	Oct-03	Sep-04	Yes	154,485	1,911	Yes
Skinner Cr.	Apr-04	Jun-04	Yes	3,665	1,879	Yes
Lindsey Cr.	Apr-04	Jun-04	Yes	-	-	No
Blind Cr.	May-76	Jun-04	No	-	-	No
Little Sandy Cr.	Sep-04	Aug-03	-	-	-	No
Deer Cr.	Apr-04	Jun-04	Yes	-	-	No
Salmon R.	May-03	Sep-04	Yes	326,948	1,287	Yes
Tribs. Only	May-97	Sep-04	Yes	-	-	Yes
Grindstone Cr.	Apr-04	Jun-04	Yes	-	-	No
Snake Cr.	Apr-02	Sep-04	Yes	-	-	Yes
Sage Cr.	May-78	Jun-04	No	-	-	No
Little Salmon R.	May-03	Sep-04	Yes	12,314	0	No
Butterfly Cr.	May-72	Jun-04	No	-	-	No
Catfish Cr.	May-03	Jul-03	Yes	-	-	No
Oswego R.						
Black Cr.	May-81	Jun-04	No	-	-	No
Big Bay Cr.	Sep-93	Jul-03	No	-	-	No
Scriba Cr.	May-84	Jul-00	Yes	-	-	No
Fish Cr.	Jun-04	Jun-04	Yes	-	-	No
Carpenter Br.	May-94	Jul-03	No	-	-	No
Putnam Br./ Coldsprings Cr.	May-96	Jun-04	Yes	-	-	No
Hall Br.	Never	May-00	No	-	-	No
Crane Br.	Never	Jun-04	No	-	-	No
Skaneateles Cr.	Never	May-95	No	-	-	No
Rice Cr.	May-72	Jun-04	No	-	-	No
Eight Mile Cr.	Apr-04	Jun-04	Yes	-	-	No
Nine Mile Cr.	May-02	Sep-04	Yes	-	-	Yes
Sterling Cr.	Apr-03	May-03	Yes	-	-	No
Blind Sodus Cr.	May-78	Jun-04	No	-	-	No
Red Cr.	Apr-03	May-03	No	-	-	No
Wolcott Cr.	May-79	Jul-98	No	-	-	No
Sodus Cr.	Jun-01	Aug-04	Yes	3,386	281	Yes
Northrop Cr.	Never	Sep-00	No	-	-	No
Irondequoit Cr.	Never	Aug-04	Yes	-	-	No
Salmon Cr.	May-96	Sep-04	Yes	814	620	Yes
Oak Orchard Cr.	May-88	Aug-04	No	-	-	No
Third Cr.	May-72	May-00	No	-	-	No
First Cr.	May-95	Aug-01	No	-	-	No
Canada						
Niagara R.	Never	Jun-03	Yes	-	-	No
Ancaster Cr.	May-03	Jun-03	No	-	-	No
Bronte Cr.	May-04	Sep-04	Yes	-	-	No
Sixteen Mile Cr.	Jun-82	May-02	No	-	-	No
Credit R.	May-02	Sep-04	Yes	92,278	172	No
Rouge R.	May-04	Oct-03	Yes	-	-	No
Petticoat Cr.	Sep-04	Jun-04	-	-	-	No
Duffins Cr.	Jun-03	Oct-03	Yes	-	-	No
Carruthers Cr.	Sep-76	May-04	No	-	-	No
Lynde Cr.	Jun-02	Oct-04	Yes	-	-	Yes
Oshawa Cr.	Jun-03	Aug-03	Yes	-	-	No

Table 16. Continued

Tributary	Last treated	Last surveyed	Larvae present in last survey[1]	Estimate of 2004 larval population	2005 metamorphosing lamprey estimate	On 2005 treatment schedule
Canada						
Farewell Cr.	Sep-03	Oct-03	No	-	-	No
Bowmanville Cr.	Sep-04	Aug-03	-	-	-	No
Wilmot Cr.	May-03	Oct-03	Yes	-	-	No
Graham Cr.	May-96	Oct-03	No	-	-	No
Wesleyville Cr.	Oct-02	May-04	Yes	-	-	No
Port Britain Cr.	Oct-02	May-03	Yes	-	-	No
Gage Cr.	May-71	May-03	No	-	-	No
Cobourg Br.	Oct-96	Oct-04	Yes	12	11	No
Covert Cr.	Oct-02	May-04	Yes	-	-	No
Grafton Cr.	Oct-02	May-04	No	-	-	No
Shelter Valley Cr.	Sep-03	Aug-03	-	-	-	No
Colborne Cr.	Sep-03	May-04	No	-	-	No
Salem Cr.	Oct-02	May-04	Yes	-	-	No
Proctor Cr.	Aug-98	May-03	Yes	-	-	No
Smithfield Cr.	Sep-86	May-04	No	-	-	No
Trent R. (Canal System)	Never	Aug-03	Yes	-	-	No
Mayhew Cr.	Jun-00	Jun-02	No	-	-	No
Moira R.	Never	Sep-02	Yes	-	-	No
Salmon R.	Jun-00	Aug-03	Yes	-	-	No
Napanee R.	Never	Sep-00	No	-	-	No

[1]Applies only to streams surveyed since last lampricide treatment.

Table 17. Status of larval sea lampreys in historically infested lentic areas of Lake Ontario during 2004.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Black R.	Black River Bay	Jul-01	Jul-01	-
Canada				
Duffin Cr.	Duffin Cr. (Offshore)	Oct-81	Oct-81	-
Oshawa Cr.	Oshawa Cr. (Offshore)	Oct-81	Oct-81	-
Wilmot Cr.	Wilmot Cr. (Offshore)	Oct-81	Oct-81	-

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 in tributaries during the spring and early summer (Fig. 3). 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.

Lake Superior

- 6,524 sea lampreys were trapped at 24 sites in 23 tributaries during 2004 (Table 18, Fig. 3).

- The estimated population of spawning-phase sea lampreys during 2004 was 74,479 (35,169 west U.S. and 39,310 east U.S. and Canada; $r^2 = 0.51$).

- No significant trend was detected from a linear regression of spawning-phase sea lamprey abundance during 1985 - 2004 (Fig. 4; $p=0.723$, $r^2=0.007$).

- Sea lamprey spawning runs were monitored in the Amnicon, Middle, Bad, Firesteel, Misery, Silver, and Poplar 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 Brule River with the Wisconsin Department of Natural Resources, and in the Miners River with the National Park Service, Pictured Rocks National Lakeshore.

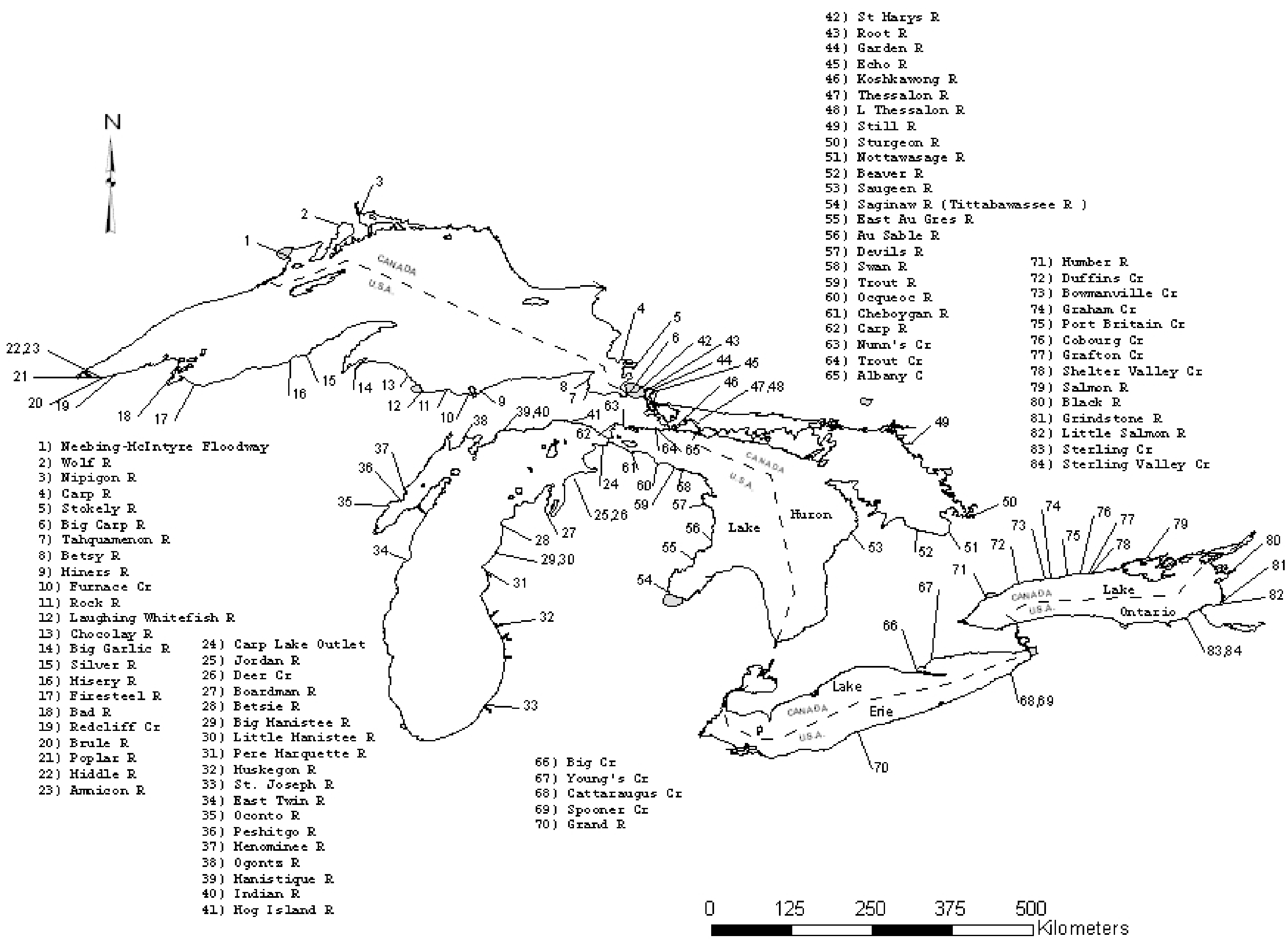

Fig. 3. Locations of tributaries where assessment traps were operated during 2004.

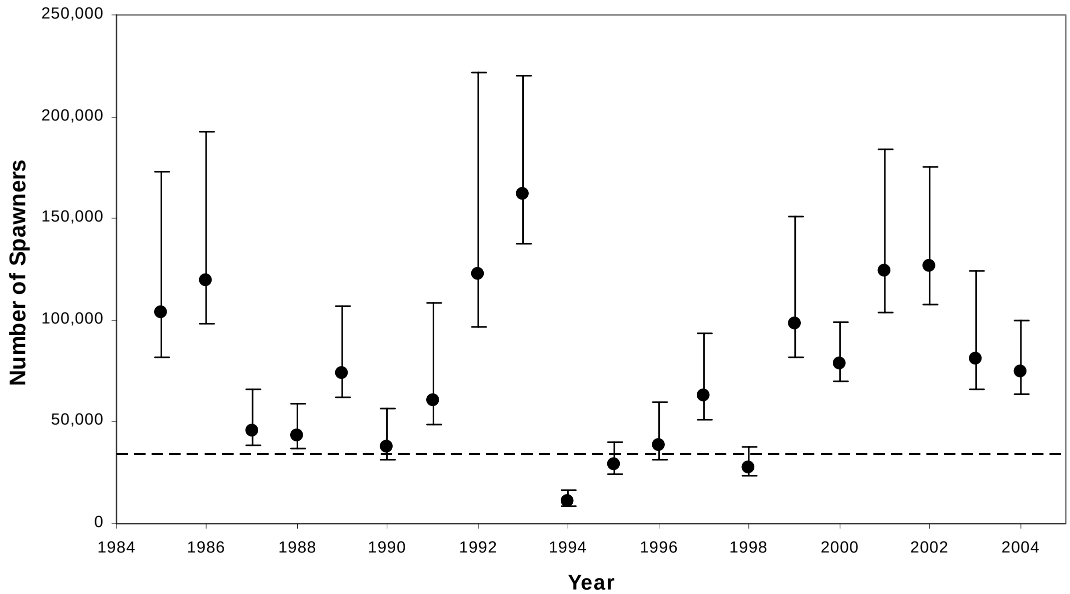

Fig. 4. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Superior during 1985 - 2004 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 18. 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 during 2004 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream Name	Number caught	Spawner estimate	Trap efficiency	Number sampled[1]	Percent males	Mean length (mm) Males	Mean length (mm) Females	Mean weight (g) Males	Mean weight (g) Females
United States									
Tahquamenon R. (7)	601	2,421	25	76	75	455	458	204	219
Betsy R. (8)	249	502	50	83	45	451	433	210	190
Miners R. (9)	80	155	52	28	64	408	415	158	157
Furnace Bay Cr. (10)	107	679	16	18	78	407	458	160	240
Rock R. (11)	415	625	66	209	48	408	413	155	165
Laughing Whitefish R. (12)	4	---	---	2	50	434	470	185	230
Chocolay R. (13)	5	---	---	0	---	---	---	---	---
Big Garlic R. (14)	13	---	---	0	---	---	---	---	---
Silver R. (15)	14	---	---	1	---	381	111	---	---
Misery R. (16)	130	431	30	18	33	441	419	266	156
Firesteel R. (17)	81	---	---	14	29	422	415	169	190
Bad R. (18)	803	8,555	9	197	47	428	432	173	183
Red Cliff Cr. (19)	14	---	---	5	88	434	405	171	124
Brule R. (20)	3,343	5,529	60	139	55	436	508	249	273
Poplar R. (21)	0	---	---	0	---	---	---	---	---
Middle R. (22)	20	28	71	7	56	412	390	186	132
Amnicon R. (23)	136	2,120	6	1	53	388	---	104	---
Total or Mean (South shore)	6,015	21,045		798	55	422	410	184	188
Canada									
Neebing-McIntyre Floodway (1)									
Neebing R.	203	507	40	0	63	---	---	---	---
McIntyre R.	113	152	74	0	51	---	---	---	---
Wolf R. (2)	1	---	---	0	---	---	---	---	---
Nipigon R. (3)	2	---	---	0	---	---	---	---	---
Carp R. (4)	157	231	68	0	66	---	---	---	---
Stokely Cr. (5)	12	---	---	0	---	---	---	---	---
Big Carp Cr. (6)	21	33	63	0	---	---	---	---	---
Total or Mean (North shore)	509	923		0	60	---	---	---	---
Total or Mean (for Lake)	**6,524**	**21,968**		**798**	**56**	**422**	**410**	**184**	**188**

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

Lake Michigan

- 39,280 sea lampreys were trapped at 18 sites in 15 tributaries during 2004 (Table 19, Fig. 3).

- Estimated population of spawning-phase sea lampreys in Lake Michigan for 2004 was 163,283 (104,779 north and 58,504 south; $r^2 = 0.79$).

- 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 Band of Odawa Indians.

- A significant positive trend (Fig. 5) was detected from a linear regression of spawner abundance on year during 1985 – 2004 ($p=0.0002$, $r^2=0.55$).

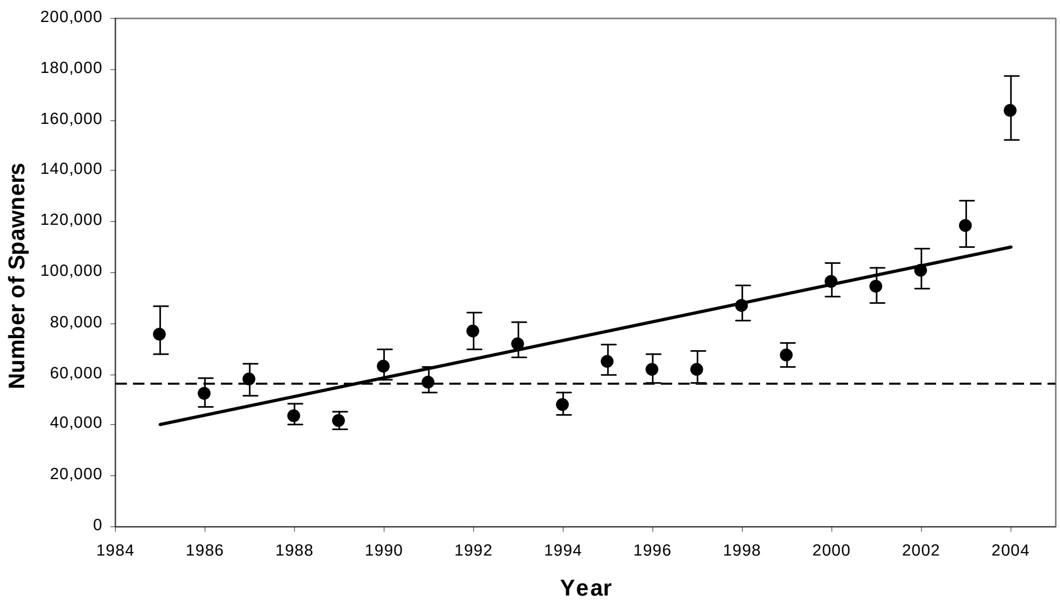

Fig. 5. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Michigan during 1985 - 2004 with trend line (solid line), 95% confidence intervals (vertical lines), and target level (dashed line).

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 in tributaries of Lake Michigan during 2004 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream Name	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
Carp Lake Outlet (24)	2,915	12,330	24	250	58	---	466	---	222
Jordan R. (25)	25	---	---	1	32	---	504	---	314
Deer Cr. (26)	163	461	35	45	49	471	462	238	255
Boardman R. (27)	506	1,559	32	87	64	460	450	227	216
Betsie R. (28)	1,882	6,292	30	161	58	475	466	231	222
Big Manistee R. (29)	980	9,385	10	60	70	466	474	222	245
Little Manistee R. (30)	208	697	30	58	35	468	472	232	239
Pere Marquette R. (31)	415	1,077	39	71	39	485	492	244	269
Muskegon R. (32)	328	2,982	11	27	81	468	464	226	227
St. Joseph R. (33)	399	1,410	28	58	53	490	484	231	248
East Twin R. (34)	693	1,292	54	100	65	443	448	188	209
Oconto R. (35)	109	276	39	0	---	---	---	---	---
Peshtigo R. (36)	3,849	11,269	34	249	55	500	472	266	223
Menominee R. (37)	405	2,292	18	21	71	462	475	271	268
Ogontz R. (38)	37	399	9	1	0	---	440	---	261
Manistique R. (39)	26,314	52,005	54	809	49	500	498	262	274
Indian R. (40)	4	4	100	1	0	---	---	---	222
Hog Island Cr. (41)	48	94	51	14	100	502	---	281	---
Total or Mean	39,280	103,824		2,013	52	476	471	240	245

[1]The number of sea lampreys from which length and weight measurements were determined. In the Carp Lake Outlet, only the females were measured and weighed.

Lake Huron

- 23,286 sea lampreys were trapped at 24 sites in 23 tributaries during 2004 (Table 20, Fig. 3).

- Estimated population of spawning-phase sea lampreys in Lake Huron for 2004 was 129,273 (113,212 north and 16,061 south; $r^2 = 0.79$).

- 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 5,656 spawning-phase sea lampreys. The estimated population in the river was 19,864 and trap efficiency was 29%.

- No significant trend was detected from a linear regression of spawning-phase sea lamprey abundance in Lake Huron on year during 1985 - 2004 (Fig. 6; $p = 0.05$, $r^2 = 0.20$).

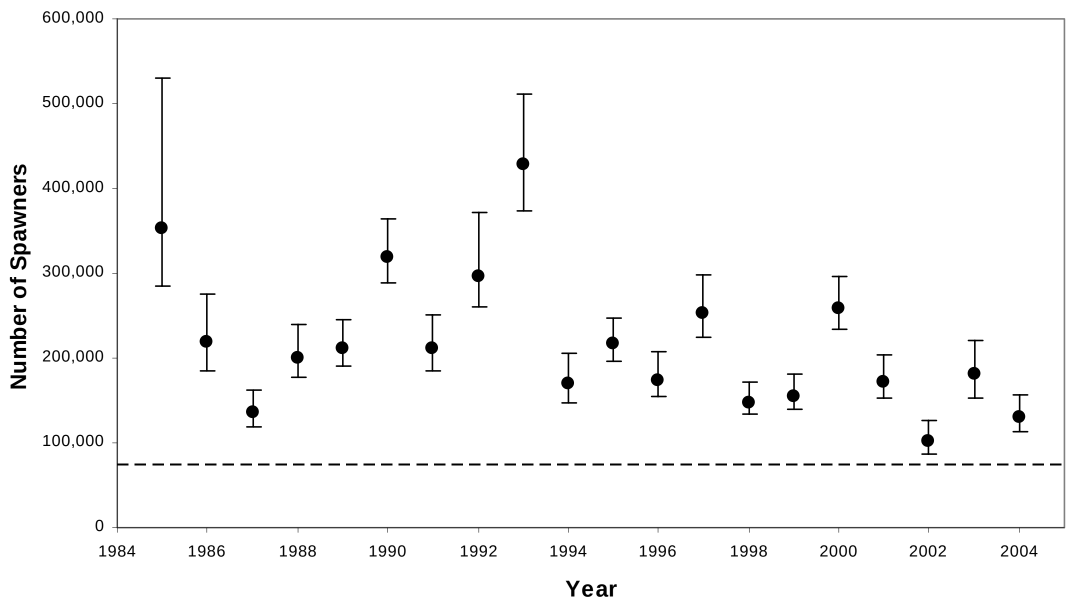

Fig. 6. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Huron during 1985 - 2004 with 95% confidence intervals (vertical lines) and target level (dashed line).

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 or nets in tributaries of Lake Huron during 2004 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream name	Number Caught	Spawner estimate	Trap efficiency	Number sampled[1]	Percent males	Mean length (mm) Males	Mean length (mm) Females	Mean weight (g) Males	Mean weight (g) Females
United States									
Tittabawassee R. (54)	26	---	---	0	---	---	---	---	---
East Au Gres R. (55)	429	4,744	9	3	100	447	---	---	---
Au Sable R. (56)	131	312	42	1	100	400	---	---	---
Devils R. (57)	622	2,924	21	120	59	486	483	252	258
Swan R. (58)	5	---	---	0	---	---	---	---	---
Trout R. (59)	0	---	---	0	---	---	---	---	---
Ocqueoc R. (60)	1,188	2,630	45	0	50	---	---	---	---
Cheboygan R. (61)	7,934	13,151	60	0	59	---	---	---	---
Carp R. (62)	47	---	---	1	55	---	445	---	220
Nunns Cr. (63)	4	---	---	0	---	---	---	---	---
Trout Cr. (64)	62	179	35	12	42	469	451	208	199
Albany Cr. (65)	70	271	26	8	63	426	492	178	227
St. Marys R. (42)	917	See Canada	See Canada	---	72	---	---	---	---
Total or Mean (U.S.)	11,435	24,211		145	67	446	468	213	226
Canada									
St. Marys R. (42)	4,739	19,864	29	0	70	---	---	---	---
Root R. (43)	110	400	28	0	72	---	---	---	---
Garden R. (44)	232	866	27	0	70	---	---	---	---
Echo R. (45)	2,492	12,755	20	0	70	---	---	---	---
Koshkawong R. (46)	163	---	---	0	66	---	---	---	---
Thessalon R. (47)	31	119	26	0	61	---	---	---	---
Little Thessalon R. (48)	4,044	5,848	69	0	63	---	---	---	---
Still R. (49)	0	---	---	0	---	---	---	---	---
Sturgeon R. (50)	0	---	---	0	---	---	---	---	---
Nottawasaga R. (51)	40	---	---	0	70	---	---	---	---
Beaver R. (52)	0	---	---	0	---	---	---	---	---
Saugeen R. (53)	0	---	---	0	---	---	---	---	---
Total or Mean (Canada)	11,851	39,852		0	68	---	---	---	---
Total or Mean (for Lake)	**23,286**	**64,063**		**145**	**67**	**446**	**468**	**213**	**226**

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

Lake Erie

- 201 spawning-phase sea lampreys were trapped in five sites in four tributaries (Table 21, Fig. 3).

- Estimated population of spawning-phase sea lampreys was 5,054, $r^2 = 0.84$.

- Assessment trapping on Big Creek, considered the best assessment stream on Lake Erie in recent years, failed during 2004 due to a mechanical problem with the inflatable barrier that occurred early in the spawning run. This is the main reason for the low confidence in the 2004 lake-wide estimate.

- No significant trend was detected from a linear regression of spawning-phase sea lamprey abundance on year during 1985 - 2004 (Fig. 7; $p=0.321$, $r^2=0.05$).

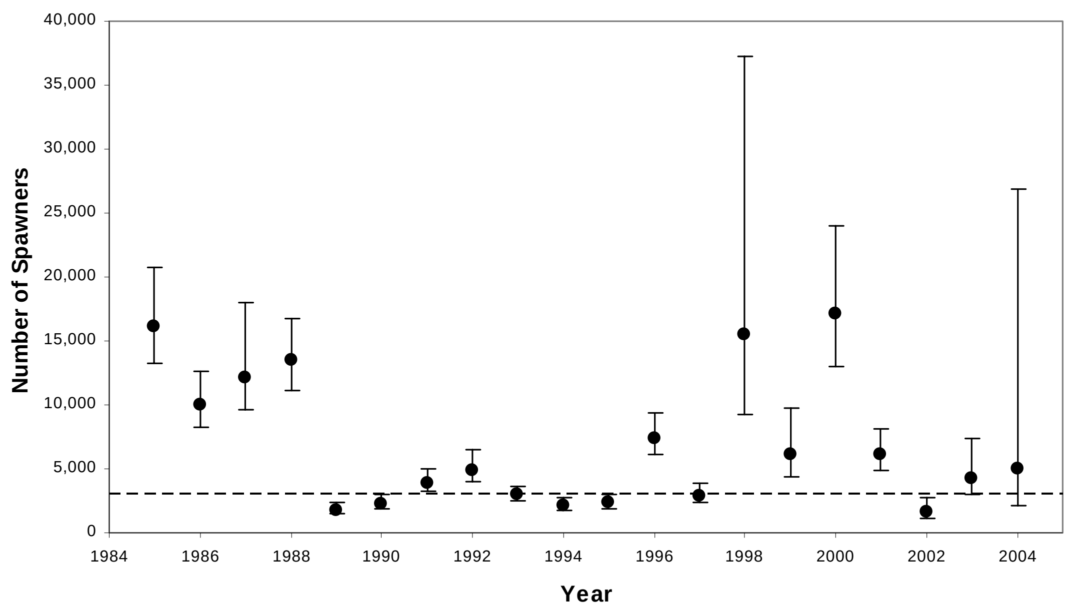

Fig. 7. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Erie during 1985 - 2004 with 95% confidence intervals (vertical lines) and target level (dashed line).

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 in tributaries of Lake Erie during 2004 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream name	Number Caught	Spawner estimate	Trap efficiency	Number sampled[1]	Percent males	Mean length (mm) Males	Mean length (mm) Females	Mean weight (g) Males	Mean weight (g) Females
United States									
Cattaraugus Cr. (68)	81	828	10	1	100	511	---	319	---
Spooner Cr. (69)	63	582	11	6	83	492	490	319	333
Grand R. (70)	35	192	18	13	33	450	490	240	274
Total or Mean (U.S.)	179	1,602		20		484	490	293	304
Canada									
Big Cr. (66)	0	---	---	0	---	---	---	---	---
Young’s Cr. (67)	22	---	---	0	---	---	---	---	---
Total or Mean (Canada)	22	---		0					
Total or Mean (for Lake)	**201**	**1,602**		**20**	**72**	**484**	**490**	**293**	**304**

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

Lake Ontario

- 7,474 spawning-phase sea lampreys were trapped at 14 tributaries (Table 22, Fig. 3).
- Estimated population of spawning-phase sea lampreys in Lake Ontario for 2004 was 51,242.
- A significant negative trend (Fig. 8) was detected from a linear regression of spawning-phase sea lamprey abundance on year during 1985 - 2004 ($p=0.010$, $r^2=0.32$).

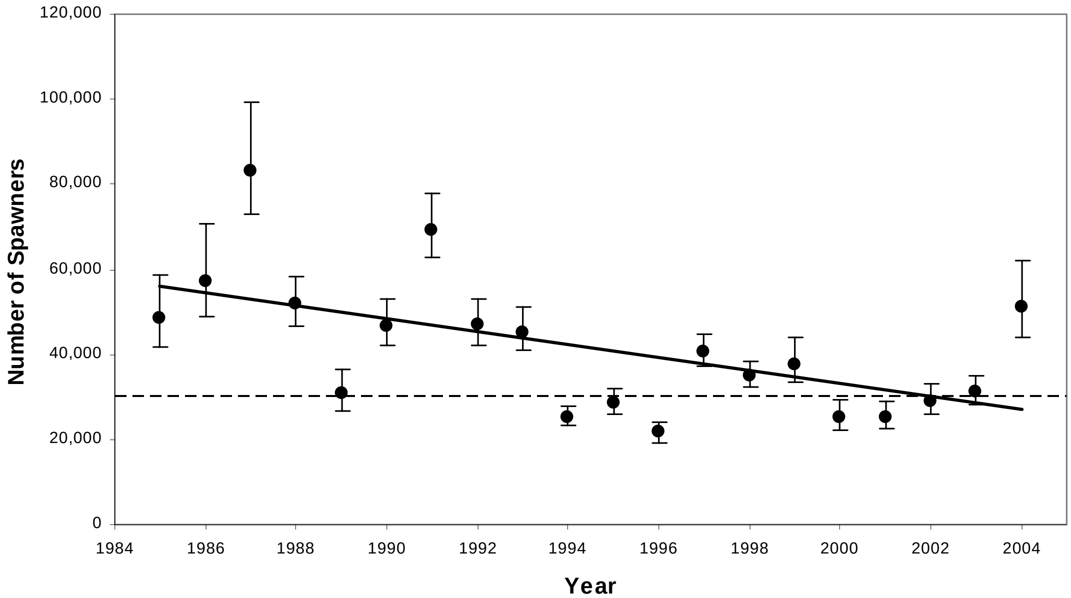

Fig. 8. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Ontario during 1985 - 2004 with trend line (solid line), 95% confidence intervals (vertical lines), and target level (dashed line).

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 in tributaries of Lake Ontario during 2004 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream name	Number Caught	Spawner estimate	Trap efficiency	Number sampled[1]	Percent males	Mean length (mm) Males	Mean length (mm) Females	Mean weight (g) Males	Mean weight (g) Females
United States									
Black R. (80)	1,628	19,871	8	0	---	---	---	---	---
Grindstone Cr. (81)	26	---	---	0	---	---	---	---	---
Little Salmon R. (82)	27	---	---	0	---	---	---	---	---
Sterling Cr. (83)	173	1,032	16	10	40	486	482	275	276
Sterling Valley Cr. (84)	144	1,375	10	7	86	475	465	257	269
Total or Mean (U.S.)	1,998	22,278		17	63	481	474	266	273
Canada									
Humber R. (71)	3,153	6,185	51	309	46	471	473	242	245
Duffins Cr. (72)	424	806	53	32	50	473	469	250	241
Bowmanville Cr. (73)	1,047	4,692	22	335	57	485	478	252	257
Graham Cr. (74)	28	45	63	6	50	487	480	247	230
Port Britain Cr. (75)	97	231	42	33	39	428	440	221	214
Cobourg Cr. (76)	242	956	25	77	35	463	451	195	205
Grafton Cr. (77)	23	35	65	0	---	---	---	---	---
Shelter Valley Cr. (78)	424	749	57	364	53	468	463	218	216
Salmon R. (79)	38	---		10	70	508	457	313	245
Total or Mean (Canada)	5,476	13,699		1,166	50	473	464	242	232
Total or Mean (for Lake)	7,474	35,977		1,183	53	474	466	247	240

[1]The number of sea lampreys from which 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 charter boats during 2004.

- 32 parasitic-phase sea lampreys attached to lake trout were collected from two management districts.

- Parasitic-phase sea lampreys were attached at a rate of 0.78 per 100 lake trout (n = 4,111).

- The recapture of spawning-phase sea lampreys that were released as metamorphosing sea lampreys during 2002 was completed. Of 1,192 metamorphosing sea lampreys marked with coded wire tags and released, two (0.17%) were recaptured as spawning adults during 2004. A total of 5,753 (5,244 U.S., 509 Canada) spawning-phase sea lampreys were scanned for coded wire tags in 16 (10 U.S., 6 Canada) Lake Superior streams during 2004. The estimated abundance of the 2003 parasitic-phase cohort is 2,288,173 (Table 23).

Lake Michigan

The Michigan and Wisconsin Departments of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats during 2004.

- 1,616 parasitic-phase sea lampreys were collected from 10 management districts; 189 were attached to lake trout and 1,427 were attached to chinook salmon.

- Parasitic-phase sea lampreys were attached at a rate of 1.87 per 100 lake trout (n = 10,123) and 0.88 per 100 chinook salmon (n = 162,019).

- A total of 1,166 metamorphosing sea lampreys were marked with coded wire tags and were released into Lake Michigan tributaries during August - December, 2004 to estimate the 2005 parasitic-phase cohort (Ogontz River-114, Jordan River-114, Betsie River-114, Black River-28, Peshtigo River-113, East Twin River-114, Pere Marquette River-229, Muskegon River-341; one sea lamprey died prior to release). Recapture of these sea lampreys as spawning-phase adults will take place during 2006.

Lake Huron

- 2,462 parasitic-phase sea lampreys (U.S.: sport - 572, Canada: commercial - 1,890) were collected from seven management districts (4 U.S., 3 Canada) during 2004.

- 206 parasitic-phase sea lampreys captured by the sport fishery were attached to lake trout and 366 were attached to chinook salmon.

- Parasitic-phase sea lampreys were attached at a rate of 1.4 per 100 lake trout (n =14,479) and 5.8 per 100 chinook salmon (n = 6,298).

- The recapture of spawning-phase sea lampreys released as metamorphosing juveniles during the spring of 2002 was completed. Of 646 metamorphosing sea lampreys marked with coded wire tags and released, 18 (2.8%) were recaptured as spawning adults in Lake Huron during 2004. A total of 22,098 spawning-phase sea lampreys were scanned for coded wire tags in 18 Lake Huron streams (8 U.S., 10 Canada; 1 international) during 2004. The estimated abundance of the 2003 parasitic cohort is 1,100,000 (Table 23).

- No tagged metamorphosing sea lampreys were released into Lake Huron during 2004.

- The recapture of spawning-phase sea lampreys released as parasites during 2003 was completed. Of 442 parasitic-phase sea lampreys marked and released in the open water of Lake Huron during 2003, 17 (3.8%) were recaptured as spawning-phase adults during 2004. The estimated abundance of the parasitic population is 687,000 (Table 23).

- A total of 255 parasitic-phase sea lampreys (captured by commercial fisheries, the Chippewa/Ottawa Resource Authority, and U.S. Geological Survey-Biological Resources Division) were marked with coded wire tags and released in northern Lake Huron during the summer and fall of 2004. Of those, 138 were released in the open waters of Lake Huron (Nunns Creek) and 118 were released in the North Channel. Recapture of these sea lampreys as spawning-phase adults will take place during 2005.

Table 23. Lake-wide population estimates (PE) and 95% confidence intervals (CI) of metamorphosing, parasitic phase, and spawning phase sea lampreys in lakes Huron and Superior during 1992-2004.

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
Lake Superior						
2000	564	419 - 486	---	---	79	70 - 91
2001	361	284 - 494	---	---	125	104 - 163
2002	794	491 - 1,736	---	---	127	108 - 157
2003	652	344 - 2,405	---	---	81	66 - 110
2004	2,288[1]	965 - 28,348	---	---	74	64 - 89
Lake Huron						
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[2]	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

[1]Estimate derived from two recaptured sea lampreys
[2]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 nontarget organisms.

Permits

Issues concerning management of environmental risk during lampricide applications were addressed to fulfill regulatory agency permit requirements for the Michigan Department of Environmental Quality, Minnesota Department of Natural Resources, New York Department of Environmental Conservation, Ohio Environmental Protection Agency, Wisconsin Department of Natural Resources, Red Cliff Band of Lake Superior Chippewas, and Seneca Nation of 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 Service is the registrant for lampricides and must report unreasonable adverse effects on humans, domestic animals, fish or wildlife, plants, other nontarget organisms, 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 2004 included observed mortalities of 74 mottled sculpin (*Cottus bairdii*) in the Little Manistee River of the Manistee River (Lake Michigan); 80 rainbow darters (*Etheostoma caeruleum*) and 40 blacknose dace (*Rhinichthys atratulus*) in Cattaraugus Creek (Lake Erie); and 1,927 stonecats (*Noturus flavus*), 67 logperches (*Percina caprodes*), 73 mudpuppies (*Necturus maculosus*), and 177 tadpole frogs (*Family Hylidae or Ranidae*) in the Great Chazy River and 1,102 silver lampreys (*Ichthyomyzon unicuspis*), 191 American brook lampreys (*Lampetra appendix*), and 144 adult frogs (*Rana* species) in the Winooski River (Lake Champlain).

Federal and State Endangered Species

Consultations with Service 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 for 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 2004; 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 applications of granular Bayluscide to assess populations of larval sea lampreys in the United States during 2004.

These protocols provided field personnel a list of protected federally and state-listed species, known locations, and steps to assure protection and avoidance. No mortality or disturbance was observed for the 26 federal- or state-listed species listed in the protocols.

Hungerford's Crawling Water Beetle

The Hungerford's crawling water beetle (*Brychius hungerfordi*, Coleoptera:Haliplidae) is a federal and state-listed endangered species and was found in the Carp Lake River (Lake Michigan) in Emmet County, Michigan during 1998. The population of larval sea lampreys was assessed in the Carp Lake River during 2003 and the stream ranked for treatment. To comply with the Endangered Species Act of 1973, it was necessary to determine the effect of lampricides on the Hungerford's beetle before a lampricide treatment. Support was received from four experts on the selection of *Haliplus* sp. (Coleoptera:Haliplidae) as a surrogate for the Hungerford's beetle. TFM toxicity tests were conducted on (*Haliplus immaculicollis*) at the Upper Midwest Environmental Sciences Center (UMESC). An Intra-Service Biological Evaluation review was completed and a Biological Opinion was issued by the Service East Lansing Field Office (Ecological Services) with terms and conditions for the proposed TFM treatment in the Carp Lake River. Consensus was achieved on a strategy designed to control 96% of the sea lamprey population (estimated at 136,000 larvae and 1,400 transformers) and minimized adverse effects on the Hungerford's crawling water beetle during the treatment conducted on October 25, 2004.

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 Service during 1995 and for the public during 1996. The lake sturgeon now has no formal Federal designation.

During 2004, 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 Department of Natural Resources to manage lampricide treatments to control sea lampreys and protect known or suspected populations of lake sturgeons in the Millecoquins, Manistique, Whitefish, and Platte rivers (Lake Michigan) and Sturgeon River, a tributary of the Cheboygan River system (Lake Huron). Assessments during and immediately after treatments of these rivers found no dead lake sturgeons. The assessments were completed to fulfill requirements specified in the 2004 certification of approval issued for lampricide treatments by the Michigan Department of Environmental Quality.

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 2004 are outlined below.

Lampricide Control Task Force

The Lampricide Control Task Force was established during December 1995.

Purpose of Task Force:

To improve the efficiency of lampricide control to maximize the numbers 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.

Members in 2004 were:

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

Progress on charges:

1. *The Commission charges the SLIC and Secretariat to work with the Lampricide Control Task Force to implement field trials to develop and review study protocols for the application of the Bayluscide 20% concentrate* - Four Lake Michigan tributaries and one Lake Huron tributary were treated with Bayluscide 20% Emulsifiable Concentrate (EC) during 2004. During the first field test on the Black River, Bayluscide EC was found to be incompatible with Tygon tubing. This problem was quickly resolved by personnel from UMESC. Also, personnel noted that the delivery system must be kept dry. Incidental contact with water caused the active ingredient in Bayluscide EC to precipitate. In spite of these minor problems, consensus of the LCTF was that Bayluscide EC was a useful treatment tool. The LCTF requested that future orders be delivered in larger containers to facilitate treatment of larger streams. Bayluscide EC will be applied to several streams in 2005, including a mid-size stream (~55 cfs) in which higher delivery rates will be tested. UMESC will also initiate a shelf-life study for quality control.

2. *Revision of Standard Operating Procedures Manual* - A major revision of *Standard operating procedures for the application of lampricides in the Great Lakes Fishery Commission integrated management of sea lamprey (Petromyzon marinus) control program* (manual) was completed in 2004. This document defines the methods used by Sea Lamprey Control personnel in the chemical control of lampreys. The U.S. Environmental Protection Agency and Health Canada have stipulated in the restricted use pesticide labels for formulations of the lampricides TFM and Bayluscide that procedures outlined in the manual be followed in all applications of lampricides. The revision of this document was followed by peer review, reprint, and redistribution. The manual was expanded, in response to a charge from SLIC, to include standard operating procedures for use of the sea lamprey sterilant Bisazir. This represents a significant addition to this document. In response to additional charges from SLIC, specified procedures have been prepared and entered into the manual. The additions include an Administrative Operating Procedure (AOP) for management of records which contains a method for archiving stream treatment data, and a revised AOP on the policy for acquisition and maintenance of an inventory of lampricide stocks. The Standard Operating Procedures sub-group also completed several initiatives related to lampricide applications: 1) Completion of a protocol for public notification of lampricide applications; 2) Revision of the press release for lampricide stream applications; 3) Development of a press release for applications of Bayluscide 3.2% Granular Sea Lamprey Larvicide; 4) Development of a public notice for posting lampricide stream applications; 5) Completion of a draft information sheet on fish consumption, irrigation, and recreational use of water during and following a stream treatment; and 6) Completion of a technical operating procedure on investigations of and responses to unexpected kills of nontarget fish. All of the above products are included in the revised manual.

4. E*very effort should be made to complete all required studies on the endangered Hungerford's crawling water beetle and submissions in the appropriate amount of time to allow treatment during 2004. (Weisser, Burkett, Gonzalez)* - About 1400 specimens of a surrogate species were collected and delivered to UMESC for testing. Toxicity tests commenced in early April, 2004 on both the larval and adult forms. The Carp Lake River was treated during October.

5. *Include the Lampricide Inventory Policy in the revision of the Manual* - The Lampricide Inventory Policy is available online. The policy was included in the revision of the manual for 2004.

6. *Lampricide Theme Paper and Treatment Effectiveness* - A revised (February 2004) copy of the theme paper was presented by Gordon McDonald to the Research Priorities Working Group during March 2004.

Long-term Planning:

Lampricide delivered during 2004

TFM (Liquid)	76,352 kg
TFM (Bars)	2,306
Bayluscide (Granules)	13,608 kg
Bayluscide (Powder)	454 kg

Research

A “Study of Issues Related to Stream pH and Lampricide Treatments” commenced at the UMESC and HBBS in 2004, and will continue through 2005.

Tactical/Operational Planning:

Border-blind Treatments.

Canadian treatment staff assisted U.S. personnel in treatment of the Manistique River in 2004.

2004 Treatments.

Additional effort was allocated for treatment of tributaries of all the Great Lakes during 2004. All scheduled treatments were successfully completed.

Manistique River Treatment.

The Manistique River, a tributary to northern Lake Michigan and the largest drainage (>2000 square miles) on the U.S. side of the Great Lakes, was successfully treated in 2003. Due to the immense population of sea lampreys in the river during this treatment, a sufficient number of residuals remained after the treatment to trigger a second treatment in 2004. The treatment again required the combined efforts of U.S. and Canadian treatment personnel for completion.

<u>Control Ranking and Evaluation Task Force</u>

This task force was initially established during April 1996 as The Assessment Task Force. In late 2003, following the establishment of the Connecting Channels and Lentic Areas Task Force and The Sea Lamprey Damage and Target Work Group, the name of the Assessment Task Force was changed to The Control Ranking and Evaluation Task Force (CRETF).

Purpose of Task Force:

Rank streams and lentic areas for sea lamprey control options, and the optimization of the long-term measures of the success of the sea lamprey control program.

Membership for 2004:

Doug Cuddy (Chair), Rod McDonald, Fraser Neave and Mike Steeves, Department of Fisheries and Oceans; Michael Fodale, Katherine Mullett, Jessica Richards and Jeffrey Slade, U.S. Fish and Wildlife Service; 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.

Progress on Objectives / Charges:

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 2005. Included in this ranking were the St. Marys River and five lentic areas 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* - Add-on treatment effort for 2005 (384 staff days) is being weighted towards those lakes that are experiencing higher sea lamprey wounding rates.

3. *Annually rank streams for selection for sea lamprey barriers* - CRETF is working 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 2004 included ranking streams for treatment using “expert judgment”, validation of QAS estimates using mark-recapture during treatment, evaluating various stream selection models and planning for the second phase of the review.

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 2004 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 2005.

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* - Much of the groundwork for this charge 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 control effort. In addition, the second phase of Larval Review under the leadership of PERM researcher, Dr. Mike Jones, will look at the optimization effort spent on control and assessment.

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 are being investigated.

8. *Develop annual border-blind schedules that maximize efficiency* - Border blind larval assessment schedules are the norm on the lower lakes. More work needs to be done on the upper lakes 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* - All task force members have been invited to participate in the development of this Theme Paper.

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 Research priorities Working Group.

Connecting Channel and Lentic Area Task Force

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

Purpose of Task Force:

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.

Members in 2004 were:

Denny Lavis (Chair) and Mike Twohey, Mike Fodale, Jeff Slade, Terry Morse, John Heinrich (U.S. Fish and Wildlife Service); Doug Cuddy, Paul Sullivan and Mike Steeves (Department of Fisheries and Oceans); 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).

Task force meetings were held on February 19 and September 9, 2004.

Progress on charges and objectives:

1. *Coordinate St. Marys control and assessment strategies, provide summary reports and ensure all tasks are appropriately addressed* - Report of 2004 activities and results were provided at SLIC and summarized for GLFC annual report. Assessment and alternative control activities for 2005 were planned and are detailed in respective task force reports. Lampricide treatment plans include treating 140 hectares. Trap work group under the Reducing Reproduction Task Force (RRTF) to 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 transformer; 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. Plan developed and under review for 2005 systematic sampling of lentic areas based upon the above

4. *Identify specific research questions or hypotheses on population dynamics to define the contribution to recruitment of lentic areas and connecting channels* - Ongoing discussion in task force; specific proposal(s) not advanced at this time.

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

6. *Advance specific proposals to refine knowledge relating to control of sea lampreys in connecting channels and lentic areas* - Specific proposal(s) not advanced at this time

7. *Identify treatment options and costs* - Lentic area habitat and production estimates are budgeted as an add-on for a total of 425 staff days and $187,000 for lakes Michigan (175 staff days and $77,000) and Superior (250 staff days and $110,000) based upon historical inventories of infested lentic areas and potentials for production

8. *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 Groups, Trap Work Group, Larval Work Group and Program Integration Work Group are part of the CCLATF and assist in formulation of proposed field actions and reporting to SLIC

Sea Lamprey Barrier Task Force

The Sea Lamprey Barrier Task Force was established in April 1991.

Purpose of Task Force:

Task Force established during April 1991 to coordinate efforts of Fisheries and Oceans Canada (Department), U.S. Fish & Wildlife Service (Service), and U.S. Army Corps of Engineers (Corps) on the construction, operation, and maintenance of sea lamprey barriers.

Members in 2004 were:

Members were Kasia Mullett (Chair), Service; Andrew Hallett, Paul Sullivan, Jerry Weise, Department; 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 on Charges:

1. *Coordinate the construction of new sea lamprey barriers that annually eliminates 1% of available habitat for sea lamprey larvae* - During 2004, construction of the Credit River barrier was completed and a permanent trap was constructed in the Beaver River. By the end of 2004, the Commission's network of 69 sea lamprey barriers in the Great Lakes had eliminated 14% of 1,900 ha of type 1 larval sea lamprey habitat from production. A total of 15 new barrier construction projects were in various stages of planning and were estimated to eliminate an additional 4% of type 1 larval habitat by 2008. Progress continued toward replacing the measures of type 1 larval habitat with production estimates of larval and transforming lampreys to gauge barrier performance and progress toward targets/milestones. The barrier work plan was modified to reflect the deferral of the Cheboygan and Rifle river sea lamprey barriers during 2003. The Commission requested that the Corps refrain from further development of these projects with an understanding that they may be pursued in the future when applicable technology is available. The Corps was notified in January 2004 that funds for Section 1135 projects were limited and only the highest priority projects could be pursued. The Corps was advised that the three highest priorities were the St. Marys River trap, Carp Lake River barrier and South Branch Galien River barrier and coordination efforts on the Bad and Conneaut should proceed. Progress on the remaining 11 Corps projects (9 barrier, 2 traps) was postponed for the duration of 2004.

2. *Coordinate the operation of all existing barriers so that they are 100 % effective in blocking spawning-phase sea lampreys* - During 2004, 11 barriers were operated (5 in Canada, 6 in United States). Level loggers were purchased and installed at most existing sea lamprey barrier sites in both Canada and the United States to gather data needed to evaluate barrier performance.

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 2004, maintenance inspections were conducted at 61 sites (31 in Canada, 30 in the United States). New safety and warning signs were installed at 16 sea lamprey barriers in the United States that were constructed with Commission funds.

4. *In consultation with the control ranking task force, annually select new construction projects from within the top ten of the ranked barrier list* - In the U.S., requests were submitted to the Corps for new Section 1135 barrier projects for Crockery Creek and North Branch Pentwater River. In Canada, the priority for 2004 was to make significant progress toward the construction of Bronte Creek barrier. Plans for a new barrier in Canada were postponed until 2005. A permanent trap in the Manistee River was submitted to the Corps as a Section 1135 project. This was one of four trap projects (3 Corps, 1 Service) in various stages of development during 2004.

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 2004, agent staffs consulted and provided mitigation advice on fish passage or dam/perched culvert removal projects for 13 de facto barriers (6 Canada, 7 United States).

6. *Develop protocol to identify and recommend withdrawal of existing nonfunctional barriers from the Commission barrier network* - The Barrier Strategy and Implementation Plan discussed the criteria used to consider decommission of nonfunctional sea lamprey barriers.

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

8. *Develop annual border-blind schedules that maximize efficiency* - Annual border-blind schedule for 2004 was developed.

9. *Annually develop estimates of costs for effort and construction for upcoming fiscal year* - Developed and recommended a fiscal year 2004 budget of $1,367,000 for continued barrier planning and construction, operations, maintenance, health and safety implementation, environmental assessments, and real estate acquisitions.

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. 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, define treatment difficulty, and determine post-barrier control costs. The treatment difficulty criterion has been tentatively defined by situations that result mostly in residual lampreys being left in the watershed and include streams that 1) require a large number of application sites that require two or more lampricide blocks to coincide, 2) are difficult to maintain MLC due to lack of access, beaver impoundments, springs, and seepage, 3) have a history of significant pH fluctuations, 4) have sensitive species, 5) require a long time to treat since the longer it takes, the greater the risk of a weather event reducing treatment effectiveness, or 6) have controlled flows that are difficult to negotiate specific discharges. The barrier teams have consulted with state, provincial, and tribal agencies to incorporate consideration of individual watershed management plans into the revised ranked list. Michigan DNR was in the process of preparing responses regarding watershed management plans and species concerns for all Michigan streams in the ranked list. 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. Once the revised ranked list is complete, the strategy and implementation plan will be revised.

11. *Annually update SOPs* - The Barrier Strategy and Implementation Plan identified the SOPs due for revision.

12. *Assist in the development and refinement of the barrier research theme paper* - Task force was solicited for feedback and the first draft of the barrier theme paper, "Innovation and Assessment Supporting Sea Lamprey Control in the Laurentian Great Lakes Using Barriers, Traps, and Fishways," was completed.

13. *Work with internal and external researchers to develop proposals and participate in field research of studies consistent with barrier research theme paper* - Task force continued to work with researchers via the task force and Research Priorities Working Group to develop proposals consistent with barrier research theme paper. John Nestler, US Army Engineer Research & Developmental Center, Vicksburg, MS was invited to task force meeting to present "Hydrodynamic Cues Used by Juvenile Salmon for Swim Path & Habitat Selection in Complex Flow Fields." Presentation discussed how strain, velocity, density and force contributed to the movement reaction of juvenile salmon. The task force was interested in applying similar research to identify the navigation strategy used by sea lampreys at barriers.

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

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 of task force:

To coordinate and optimize the pheromone, sterile-male release, and trapping strategies in an integrated program of sea lamprey control; and to support the Great Lakes Fishery Commission's Strategic Vision Milestones:

Members in 2004 were:

Michael Twohey (chairperson), Gary Klar, Kasia Mullett, and Jessica Richards, U.S. Fish and Wildlife Service; Weiming Li, Mike Jones, and Mike Wagner, Michigan State University; Gavin Christie and Dale Burkett, Great Lakes Fishery Commission; Doug Cuddy and Rod McDonald; Department of Fisheries and Oceans; Cindy Kolar 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 on Objectives:

1. *Develop and periodically refine the pheromone, SMRT, and trapping for control research theme papers* - Pheromones, SMRT, and trapping (Barrier theme) themes were published on the GLFC website. Themes are undergoing review and will be updated in 2005.

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 given the current understanding of pheromone communication in sea lamprey. Broad strategies have been prioritized based on cost, probability of success, degree of complexity, and time to implement. Research questions have been inserted into the research theme that will guide future field trials. Field trials were conducted during 2004 (Jones *et al*., GLFC Proof of Concept Study) in two Lake Huron tributaries. The studies demonstrated a strong tendency for migrating sea lampreys to enter a tributary and traps treated with larval extract vs. a tributary and traps not treated with larval extract. Also, ovulating females were more attracted to traps baited with more spermiating males than traps baited with fewer spermiating males. Additional studies by Nick Johnson (MSU) showed that traps baited with water conditioned by spermiating males caught as many ovulating females as traps baited with live spermiating males. Investigation of synthetic 3kPZS and 3kACA continued.

   Dr. Mike Wagner was recruited to MSU to lead investigations of pheromone field applications. Pheromone field studies for 2005/2006 will build on the proof of concept studies of the previous year. Investigators will attempt to reveal features of sea lamprey behavior that are most important to trapping and control, and provide an integrated approach to the fieldwork. Specific objectives are: 1) to determine if controlled releases of migratory pheromone can effectively influence the migratory behavior of adult lampreys in the presence of a competing background source of pheromone; 2) to determine if the number of ovulating female lamprey captured by a baited trap is a function of the quantity of bait (number of spermiating males); 3) to determine if increasing the number of spermiating males in baited traps will increase the total capture rate of at-large ovulating females; 4) to determine whether sexually mature females are more attracted to the quantity of sex pheromone released by a male or the diversity of male sources.

   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. While Hansen and Manion (1976) presented substantial evidence that females could be sterilized with the same dose of bisazir that is effective on males, some uncertainty remains (Hanson and Manion 1976, Dabrowski completion report 2003). Investigation of sterile female efficacy at The Hammond Bay Biological Station during 2004 showed survival of eggs from 9 matings with sterile females ranged from 0.0 – 4.3 % and control matings ranged from 0.0 – 59.7 %. Complete sterility is not a requirement of the technique and the effect of this level of fertility was being investigated using the Klassen et al. (2004) model. A proposal for a field trial in 2006 was being drafted.

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 trap work group was working to understand variables that affected trap efficiencies in the St. Marys River. Studies on the traps at the Great Lake Power Company during 2004 revealed retentions of nearly 100% for the attractant water trap and 30 – 80% for the portable traps. Changes in water flow, schedules, and other variables were being examined to determine potential effects on trap efficiency. Plans were progressing for a new St. Marys River trap on the south side of the Great Lake Power Company site. Meetings were held with Great Lake Power Company and a contractor was hired to develop plans. Construction could be complete by June 1, 2005. Construction of a new trap at the Sault Edison plant was on track for completion in 2005. The Manistee, Bad, and Mississagi rivers were investigated for their potential to provide additional males for SMRT. A pilot trapping project was proposed for the Mississagi, a large river in the North Channel with potential to provide thousands of males. The task force was monitoring effectiveness of trapping for control in some Lake Champlain tributaries.

4. *Evaluate results of laboratory and field research and revise application strategies accordingly* **-** Pheromone field studies for 2005/2006 will build on the proof of concept studies of the previous year. 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. Efficacy of bisazir to sterilize females was evaluated at Hammond Bay during 2004. A low level of survival was observed. A model by Klassen et al. (2004) will be used to evaluate the effect. Additional efficacy studies were being planned. A proposal to conduct a field trial with sterile females was being developed for 2006. 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. Results of telemetry studies were used to identify additional trapping sites on the St. Marys River. New traps were planned for the south end of the Great Lakes Power site and at the Sault Edison plant. Results of sterile-male releases and trapping in the St. Marys River during 1991 – 2004 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* - Dr. Mike Wagner was recruited to MSU as an assistant professor in Fisheries and Wildlife and was leading development of pheromone field applications. Pheromone field experiments occurred during 2004, and were planned for 2005 with investigators from three universities and the control agents. Control agents from the U.S. and Canada with expertise in trapping were integral to the field studies. Good Laboratory Practice training was being provided by the Upper Mississipi Environmental Sciences Center (UMESC). This approach was providing a strong interdisciplinary team and building critical expertise for future implementation of a pheromone control strategy. Extraction of migratory pheromone was occurring at Hammond Bay with support from Peter Sorensen (University of Minnesota) and both control agents. The task force was collaborating with PERM scientists to identify research priorities in trap design. The task force continued to collaborate with Jones on compensatory mechanism studies. The Hammond Bay Biological Station continued to provide support for SMRT.

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 obtained for the 2004 field experiments, and were being renewed for 2005 field experiments. Good Laboratory Practice training was coordinated by UMESC for field trial workers to support registration requirements. A report on field trial results was drafted for the State of Michigan. Future registration strategies were evaluated by UMESC, including simultaneous registration in the U.S. and Canada, data requirements, and likely wavers. Before registration can be pursued, the active ingredients must be isolated and identified.

7. *Work with control ranking task force on issues of compensatory response of sea lampreys to reduced abundance and behavioral 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. Control agents continued to collaborate with Dr. Jones on 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 border.

9. *Annually update standard operating procedures* - 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 2005. The trap work group established methods and schedules for trap operation on the St. Marys River. Procedures were detailed in the agents' annual work 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 pheromone work group was instrumental in helping to formulate plans for pheromone field experiments. Control agents, internal research and external research all collaborated on field experiments in 2004 and continued as co-investigators with Dr. Michael Wagner for field trials planned for 2005. The task force was considering recommendations of the SMRT Expert Review Panel in formulating research plans. Efficacy of sterilization, Q/A, and potential for sterile female release continued to be investigated with help from internal and external research. New applications of technology were being investigated to improve trapping efficiencies.

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 internal researchers who have membership on this task force and who attend the Research Priorities Working Group core meeting.

OUTREACH

Activity or event	Number of occurrences U.S.	Number of occurrences Canada	Staff days U.S.	Staff days Canada
School Presentations	15	3	21	1
Sports shows	7	5	55	73
Youth fishing	0	1	0	1
Civic groups	8	1	7.5	1
Media interviews	6	8	2	2
Media mailings/email	1,222	45	22	3
Station public displays	31	3	50	1.5
Landowner notification	207	550	3.2	20
Employment outreach	5	-	4	-
Public Aquarium	-	155	-	6
Total outreach	1,501	771	164.7	108.5

PERMANENT EMPLOYEES OF THE SEA LAMPREY MANAGEMENT PROGRAM

U.S. Fish and Wildlife Service
Marquette Biological Station
Gerald Klar, Field Supervisor

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

Assessment Supervisor: Katherine Mullett
Fishery Biologist:
  Michael Fodale, Larval Supervisor
  Jessica Richards, Adult Supervisor
  Michael Twohey, Sterile Male Supervisor
  John Weisser, Risk Assessment Supervisor
  Mary Henson
  Cheryl Kaye
  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
Control Fishery Biologist:
  Alex Gonzalez, Treatment Supervisor
  Kathy Hahka
Lead Physical Science Technician:
  Jeffrey Sartor
Physical Science Technician:
  Kevin Butterfield
  Ken Chaltry
  Tim Sullivan

Assessment Fishery Biologist:
  Jeffrey Slade, Larval Supervisor
  Amy DeWeerd
Biological Science Technician:
  Lois Mishler
  Lynn Kanieski
Administration Support:
  Robert Anderson
  Joe Tyron
  Tana Reimer
Computer Assistant: Barry Matthews

Department of Fisheries and Oceans Canada
Sea Lamprey Control Centre – Sault Ste. Marie, Ontario Canada
Robert Young, Division Managers

Section Head Control: Paul Sullivan
Lampricide Treatment Biologist: Brian Stephens
Control Technicians:

Randy Stewart	Michael MacKenna
Barry Scotland	Shawn Robertson
Chris Sierzputowski	Charlie Boudreau
Peter Grey	Glenn Goulay
Jamie Smith	John Tibbles
Jamie Storozuk	Jerome Keen

Integrated Management of Sea Lamprey Biologist:
  Jerry Weise
Property & Contract Manager: Lisa Vine, Acting
Accounts Clerk: Lisa Vine
Clerk-Receptionist: Christine Reid

Section Head Assessment: Douglas Cuddy
Larval Assessment Project Supervisor: Todd Steves
Fishery Biologist:
  Rod McDonald
  Fraser Neave
Assessment Technicians:

Ed Achtemichuk	Thomas Voigt
Gale Bravener	Sean Morrison
Chris Cowper	Kevin Tallon
Andy Treble	Richard Middaugh
Jeff Rantamaki	James Richard

Barrier Co-coordinator: Andrew Hallett
  Barrier Technologist: Joseph Hodgson
Maintenance Supervisor: Brian Greene
Administrative Clerk: Melanie McCaig