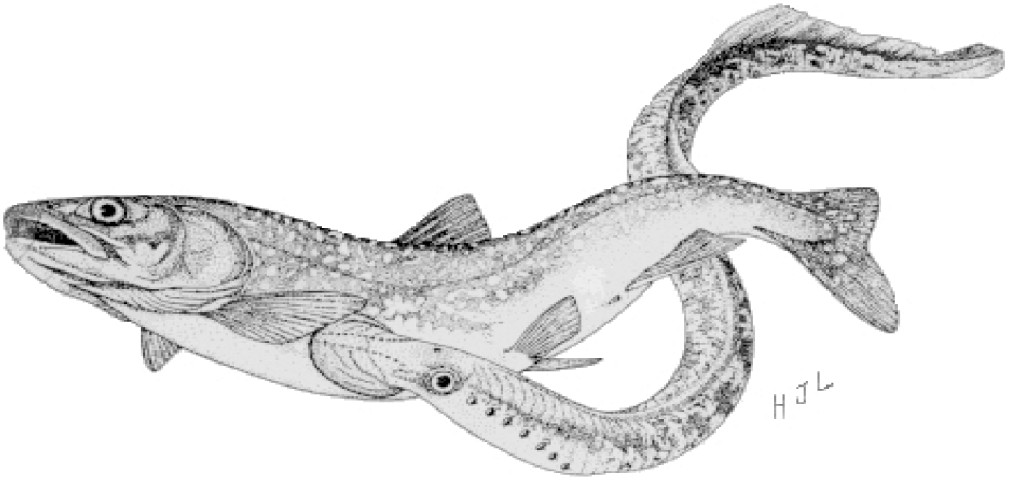
INTEGRATED MANAGEMENT OF SEA LAMPREYS IN THE GREAT LAKES 2006

ANNUAL REPORT TO THE

GREAT LAKES FISHERY COMMISSION



by

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EXECUTIVE SUMMARY

This report summarizes activities in the integrated management of sea lampreys conducted by the United States Fish and Wildlife Service and Department of Fisheries and Oceans Canada in the Great Lakes during 2006. Lampricide treatments were conducted on 70 tributaries. Larval assessment crews conducted surveys in 311 tributaries and 45 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated at 69 sites in 66 tributaries to estimate spawning-phase sea lamprey abundance in each Great Lake. The reduction of sea lamprey abundance from trapping and sterile male release in the St. Marys River was estimated at 84% and is similar to the 87% average estimated during 1997-2006. Sea lamprey barriers continue to be an effective alternative to lampricide treatments and a Commission network of structures was operated and maintained while new barriers were pursued on key tributaries. Environmental issues related to the implementation of these sea lamprey management activities were coordinated and addressed.

We evaluate sea lamprey populations relative to Fish Community Objectives for each of the lakes. In Lake Superior, lamprey abundance (77,488) decreased 36% from 2005. While it has been relatively stable during the early 2000s, it is still above the targets observed in the mid 1990s. Abundance in Lake Michigan (122,136) increased during 2006 despite the decrease observed between 2004 and 2005. Lake Huron sea lamprey abundance (157,286) continues to be relatively stable and remains just above the target. Similar to last year, the numbers of sea lampreys in Lake Erie (15,874) and Lake Ontario (60,014) were well above targets.

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 2006 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 explicit target numbers for sea lampreys that will meet this Fish Community Objective. The target and range were calculated from the average number 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 numbers of sea lampreys during that same period 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. These model estimates are updated each year with new spawning-phase catch data. Marking rates of less than five per 100 fish correlate to an annual rate of sea lamprey induced mortality in lake trout of less than 5%, based on a relationship between marking rates and the probability of surviving a sea lamprey attack. Comparable targets for sea lamprey numbers that support the Fish Community Objectives have been calculated for the other lakes using this methodology. The calculated target abundance using all data including the 2006 spawning-phase abundance estimates was 34,000 +/- 17,000 sea lampreys in Lake Superior**.**

During 2006, the number of sea lampreys was significantly greater than the target number with the spawning population estimated to be 77,488 (95% CI; 67,569 – 90,634; Fig. 4). There is no overall trend in sea lamprey populations over the last 20 years. Lake-wide estimates of spawning lamprey numbers increased above the target range beginning during 1999 and have remained above targets since that time. Wounding rates have increased continuously since the 1994 spawning year and have been highest in the western and northwestern portions of the lake.

The Commission has increased control and assessment effort to reduce sea lamprey populations. The causes of the increase in sea lamprey numbers during the late 1990s are unclear. Sea lampreys may have survived treatments, been produced from streams that were not treated, or come from areas in the lake that have not been treated. All known and potential sources of sea lampreys have been surveyed during 2004-6. Treatments have been increased and all of these sources have been treated. Treatment effort during 2005 and 2006 was at the highest level in 20 years. The large Lower Nipigon River was successfully treated during 2006. A new program of identifying, mapping, and treating lentic areas was begun during 2005, and treatment of these areas in the lake near river mouths continued during 2006. The effect of the increased control effort will be assessed from the 2007 and 2008 adult assessment results.

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 explicit target numbers for sea lampreys that will support their Fish Community Objectives. The target and range were calculated from the average number 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 numbers of sea lampreys during that same period 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. These model estimates are updated each year once the model is calibrated with new spawning-phase catch data. Marking rates of less than five per 100 fish correlate to an annual rate of sea lamprey induced mortality in lake trout of less than 5%, based on a relationship between marking rates and the probability of surviving a sea lamprey attack. Comparable targets for sea lamprey numbers that support the Fish Community Objectives have been calculated for the other lakes using this methodology. The calculated target abundance using all data including the 2006 spawning-phase abundance estimates was 61,000 +/- 12,000 sea lampreys in Lake Michigan.

During 2006, sea lamprey numbers were greater than the Fish Community Objective target for Lake Michigan. Sea lamprey numbers were estimated to be 122,136 (112,332 – 132,760, 95% confidence interval), a significant increase from 2005 despite the decrease observed between 2004 and 2005 (see Fig. 5). Sea lamprey numbers were less than or within the target range prior to the 2000 spawning year, but showed a significant trend upward to a peak abundance of 164,695 during 2004 (154,259 - 178,649). Marking rates have trended upward but have been greater than target levels since 1995. Marking rates did not decline during 2005. These marking rates may be affected by the abundance of lake trout as well as the abundance of sea lampreys.

Control efforts have been targeted at all potential sources of the increase in sea lampreys in Lake Michigan. The upward trend in sea lamprey numbers over the period of observation may have been caused by changes in treatment effort, changes in treatment effectiveness, changes in the process used to select streams for treatment, and/or new untreated sources of sea lampreys. Sea lampreys in Lake Michigan are likely to be coming from all of these sources. Increased and improved control efforts should reduce their numbers toward target levels.

The Commission added staff and purchased additional TFM to increase treatments during 2006. The numbers of stream treatments declined in Lake Michigan during the late 1990s as the Commission focused efforts on the St. Marys River. The Commission increased the number of treatments in all lakes during 2001 with special emphasis on increasing suppression in Lake Michigan. More stream treatments were carried out on Lake Michigan during 2001 – 2006 than during the previous five years. Geographic efficiency was applied to expand the number of streams treated. Control crews added small streams that would not have ranked for treatment, but could be accomplished during field trips because they were located near other scheduled streams.

The control agents implemented options to improve treatment effectiveness during 2006. Stream treatment protocols were changed during the early 1990s to improve their efficiency and to use less TFM. Further changes were enacted during the late 1990s to protect young lake sturgeons. These changes may have reduced the effectiveness of the lampricide treatments. Options for improving treatment effectiveness were identified including: applying longer lampricide blocks, using higher concentrations, increasing secondary applications of lampricides to backwaters and small tributary confluences, and scheduling of streams to increase the likelihood of favorable flow conditions. The control agents used these options on streams where they believed the kill of larval sea lampreys could be increased.

Treatment effectiveness was improved further by reducing constraints on lampricide treatments that had been developed to protect the lake sturgeon. Following the Commission's guidance, the agents negotiated application of a modified sturgeon protocol with the states of Michigan, Wisconsin, and involved tribes during 2005 and 2006. This modified protocol increased applications of lampricides to normal concentrations, but still scheduled treatments of streams with sturgeon reproduction later during the year, when young lake sturgeon are less vulnerable.

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 to meet the objective of a 75% reduction in parasitic-phase sea lampreys and to support the other Fish Community Objectives. This target and range were calculated as 25% of the estimated average lake-wide population of sea lampreys during the 5-year period prior to the completion of

the Fish Community Objectives (1989–1993). Estimates of the numbers of spawning-phase sea lampreys were used as an indicator of parasitic-phase abundance in Lake Huron. The lake-wide population of spawning-phase sea lampreys was estimated from a combination of mark-recapture estimates of migrants in streams with traps and regression model-predicted numbers in streams without traps. These estimates are updated each year once the model is calibrated with new spawning-phase catch data. The other Great Lakes do not have explicit targets for sea lamprey abundance in their Fish Community Objectives. Instead, targets have been estimated for the other lakes based on observations of marking rates that were low enough to affect insignificant mortality on lake trout. The current calculated target population of sea lampreys in Lake Huron is 70,000 +/- 20,000.

During 2006, sea lamprey abundance was greater than the target level (157,286, 95% CI; 138,377 – 187,473) (Fig. 6). The population estimate increased from 2005. Sea lamprey abundance in Lake Huron has been greater than target levels throughout the last 20 years. During the 1990s there were more sea lampreys in Lake Huron than in all the other Great Lakes combined. Since 2001, the population estimates have been significantly lower than estimates during the previous 10 years. Wounding rates on lake trout have declined to a greater degree during the same period.

The abundance of sea lampreys in Lake Huron during the 1980s and 1990s was attributed to production from the St. Marys River, the large connecting channel with Lake Superior. The population of larval sea lampreys in the river was estimated at 5.2 million during the mid 1990s and was considered large enough to be producing the majority of sea lampreys feeding in the lake. The discharge of the St. Marys River precluded treatment with liquid TFM. During 1997, an innovative control program was implemented on the river that integrated spot treatments with Bayluscide 3.2% Granular Sea Lamprey Larvicide and the alternative control methods of trapping and sterile male release. During 1998-2001 the first full round of approximately 850 ha of spot treatments was completed. These spot treatments have contributed to the decline in sea lamprey numbers and marking rates observed since 2001. This integrated program continued through 2006 with spot treatments of the most densely populated areas (about 80 ha per year) and with increased trap capture of migrating adults combined with maximum release of sterilized males.

Lake Erie

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

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

The lake trout management plan for rehabilitation of self-sustaining stocks in the eastern basin of Lake Erie prescribed a maximum annual mortality of less than 40% to permit the establishment

and maintenance of suitable stocks of spawning adults. Mortality was to be controlled through management of fishery exploitation and continued suppression of sea lampreys.

During 2004, the Lake Erie Committee agreed to explicit target numbers of sea lampreys that will meet this Fish Community Objective by calculating the abundance of sea lampreys that have led to tolerable levels of mortality on lake trout in the past. The target and range were calculated from the average number of sea lampreys estimated for the 5-year period, 1991-1995, when marking rates were closest to 5 marks per 100 fish (4.4 A1-3 marks per 100 lake trout >21"). The lake-wide numbers of sea lampreys during that period 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. These model estimates are updated each year with new spawning-phase catch data. Marking rates of less than 5 per 100 fish correlate to an annual rate of sea lamprey induced mortality in lake trout of less than 5%, based on a relationship between marking rates and the probability of surviving a sea lamprey attack. Comparable targets for sea lamprey numbers that support the Fish Community Objectives have been calculated for the other lakes using this methodology. The current calculated target population for sea lampreys in Lake Erie is 4,000 +/- 2,000.

Sea lamprey abundance in Lake Erie was significantly greater than the target during 2006. The population of spawning phase sea lampreys during 2006 was estimated to be 15,874 (95% CI; 12,856-20,946) (Fig. 7). The precision of the 2006 estimate was improved because of successful operation of the Big Creek barrier and trap. The 2006 spawner population estimate is not significantly less than population estimates for years prior to the first treatment (1986). Marking rates also increased with significantly greater rates observed during fall 2005. This reflects feeding of sea lampreys observed spawning during 2006.

The initial round of stream treatments during 1986 and suppression during the following eight years resulted in an annual sea lamprey population within the target range. During the late 1990s sea lamprey numbers increased to pre-treatment levels, which was probably due to deferral of some treatments, failure to treat all sea lamprey-infested areas in some streams, and sub-optimal treatment efficacy resulting from changes in procedures to protect nontarget organisms. Extensive surveys of larval populations that considered all potential sources of sea lampreys resulted in successful stream treatments and suppression to target levels for four years. Since 2001 the Commission has increased treatment effort across the Great Lakes basin to improve suppression, and control has been increased on Lake Erie from the levels during the 1990s. In response to the increase observed in the 2006 spawning-phase numbers, five treatments of major producers were scheduled during 2006. The effect of this control effort will be evaluated during 2007 and 2008. Assessments of potential new sea lamprey producing streams and connecting channels and evaluations of larvae that have survived treatments remain a priority.

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 during 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 rate (A1) of lake trout larger than 431 mm is less than 2 marks/100 fish.

This objective is meant to maintain an annual survival rate of 60% or greater for lake trout 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 explicit target numbers for sea lampreys that will meet the Fish Community Objectives. A target and range for the numbers of sea lampreys were calculated from historical estimates during a 5-year period of tolerable wounding rates. First calculated using the same wound statistics as the other lakes (A1-3 marks), the target estimates were revised during 2006 using A1 marks because these fresh wounds were more consistently recorded on Lake Ontario. Also, a target wounding rate of less than two fresh wounds per 100 fish was explicitly identified as producing tolerable mortality in the lake trout rehabilitation plan. The sea lamprey target was calculated as the average number during the 5-year period, 1993-1997, when marking rates were closest to two marks per 100 fish (1.6 A1 marks per 100 lake trout >21"). The lake-wide numbers 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. These model estimates are updated each year with new spawning-phase catch data. The 2006 target calculated using all available data was 30,000 +/- 7,000 sea lampreys in Lake Ontario.

During 2006, the population of sea lampreys was estimated to be greater than the target range (60,014, 95% CI: 56,376-64,053; see Fig. 8). The spawning population increased to greater than target numbers beginning during 2004, however, sea lamprey population estimates were at or less than the target range for 9 of the 10 years prior to 2004. Wounding rates on lake trout varied around the target rate since 1997, but increased to 3.9 A1 marks per 100 fish during 2005. The difference between these indices may be a function of changes in the predator-prey ratio in Lake Ontario.

Recent increases in numbers suggest that more sea lampreys are surviving treatments. They may also continue to enter the lake from untreated sources such as historically uninfested streams or infested lentic areas. All streams considered regular sea lamprey producers have been treated in recent years. The Commission increased stream treatment effort during 2001 from levels applied during the latter 1990s to improve suppression in all lakes. On average, more lampricide treatments were conducted on Lake Ontario since 2001 than during the previous 5 years, due in part to the requirement to treat more residual populations. The 2002 treatment of the complicated and productive Black River may have been less effective than previous treatments

because it is suspected that the TFM:1.0% niclosamide predictive tables underestimate the minimum lethal concentration (MLC) for a tributary with low total alkalinity. The Black River was retreated in 2004 to eliminate a large residual population that was identified by post-treatment surveys. At the time of treatment flow-through toxicity testing demonstrated that the predicted MLC was at least 20% less than the concentration required to produce a 99.9% kill. Research will be conducted at the Upper Midwest Environmental Sciences Center (UMESC) in 2007 to investigate this issue. Larval sea lampreys were first detected in the Niagara River in 1987 and during 1999 the larval population was quantitatively estimated at 39,000. Larval sea lamprey catch for catch-per-unit-effort surveys in the Lower Niagara River peaked in 2002 at 82, which was more than double the total collected during three previous surveys. Two subsequent surveys in 2003 and 2006 produced 34 and 0 larvae, respectively. A1-A3 marking rates monitored by Environment Canada during spring lake trout surveys conducted off the mouth of the Niagara River between 2003 and 2006 increased from 2 to 32 marks per 100 lake trout, casting further suspicion on the Lower Niagara as a contributor of parasitic sea lampreys to Lake Ontario. The river will be examined during 2007 using RoxAnn seabed classification technology and Bayluscide 3.2% Granular Sea Lamprey Larvicide.

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 Bayluscide 3.2% Granular Sea Lamprey Larvicide to scheduled lentic areas. Specialized equipment and techniques are employed to provide concentrations of lampricides sufficient to eliminate 99.9% of the sea lamprey larvae while minimizing the risk to nontarget organisms. However, some areas within the stream may not receive a lethal dose of lampricides because of chemical and hydrological variations within the stream. This results in an average reduction of about 95% of the sea lamprey larvae in the stream. During recent years the combination of improved analytical and predictive techniques has allowed treatment personnel to reduce the amount of lampricide used (kg/yr) in Great Lakes tributaries by 35%. Table 1 summarizes 2006 lampricide applications in tributaries of the Great Lakes.

The Lampricide Control Task Force was established by the Commission 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 2006 report of the task force is presented on page 70.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes, 2006.

Lake	Number of streams	Discharge (m^3/s)	TFM[1] (kg)	Bayluscide[1] (kg)	Distance treated (km)
Superior	21	170.4	18,532.5	805.3	614.7
Michigan	19	119.4	19,397.6	236.2	838.7
Huron	14	44.2	5,786.2	543.4	386.8
Erie	5	21.5	3,582.9	0.6	217.4
Ontario	10	13.1	2,965.3	14.9	178.5
Total	**69**	**368.6**	**50,264.5**	**1,600.4**	**2,236.1**

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

Lake Superior

Lake Superior has 1,566 tributaries (733 U.S.**,** 833 Canada). One hundred forty-eight tributaries (94 U.S.**,** 54 Canada) have historical records of larval sea lamprey production, and of these, 75 tributaries (45 U.S.**,** 30 Canada) have been treated with lampricides at least once during 1997-2006. Fifty-one tributaries (34 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 2006. Table 2 provides details on the application of lampricides to tributaries treated during 2006 and Fig. 1 shows the locations of the tributaries.

- Treatments with lampricides were completed in 21 tributaries (17 U.S., 4 Canada).
- Mortality of nontarget organisms was negligible during all treatments.
- Stream discharge was low during treatments of the Traverse, Little Garlic, Huron, Silver, and Ravine rivers, and Lowney Creek. Low discharge made additional application sites necessary to effectively maintain lampricide concentrations. Extremely low discharge necessitated extensive spraying of TFM in the Little Garlic, Huron, and Ravine rivers, and Lowney Creek.
- The Sturgeon River was added to the treatment schedule to eliminate larvae that survived the previous treatment. The last treatment during 2005 was completed in high stream discharge and with low lampricide concentrations prescribed by the lake sturgeon protocol. Conditions during the 2006 treatment were different with low discharge and correspondingly higher minimum lethal concentrations of lampricides.

- Treatment of the Nemadji River was initiated further upstream than in past treatments. TFM was applied to Blackhoof Creek, which had not been treated previously.

- The Gratiot River was treated for the first time since 1984.

- The Dead River was treated for the first time since the flood during 2003. Extensive changes of the river channel had occurred and larval sea lampreys were found throughout many backwater areas that required spraying with TFM.

- Treatment of the upper AuTrain River required higher than normal amounts of lampricides. Drawdown of the Au Train Basin, necessary to complete repairs of control structures, created a combination of high discharge and high pH and alkalinity, which raised minimum lethal concentrations.

- The Pic River was treated with lampricide after two consecutive years of deferral due to high stream discharge.

- Larval sea lamprey mark-recapture population studies were conducted during the treatments of the Kaministiquia and Nipigon rivers.

- The Carp River (Canada) was added to the treatment schedule late in the season due to the presence of significant numbers of transforming sea lampreys upstream of the sea lamprey barrier dam. The lampreys resulted from a PhD thesis study that was completed during 2006.

- Treatments of the Pays Plat, Little Pays Plat, and Cloud rivers were deferred until 2007 due to insufficient stream discharge.

Table 2. Details on the application of lampricides to tributaries of Lake Superior, 2006 (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					
Black R. harbor (24)	May 31			10.2[3]	
Nemadji R. (25)	Jun 2	4.0	776.1	0	125.6
Gratiot R. (23)	Jun 16		22.4	0	3.2
Traverse R. (22)	Jun 17	0.1	40.5	0	14.5
Carp R. (14)	Jun 26	1.7	261.7	0	4.8
L. Garlic R. (16)	Jun 28	0.1	21.9	0	8.1
Dead R. (15)	Jul 5	2.3	197.2	0	1.6
Garlic R. (17)	Jul 6	1.0	129.8	0	9.7
Chocolay R. (13)	Jul 14	3.4	370.7	1.9	41.9
AuTrain R. (12)	Jul 18	3.3	628.5	1.8	12.9
Beaver Lake Cr. (11)					
Lowney Cr.	Jul 26	0.4	55.3	1.7[3]	3.2
Silver R. (20)	Sep 7	0.2	58.6	0	8.1
Ravine R. (19)	Sep 8	0.1	27.6	0	8.1
Sucker R. (10)	Sep 9	1.2	293.4	0	32.8
Huron R. (18)	Sep 11	0.3	101.6	0	14.5
Sturgeon R. (21)	Oct 8	6.7	889.4	9.5	83.7
Betsy R. (9)	Oct 12	1.5	89.0	0	15.4
Tahquamenon R. (8)	Oct 14	26.6	1,235.3	14.3	37.8
Total (U.S.)		52.9	5,199.0	39.4	425.9
Canada					
Chippewa R. (7)	Jun 29			117.7[3]	
Batchawana R. (6)	Jul 5			336.3[3]	
Pic R. (4)	Jul 13	15.2	2,624.8	47.8	99.6
Kaministiquia R. (1)	Jul 26	31.0	2,857.3	26.7	77.2
Gravel R. (3)	Aug 1			119.1[3]	
Nipigon R. (2)	Aug 15	70.0	7,780.0	118.3	4.2
Carp R. (5)	Nov 1	1.3	71.4	0	7.8
Total (Canada)		117.5	13,333.5	765.9	188.8
Total (for lake)		**170.4**	**18,532.5**	**805.3**	**614.7**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 124 TFM bars (25.8 kg active ingredient) applied in 11 streams.
[3]Includes Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to lentic areas.

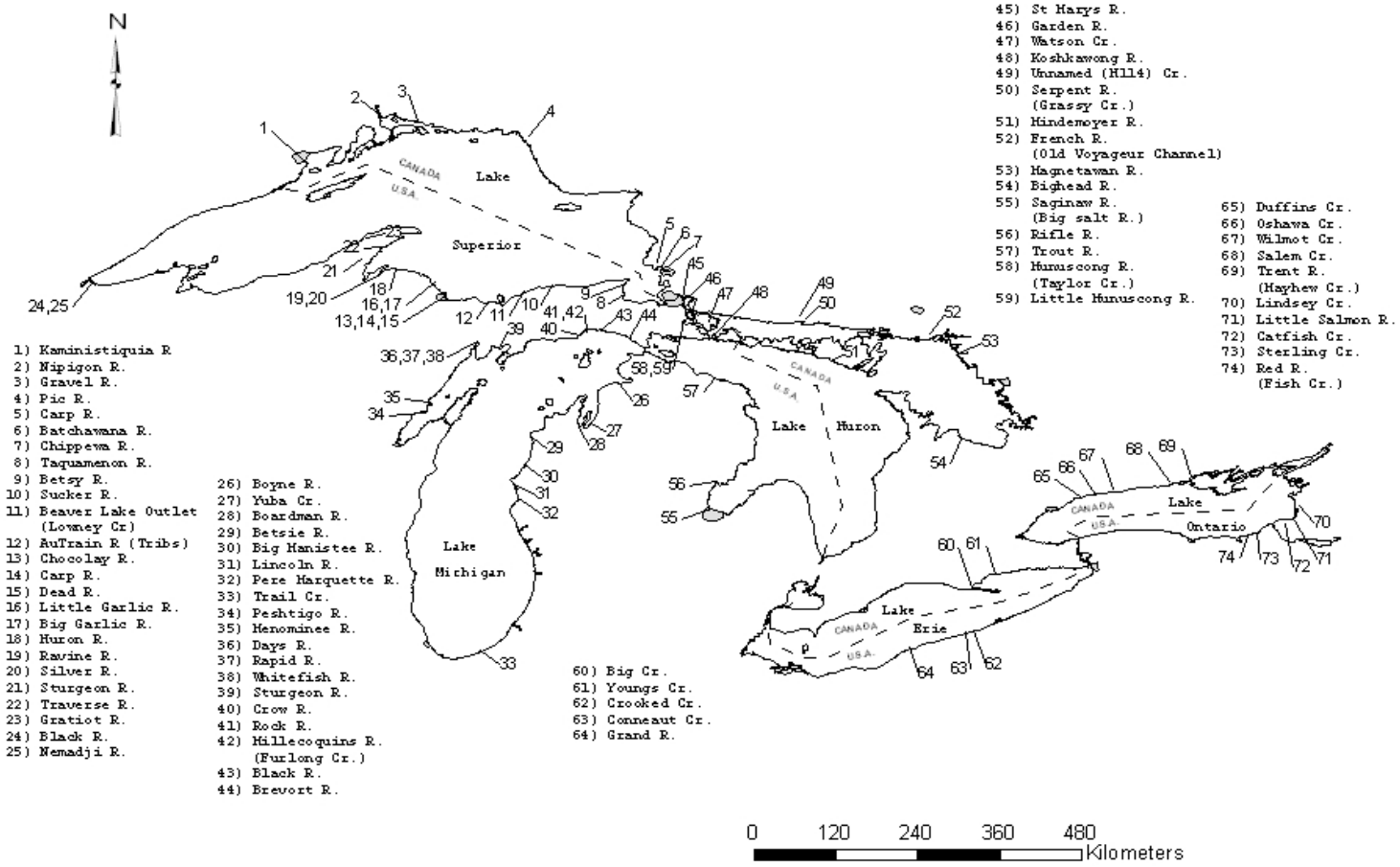

Fig. 1. Locations of tributaries treated with lampricides during 2006.

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-one tributaries have historical records of larval sea lamprey production, and of these, 68 tributaries have been treated with lampricides at least once during 1997-2006. Thirty-four tributaries are treated on a regular 3-5 year cycle.

The following statements highlight the lampricide control program for Lake Michigan during 2006. Table 3 provides details on the application of lampricides to tributaries treated during 2006 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in all 20 scheduled tributaries except Casco Creek, a tributary of the Kewaunee River that had not been treated previously. The treatment, scheduled for early October, was deferred due to the presence of many dead and dying spawning Chinook salmon.

- Several of the largest sea lamprey-producing tributaries of Lake Michigan were treated during 2006 including the Whitefish, Peshtigo, Big Manistee, Pere Marquette, and Sturgeon rivers. Ludington and Marquette Biological Station control crews treated the Pere Marquette River system, and the Big Manistee River system was treated by a combined crew from both U.S. stations and the Sault Ste. Marie, Ontario station.

- A modified lake sturgeon treatment protocol (*Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons* (Acipenser fulvescens)) was negotiated with the Michigan and Wisconsin Departments of Natural Resources. The Big Manistee, Whitefish, and Peshtigo rivers were treated according to the modified protocol, which limits lampricide concentrations to 1.4 times the minimum lethal concentration (the concentration required to kill 99.9% of sea lampreys during a 12-hour treatment). The modified protocol will continue to be followed until numbers of sea lampreys in Lake Michigan no longer exceed target levels.

- The Boyne River harbor in Lake Charlevoix was spot-treated with Bayluscide 3.2% Granular Sea Lamprey Larvicide. Infested areas in the Menominee and Boardman rivers were also spot-treated; this technique was used as an alternative to whole-volume TFM treatments of these streams. Some infested areas targeted on the Menominee River did not receive granular Bayluscide applications due to the presence of heavy aquatic plant growth and have been rescheduled for 2007.

- Stream discharges during lampricide treatments were highly variable. Discharge was low during treatments of the Rapid and Black rivers, and Furlong Creek, a tributary of the Millecoquins River. In contrast, rainfall prior to treatment of the Whitefish River resulted in high discharge that facilitated maintenance of lampricide concentrations.

- A mandatory adverse effects 6(a)(2) report was submitted to the U.S. Environmental Protection Agency after spawning Chinook salmon were killed during treatment of the Betsie River. Numbers of nontarget fish killed in other treatments were minimal.

Table 3. Details on the application of lampricides to tributaries of Lake Michigan during 2006 (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)
Rapid R. (37)	May 5	2.3	411.3	0.0	88.6
Whitefish R. (38)	May 7	14.2	2,085.8	7.9	96.6
Boyne R. (26)	May 17	3.4	465.8	20.5	6.4
Boardman R. (28)	May 19	0.4	105.8	0.4	5.8
Yuba Cr. (27)	May 18	0.4	58.1	0.0	1.6
Crow R. (40)	Jun 2	0.7	200.8	0.0	7.6
Millecoquins R.					
Furlong Cr. (42)	Jun 4	0.3	53.3	0.0	20.6
Rock R. (41)	Jun 4	0.2	39.0	0.0	1.6
Black R. (43)	Jun 17	0.3	150.1	0.0	22.5
Lincoln R. (31)	Jul 5	2.8	460.2	0.0	34.1
Sturgeon R. (39)	Jul 13	2.5	742.9	0.0	116.9
Trail Cr. (33)	Jul 29	2.0	459.2	0.0	26.6
Pere Marquette R. (32)	Aug 12	18.4	3,518.6	37.1	209.1
Big Manistee R. (30)	Aug 25	49.8	8,063.9	91.5	141.2
Betsie R. (29)	Sep 7	3.8	529.7	5.8	18.5
Brevort R. (44)	Oct 5	1.6	209.5	0.0	14.8
Days R. (36)	Oct 5	0.2	80.7	0.0	6.9
Menominee R. (35)	Oct 7			53.0	
Peshtigo R. (34)	Oct 9	16.1	1,762.9	20.0	19.3
Total		**119.4**	**19,397.6**	**236.2**	**838.7**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 411TFM Bars (85.8 kg active ingredient) applied in 12 streams.
[3]Includes 67.9 kg Bayluscide 3.2% Granular Sea Lamprey Larvicide

Lake Huron

Lake Huron has 1,761 tributaries (427 U.S., 1,334 Canada). One hundred seventeen tributaries (61 U.S., 56 Canada) have historical records of larval sea lamprey production, and of these, 68 tributaries (32 U.S., 36 Canada) have been treated with lampricide at least once during 1997-2006. Forty-five tributaries (23 U.S., 22 Canada) are treated on a regular 3-5 year cycle.

The following statements highlight the lampricide control program for Lake Huron during 2006. Table 4 provides details on the application of lampricides to tributaries treated during 2006 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in 14 tributaries (5 United States, 9 Canada) and the St. Marys River.

- A total of 96 ha (22 U.S., 74 Canada) of the St. Marys River was treated with Bayluscide 3.2% Granular Sea Lamprey Larvicide. Applications to waters on both sides of the international border were conducted by Department personnel.

- A 4.2 km section of the upper Little Munuscong River was not treated due to insufficient discharge.

- The Bighead River was added to the treatment schedule during October after significant numbers of metamorphosing sea lampreys were captured during late season surveys. However, only 8 of the targeted 57 km were exposed to lethal concentrations of lampricides due to rain storms. The treatment was deferred to 2007.

- A modified lake sturgeon treatment protocol (*Protocol for Application of Lampricides to Streams with Populations of Young-of-Year Lake Sturgeons (*Acipenser fulvescens)) was negotiated with the Michigan Department of Natural Resources. The modified protocol will continue to be followed until numbers of sea lampreys in Lake Huron no longer exceed target levels. The Rifle River was treated under the modified protocol which limits lampricide concentrations to 1.4 times the minimum lethal concentration (the concentration required to kill 99.9% of sea lampreys during a 12-hour treatment).

- A 50-person combined crew from the Marquette, Ludington, and Sault Ste. Marie offices treated the Rifle River in eastern Lower Michigan.

- The Trout River was treated for the second consecutive year to provide a lamprey-free environment for pheromone research.

- Department staff treated two streams in the eastern upper peninsula of Michigan, the Little Munuscong River and Taylor Creek, a tributary of the Big Munuscong River.

Table 4. Details on the application of lampricides to tributaries of Lake Huron during 2006 (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					
Saginaw R. (55)					
Big Salt R.	May 5	3.2	809.2	0	62.6
Big Munuscong R. (58)					
Taylor Cr.	Jun 27	0.5	149.9	0	9.2
Little Munuscong R. (59)	Jun 28	0.2	73.0	0	9.3
St. Marys R. (45)	Jul 21			120.6[3]	
Trout R. (57)	Jul 31	0.1	48.7	0	8.1
Rifle R. (56)	Sep 23	6.5	2,691.9	10.7	195.8
Total (for U.S.)		10.5	3,772.7	131.3	285.0
Canada					
Watson Cr. (47)	May 16	0.2	10.1	0	1.6
Mindemoya R. (51)	Jun 3	1.0	242.3	0	8.5
Magnetewan R. (53)	Jun 3	21.3	878.6	0.1	8.5
H-114 (49)	Jun 5	0.1	1.3	0	0.4
Serpent R. (50)					
Grassy Cr.	Jun 5	0.1	3.0	0	3.5
French R. (52)					
Old Voyageur Channel	Jun 6	6.5	131.2	0	1.4
Koshkawong R. (48)	Jun 8	0.2	22.3	0	1.6
Garden R. (46)	Jun 19	3.9	475.6	0.1	68.3
St. Marys R. (45)	Jul 13			411.9[3]	
Bighead R. (54)	Oct 27	0.4	249.1	0	8.0
Total (for Canada)		33.7	2,013.5	412.1	101.8
Total (for lake)		**44.2**	**5,786.2**	**543.4**	**386.8**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 149.5 TFM Bars (31.2 kg active ingredient) applied in 5 streams.
[3]Includes 532.5 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). Thirty tributaries (15 U.S., 15 Canada) have historical records of larval sea lamprey production, and of these, 9 tributaries (6 U.S., 3 Canada) have been treated with lampricide at least once during 1997-2006. Six tributaries (4 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 2006. Table 5 provides details on the application of lampricides to tributaries treated during 2006 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in five tributaries (3 U.S., 2 Canada).

- The Grand River and Conneaut and Crooked creeks were treated with composite crews of permanent personnel from Service and Department crews before the normal field season. This field trip was scheduled early to avoid the opening day of trout season in Pennsylvania. Snowfall that occurred prior to the start of these treatments kept stream discharges high and water temperatures cold.

- The Grand River treatment was interrupted by heavy rainfall that decreased TFM concentrations in the lower section of the river.

- During the treatment of Conneaut Creek the pH unexpectedly decreased in the lower section of the stream which increased toxicity to sensitive nontarget organisms; a 6(a)(2) report to the U. S. Environmental Protection Agency was filed for stonecats and mudpuppies. Mortality of nontarget organisms was negligible for other treatments.

- Venison Creek, a tributary to Big Creek, was treated upstream of the sea lamprey barrier dam due to the presence of two age classes of larval lampreys.

Table 5. Details on the application of lampricides to tributaries of Lake Erie during 2006 (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					
Grand R (64)	Apr 6	10.8	1,128.2	0	35.4
Conneaut Cr. (63)	Apr 9	4.2	698.5	0	96.6
Crooked Cr. (62)	Apr 9	0.8	173.1	0	10.6
Total (for U.S.)		15.8	1,999.8	0	142.6
Canada					
Youngs Cr. (61)	Sep 7	0.8	154.6	0	0.3
Big Cr. (60)	Sep 9	4.9	1,428.5	0.6	74.5
Total (for Canada)		5.7	1,583.1	0.6	74.8
Total (for lake)		**21.5**	**3,582.9**	**0.6**	**217.4**

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

Lake Ontario

Lake Ontario has 659 tributaries (254 U.S., 405 Canada). Sixty-one tributaries (30 U.S., 31 Canada) have historical records of larval sea lamprey production, and of these, 39 tributaries (18 U.S., 21 Canada) have been treated with lampricide at least once during 1997-2006. Twenty-nine tributaries (16 U.S., 13 Canada) are treated on a regular 3-5 year cycle.

The following statements highlight the lampricide control program for Lake Ontario during 2006. Table 6 provides details on the application of lampricides to tributaries treated during 2006 and Fig. 1 shows the locations of the tributaries.

- Lampricide treatments were completed in 10 tributaries (5 U.S., 5 Canada).

- Red Creek was added to the treatment schedule because larval surveys conducted during the spring of 2006 indicated the presence of significant numbers of larvae of transformable size.

- Treatments were initiated upstream of the normal application sites on Sterling and Catfish creeks due to the presence of larval lampreys upstream of previously impassable structures.

- A larval sea lamprey mark-recapture population study was conducted during treatment of Oshawa Creek.

Table 6. Details on the application of lampricides to tributaries of Lake Ontario during 2006 (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					
Catfish Cr. (72)	Apr 22	1.7	239.3	0	14.1
Little Salmon R. (71)	Apr 25	3.8	394.5	0	37.9
Lindsey Cr. (70)	Apr 28	0.6	83.4	0	9.8
Sterling Cr. (73)	Apr 30	2.2	635.9	0	27.5
Red Cr. (74)	May 2	0.5	233.9	0	10.9
Total (for U.S.)		8.8	1,587.0	0	100.2
Canada					
Trent R. (69)					
Mayhew Cr.	May 26	0.4	118.5	0	2.4
Oshawa Cr. (66)	May 26	1.1	360.9	0	19.5
Salem Cr. (68)	May 27	0.2	55.8	0	2.1
Wilmot Cr. (67)	May 28	0.8	333.8	0	18.8
Duffins Cr. (65)	May 30	1.8	509.3	0	35.5
Trent R. (69)	Sep 6			14.9	
Total (for Canada)		4.3	1,378.3	14.9	78.3
Total (for lake)		**13.1**	**2,965.3**	**14.9**	**178.5**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 38.3 TFM bars (8.0 kg active ingredient) applied in 4 streams.
[3]Bayluscide 3.2% Granular Sea Lamprey Larvicide applied to the Trent River.

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 over 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 during 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 during 2003. The report of progress of the Task Force is presented on page 80.

Highlights of the SMRT program during 2006 are presented in Table 7 and include the following:

- 27,193 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Amnicon (216), Au Sable (88), Bad (498), Betsie (434), Boardman (126), Brule (41), Cheboygan (4,562), East Au Gres (12), Echo (1,113), Greene (19), Koshkawong (76), Manistee (514), Manistique (6,349), Menominee (124), Middle (797), Muskegon (512), Ocqueoc (1,596), Pere Marquette (130), Peshtigo (1,294), St. Joseph (178), St. Marys (6,024), Thessalon (923), Tittabawassee (28), and Trout (7) rivers, Carp Lake Outlet (332), and Humber River/Duffins Creek (1,200).

- 25,879 sterilized male sea lampreys were released in the St Marys River during May-July (Table 7). The estimated resident population of spawning-phase sea lampreys in the St Marys River was 24,836 (16,167 males). Assessment traps removed 10,127 sea lampreys (6,878 males), an estimated reduction of 41% from trapping. The ratio of sterile to resident male sea lampreys remaining in the St Marys River was estimated at 3:1 (25,879 sterile: 9,562 resident).

- The estimated reduction from trapping and sterile male release was 84% during 2006. The estimated reduction from trapping and sterile male release averaged 87% during 1997-2006.

- The release of sterile males combined with trapping reduced the estimated number of effective fertile females in the river from about 8,669 to 1,389 during 2006.

- A total of 671 grams of Bisazir was used during 2006. Injections averaged 25 mg per sea lamprey.

Table 7. Effects of trapping and sterile-male-release, and predicted suppression of sea lamprey reproduction in the St. Marys River during 1997-2006.

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Population estimate	8,162	20,235	19,860	38,829	25,311	13,619	27,011	19,864	18,790	24,836
Males (%)	56	57	60	64	63	63	66	70	64	65
Lampreys removed by traps (%)	30	35	53	48	45	59	33	27	45	41
Sterile males released	17,181	16,743	26,285	43,184	31,459	22,684	27,963	26,472	30,581	25,879
Ratio sterile to untreated males	5.4:1	2.2:1	4.7:1	3.3:1	3.6:1	6.4:1	2.3:1	2.6:1	4.6:1	3:1
Reduction in reproduction (%)[1]	89	80	92	88	88	94	80	80	90	84
Spawning females[2]	402	1,771	638	1,670	1,113	289	1,860	1,203	673	1,389

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

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

Barriers

The *Strategic Vision of the Great Lakes Fishery Commission for the First Decade of the New Millennium* contains a milestone which states that 50% of sea lamprey suppression and a 20% reduction in TFM use will be accomplished through alternative control technologies, including barriers. Ultimately, supression will be measured in terms of reductions in larval sea lamprey production. While estimates of larval production suppressed by barriers are developed, an interim measure of preferred (Type 1) larval sea lamprey habitat was used as a surrogate to measure the contribution of barriers to the Commission's vision. 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 2006, the Commission's network of 69 sea lamprey barriers in the Great Lakes eliminated over 11% 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 on page 76.

Lake Superior

Presently, there are 15 sea lamprey barriers on Lake Superior (Fig. 2).

New Construction

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

Operation and Maintenance of Existing Barriers

- Service and Department personnel performed routine maintenance and safety inspections on 12 barriers (5 U.S., 7 Canada).

- Wolf River - Long Point Conservation Authority was contracted to inspect the barrier. The barrier was extended on the east bank and a steel lip was added.

- Furnace Creek - The stop-log barrier was operational from February 22 through September 6.

- Big Carp River - The stop-log barrier was operational from April 18 through July 20.

- Little Carp River - The stop-log barrier was operational from April 19 through July 21.

- Stokely and Gimlet creeks - Contracts were let and completed for repair of areas damaged by rust.

- Sheppard Creek - The barrier was decommissioned after the gabions and concrete deteriorated beyond repair.

- Miners River - A breach in the barrier was discovered during 2004. Repairs are scheduled pending completion of the environmental assessment.

Ensured Blockage at Other Barriers

- Trout Brook (Silver Creek Road) and Billy Creek - The U.S. Fish and Wildlife Service, Ashland Fishery Resource Office consulted with Marquette Biological Station (MBS) personnel regarding culvert replacements to enhance fish passage in the Bad River system. MBS staff determined that the proposed projects would not affect sea lamprey control efforts.

Lake Michigan

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

New Construction

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

- The Paw Paw River sea lamprey barrier project was terminated due to concerns about the reliability of variable crest technology.

Operation and Maintenance of Existing Barriers

- Carp Lake River – A final inspection was completed and the barrier and sea lamprey trap were operational during the spawning run. The trap was modified to eliminate escapement and improve serviceability. New valves will be installed during 2007 to better control attraction water intake.

- Pere Marquette River – The electrical barrier was activated from March 2 through July 31. The fishway was operated seven days per week from March 2 through June 23 and during weekdays from June 24 through July 31. The fishway passed 6,549 steelhead, 18,806 suckers, 195 brown trout, and 124 Chinook salmon. A total of 512 sea lampreys were captured. The barrier and fishway will continue to be operated and evaluated for one more treatment cycle. The 89 percent reduction of metamorphosed sea lampreys upstream of the barrier and the contribution of this technology to the effort to move toward target levels in Lake Michigan influenced this decision.

- Jordan River – The Commission decided not to operate the electrical barrier because it was not effectively blocking spawning sea lampreys.

- Service personnel performed routine maintenance and safety inspections on eight barriers. Bracing was installed under the lip on the West Branch Whitefish River barrier.

Ensured Blockage at Other Barriers

- Boardman River – Mark Breederman of the Boardman River Dams Settlement Agreement Implementation Team was contacted to ensure that sea lamprey management interests would be considered in removal and modification projects proposed for several dams in this system. Modification of the Union Street dam fish ladder to pass lake sturgeons was discussed.

- Green River (Jordan River) – The USFWS Green Bay Fishery Resource Office (USFWS-GBFRO), Michigan Department of Natural Resources (MDNR), and MBS continue coordination efforts to remove a dam on this tributary.

- Antrim Creek (Jordan River) – The USFWS-GBFRO consulted MBS on a dam removal project. MBS staff determined that removal would not affect sea lamprey control efforts.

- Dair Creek (Betsie River) – The MDNR consulted the MBS on the removal of a dam upstream of the Homestead Dam on the Betsie River. MBS staff determined that removal would not affect sea lamprey control efforts.

- Stover Creek – MBS continued coordination with the Irish Boat Shop, owner of a dam located near the mouth, to ensure that the rebuilt structure remains a sea lamprey barrier.

Lake Huron

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

New Construction

- A new barrier project in development for the Au Gres River was placed on hold due to lack of funding from the U.S. Army Corps of Engineers.

- New barrier projects were in development for the Black Mallard River and Schmidt Creek.

- Bighead River - Stream fish community assessments were conducted for a second year as part of the environmental assessment required prior to construction of a proposed barrier.

- St. Marys River - Construction of the Sault Edison trap was completed for the 2006 trapping season. Only 5 of the 10 traps were operational due to low water levels; attractant flow was low or non-existent at the entrance of the traps. The traps captured 182 sea lampreys. Modifications to increase the flow will be completed prior to the 2007 trapping season.

Operation and Maintenance of Existing Barriers

- MBS and Department personnel performed routine maintenance and safety inspections on 11 barriers (5 U.S. and 6 Canada).

- Albany Creek - The lift gate barrier was operational from March 7 through August 4.

- Greene Creek - The stop-log barrier was operational from March 22 through September 1.

- Ocqueoc River - The electrical barrier was operational from March 20 through August 1. Smith-Root completed changes to the automated system so the electrical component of the barrier will be operational by March 1, 2007. Erosion on the access road and around the abutments was repaired. Deeper jumping pools have improved fish passage, and trap efficiency was increased by 14%.

- Browns Creek - Stream banks were stabilized to prevent erosion and the jumping pool downstream of the barrier was deepened to ensure that a one-foot vertical drop between the crest of the barrier and the tail-race was maintained to prevent lamprey escapement upstream.

Ensured Blockage at Other Barriers

- Potagassining River - The Michigan Department of Natural Resources consulted with MBS personnel regarding dam removal to enhance fish passage. MBS staff determined that modifications would not affect sea lamprey control efforts.

- Saugeen River – The Department participated in a steering committee formed by Ontario Ministry of Natural Resources (OMNR) to formulate a strategy to repair Dennys Dam. Construction of the dam was jointly funded by OMNR and the Department during 1969 for the purpose of blocking sea lampreys.

Lake Erie

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

Operation and Maintenance of Existing Barriers

- Department personnel performed routine maintenance and safety inspections on eight barriers in Canada.

- Long Point Conservation Authority inspected five Lake Erie barriers. Increased inspection frequency promotes early detection of potential problems that could lead to escapement or dam safety issues.

- Big Creek - Repairs made to the inflatable crest during 2005 improved spawning-phase trapping operations during 2006 and contributed significantly to the lake-wide population

estimate. Larval collections during the fall lampricide treatment indicated that the barrier was effective in blocking the 2006 spawning migration.

- Venison Creek – Escapement of spawning sea lampreys made treatment necessary during 2006. It has since been discovered that a local farmer has periodically manipulated stop-logs at the barrier. The Department will replace two missing stop-logs at the dam and a lock will be installed to prevent tampering.

Ensured Blockage at Other Barriers

- Euclid Creek – MBS staff are working with the Euclid Watershed Council to replace an existing dam with a sea lamprey barrier.

- Ashtabula River - The Ohio Department of Natural Resources consulted with MBS staff regarding removal of the Haddock Road Dam to enhance fish passage. MBS staff determined that modifications would not affect sea lamprey control efforts.

Lake Ontario

Presently, there are 15 sea lamprey barriers on Lake Ontario tributaries (Fig. 2).

New Construction

- Pekin Brook (Salmon River) - Department personnel met with New York Department of Environmental Conservation staff in Altmar, New York to discuss a proposal to construct a sea lamprey barrier. Initial site selection was completed.

Operation and Maintenance of Existing Barriers

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

- Salmon River - Fences were installed as a public safety and security measure.

Ensured Blockage at Other Barriers

- Shelter Valley Creek - The lease agreement has expired at this barrier site and the landowner has informed the Department that they may request the removal of the barrier.

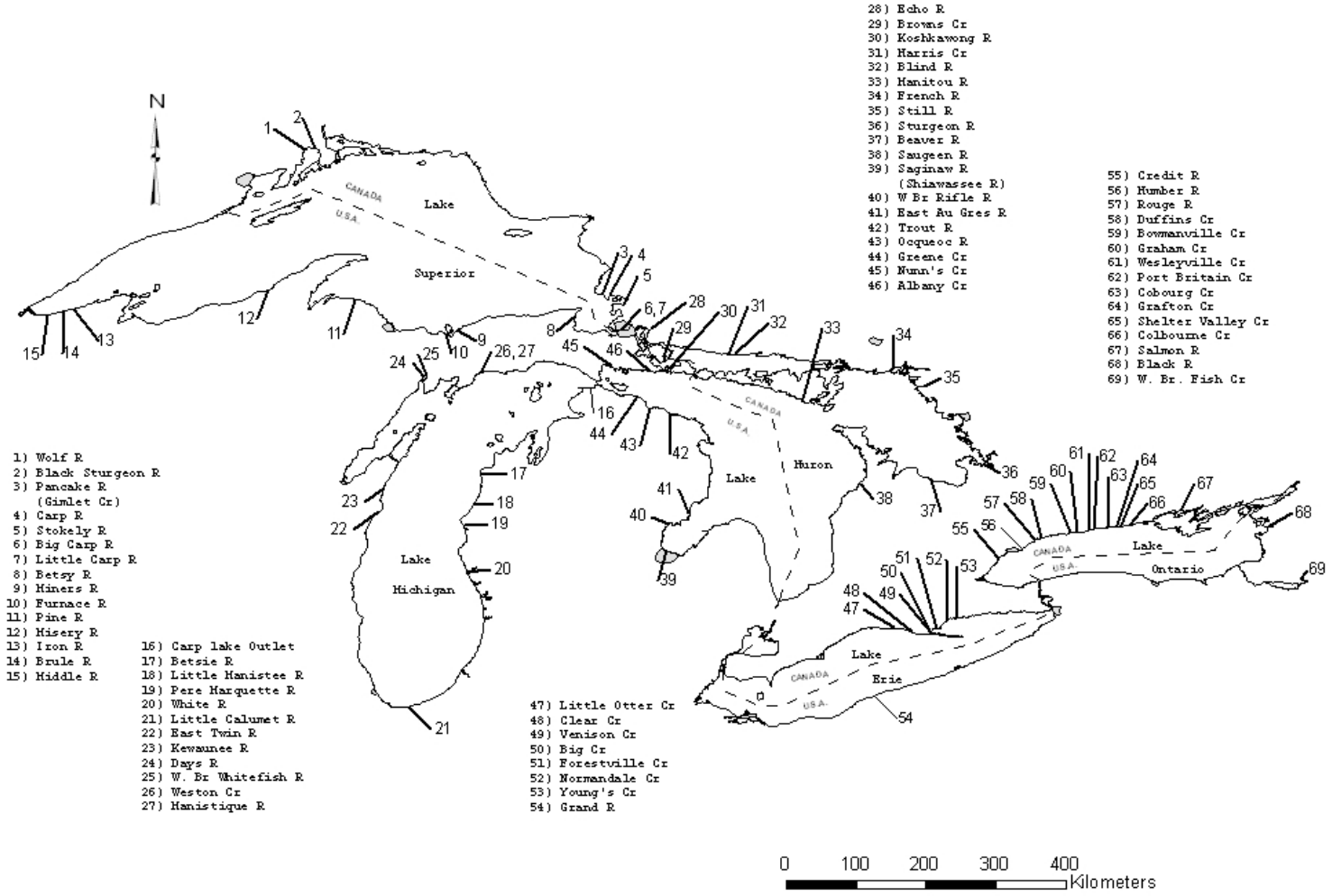

Fig. 2. Locations of tributaries with sea lamprey barriers.

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 numbers and distribution of larvae in deepwater areas.

Tributaries considered for lampricide treatment during 2007 were assessed during 2006 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 2007 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 2007 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 74.

Lake Superior

- Qualitative assessments of larval sea lamprey populations were conducted in 72 tributaries (54 U.S., 18 Canada) and offshore of 13 U.S. tributaries. These data were used to update the status of larval sea lamprey populations in historically infested Lake Superior tributaries and lentic areas (Tables 8 and 9).

- Populations of larval sea lampreys were estimated in 30 tributaries (17 U.S., 13 Canada; Table 8) and offshore of 8 Canadian tributaries.

- Post-treatment assessments were conducted in 15 tributaries (11 U.S., 4 Canada) to determine the effectiveness of lampricide treatments during 2005 and 2006 (Table 8). Post-treatment populations of larval sea lampreys were estimated in two U.S. tributaries (Carp and Bad rivers) and one Canadian tributary (Jackfish River).

- Assessments to detect the presence of new larval sea lamprey populations were conducted in seven tributaries (2 U.S., 5 Canada).

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

- Paired quantitative assessment and catch-per-unit-effort samplings were conducted cooperatively with researchers from Michigan State University in 11 tributaries (6 U.S., 5 Canada) as part of a study designed to evaluate an alternative model for selecting streams for lampricide application.

- The St. Louis River was evaluated during 2006. Dredge samples and GIS technology were used to map larval habitat in the mainstream. Granular Bayluscide was applied to fifty-five 518 m^2 plots of optimal larval habitat; a total of 18 sea lamprey larvae were recovered. Tributaries to the St. Louis River were evaluated with backpack electrofishing units, but no sea lamprey larvae were recovered.

- A mark-recapture estimate of the larval and recently metamorphosed lamprey populations was made in conjunction with the lampricide treatment of the lower Nipigon River. The estimated populations (95% confidence intervals) are 140,567 (43,810-237,324) larval and 5,104 (659-9,550) metamorphosed sea lampreys. Population estimates were also made during the lampricide treatment of a portion of the lower Kaministiquia River from upstream of Old Fort William to the turning basin at the pulp mill downstream of Highway 61. Population estimates for this portion of the lower Kaministiquia River are 1,205,250 (524,060-1,886,440) larval and 5,319 (1,583-9,055) metamorphosed sea lampreys. Both estimates of larval lamprey numbers are 3 to 4 times greater than model estimates based on data collected during 2005. Estimates of metamorphosed lamprey numbers are more variable, with model estimates of 15,693 for the lower Nipigon River and 1,135 for the treated portion of the lower Kaministiquia River. Both streams remained cost-effective to treat regardless of which estimate of metamorphosed sea lamprey numbers is used.

- The Ministry of Natural Resources and Department biologists are evaluating a proposal to modify or remove the Black Sturgeon River Dam to enhance walleye reproduction. The dam is currently a barrier to sea lampreys. An estimate was made of the population of northern brook lampreys (*Ichthyomyzon fossor*) in the area between the outflow of Eskwanonwatin Lake and the current sea lamprey barrier at the Camp 43 dam to provide a surrogate for sea lamprey production potential. The population was estimated to be 14,741,410 larvae and 115,066 metamorphosed sea lampreys. Any action that would enable passage of sea lampreys above the dam would likely result in a significant increase in parasitic sea lampreys and treatment costs.

Table 8. Status of larval sea lampreys in Lake Superior tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed in 2006.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment)		Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
			Residuals present	Recruitment evident			
United States							
Waiska R.	Aug-01	Jul-06	Yes	Yes	4,843	2,648	**2007**
Sec. 11 SW Trib.	Never	Sep-04	---	Yes	---	---	Unknown
Pendills Cr.	Sep-88	Jun-06	---	Yes	---	---	Unknown
Grants Cr.	Jul-63	Jul-06	---	Yes	362	5	Unknown
Naomikong Cr.	Jul-63	Jun-04	---	No	---	---	Unknown
Ankodosh Cr.	Jul-73	Jun-06	---	Yes	990	14	Unknown
Roxbury Cr.	Never	Jun-06	---	Yes	686	1	Unknown
Galloway Cr.	Jun-92	Aug-06	---	Yes	232	1	**2007**
Tahquamenon R.	Oct-06	Aug-06	---	---	---	---	Unknown
Betsy R.	Oct-06	Jun-05	---	---	---	---	Unknown
Three Mile Cr.	Jun-62	Jun-04	---	No	---	---	Unknown
Little Two Hearted R.	Sep-04	Jun-05	Yes	No	---	---	2008
Two Hearted R.	Aug-04	Jun-05	Yes	No	---	---	2008
Dead Sucker R.	Jul-75	Jun-06	---	No	---	---	Unknown
Sucker R. (Alger)	Sep-06	Jun-06	---	---	---	---	2010
Chipmunk Cr.	Sep-62	Jul-04	---	No	---	---	Unknown
Carpenter Cr.	Aug-05	May-05	---	---	---	---	Unknown
Sable Cr.	Sep-89	Jul-05	---	Yes	---	---	Unknown
Hurricane R.	Never	Jul-04	---	No	---	---	Unknown
Sullivans Cr.	Jul-04	Jul-04	---	---	---	---	Unknown
Seven Mile Cr.	Jul-67	Jul-06	---	No	---	---	Unknown
Beaver Lake Cr. – Lowney Cr.	Jul-06	Oct-05	---	---	---	---	Unknown
Mosquito R.	Jun-73	Jul-03	---	Yes	---	---	Unknown
Miners R. barrier downstream	Jun-04	Jun-03	---	---	---	---	**2007**
Miners R. barrier to Miners Falls	Sep-77	Jul-06	---	Yes	9,964	104	**2007**
Munising Falls Cr.	Sep-64	Jun-05	---	No	---	---	Unknown
Anna R.	Sep-65	Jun-06	---	No	---	---	Unknown
Furnace Cr.	Sep-93	Oct-06	---	Yes	7,421	271	**2007**
Five Mile Cr.	Oct-98	Jun-06	No	Yes	---	---	**2007**
Au Train R. (upper)	Jul-06	Jun-06	---	---	---	---	Unknown
Au Train R. (Buck Bay Cr.)	Jul-06	Oct-05	---	---	---	---	Unknown
Au Train R. (lower)	Aug-97	Oct-05	---	No	---	---	Unknown
Rock R.	Jul-02	Jun-05	No	No	---	---	Unknown
Deer Lake Cr.	Aug-70	Jun-06	---	No	---	---	Unknown
Laughing Whitefish R.	Jul-05	Oct-05	No	No	---	---	Unknown
Sand R.	Jul-85	Jun-05	---	No	---	---	Unknown
Chocolay R.	Jul-06	Sep-06	No	Yes	---	---	2009
Carp R.	Jun-06	Aug-06	Yes	Yes	472	0	Unknown
Dead R.	Jul-06	Jul-05	---	---	---	---	Unknown
Harlow Cr.	Jul-02	Jul-06	Yes	Yes	---	---	**2007**
Little Garlic R.	Jun-06	Aug-06	Yes	No	---	---	2009
Garlic R. (entire)	Jul-06	Aug-06	Yes	No	---	---	2009

Table 8. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Salmon Trout R. (Marquette)	Jul-05	Oct-06	No	Yes	---	---	2008
Pine R.	Jul-04	Jul-06	No	No	---	---	Unknown
Huron R.	Sep-06	Oct-06	Yes	No	---	---	2010
Ravine R.	Sep-06	Oct-06	Yes	No	---	---	**2007**
Slate R.	Sep-85	Aug-04	---	No	---	---	Unknown
Silver R.	Sep-06	Oct-06	No	No	---	---	**2007**
Falls R.	Sep-97	Jun-06	No	Yes	---	---	**2007**
Six Mile Cr.	May-63	Jul-04	---	No	---	---	Unknown
Sturgeon R.	Oct-06	Sep-06	---	---	---	---	2010
Pilgrim R.	Aug-62	Sep-04	---	No	---	---	Unknown
Trap Rock R.	Aug-05	Sep-05	No	---	---	---	2009
McCallum Cr.	Aug-63	Sep-05	---	No	---	---	Unknown
Traverse R.	Jun-06	Oct-06	Yes	Yes	---	---	2010
Little Gratiot R.	Aug-72	Sep-05	---	No	---	---	Unknown
Eliza Cr.	Oct-77	Jul-06	---	Yes	3,789	103	**2007**
Gratiot R.	Jun-06	Jul-06	Yes	No	---	---	Unknown
Smiths Cr.	May-64	Jul-04	---	No	---	---	Unknown
Boston-Lily Cr.	Aug-62	Jul-04	---	No	---	---	Unknown
Salmon Trout R. (Houghton)	Aug-92	Aug-06	---	Yes	---	---	Unknown
Mud Lake Outlet	Oct-73	Sep-05	---	No	---	---	Unknown
Graveraet R.	Aug-63	Jun-06	---	No	---	---	Unknown
Elm R.	Jun-84	Jun-06	---	Yes	---	---	Unknown
Misery R.							
barrier downstream	Sep-00	Jun-06	Yes	Yes	---	---	**2007**
Misery R.							
barrier upstream	Sep-00	Sep-05	Yes	No	---	---	Unknown
East Sleeping R.	Aug-04	Sep-05	No	Yes	---	---	2008
Firesteel R.	May-05	Sep-05	No	---	---	---	2008
Ontonagon R.	Jul-05	Sep-06	Yes	Yes	---	---	2008
Potato R.	May-05	Jun-06	Yes	No	---	---	2008
Floodwood R.	Never	May-00	---	No	---	---	Unknown
Cranberry R.	May-05	Sep-05	Yes	---	---	---	2008
Little Iron R.	Sep-75	Aug-04	---	No	---	---	Unknown
Union R.	May-64	Aug-04	---	No	---	---	Unknown
Black R.	Aug-88	Sep-92	---	No	---	---	Unknown
Montreal R.	Jul-75	Aug-03	---	No	---	---	Unknown
Washington Cr.	Jun-80	Sep-04	---	No	---	---	Unknown
Bad R.	Sep-05	Sep-06	Yes	Yes	1,893,608	18,993	**2007**
Fish Cr.- Eileen Twp.	Sep-80	Jul-06	---	Yes	---	---	**2007**
Red Cliff Cr.	Jun-04	Jul-06	Yes	Yes	6,802	257	**2007**
Raspberry R.	Jun-63	Jun-04	---	No	---	---	Unknown
Sand R.	Oct-91	Jul-06	---	Yes	130	0	Unknown
Cranberry R.	Never	Jun-06	---	No	---	---	Unknown
Iron R.							
barrier downstream	Never	Aug-06	---	Yes	---	---	Unknown
barrier upstream	Never	Aug-04	---	No	---	---	Unknown

Table 8. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Poplar R.	Aug-03	Aug-06	No	Yes	58,272	246	**2007**
Middle R. barrier downstream	Jun-02	Aug-06	No	Yes	28,700	782	**2007**
Amnicon R.	Jun-04	Jun-06	Yes	Yes	---	---	**2007**
Nemadji R. (entire)	Jun-06	Aug-06	No	Yes	---	---	Unknown
St. Louis R.	Sep-87	Jul-06	---	Yes	---	---	Unknown
Sucker R.	Never	Jul-06	---	No	---	---	Unknown
Gooseberry R.	Aug-76	Jul-06	---	No	---	---	Unknown
Splitrock R.	Aug-76	Jul-06	---	No	---	---	Unknown
Poplar R.	Jul-77	Jul-06	---	No	---	---	Unknown
Arrowhead R.	Sep-83	Jul-06	---	Yes	---	---	Unknown
Canada							
East Davignon Cr.	May-72	Jun-06	No	No	---	---	Unknown
West Davignon Cr.	Jun-04	Jun-06	Yes	No	---	---	2009
Little Carp R.	Sep-01	Jun-06	Yes	Yes	192	42	2008
Big Carp R.	Sep-01	Aug-06	Yes	Yes	22,025	350	**2007**
Cranberry Cr.	Jun-04	Jul-05	No	No	---	---	2010
Goulais R.	Jun-05	Jun-06	Yes	Yes	---	---	2009
Bostons Cr.	Never	Jul-05	---	No	---	---	Unknown
Horseshoe Cr.	Never	Jul-05	---	No	---	---	Unknown
Haviland Cr.	Never	Jul-05	---	Yes	---	---	Unknown
Stokely Cr.	Sep-00	Jul-06	Yes	Yes	---	---	Unknown
Tier Cr.	Never	Jul-05	---	No	---	---	Unknown
Harmony R.	Jun-90	Jul-06	No	Yes	500	0	Unknown
Sawmill Cr.	Jun-68	Jul-05	No	No	---	---	Unknown
Jones Landing Cr.	Never	Jun-00	---	No	---	---	Unknown
Tiny Cr.	Never	Jul-05	---	No	---	---	Unknown
Chippewa R.	Oct-04	Jul-06	Yes	Yes	---	---	2010
Unger Cr.	Never	Jun-00	---	No	---	---	Unknown
Batchawana R.	Jul-03	Jul-06	Yes	Yes	435,679	3,159	**2007**
Digby Cr.	Never	Jul-05	---	No	---	---	Unknown
Carp R.	Nov-06	Sep-06	---	---	---	---	2010
Pancake R.	Sep-04	Jul-05	Yes	Yes	---	---	2009
Westman Cr.	Never	Sep-04	---	Yes	---	---	Unknown
Agawa R.	Jul-01	Jun-06	Yes	Yes	6,040	449	**2007**
Sand R.	Sep-71	Jun-06	No	No	---	---	Unknown
Baldhead R.	Never	Jun-06	---	No	---	---	Unknown
Gargantua R.	Aug-04	Jun-06	No	Yes	---	---	2009
Michipicoten R.	Aug-04	Jun-06	Yes	Yes	---	---	2009
Dog R.	Aug-63	Jul-02	No	No	---	---	Unknown
White R.	Aug-05	Jun-06	No	No	---	---	2010
Pic R.	Jul-06	Jul-03	---	---	---	---	2012
Little Pic R.	Sep-94	Jul-06	No	Yes	5,116	5	Unknown
Prairie R.	Jul-94	Jul-06	No	No	---	---	Unknown
Steel R.	Aug-04	Jul-06	Yes	Yes	---	---	2008

Table 8. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Gravel R.	Aug-04	Aug-05	Yes	Yes	---	---	2009
Little Gravel R.	Jul-03	Aug-06	Yes	Yes	5,445	20	2008
Cypress R.	Jul-03	Aug-06	Yes	Yes	36,902	400	**2007**
Jackpine R.	Never	Aug-05	---	No	---	---	Unknown
Jackfish R.	Nov-05	Aug-06	Yes	Yes	8,556	377	**2007**
Nipigon R.							
Upper Nipigon R.	Aug-03	Aug-06	Yes	Yes	---	---	2009
Lower Nipigon R.	Aug-06	Aug-06	---	---	---	---	Unknown
Cash Cr.	Aug-03	Jul-05	No	Yes	---	---	2009
Polly Cr	Jul-87	Jul-04	No	No	---	---	Unknown
Stillwater Cr.	Aug-05	Jul-04	---	---	---	---	2010
Otter Cove Cr.	Aug-71	Jul-02	No	No	---	---	Unknown
Black Sturgeon R.	Aug-05	Aug-04	---	---	---	---	2011
Big Squaw Cr.	Jun-72	Aug-05	No	No	---	---	Unknown
Wolf River	Jul-03	Aug-06	Yes	Yes	722,516	1,558	**2007**
Coldwater Creek	Never	Aug-06	---	Yes	92,139	567	**2007**
Pearl R.	Aug-04	Aug-06	Yes	Yes	---	---	2009
Blende Cr.	Aug-64	Aug-05	No	No	---	---	Unknown
MacKenzie R.	Sep-78	Aug-06	No	Yes	---	---	Unknown
Neebing-McIntrye Floodway	Aug-97	Aug-06	No	Yes	28,269	148	**2007**
Kaministikwia R.	Aug-02	Aug-06	Yes	Yes	---	---	2010
Cloud R.	Jul-94	Aug-05	No	Yes	17,908	1,840	**2007**
Pine R.	Jul-73	Aug-05	No	No	---	---	Unknown
Pigeon R.	Aug-99	Aug-06	No	Yes	32,573	288	**2007**

Table 9. Status of larval sea lampreys in historically infested lentic areas of Lake Superior during 2006.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Grants Cr.	Tahquamenon Bay	Sep-05	Never	Never
Ankodosh Cr.	Tahquamenon Bay	Aug-06	Aug-06	Never[2]
Roxbury Cr.	Tahquamenon Bay	Aug-06	Aug-06	Never[2]
Galloway Cr.	Tahquamenon Bay	Aug-04	Jul-88	Never
Sucker R.	Grand Marais Harbor	Aug-04	Aug-90	Never
Beaver Lake Outlet	Beaver Lake (Lowney Cr. - offshore)	Jul-06	Jul-06	Never[2]
Anna R.	Munising Bay	Aug-06	Aug-06	Never[2]
Furnace Cr.	Furnace Bay	Sep-04	Sep-04	Never[2]
	Furnace Lake (Hanson Cr. - offshore)	Aug-01	Sep-79	Never
	Furnace Lake (Gongeau Cr.- offshore)	Aug-01	Sep-79	Never
Dead R.	Presque Isle Harbor	Jul-06	Jul-06	Never[2]
Harlow Cr.	Harlow Lake (Bismark Cr.- offshore)	Jul-06	Jul-06	Never[2]
Little Garlic R.	Little Garlic R.	Sep-05	Jul-86	Never
Garlic R.	Garlic R.	Sep-05	Sep-05	Never[2]
Ravine R.	Huron Bay	Jul-06	Jul-06	Aug-87
Slate R.	Huron Bay	Jul-91	Aug-82	Never
Silver R.	Huron Bay	Aug-04	Aug-04	Never[2]
Falls R.	Huron Bay	Jul-06	Jul-06	Never[1]
Trap Rock R.	Torch Lake	Aug-06	Aug-06	Never[2]
Eliza Cr.	Eagle Harbor	Jul-03	Sep-78	Never
Black R.	Black River Harbor	Sep-06	Sep-05	May-06
Fish Cr. (Eileen Twp.)	Chequamegon Bay	Aug-06	Aug-06	Never[2]
Red Cliff Cr.	Buffalo Bay	Jul-05	Jun-97	Never
Canada				
Goulais R.	Goulais Bay	Jul-92	Jul-88	Aug-85
Haviland Cr.	Haviland Bay	Jul-06	Jul-06	Never[2]
Stokely Cr.	Haviland Bay	Jul-06	Jul-06	Aug-85
Harmony R.	Batchawana Bay	Jul-06	Jul-06	Aug-87
Chippewa R.	Batchawana Bay	Jul-06	Jul-06	Aug-87
Batchawana R.	Batchawana Bay	Aug-05	Aug-05	Aug-05
Carp R.	Batchawana Bay	Jul-06	Jul-06	Aug-85
Gravel R.	Mountain Bay	Aug-06	Aug-06	Aug-05
Little Gravel R.	Mountain Bay	Aug-06	Aug-06	Aug-05
Little Cypress R.	Nipigon Bay	Aug-78	Aug-78	Never
Cypress R.	Cypress Bay	Aug-05	Aug-05	Aug-05
Jackpine R.	Nipigon Bay	Jul-02	Jul-89	Never
Jackfish R.	Nipigon Bay	Aug-05	Aug-05	Never[2]
	Lake Helen	Aug-06	Aug-06	Aug-03
	Nipigon Bay	Jul-03	Jul-03	Aug-05
Nipigon R.	Polly Lake	Aug-05	Jul-90	Jul-87
Black Sturgeon R.	Black Bay	Jul-04	Jul-04	Never[2]
Wolf R.	Black Bay	Jul-04	Jul-04	Never[2]
MacKenzie R.	MacKenzie Bay	Aug-06	Aug-06	Aug-05
Current R.	Thunder Bay	Aug-05	Aug-05	Never[2]
Neebing-McIntyre Floodway	Thunder Bay	Aug-05	Jul-90	Never
Pigeon R.	Pigeon Bay	Aug-76	Aug-76	Never

[1]Scheduled for treatment during 2007

[2]Low-density larval populations monitored with granular Bayluscide surveys

Lake Michigan

- Assessments of sea lamprey larvae were conducted in 78 tributaries and offshore of 18 tributaries. These data were used to update the status of larval sea lamprey populations in streams and lentic areas with a history of sea lamprey production (Tables 10 and 11).

- Larval populations were estimated in 25 tributaries for potential lampricide treatment during 2007 (Table 10).

- Post-treatment assessments were conducted in 20 tributaries to determine the effectiveness of lampricide treatments during 2005 and 2006. Post-treatment larval populations were estimated in six tributaries (Trail Creek and the Black, Sturgeon, Whitefish, Cedar, and Oconto rivers).

- Assessments to detect the presence of new sea lamprey populations were conducted in three tributaries along the east shore and four tributaries along the west shore. One new population was found offshore of the Escanaba River, Delta County, MI.

- Paired quantitative assessment and catch-per-unit-effort sampling methods were conducted cooperatively with researchers from Michigan State University in 19 tributaries as part of a larger project to test a potentially more efficient sampling method for selecting streams for lampricide application. Personnel from the Marquette and Ludington Biological stations participated in mark-recapture estimates of larval sea lamprey populations in Trail Creek and the Boyne, Betsie, Lincoln, and Crow rivers as an additional component to this study. Researchers from Michigan State University used the mark-recapture estimates to evaluate which larval assessment sampling methodology results in the most cost-effective method of ranking streams for lampricide application.

Table 10. Status of larval sea lampreys in Lake Michigan tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed during 2006.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment)		Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
			Residuals present	Recruitment evident			
Brevort R. (Lower)	Oct-06	Aug-06	---	---	---	---	2010
Brevort R. (Upper)	Oct-87	Aug-06	---	Yes	8,539	4	2008
Paquin Cr.	Oct-87	May-06	---	Yes	---	---	2008
Davenport Cr.	Aug-63	May-06	---	Yes	---	---	2008
Hog Island Cr.	May-04	May-06	Yes	Yes	---	---	**2007**
Sucker R.	Jun-61	Jun-05	---	Yes	---	---	Unknown
Black R.	Jun-06	Oct-06	Yes	Yes	3,377	7	2009
Mile Cr.	Sep-72	Aug-06	---	Yes	58	0	2009
Millecoquins R.							
Upper	May-91	Oct-06	---	Yes	17,671	266	**2007**
McAlpine Cr.	May-86	Oct-06	---	Yes	29,884	2	**2007**
Furlong Cr.	May-06	Jul-06	Yes	Yes	---	---	**2007**
Rock R.	May-06	Sep-06	No	Yes	---	---	2009
Crow R.	May-06	Sep-06	No	Yes	---	---	2009
Cataract R.	Aug-04	May-04	---	---	---	---	2008
Pt. Patterson Cr.	Sep-83	May-06	---	No	---	---	Unknown
Hudson Cr.	May-98	Sep-06	No	Yes	6,542	11	2008
Swan Cr.	Jul-92	Jun-04	No	No	---	---	Unknown
Seiners Cr.	May-84	Jun-04	No	No	---	---	Unknown
Milakokia R.	Jun-04	Oct-06	Yes	Yes	---	---	**2007**
Bulldog Cr.	Jun-97	Jun-06	---	Yes	---	---	2008
Gulliver Lake Outlet	May-00	May-06	No	Yes	386	82	**2007**
Marblehead Cr.	May-05	Jun-04	---	---	---	---	2009
Manistique R.							
Above Dam	Oct-04	Jun-06	Yes	Yes	---	---	**2007**
Below Dam	Oct-04	Sep-06	Yes	Yes	---	---	**2007**
Estuary	Oct-04	Sep-06	Yes	Yes	---	---	**2007**
Southtown Cr.	Jun-77	Jun-06	---	Yes	---	---	2008
Thompson Cr.	Never	Aug-94	---	No	---	---	Unknown
Johnson Cr.	Aug-81	Jun-04	---	Yes	---	---	2008
Deadhorse Cr.	Jul-04	Jun-03	---	---	---	---	2008
Gierke Cr.	Never	Jun-04	---	Yes	---	---	2009
Bursaw Cr.	Jul-04	Jun-05	Yes	Yes	---	---	2009
Parent Cr.	Jun-91	Aug-06	---	Yes	216	11	2008
Poodle Pete Cr.	Aug-01	Jun-05	No	No	---	---	Unknown
Valentine Cr.	Jun-97	Jun-05	---	Yes	---	---	2010
Little Fishdam R.	May-01	Jul-04	No	No	---	---	2010
Big Fishdam R.	Aug-04	Oct-06	---	---	26,352	26	2008
Sturgeon R.	Jun-03	Oct-06	Yes	Yes	25,689	276	2008
Ogontz R.	Jul-03	Sep-06	Yes	Yes	---	---	**2007**
Squaw Cr.	Aug-00	Jun-04	---	---	---	---	Unknown
Hock Cr,	May-81	Sep-06	---	No	---	---	Unknown
Whitefish R.	May-06	Sep-06	Yes	Yes	---	---	2009
Rapid R.	May-06	Sep-06	No	No	---	---	2009
Tacoosh R.	Jun-04	Jun-06	Yes	Yes	---	---	**2007**
Days R.	Oct-06	Sep-06	---	---	---	---	**2007**
Portage Cr.	Sep-05	Jun-05	---	---	---	---	2008

Table 10. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Ford R.	Jun-05	Jun-06	Yes	Yes	---	---	2008
Sunnybrook Cr.	May-71	May-05	---	No	---	---	Unknown
Bark R.	Oct-03	Sep-06	Yes	Yes	127,972	1,072	**2007**
Cedar R.	Jun-05	Oct-06	Yes	Yes	403,329	3,980	**2007**
Sugar Cr.	Aug-77	Jun-05	---	Yes	---	---	2008
Arthur Bay Cr.	Apr-70	May-05	---	No	---	---	Unknown
Rochereau Cr.	Apr-63	Jul-04	---	No	---	---	Unknown
Johnson Cr.	Apr-63	Jul-04	---	No	---	---	Unknown
Bailey Cr.	May-02	Sep-06	No	Yes	7,596	2	**2007**
Beattie Cr.	Oct-01	Sep-06	No	Yes	---	---	**2007**
Springer Cr.	May-99	Jul-05	No	Yes	---	---	2008
Menominee R.	Oct-06	Sep-06	---	Yes	---	---	**2007**
Little R.	Aug-87	Sep-04	---	No	---	---	Unknown
Peshtigo R.	Oct-06	Sep-04	---	---	---	---	2009
Oconto R.	Jul-05	Oct-06	Yes	Yes	776	71	2008
Pensaukee R.	Nov-77	Aug-06	---	No	---	---	Unknown
Suamico R.	Never	Sep-05	---	No	---	---	Unknown
Ephraim Cr.	Apr-63	May-03	---	No	---	---	Unknown
Hibbards Cr.	May-02	Aug-06	No	Yes	8,379	100	**2007**
Whitefishbay Cr.	May-87	Aug-06	---	No	---	---	Unknown
Lilly Bay Cr.	Apr-63	May-03	---	No	---	---	Unknown
Bear Cr.	May-75	May-03	---	No	---	---	Unknown
Door Co. 23 Cr.	May-79	Aug-06	---	Yes	75	1	**2007**
Ahnapee R.	Apr-64	Sep-04	---	No	---	---	Unknown
Three Mile Cr.	May-75	Aug-06	---	Yes	1,007	26	2008
Kewaunee R.	May-75	Sep-04	---	No	---	---	Unknown
Casco Cr.	Never	Sep-05	---	Yes	---	---	**2007**
East Twin R.	Jun-04	Jun-03	---	---	---	---	2008
Fischer Cr.	May-87	Sep-04	---	No	---	---	Unknown
Carp Lake R.	Oct-04	Aug-06	Yes	Yes	---	---	Unknown
Big Stone Cr.	May-97	Aug-05	No	Yes	2,541	226	**2007**
Big Sucker R.	May-89	Aug-06	No	Yes	8,251	203	**2007**
Wycamp Lake Outlet	May-00	Jun-05	No	No	---	---	Unknown
Horton Cr.	Oct-04	Jul-06	No	Yes	---	---	Unknown
Boyne R.	May-06	Jul-06	Yes	---	---	---	2010
Porter Cr.	Oct-04	Jul-06	Yes	Yes	---	---	Unknown
Jordan R.	Jul-02	Oct-06	Yes	Yes	122,751	15,767	**2007**
Monroe Cr.	Oct-72	Jul-06	No	Yes	854	16	**2007**
Loeb Cr.	Oct-04	Aug-04	---	---	---	---	Unknown
McGeach Cr.	Oct-99	Jun-05	No	No	---	---	Unknown
Elk Lake Outlet	Sep-04	Jul-06	No	---	---	---	Unknown
Yuba Cr.	May-06	Jun-06	No	---	---	---	Unknown
Acme Cr.	Aug-63	Jun-06	No	No	---	---	Unknown
Mitchell Cr.	Sep-03	Jun-06	No	Yes	---	---	2009
Boardman R.	May-06	May-06	No	---	---	---	Unknown
Leo Cr.	Never	May-04	---	No	---	---	Unknown
Goodharbor Cr.	Oct-01	Sep-06	No	Yes	38,351	38	**2007**

Table 10. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Crystal R.	Oct-72	May-04	No	No	---	---	Unknown
Platte R. (upper)	Jul-03	Sep-06	Yes	Yes	885,938	1,710	**2007**
Platte R. (middle)	Jul-01	Sep-06	Yes	Yes	324,129	2,446	**2007**
Platte R. (lower)	Sep-04	Sep-06	Yes	Yes	---	---	**2007**
Betsie R.	Sep-06	Sep-06	No	---	---	---	2010
Bowen Cr.	Never	Jul-04	---	No	---	---	Unknown
Big Manistee R.	Aug-06	Sep-06	Yes	---	---	---	Unknown
L. Manistee R.	Jul-04	Sep-06	No	Yes	---	---	2008
Gurney Cr.	Jul-05	Aug-06	Yes	No	---	---	Unknown
Cooper Cr.	Never	Jun-05	---	Yes	---	---	Unknown
Lincoln R.	Jul-06	Sep-06	Yes	---	---	---	2010
Pere Marquette R.	Aug-06	Sep-06	No	---	---	---	Unknown
Bass Lake Outlet	Aug-78	Jul-04	No	No	---	---	Unknown
Pentwater R. (North Br.)	Jul-03	Jun-06	No	Yes	77,418	8,491	**2007**
Lambricks Cr.	Sep-84	Jun-05	No	No	---	---	Unknown
Stony Cr.	Jul-87	Jun-05	No	Yes	---	---	Unknown
Flower Cr.	Sep-81	Sep-05	No	No	---	---	Unknown
White R.	Aug-05	Aug-06	Yes	Yes	30,642	10,611	**2007**
Duck Cr.	Jul-84	Jun-06	No	No	---	---	Unknown
Muskegon R.	Aug-05	Jun-06	Yes	No	---	---	2008
Brooks Cr.	Aug-05	Jul-05	---	---	---	---	2009
Cedar Cr.	Aug-05	Jul-05	---	---	---	---	2009
Bridgeton Cr.	Jul-04	Jun-06	No	No	---	---	2008
Minnie Cr.	Aug-04	Jun-06	No	Yes	---	---	2008
Bigelow Cr.	Aug-05	May-05	---	---	---	---	2009
Black Cr.	Aug-70	Jun-04	No	Yes	---	---	Unknown
Grand R.	Never	Sep-03	---	No	---	---	Unknown
Norris Cr.	Jun-00	Aug-06	No	Yes	1,195	744	**2007**
Lowell Cr	Sep-65	Aug-05	No	No	---	---	Unknown
Buck Cr.	Sep-65	Aug-05	No	No	---	---	Unknown
Rush Cr.	Sep-65	Aug-05	No	No	---	---	Unknown
Sand Cr.	Sep-96	Aug-06	No	Yes	1,279	521	**2007**
Crockery Cr.	Sep-04	Sep-04	No	---	---	---	Unknown
Bass R.	Aug-04	Sep-03	---	---	---	---	Unknown
Pigeon R.	Oct-64	Jun-04	No	No	---	---	Unknown
Pine Cr.	Oct-64	Jun-04	No	No	---	---	Unknown
Gibson Cr.	Jul-84	Sep-04	No	No	---	---	Unknown
Kalamazoo R.	Never	Jul-02	---	No	---	---	Unknown
Bear Cr.	Aug-04	Sep-04	No	---	---	---	Unknown
Sand Cr.	Aug-04	Sep-04	Yes	---	---	---	Unknown
Mann Cr.	Jul-02	Aug-06	No	Yes	1,387	93	**2007**
Rabbit R.	Jul-81	Oct-05	No	Yes	---	---	Unknown
Swan Cr.	Jul-77	Aug-06	No	Yes	---	---	Unknown
Allegan 3 Cr.	Sep-65	Jun-04	No	No	---	---	Unknown
Allegan 4 Cr.	Oct-78	Jun-06	No	Yes	---	---	Unknown
Allegan 5 Cr.	Never	Jun-04	---	No	---	---	Unknown

Table 10. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Black R.	Jun-01	Jun-04	No	No	---	---	Unknown
Brandywine Cr.	Oct-85	Jun-06	No	Yes	---	---	Unknown
Rogers Cr.	May-98	Jun-06	No	No	---	---	Unknown
St. Joseph R.	Never	Jul-02	---	Yes	---	---	Unknown
Pipestone Cr.	Aug-03	Jun-06	No	No	---	---	Unknown
Meadow Dr.	Oct-65	May-03	No	No	---	---	Unknown
Hickory Cr.	Oct-65	May-03	No	No	---	---	Unknown
Paw Paw R.	May-05	Oct-05	No	No	---	---	2008
Blue Cr.	May-01	Jun-06	No	No	---	---	Unknown
Mill Cr.	May-05	Oct-05	No	No	---	---	2008
Brandywine Cr.	May-05	Oct-05	No	No	---	---	2008
Brush Cr.	May-05	Oct-05	No	No	---	---	2008
Galien R. (N. Br.)	May-02	Sep-06	Yes	Yes	169	93	**2007**
E. Br. Galien & Dowling Cr.	May-02	Sep-06	No	Yes	59	57	**2007**
S. Br. Galien & Galina Cr.	Oct-05	Jun-06	Yes	---	---	---	2009
Spring Cr.	Oct-05	Jun-06	No	---	---	---	2009
South Br. Spring Cr.	Oct-05	Jun-06	No	---	---	---	2009
State Cr.	May-86	Jul-04	No	No	---	---	Unknown
Trail Cr.	Jul-06	Aug-06	No	---	---	---	2010
Donns Cr.	May-66	Jun-06	No	No	---	---	Unknown
Burns Ditch	Jul-99	Jul-04	No	No	---	---	Unknown

Table 11. Status of larval sea lampreys in historically infested areas of Lake Michigan during 2006.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Hog Island Cr.	Hog Island Cr. (Offshore)	Aug-06	Aug-06	Never[1]
Black R.	Black R. (Offshore)	Aug-06	Aug-06	Never[2]
Milakokia R.	Seul Choix Bay	Jul-86	Aug-80	Never
Manistique R.	Manistique R. (Offshore)	Sep-06	Sep-06	Aug-03
Bursaw Cr.	Bursaw Cr. (Offshore)	Jul-86	Jul-76	Never
Ogontz R.	Ogontz R. (Offshore)	Sep-06	Aug-05	Never[2]
Whitefish R.	Big Bay De Noc	Jul-97	Aug-93	Never
Rapid R.	Little Bay De Noc	Aug-88	Jul-80	Never
Days R.	Little Bay De Noc	Jul-06	Jul-06	Never[2]
Escanaba R.	Little Bay De Noc	Jul-06	Jul-06	Never[2]
Portage Cr.	Portage Bay	Jul-84	Jul-77	Never
Ford R.	Green Bay	Jun-87	Jun-84	Never
Cedar R.	Green Bay	Jul-06	Jul-06	Never[2]
Beattie Cr.	Green Bay	Jul-85	Jul-85	Never
Menominee R.	Green Bay	Sep-06	Sep-06	Never[2]
Whitefish Bay Cr.	Whitefish Bay	Sep-06	Never	Never
Carp Lake R.	Cecil Bay	Aug-06	Aug-06	Never[2]
Bear R.	Little Traverse Bay	May-06	May-06	Never[1]
Horton Cr.	Horton Bay (Lake Charlevoix)	Jul-06	Jun-04	Never[2]
Boyne R.	Boyne Harbor (Lake Charlevoix)	May-04	May-04	May-06
Porter Cr.	Lake Charlevoix	Jul-06	Jul-06	Never[2]
Jordan R.	Lake Charlevoix	Jul-06	Jul-06	Never[1]
Monroe Cr.	Lake Charlevoix	Jul-06	Jul-06	Never[2]
Mitchell Cr.	Grand Traverse Bay (East Arm)	May-04	May-04	Never[2]
Boardman R.	Grand Traverse Bay (West Arm)	Jun-06	May-04	Never[2]
Leland R.	Leland R. (Offshore)	May-06	May-06	Never[2]
Platte R.	Loon Lake	Sep-00	Aug-96	Never
	Platte Lake	Jul-03	Jul-03	Never[2]
Betsie R.	Betsie Lake	Aug-83	Aug-83	Never[2]
Big Manistee R.	Manistee Lake	Sep-06	Aug-90	Never

[1] Scheduled for treatment during 2007.
[2] Low-density larval populations monitored with granular Bayluscide surveys.

Lake Huron

- Qualitative assessments of larval sea lamprey populations were conducted in 64 tributaries (34 U.S., 30 Canada) and offshore of 4 tributaries (3 U.S., 1 Canada). These data were used to update the status of larval sea lamprey populations in historically infested Lake Huron tributaries and lentic areas (Tables 12 and 13).

- Populations of larval sea lampreys were estimated in 25 tributaries (13 U.S., 12 Canada; Table 12 and offshore of 1 Canadian tributary.

- Post-treatment assessments were conducted in 16 tributaries (7 U.S., 9 Canada) to determine the effectiveness of lampricide treatments during 2005 and 2006 (Table 12). Post-treatment populations of larval sea lampreys were estimated in two Canadian tributaries (Timber Bay Creek and Naiscoot River).

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in 25 tributaries (4 U.S., 21 Canada).

- Paired quantitative assessment and catch-per-unit-effort samplings were conducted cooperatively with researchers from Michigan State University in 12 tributaries (10 U.S., 2 Canada) as part of a study designed to evaluate an alternative model for selecting streams for lampricide application. Personnel from the Marquette Biological Station participated in production of mark-recapture estimates of larval sea lamprey populations in the Little Munuscong and Big Munuscong rivers as an additional component to this study. Researchers from Michigan State University used the mark-recapture estimates to evaluate which larval assessment sampling methodology results in the most cost-effective method of ranking streams for lampricide application.

- Larval sea lampreys were collected from one tributary for ongoing migratory pheromone research being conducted by Michigan State University and the University of Minnesota, and from two U.S. tributaries for statolith microchemistry research being conducted by the National Oceanic and Atmospheric Administration, Ann Arbor, Michigan.

- Monitoring of larval sea lampreys in the St. Marys River continued during 2006. Approximately 1,000 sites were sampled with 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 2.0 million (95% CI, 1.5.-2.5 million).

- A mark-recapture estimate of the larval sea lamprey population was made in conjunction with the lampricide treatment of the Mindemoya River. The estimated population is 21,205 (95% CI, 18,407-24,003). This estimate of larval lamprey numbers is lower than the model estimate of 31,215 sea lamprey larvae, forecast from data collected during 2005. Due to the timing of the treatment during early June, sea lampreys did not show external evidence of metamorphosis, so no estimate of the abundance of recently metamorphosed sea lampreys was possible.

Table 12. Status of larval sea lampreys in Lake Huron tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed in 2006.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Proposed Next Treatment Year
United States							
Mission Cr.	Never	Jul-06	---	No	---	---	Unknown
Frenchette Cr.	Never	Aug-07	---	No	---	---	Unknown
Ermatinger Cr.	Never	Aug-07	---	No	---	---	Unknown
Charlotte R.	Oct-81	Aug-04	No	No	---	---	Unknown
Little Munuscong R.	Jun-06	Jul-06	No	No	---	---	Unknown
Big Munuscong R. (Mainstream)	Jun-99	Aug-04	No	No	---	---	Unknown
Big Munuscong R. (Taylor Creek)	Jun-06	Jul-06	No	No	---	---	Unknown
Carlton Cr.	Sep-01	Jun-05	No	No	---	---	2009
Canoe Lake Outlet	May-70	Jul-04	No	No	---	---	Unknown
Caribou Cr.	Jun-04	Sep-06	Yes	Yes	3,685	20	**2007**
Bear Lake Outlet	Jun-77	May-06	No	No	---	---	Unknown
Carr Cr.	May-78	Jun-06	---	No	---	---	Unknown
Joe Straw Cr.	May-75	Jun-05	No	No	---	---	Unknown
Huron Point Cr.	Never	May-06	---	No	---	---	Unknown
Albany Cr.	Sep-01	May-06	Yes	Yes	---	---	**2007**
Trout Cr.	Oct-05	Sep-04	---	No	---	---	2009
Beavertail Cr.	Jun-05	Jul-06	Yes	Yes	---	---	2009
Prentiss Cr.	May-01	May-04	No	No	---	---	Unknown
McKay Cr.	Sep-01	Sep-06	Yes	Yes	24,522	2,943	**2007**
Flowers Cr.	Sep-83	May-02	No	No	---	---	Unknown
Ceville Cr.	Sep-05	Sep-04	---	No	---	---	2009
Hessel Cr.	Jun-04	Oct-06	Yes	Yes	1,915	0	2008
Steeles Cr.	May-05	Oct-04	---	No	---	---	2009
Nunns Cr.	Sep-01	Jul-06	No	Yes	---	---	Unknown
Pine R.	Jun-06	Jun-06	Yes	Yes	---	---	2008
McCloud Cr.	Oct-72	Jul-06	No	No	---	---	Unknown
Carp R.	Sep-03	Aug-06	Yes	Yes	---	---	**2007**
Martineau Cr.	Oct-93	Oct-06	---	Yes	1,375	135	**2007**
266-20 Cr.	Aug-76	Jun-04	No	No	---	---	Unknown
Beaugrand Cr.	Never	May-02	---	No	---	---	Unknown
Little Black R.	May-67	Sep-04	No	No	---	---	Unknown
Cheboygan R.	Oct-83	May-06	No	Yes	---	---	Unknown
Laperell Cr.	May-00	Jun-05	No	No	---	---	Unknown
Meyers Cr.	Sep-99	Jun-05	No	No	---	---	Unknown
Maple R.	Sep-03	Aug-06	No	Yes	46,112	637	**2007**
Pigeon R.	Sep-03	Aug-06	No	Yes	90,341	2,092	**2007**
Little Pigeon R.	Aug-98	Oct-06	No	No	---	---	Unknown
Sturgeon R.	Aug-04	May-04	---	---	---	---	2008
Elliot Cr.	May-04	Jun-04	No	---	---	---	2008
Greene Cr.	Oct-01	Aug-06	No	Yes	1,196	147	**2007**
Grass Cr.	May-78	May-03	No	No	---	---	Unknown
Mulligan Cr.	May-94	Jun-04	No	No	---	---	Unknown
Grace Cr.	Jun-05	Sep-06	Yes	Yes	---	---	2008
Black Mallard Cr.	May-03	Oct-06	Yes	Yes	97,400	4,542	**2007**
Seventeen Cr.	May-67	May-03	No	No	---	---	Unknown
Ocqueoc R.	Jul-02	Sep-06	Yes	Yes	---	---	Unknown
Johnny Cr.	Sep-70	May-03	No	No	---	---	Unknown

Table 12. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Proposed Next Treatment Year
Schmidt Cr.	Jun-04	Sep-06	No	Yes	---	---	2008
Trout R.	Aug-06	Jul-06	Yes	Yes	---	---	Unknown
Swan R.	May-96	Sep-06	No	Yes	148,364	601	**2007**
Middle Lake Outlet	Jun-67	Sep-04	No	No	---	---	Unknown
Grand Lake Outlet	Never	Jun-05	---	No	---	---	Unknown
Long Lake Cr.	Jun-04	Sep-06	Yes	Yes	30,571	1,286	**2007**
Squaw Cr.	Jun-67	May-03	No	No	---	---	Unknown
Devils R.	Jun-04	Sep-06	No	Yes	---	---	2008
Black R.	May-03	Sep-06	Yes	Yes	157,967	4,120	**2007**
Au Sable R.	Aug-03	Sep-06	Yes	Yes	4,128,933	54,912	**2007**
Pine R.	May-87	May-03	No	No	---	---	Unknown
Tawas Lake Outlet	Jun-03	Aug-06	No	No	---	---	Unknown
Cold Cr.	Jun-03	Aug-06	No	No	---	---	Unknown
Sims Cr.	Sep-05	Oct-05	No	No	---	---	2009
Grays Cr.	Sep-05	Oct-05	Yes	No	---	---	2009
Silver Cr.	Sep-05	Oct-05	Yes	No	---	---	2009
East Au Gres R.	Aug-05	Oct-05	Yes	No	---	---	2009
Au Gres R.	Jun-04	Oct-06	No	Yes	272,453	3,015	**2007**
Rifle R.	Sep-06	Oct-06	Yes	---	---	---	2010
Saginaw R.							
Cass R.	Oct-84	Jul-05	No	Yes	---	---	Unknown
Juniata Cr.	Sep-05	Oct-05	No	No	---	---	2009
Tittabawasse R.	Never	Jul-03	---	No	---	---	Unknown
Chippewa R. (upper)	Jul-05	Sep-05	No	No	---	---	2008
Coldwater R.	Jul-05	Sep-04	---	---	---	---	Unknown
Chippewa R. (lower)	Jul-05	Sep-05	Yes	No	---	---	2008
Pine R.	Jun-03	Aug-06	No	Yes	---	---	2008
Little Salt Cr.	May-02	Jun-05	No	Yes	---	---	2008
Big Salt Cr.	Jul-05	Aug-06	No	No	---	---	2008
North Br.	Never	Jun-05	---	No	---	---	Unknown
Carroll Cr.	May-02	Sep-06	No	Yes	621	141	**2007**
Big Salt R.	May-06	May-06	No	---	---	---	Unknown
Bluff Cr.	May-06	Oct-05	No	---	---	---	Unknown
Shiawassee R.	Jun-02	Aug-06	No	Yes	6,727	3,840	**2007**
Rock Falls Cr.	Never	May-01	---	No	---	---	Unknown
Sucker Cr.	Never	Jul-02	---	No	---	---	Unknown
Cherry Cr.	Never	May-01	---	No	---	---	Unknown
Mill Cr.	May-85	May-01	No	No	---	---	Unknown
St. Marys River	Aug-06	Aug-06	Yes	Yes	---	---	**2007**
Canada							
Root R.							
Main	Oct-05	Jun-06	Yes	No	---	---	2009
West Root	Oct-05	Jun-06	Yes	No	---	---	2009
Garden R.	Jun-06	Aug-05	---	---	---	---	2010
Echo R.							
Upper	Oct-99	Jul-06	No	No	---	---	Unknown
Lower	Oct-99	Oct-05	Yes	Yes	---	---	2008
Bar/Iron Cr.	Oct-04	Jun-05	No	No	---	---	2010

Table 12. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Proposed Next Treatment Year
Bar R.	Oct-01	Aug-06	Yes	Yes	---	---	Unknown
Sucker Cr.	May-05	Aug-06	No	No	---	---	2010
Twotree R.	Oct-01	Aug-06	No	Yes	---	---	Unknown
Richardson Cr.	May-04	Aug-06	Yes	No	---	---	Unknown
Watson Cr.	May-06	May-06	Yes	No	---	---	2010
Gordon Cr.	May-01	Aug-05	Yes	Yes	---	---	2009
Browns Cr.	Oct-03	May-06	No	No	---	---	Unknown
Koshkawong R.	Jun-06	Aug-05	---	---	---	---	2010
No Name	Aug-75	Jul-05	No	Yes	---	---	Unknown
No Name	Sep-75	Jul-05	No	Yes	---	---	Unknown
MacBeth Cr.	Jun-67	Aug-05	No	No	---	---	Unknown
Thessalon R.							
Upper	Jul-02	Aug-06	Yes	Yes	8,285	4,482	**2007**
Lower	Jun-05	Aug-06	Yes	No	---	---	2009
Livingstone Cr.	Jun-00	Jul-04	No	No	---	---	Unknown
Mississagi R.							
Main	Aug-04	Aug-06	Yes	Yes	---	---	2008
Pickerel Cr.	Jun-98	Jun-06	No	No	---	---	Unknown
Blind R.	May-84	Jun-06	No	No	---	---	Unknown
Lauzon R.	Jul-04	Jun-06	Yes	Yes	1,352	107	**2007**
Spragge Cr.	Oct-95	Jun-06	No	No	---	---	Unknown
No Name	Jun-02	Jun-06	No	No	---	---	2010
Serpent R.							
Main	Jun-00	Jun-06	No	Yes	18,187	52	2008
Grassy Cr.	Jun-06	Jun-06	No	No	---	---	2010
Spanish R.	Sep-02	Jun-06	Yes	Yes	---	---	2009
Kagawong R.	Aug-67	Jun-06	No	No	---	---	Unknown
Unnamed	Jun-02	Jun-06	No	Yes	---	---	2009
Silver Cr.	Jul-04	Jun-06	Yes	Yes	---	---	2010
Sand Cr.	Oct-01	Jun-04	Yes	No	---	---	Unknown
Mindemoya R.	Jun-06	Jun-06	No	No	---	---	2010
Timber Bay Cr.	Oct-05	Jun-06	Yes	No	23,288	789	**2007**
Manitou R.	Sep-99	May-06	Yes	Yes	4,588	796	**2007**
Blue Jay Cr.	Jun-03	Jun-06	Yes	Yes	53,939	154	**2007**
Kaboni Cr.	Oct-78	May-06	No	No	---	---	Unknown
Chikanishing R.	Jul-03	May-05	No	No	---	---	2010
French R. System							
O.V. Channel	Jun-92	Jul-05	No	Yes	---	---	Unknown
Wanapitei R.	Jul-05	Jun-04	---	---	---	---	2010
Key R. (Nesbit Cr.)	Sep-72	Jul-05	No	No	---	---	Unknown
Still R.	Jun-96	Jun-06	No	Yes	---	---	Unknown
Magnetawan R.	Jun-06	Jun-06	No	No	---	---	2011
Naiscoot R.	Jun-04	Jun-06	Yes	Yes	14,304	64	2009
Shebeshekong R.	Never	Jul-04	---	No	---	---	Unknown
Boyne R.	Jun-03	Aug-06	Yes	Yes	274	25	2008
Musquash R.	Sep-05	Jun-06	No	No	---	---	Unknown

Table 12. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2005 Larval Population	2006 Metamorphosing Estimate	Proposed Next Treatment Year
McDonald Cr.	Never	Jun-99	---	No	---	---	Unknown
Simcoe/Severn System	Never	Jun-06	---	Yes	---	---	Unknown
Coldwater R.	Never	Jun-06	---	No	---	---	Unknown
Sturgeon R.	Jun-03	Jun-06	No	Yes	16,175	362	2009
Hog Cr.	Sep-78	Oct-06	No	No	---	---	Unknown
Lafontaine Cr.	Jun-68	May-04	No	No	---	---	Unknown
Nottawasaga R.							
Main (incl. Boyne and Bear creeks)	May-02	Jun-06	No	Yes	---	---	2009
Pine R.	Jun-07	May-07	---	---	---		2009
Pretty R.	May-72	Jun-06	No	No	---	---	Unknown
Silver Cr.	Sep-82	Jun-04	No	No	---	---	Unknown
Bighead R.	Jun-03	Oct-06	Yes	Yes	1,705,376	80,899	**2007**
Bothwells Cr.	Jun-79	Jun-06	No	No	---	---	Unknown
Sydenham R.	Jun-72	May-04	No	No	---	---	Unknown
Sauble R.	Jun-04	Jul-05	No	Yes	---	---	2010
Saugeen R.	Jun-71	May-04	Yes	No	---	---	Unknown
Bayfield R.	Jun-70	May-06	No	No	---	---	Unknown

Table 13. Status of larval sea lampreys in historically infested areas of Lake Huron during 2006.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Albany Cr.	Albany Bay (Offshore)	Sep-06	Aug-05	Never
Trout Cr.	Trout Cr. (Offshore)	Aug-05	Aug-05	Never[2]
McKay Cr.	McKay Bay	Sep-06	Sep-06	Never[1]
Flowers Cr.	Flowers Bay	Jul-81	Jul-80	Never
Nunns Cr.	St. Martin Bay	Aug-87	Aug-87	Never
Pine R.	St. Martin Bay	Jul-97	Jul-97	Never
Carp R.	St. Martin Bay	Aug-06	Aug-06	Sep-80[1]
Cheboygan R.	Straits of Mackinac	Sep-03	Aug-93	Never
	Burt Lake (Sturgeon R.)	Aug-03	Aug-98	Never
Elliot Cr.	Duncan Bay	Jun-04	Aug-86	Never
Mulligan Cr.	Mulligan Cr. (Offshore)	Sep-84	Aug-73	Never
Ocqueoc R.	Hammond Bay	Jun-04	Sep-86	Never
Devils R.	Thunder Bay	Oct-04	Aug-76	Never
Au Sable R.	Au Sable R. (Offshore)	Jul-04	Jul-04	Never[2]
East Au Gres R.	East Au Gres R. (Offshore)	Aug-88	Jun-86	Never
Canada				
Echo R.	Solar Lake	Jul-06	Sep-93	Jul-87
	Stuart Lake	May-90	May-90	Jul-80
Two Tree R.	North Channel	Aug-81	Aug-81	Never
Gordon's Cr.	North Channel	Aug-91	Aug-91	Jul-84
Brown's Cr.	North Channel	Aug-91	Aug-91	Aug-87
Koshkawong	North Channel	Aug-91	Aug-91	Never
No Name	North Channel	Sep-71	Sep-71	Never
Mississagi R.	North Channel	Aug-90	Aug-90	Jul-81
Kagawong R.	Mudge Bay	Jul-90	Jul-90	Aug-87
Mindemoya	Providence Bay	Jul-88	Jul-88	Jul-81
Manitou R.	Michael's Bay	Jul-90	Jul-90	Aug-87
Magnetawan R.	Byng Inlet	Jul-06	Jul-06	Jul-99

[1]Scheduled for treatment during 2007

[2]Low-density larval populations monitored with granular Bayluscide surveys

Lake Erie

- Qualitative assessments of larval sea lamprey populations were conducted in 26 tributaries (11 U.S., 15 Canada) and offshore of 2 United States tributaries. These data were used to update the status of larval sea lamprey populations in historically infested Lake Erie tributaries and lentic areas (Tables 14 and 15).

- The population of larval sea lampreys was estimated in one United States tributary (Table 14).

- Post-treatment assessments were conducted in seven (4 U.S., 3 Canada) tributaries to determine the effectiveness of lampricide treatments during 2005 and 2006.

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in 11 (4 U.S., 7 Canada) tributaries.

- Surveys with Bayluscide 3.2% Granular Sea Lamprey Larvicide (ten 500 m^2 plots) conducted on the Canadian side of the Detroit River captured no sea lampreys.

- Paired quantitative assessment and catch-per-unit-effort samplings were conducted cooperatively with researchers from Michigan State University in one United States tributary as part of a study designed to evaluate an alternative model for selecting streams for lampricide application.

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 2006.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment)		Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
			Residuals present	Recruitment evident			
United States							
Buffalo R.	Never	Sep-06	---	No	---	---	Unknown
Delaware Cr.	Sep-05	Aug-06	No	No	---	---	2008
Cattaraugus Cr.	Sep-04	Sep-06	Yes	Yes	29,390	1,587	**2007**
Halfway Brook	Oct-86	Jun-03	---	No	---	---	Unknown
Canadaway Cr.	Oct-86	Aug-05	---	No	---	---	2009
Crooked Cr.	Apr-06	Aug-06	No	Yes	---	---	2009
Raccoon Cr.	Sep-05	Aug-05	---	---	---	---	2008
Conneaut Cr.	Apr-06	Aug-06	Yes	Yes	---	---	2009
Wheeler Cr.	Never	Aug-05	---	No	---	---	Unknown
Grand R.	Apr-06	Aug-06	No	Yes	---	---	2009
Chagrin R.	Never	Aug-05	---	Yes	---	---	Unknown
Black R.	Never	Jun-05	---	Yes	---	---	Unknown
Pine R.	Apr-88	Jun-05	---	No	---	---	Unknown
Belle R.	Never	Jun-05	---	No	---	---	Unknown
Clinton R.	Never	Oct-05	---	No	---	---	Unknown
St. Clair R.	Never	Jul-05	---	No	---	---	Unknown
Canada							
St. Clair R.	Never	Jul-04	---	Yes	---	---	Unknown
Thames R.	Never	Jul-04	---	No	---	---	Unknown
Detroit R.	Never	Jun-06	---	No	---	---	Unknown
East Cr.	Jun-87	Aug-06	No	No	---	---	Unknown
Catfish Cr.	Jun-87	May-04	No	No	---	---	Unknown
Silver Cr.	Never	May-05	---	Yes	---	---	Unknown
Big Otter Cr.	Jun-04	Aug-06	No	Yes	---	---	**2007**
South Otter Cr.	Oct-86	May-05	No	No	---	---	Unknown
Clear Cr.	May-91	Aug-06	No	No	---	---	Unknown
Big Cr.	Sep-06	Aug-06	---	---	---	---	2010
Forestville Cr.	May-89	Aug-06	No	No	---	---	Unknown
Normandale Cr.	Jun-87	Aug-06	No	No	---	---	Unknown
Fishers Cr.	Jun-87	Aug-06	No	No	---	---	Unknown
Young's Cr.	Sep-06	May-05	---	---	---	---	Unknown
Grand R.	Never	Jun-06	---	No	---	---	Unknown
Welland R.	Never	Jul-06	---	No	---	---	Unknown

Table 15. Status of larval sea lampreys in historically infested areas of Lake Erie during 2006.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Cattaraugus Cr.	Sunset Bay	Aug-06	Aug-06	Never[1]
Conneaut Cr.	Conneaut Harbor	Jul-06	Jul-06	Never[1]
Grand R.	Fairport Harbor	Aug-05	Jun-87	Never

[1]Low-density larval population monitored with granular Bayluscide surveys

Lake Ontario

- Qualitative assessments for larval sea lamprey populations were conducted in 35 tributaries (21 U.S., 14 Canada). These data were used to update the status of larval sea lamprey populations in historically infested Lake Ontario tributaries and lentic areas (Tables 16 and 17).

- Populations of larval sea lampreys were estimated in 13 tributaries (6 U.S., 7 Canada; Table 16).

- Post-treatment assessments were conducted in 14 tributaries (8 U.S., 6 Canada) to determine the effectiveness of lampricide treatments during 2005 and 2006. Post-treatment populations of larval sea lampreys were estimated in two U.S. tributaries (Salmon River and Lindsey Creek) and three Canadian tributaries (Mayhew, Wilmot, and Oshawa creeks; Table 16).

- Assessments to detect the presence of new populations of larval sea lampreys were conducted in nine tributaries (1 U.S., 8 Canada).

- Surveys with Bayluscide 3.2% Sea Lamprey Larvicide (12 x 500m^2 plots) conducted on the Canadian side of the Niagara River captured no sea lamprey larvae.

- A mark-recapture estimate of the larval sea lamprey population was made in conjunction with the lampricide treatment of Oshawa Creek. The estimated population was 26,109 (95% CI, 23,906 - 28,311). This estimate of larval lamprey numbers is less than the quantitative model estimate of 47,339 sea lamprey larvae, forecast from data collected during 2005. Due to the timing of the treatment during May, sea lampreys did not show external evidence of metamorphosis, so no estimate of the numbers of recently metamorphosed sea lampreys was possible.

Table 16. Status of larval sea lampreys in Lake Ontario tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed in 2006.

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
United States							
Black R.	Jul-04	Sep-06	Yes	Yes	146,770	4	2008
Stony Cr.	Sep-82	Jun-04	No	No	---	---	Unknown
Sandy Cr.	Never	Jul-05	---	No	---	---	Unknown
South Sandy Cr.	May-05	Jul-05	Yes	Yes	---	---	2008
Skinner Cr.	Apr-05	Apr-06	Yes	No	---	---	Unknown
Lindsey Cr.	Apr-06	Jul-06	Yes	Yes	561	125	2010
Blind Cr.	May-76	Jun-04	No	No	---	---	Unknown
Little Sandy Cr.	Jun-05	Apr-06	Yes	Yes	---	---	2008
Deer Cr.	Apr-04	Sep-06	Yes	No	---	---	Unknown
Salmon R.	May-05	Sep-06	Yes	Yes	126,942	1,274	**2007**
Grindstone Cr.	Apr-04	Oct-06	Yes	Yes	159,938	881	**2007**
Snake Cr.	Apr-05	Jul-05	No	No	---	---	2008
Sage Cr.	May-78	Jun-04	No	No	---	---	Unknown
Little Salmon R.	Apr-06	Sep-06	No	Yes	---	---	2009
Butterfly Cr.	May-72	Jun-04	No	No	---	---	Unknown
Catfish Cr.	Apr-06	Sep-06	Yes	Yes	---	---	2009
Oswego R.							
Black Cr.	May-81	Jul-06	No	No	---	---	Unknown
Big Bay Cr.	Sep-93	Jul-06	No	No	---	---	Unknown
Scriba Cr.	May-84	Jul-05	No	Yes	---	---	Unknown
Fish Cr.	Jun-04	Sep-06	Yes	Yes	52,221	2,456	**2007**
Carpenter Br.	May-94	Jul-06	No	No	---	---	Unknown
Putnam Br./Coldsprings Cr.	May-96	Apr-05	No	Yes	---	---	Unknown
Hall Br.	Never	Apr-05	---	No	---	---	Unknown
Crane Br.	Never	Jul-06	---	No	---	---	Unknown
Skaneateles Cr.	Never	Jul-05	---	No	---	---	Unknown
Rice Cr.	May-72	Apr-06	No	No	---	---	Unknown
Eight Mile Cr.	Apr-04	Sep-06	Yes	Yes	5,018	427	**2007**
Nine Mile Cr.	Jun-05	Jul-05	No	No	---	---	2008
Sterling Cr.	May-06	Sep-06	Yes	Yes	---	---	2009
Blind Sodus Cr.	May-78	Jun-04	No	No	---	---	Unknown
Red Cr.	May-06	Oct-06	No	No	---	---	Unknown
Wolcott Cr.	May-79	Oct-05	No	No	---	---	Unknown
Sodus Cr.	May-05	Oct-05	No	No	---	---	2008
Irondequoit Cr.	Never	Aug-04	---	Yes	---	---	Unknown
Northrup Cr.	Never	Sep-00	---	No	---	---	Unknown
Salmon Cr.	Apr-06	Sep-05	---	---	---	---	Unknown
Oak Orchard Cr.	May-88	Aug-04	No	No	---	---	Unknown
Third Cr.	May-72	May-00	No	No	---	---	Unknown
First Cr.	May-95	Oct-05	No	No	---	---	Unknown
Canada							
Niagara R.	Never	Jul-06	---	No	0	0	Unknown
Ancaster Cr.	May-03	May-05	No	No	---	---	Unknown
Grindstone Cr.	Never	May-05	---	Yes	---	---	Unknown
Bronte Cr.	May-04	Aug-06	Yes	Yes	106,898	23,110	**2007**

Table 16. continued

Tributary	Last Treated	Last Surveyed	Status of larval lamprey population (most recent survey since treatment) Residuals present	Recruitment evident	Estimate of 2006 Larval Population	2007 Metamorphosing Estimate	Proposed Next Treatment Year
Sixteen Mile Cr.	Jun-82	May-05	No	Yes	---	---	Unknown
Credit R.	May-02	Sep-05	No	Yes	---	---	Unknown
Rouge R.	May-04	Aug-06	Yes	Yes	553	254	**2007**
Petticoat Cr.	Sep-04	May-06	No	No	---	---	Unknown
Duffins Cr.	May-06	May-06	---	---	---	---	2009
Carruthers Cr.	Sep-76	May-04	No	No	---	---	Unknown
Lynde Cr.	Sep-05	May-06	No	No	---	---	2009
Oshawa Cr.	May-06	May-06	No	No	0	0	2009
Farewell Cr.	Sep-03	Jul-06	Yes	Yes	7,648	2,078	**2007**
Bowmanville Cr.	Sep-04	Jun-05	Yes	Yes	---	---	2008
Wilmot Cr.	May-06	May-06	No	No	0	0	2009
Graham Cr.	May-96	Jun-05	No	No	---	---	Uknown
Wesleyville Cr.	Oct-02	May-06	No	No	---	---	Unknown
Port Britain Cr.	Oct-02	Jul-06	No	Yes	858	193	**2007**
Gage Cr.	May-71	May-06	No	No	---	---	Unknown
Cobourg Br.	Oct-96	Jun-06	No	No	---	---	Unknown
Covert Cr.	Sep-05	Jun-06	No	No	---	---	Unknown
Grafton Cr.	Oct-02	Jun-06	No	Yes	---	---	**2007**
Shelter Valley Cr.	Sep-03	Jun-06	No	No	---	---	Unknown
Colborne Cr.	Sep-03	Jun-05	No	No	---	---	Unknown
Salem Cr.	May-06	May-06	No	No	0	0	2009
Proctor Cr.	Aug-98	Jun-05	No	No	---	---	Unknown
Smithfield Cr.	Sep-86	Jun-06	No	No	---	---	Uknown
Trent R. (Canal System)	Never	Jul-05	---	Yes	---	---	Unknown
Mayhew Cr.	May-06	Jul-06	Yes	No	---	---	2009
Moira R.	Never	Jun-06	---	Yes	---	---	Unknown
Salmon R.	Jun-00	Jun-06	No	Yes	452	4	Unknown
Napanee R.	Never	Jun-05	---	Yes	---	---	Unknown

Table 17. Status of larval sea lampreys in historically infested areas of Lake Ontario during 2006.

Stream Name	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Black R.	Black River Bay	Sep-06	Sep-06	Never[1]
Canada				
Duffins Cr.	Duffins Cr. (Offshore)	Oct-81	Oct-81	Never
Oshawa Cr.	Oshawa Cr. (Offshore)	Oct-81	Oct-81	Never
Wilmot Cr.	Wilmot Cr. (Offshore)	Oct-81	Oct-81	Never

[1]Low-density larval population monitored with granular Bayluscide surveys

Spawning-Phase

The long-term effectiveness of the control program has been measured by the annual estimation of the lake-wide populations of spawning-phase sea lampreys. Traps and nets were used to capture migrating spawning-phase sea lampreys during the spring and early summer in a subset of streams with sea lamprey spawning runs. Multiple regression models are used to estimate the relationship between spawning runs and within-stream biotic and abiotic factors such as larval population abundance and stream discharge. These models are used to estimate spawning populations in streams that are not trapped. Lake-wide populations have 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

- 7,088 sea lampreys were trapped in 19 tributaries during 2006 (Fig. 3, Table 18).

- The estimated population of spawning-phase sea lampreys during 2006 was 77,488 (42,868 U.S - west, 15,199 - U.S east, and 19,421 Canada).

- Sea lamprey spawning runs were monitored in the Amnicon, Middle, Bad, Firesteel, Misery, and Silver rivers through cooperative agreements with the Great Lakes Indian Fish and Wildlife Commission, in Red Cliff Creek with the Red Cliff Band of Lake Superior Chippewas, in the Brule River with the Wisconsin Department of Natural Resources, and in the Miners River with the National Park Service, Pictured Rocks National Lakeshore.

- Lake-wide estimates of spawning-phase sea lamprey numbers increased above the target range beginning during 1999 and have remained above targets since that time (Fig. 4). There is no overall trend in sea lamprey numbers over the last 20 years.

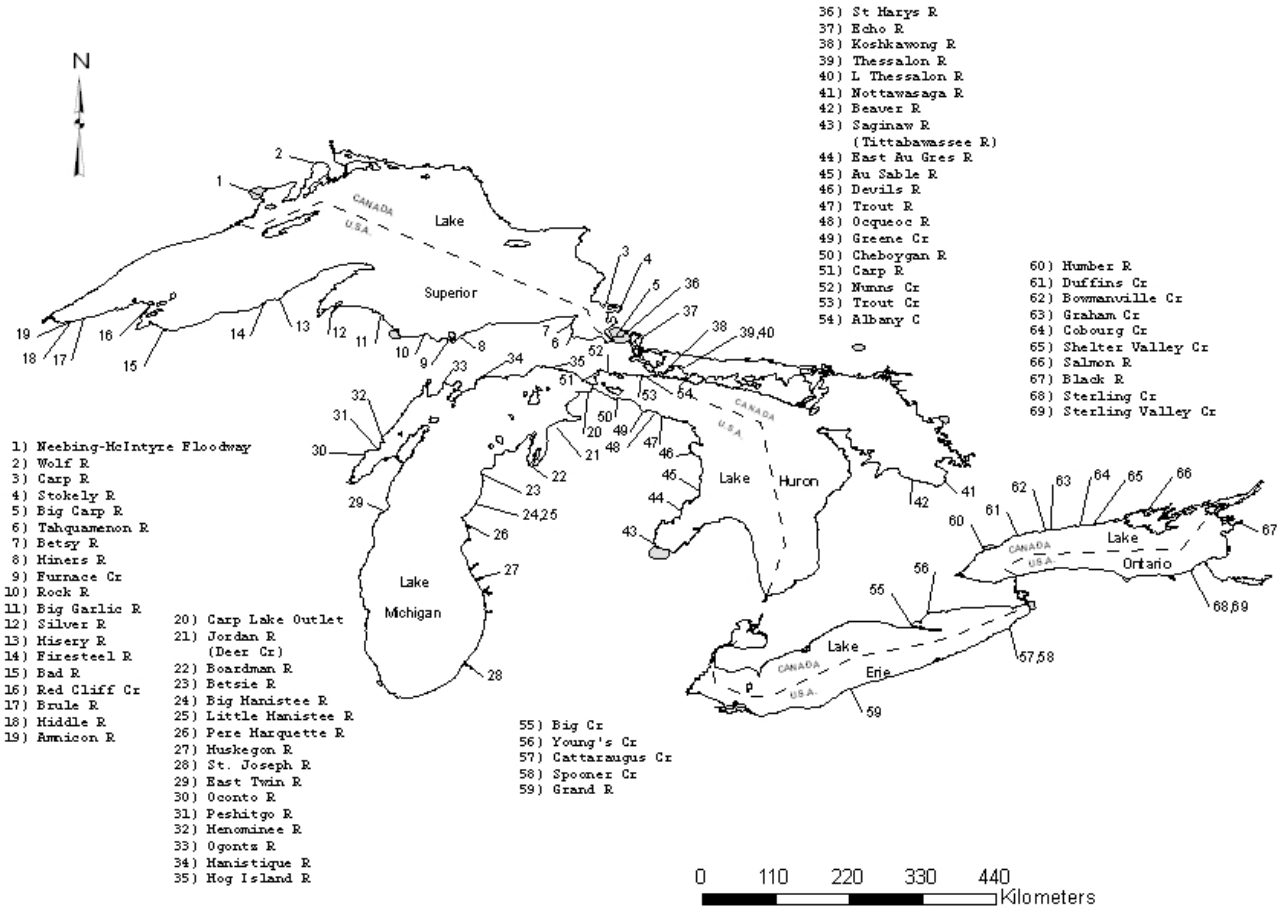

Fig. 3. Locations of tributaries where assessment traps were operated during 2006.

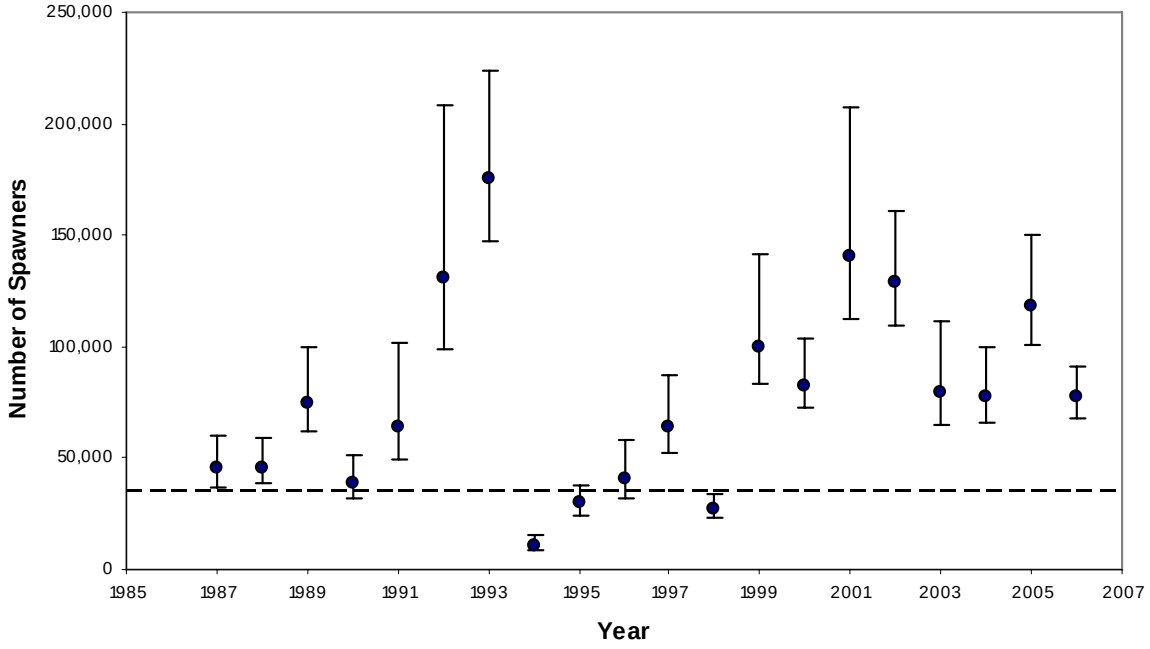

Fig. 4. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Superior during 1987 - 2006 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 18. Stream name, number caught, spawner estimate, trap efficiency (percent), number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Superior during 2006 (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)		Mean weight (g)	
						Males	Females	Males	Females
United States									
Tahquamenon R. (6)	731	7,453	10	24	63	444	434	200	167
Betsy R. (7)	469	924	51	105	46	502	498	262	268
Miners R. (8)	121	274	44	21	81	428	431	192	202
Furnace Cr. (9)	167	863	19	17	65	382	417	257	258
Rock R. (10)	206	474	43	57	53	449	433	201	201
Big Garlic R. (11)	106	333	---	27	89	483	480	265	266
Silver R. (12)	45	182	---	4	50	418	440	---	---
Misery R. (13)	556	855	65	279	52	420	409	175	172
Firesteel R. (14)	3	---	---	0	---	---	---	---	---
Bad R. (15)	1,603	18,912	8	180	28	452	439	207	191
Red Cliff Cr. (16)	17	---	---	5	80	421	405	154	114
Brule R. (17)	128	249	51	44	77	427	416	186	174
Middle R. (18)	1,814	3,017	60	329	53	441	440	218	218
Amnicon R. (19)	685	7,437	9	21	60	488	479	252	283
Total or Mean (South shore)	6,651			1,113	54	439	431	206	197
Canada									
Neebing R. (1)	123	365	34	0	---	---	---	---	---
Wolf R. (2)	7	---	---	0	---	---	---	---	---
Carp R. (3)	280	461	61	0	---	---	---	---	---
Stokely Cr. (4)	13	---	---	0	---	---	---	---	---
Big Carp Cr. (5)	14	---	---	0	50	---	---	---	---
Total or Mean (North shore)	437			0	50	---	---	---	---
Total or Mean (for Lake)	**7,088**			**1,113**	**54**	**439**	**431**	**206**	**197**

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

Lake Michigan

- 25,217 sea lampreys were trapped at 16 sites in 15 tributaries during 2006 (Fig. 3, Table 19).

- The estimated population of spawning-phase sea lampreys in Lake Michigan was 122,136 (74,736 north and 47,400 south), which is greater than the Fish Community Objective target and a significant increase from 2005 despite the decrease observed between 2004 and 2005 (Fig. 5).

- Sea lamprey numbers were less than or within the target range prior to the 2000 spawning year, but have been greater than targets since the 2000 spawning year with a peak abundance of 164,695 during 2004 (Fig. 5).

- 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 Carp Lake Outlet with the Little Traverse Bay Bands of Odawa Indians.

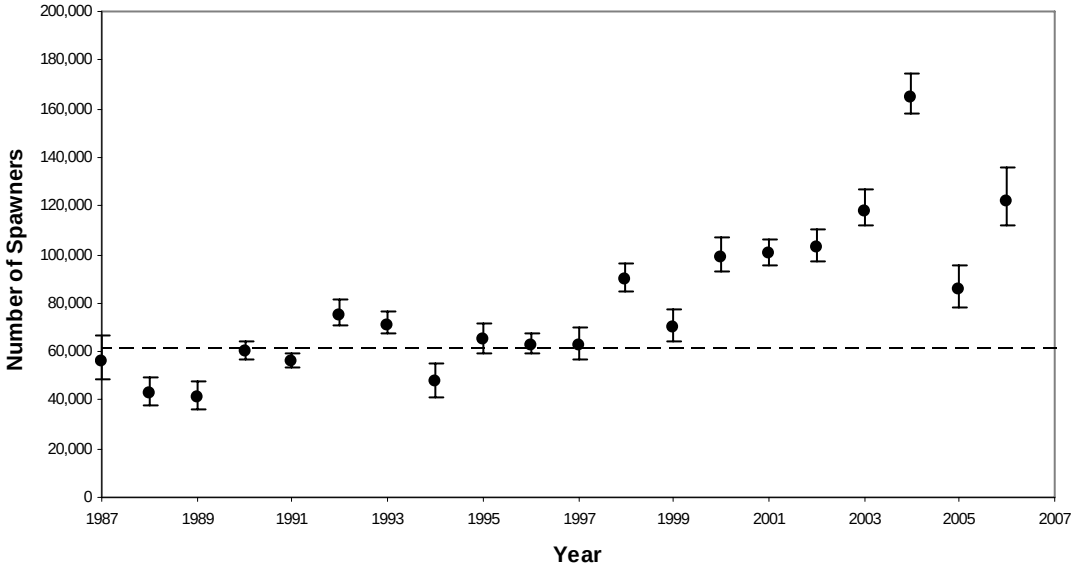

Fig. 5. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Michigan during 1987 - 2006 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 19. Stream name, number caught, spawner estimate, trap efficiency (percent), number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of Lake Michigan during 2006 (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)		Mean weight (g)	
						Males	Females	Males	Females
Carp Lake Outlet (20)	821	2,783	29	31	55	492	489	239	273
Jordan R. (21)	---	---	---	---	---	---	---	---	---
Deer Cr.	66	---	---	0	---	---	---	---	---
Boardman R. (22)	492	943	52	66	56	482	489	263	276
Betsie R. (23)	1,267	3,324	38	105	46	502	498	262	268
Big Manistee R. (24)	1,077	8,605	13	15	47	487	490	263	270
Little Manistee R. (25)	169	218	77	9	44	515	508	348	317
Pere Marquette R. (26)	588	1,344	44	50	34	590	499	301	290
Muskegon R. (27)	1,290	3,974	32	65	54	501	497	259	278
St. Joseph R. (28)	505	1,433	35	55	44	501	509	252	265
East Twin R. (29)	209	605	35	52	56	476	455	233	214
Oconto R. (30)	46	75	61	21	46	493	493	257	291
Peshtigo R. (31)	3,915	4,325	91	594	45	497	498	260	270
Menominee R. (32)	683	2,936	23	65	63	495	502	243	267
Ogontz R. (33)	71	796	9	4	50	430	345	255	126
Manistique R. (34)	13,910	46,019	30	481	50	503	497	269	275
Hog Island Cr. (35)	108	352	31	32	81	498	452	259	231
Total or Mean	**25,217**			**1,645**	**53**	**498**	**496**	**262**	**271**

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

Lake Huron

- 30,260 sea lampreys were trapped at 19 sites in 18 tributaries during 2006 (Fig. 3, Table 20).

- The estimated population of spawning-phase sea lampreys in Lake Huron for 2006 was 157, 286 (141,627 north and 15,659 south), which was greater than the Fish Community Objective target and an increase from the 2005 population estimate (Fig. 6).

- Since 2001, population estimates have been significantly less than the estimates during the previous 10 years.

- 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 10,592 spawning-phase sea lampreys. The estimated population in the river was 24,836 and trap efficiency was 44%.

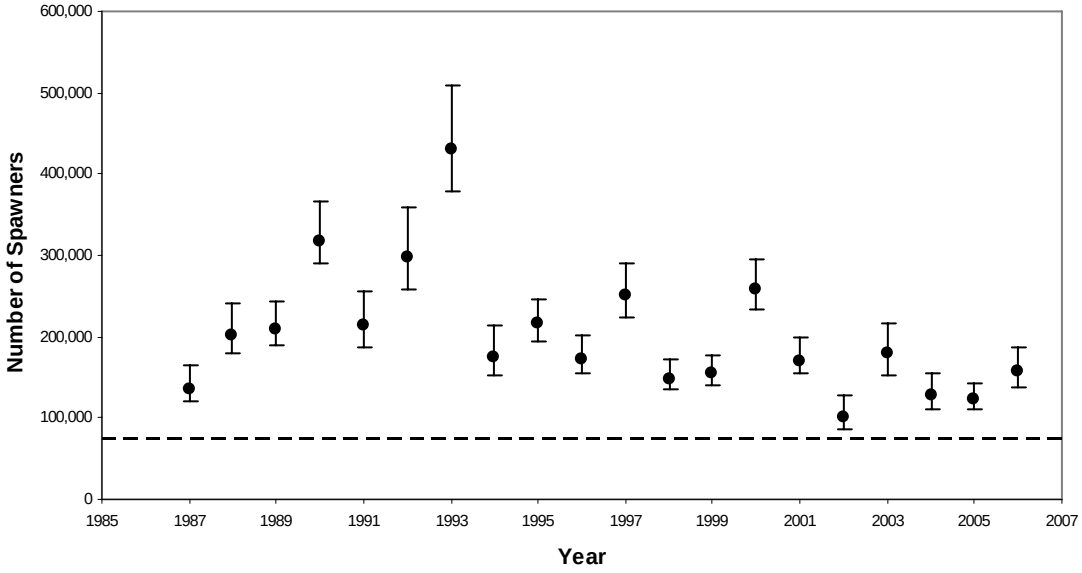

Fig. 6. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Huron during 1987 - 2006 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 20. Stream name, number caught, spawner estimate, trap efficiency (percent), number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Huron during 2006 (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)		Mean weight (g)	
						Males	Females	Males	Females
United States									
Tittabawassee R. (43)	167	---	---	1	---	500	---	265	---
East Au Gres R. (44)	231	1,250	18	8	88	446	410	179	320
Au Sable R. (45)	575	3,366	17	14	79	467	447	252	191
Devils R. (46)	114	230	50	47	68	493	498	254	281
Trout R. (47)	32	---	---	0	---	---	---	---	---
Ocqueoc R. (48)	3,479	7,516	46	103	50	455	462	236	260
Greene Cr. (49)	99	266	37	5	40	510	500	250	274
Cheboygan R. (50)	10,400	20,090	52	421	58	477	478	236	244
Carp R. (51)	53	25	21	1	---	555	345	---	---
Nunns Cr. (52)	2	---	---	0	---	---	---	---	---
Trout Cr. (53)	4	---	---	0	---	---	---	---	---
Albany Cr. (54)	55	308	18	6	100	439	---	---	---
St. Marys R. (36)	3,443	See Canada	See Canada	---	65	---	---	---	---
Total or Mean (U.S.)	18,654			606	59	474	476	237	249
Canada									
St. Marys R. (36)	7,149	24,836	43	0	65	---	---	---	---
Echo R. (37)	2,041	5,941	34	0	64	---	---	---	---
Koshkawong R. (38)	111	---	---	0	68	---	---	---	---
Thessalon R. (39)	43	618	7	0	94	---	---	---	---
Little Thessalon R. (40)	2,250	3,635	75	0	63	---	---	---	---
Nottawasaga R. (41)	12	---	---	0	82	---	---	---	---
Beaver R. (42)	0	---	---	0	---	---	---	---	---
Total or Mean (Canada)	11,606			0	65	---	---	---	---
Total or Mean (for Lake)	**30,260**			**606**	**61**	**474**	**476**	**237**	**249**

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

Lake Erie

- 1,943 spawning-phase sea lampreys were trapped in 5 sites in 4 tributaries (Fig. 3, Table 21).

- The estimated population of spawning-phase sea lampreys was 15,874 (3,581 U.S. and 12,293 Canada) which is significantly greater than the Fish Community Objective target during 2006.

- The precision of the 2006 estimate was improved through successful operation of the Big Creek barrier and trap. The 2006 population estimate is not significantly different from the population estimates for years prior to the first treatment (1986).

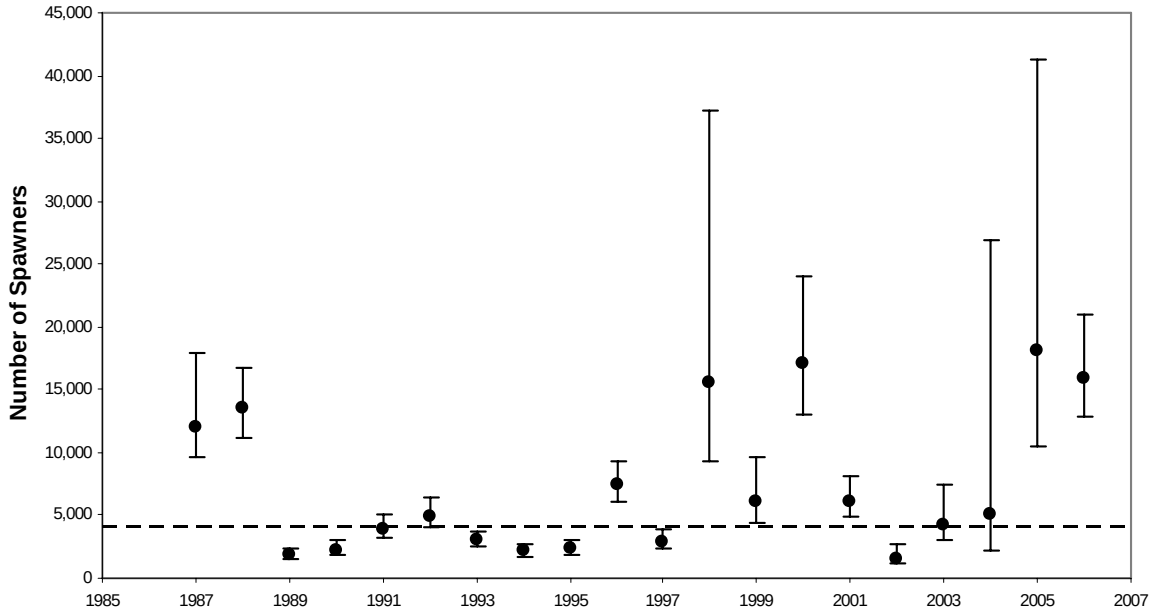

Fig. 7. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Erie during 1987 - 2006 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 21. Stream name, number caught, spawner estimate, trap efficiency (percent), number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of Lake Erie during 2006 (Number in parentheses corresponds to location of stream in Fig. 3).

Stream name	Number caught	Spawner estimate	Trap efficiency	Number sampled	Percent males	Mean length (mm)		Mean weight (g)	
						Males	Females	Males	Females
United States									
Cattaraugus Cr. (57)	4	---	---	0	---	---	---	---	---
Spooner Cr. (58)	2	---	---	0	---	---	---	---	---
Grand R. (59)	60	---	---	0	---	---	---	---	---
Total (U.S.)	66			0	---	---	---	---	---
Canada									
Big Cr. (55)	1,737	6,342	27	0	---	---	---	---	---
Young's Cr. (56)	140	430	33	0	---	---	---	---	---
Total (Canada)	1,877			0					
Total (for lake)	**1,943**			**0**	**---**	**---**	**---**	**---**	**---**

Lake Ontario

- 11,979 spawning-phase sea lampreys were trapped in 10 tributaries (Fig. 3, Table 22).
- The estimated population of spawning-phase sea lampreys in Lake Ontario for 2006 was 60,014 (36,369 U.S. and 23,645 Canada), which is greater than the Fish Community Objective target (Fig. 8).
- Sea lamprey population estimates were at or below the target range for 9 of the 10 years prior to 2004 (Fig. 8).

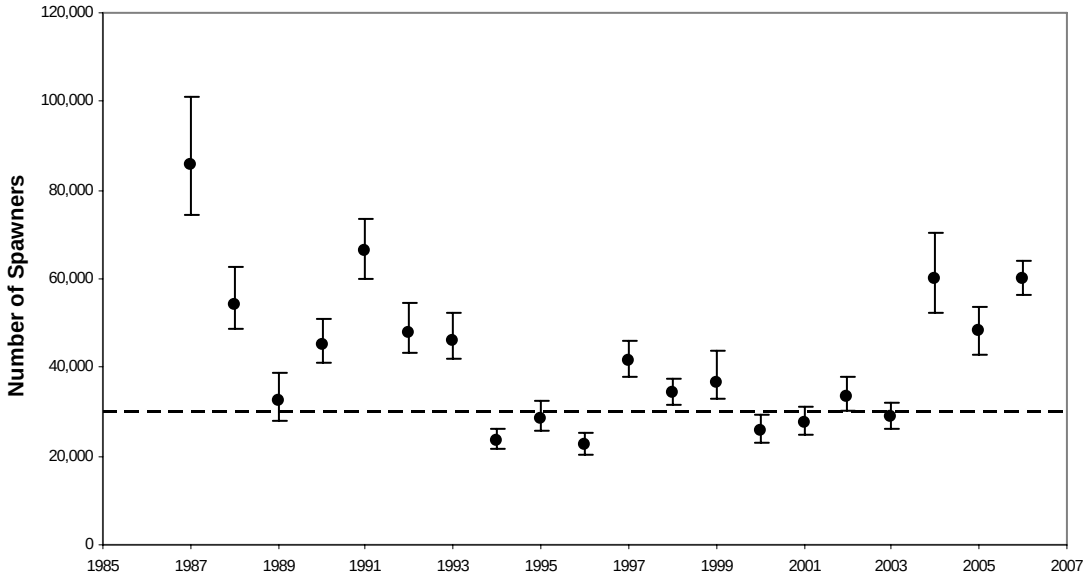

Fig. 8. Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Ontario during 1987 – 2006 with 95% confidence intervals (vertical lines) and target level (dashed line).

Table 22. Stream name, number caught, spawner estimate, trap efficiency (percent), number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps in tributaries of Lake Ontario during 2006 (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. (67)	2,679	7,487	36	293	62	499	500	261	270
Sterling Cr. (68)	153	---	---	0	---	---	---	---	---
Sterling Valley Cr. (69)	13	---	---	0	---	---	---	---	---
Total or Mean (U.S.)	2,845			293	62	499	500	261	270
Canada									
Humber R. (60)	5,886	12,391	48	570	51	484	478	259	257
Duffins Cr. (61)	1,647	4,015	41	164	52	493	486	266	265
Bowmanville Cr. (62)	443	2,518	18	146	62	484	470	255	236
Graham Cr. (63)	147	241	61	41	39	481	495	242	254
Cobourg Cr. (64)	259	300	86	85	31	473	485	233	249
Shelter Valley Cr. (65)	609	1,038	59	162	66	514	510	257	253
Salmon R. (66)	143	433	33	33	36	499	490	295	272
Total or Mean (Canada)	9,134			1,201	52	490	483	258	255
Total or Mean (for Lake)	**11,979**			**1,494**	**56**	**492**	**486**	**259**	**258**

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

Parasitic Phase

Lake Superior

There has been an increase in wounding rates since the 1994 spawning year. The wounding rates have been highest in the northwest and west portions of the lake, suggesting sources of additional sea lampreys are in those areas.

The Michigan Department of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fishes caught by charter boats during 2006.

- 112 parasitic-phase sea lampreys attached to lake trout were collected from 4 management districts.

- Parasitic-phase sea lampreys were attached at a rate of 2.99 per 100 lake trout (n = 3,740).

Lake Michigan

Marking rates have trended upward, and have been greater than target levels since 1995. Marking rates increased during 2005. These marking rates may be affected by the abundance of lake trout as well as the abundance of sea lampreys.

The Michigan and Wisconsin Departments of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fishes caught by sport charter fishers during 2006.

- 2,696 parasitic-phase sea lampreys were collected from 13 management districts; 254 were attached to lake trout and 2,442 were attached to Chinook salmon.

- Parasitic-phase sea lampreys were attached at a rate of 2.13 per 100 lake trout (n = 1,951) and 1.21 per 100 Chinook salmon (n = 201,526).

A lake-wide mark-recapture study using animals released as metamorphosing-phase juveniles was initiated during the fall of 2004 and continued during 2005. No coded-wire tagged metamorphosing sea lampreys were released into Lake Michigan during 2006.

- Of 1,166 metamorphosing-phase sea lampreys marked with coded wire tags and released during 2004, 39 (3.3%) were recaptured as spawning-phase adults in Lake Michigan during 2006. A total of 24,063 spawning-phase sea lampreys were scanned for coded wire tags in 16 Lake Michigan streams during 2006. The estimated number of the 2004 metamorphosing-phase cohort is 702,066 (95% CI, 532,839-1,008,910).

Lake Huron

Wounding rates on lake trout have declined since 2001, compared to the previous ten years.

The Michigan Department of Natural Resources provided data on the frequency of parasitic-phase sea lampreys attached to fishes caught by sport charter fishers during 2006.

- 456 parasitic-phase sea lampreys were collected from 6 management districts; 168 were attached to lake trout and 288 were attached to Chinook salmon.

- Parasitic-phase sea lampreys were attached at a rate of 1.8 per 100 lake trout (n = 9,471) and 12.5 per 100 Chinook salmon (n = 2,299).

Canadian commercial fishers collected parasitic-phase sea lampreys during 2006.

- A total of 2,361 parasitic-phase sea lampreys (770 - Main Basin, 1230 - North Channel, 0 - Georgian Bay, 361 - unknown) were collected and used for research.

A lake-wide, mark-recapture study using animals released as metamorphosing-phase juveniles was initiated during the fall of 1997 and continued through 2005. However, no coded-wire tagged metamorphosing sea lampreys were released into Lake Huron during 2003 and 2004; therefore no animals were available for recapture during 2006. No coded-wire tagged metamorphosing sea lampreys were released into Lake Huron during 2006 (Table 23).

A lake-wide mark-recapture study using animals released as parasitic-phase lampreys was initiated during 1993 and continued through 2005. No coded-wire tagged parasitic-phase sea lampreys were released into Lake Huron during 2006.

Table 23. Lake-wide population estimates (PE) and 95% confidence intervals (CI) of metamorphosing, parasitic, and spawning-phase sea lampreys in Lake Huron during 1992-2006.

Spawning Year	Estimate of metamorphosing lampreys (thousands)		Estimate of parasitic-phase lampreys (thousands)		Estimate of spawning-phase lampreys (thousands)	
	PE	95% CI	PE	95% CI	PE	95% CI
1992	639	492 - 907	-----	-----	296	260-371
1993	686	459 - 1,257	-----	-----	429	374-511
1994	-----	-----	515	409 - 688	171	147-206
1995	-----	-----	629	518 - 798	217	197-247
1999	803	505 - 1,737	1,361	788 - 3,527	154	140-181
2000	644	513 - 865	1,759	1,255 - 2,848	259	234-297
2001	578	491 - 702	2,302	1,089 - 14,800	171	152-204
2002	1,000 [1]	374 - 7,813	779	442 - 2,203	102	87-127
2003	630	443 - 1,032	1,909	958 - 8,715	180	153-221
2004	1,100	701-2,301	687	451-1,337	129	113-157
2005	-----	-----	611	305-2,766	122	108-145
2006	-----	-----	-----	-----	157	138-187

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

Lake Erie

Marking rates show the same pattern of increase as the other Great Lakes with significantly greater rates observed during fall 2005 (reflecting feeding of sea lampreys observed spawning during 2006).

Lake Ontario

Wounding rates on lake trout did not increase until 2005 when the fall observation was 3.9 A1 marks per 100 fish. Wounding rates had varied around the target rate since 1997. The difference between these indices may be a function of changes in the predator-prey ratio in Lake Ontario.

RISK ASSESSMENT

Risk assessment addresses environmental issues related to the implementation of sea lamprey management activities. This involves 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 risk to nontarget organisms.

Permits

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

Reports were prepared to comply with the U.S. Environmental Protection Agency (USEPA) June 16, 1998 ruling of Section 6(a)(2) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This section of FIFRA requires pesticide registrants to report to the USEPA 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, wildlife, plants, other nontarget organisms, water, and damage to property. Incident reports are required with the observed death of a single organism of a Federally-listed endangered, threatened, or candidate species and with observed mortalities of more than 50 individuals of any nontarget species or taxa during a lampricide application.

Reports filed during 2006 included observed mortalities of 371 Chinook salmon (*Oncorhynchus tshawytscha*) in the Betsie River (Lake Michigan), 60 bluntnose minnows (*Pimephales notatus*) and 142 Stonecats (*Noturus flavus*) in the Saginaw River (Lake Huron), and 810 Stonecats (*Noturus flavus*) and 121 Mudpuppies (*Necturus maculosus maculosus*) in Conneaut Creek (Lake Erie).

Federal and State Endangered Species

Consultations with Service offices and state agencies were held to discuss and to assess the potential risk of proposed lampricide applications to Federal-(endangered, threatened, and candidate) and state-listed (endangered, threatened, and special concern) species, and to develop procedures that protect and 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 2006*; and

- *Protocol to protect and avoid disturbance to Federal and/or state-listed endangered, threatened, candidate, proposed, or special concern species and critical or proposed critical habitats in or near Great Lakes streams scheduled for granular Bayluscide assessments in the United States during 2006*.

The protocols provided field personnel with a list of protected Federal- and state-listed species and their known locations, and steps to assure avoidance and protection. No mortality or disturbance was observed for the 24 Federally- or state-listed species listed in the protocols.

Lake Sturgeon

During 1982, the lake sturgeon (*Acipenser fulvescens*) was 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 2006, 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 sturgeons recently have been documented include the Bad, Ontonagon, Sturgeon, and St. Louis rivers (Lake Superior); Fox, Grand, Kalamazoo, Manistee, Manistique, Manitowoc, Menominee, Millecoquins, Milwaukee, Muskegon, Oconto, Peshtigo, and St. Joseph rivers (Lake Michigan); Carp, Cheboygan, Rifle, Saginaw, and St. Marys rivers (Lake Huron); Detroit and St. Clair rivers (Lake Erie); and Black, Genesee, and Niagara rivers (Lake Ontario).

Consensus was achieved with the Michigan and Wisconsin Departments of Natural Resources to manage lampricide treatments to control sea lampreys while minimizing risk to lake sturgeons in the Sturgeon, Whitefish, Menominee, Peshtigo, Big Manistee, and Pere Marquette rivers (Lake Michigan) and the Rifle River (Lake Huron). Assessments during and immediately after treatments of these rivers found no dead lake sturgeons. Some assessments were completed to fulfill requirements specified in the 2006 Certifications of Approval issued for lampricide treatments by the Michigan Department of Environmental Quality.

Programmatic Review

Sea lamprey management (SLM) involves extensive field work, so there is the possibility of direct and indirect impacts on Federally-listed threatened, endangered and candidate species and critical habitats. Annually, more than 200 streams are assessed to estimate sea lamprey populations and about 50 streams are treated with lampricides to control sea lamprey populations. Positive streams, containing significant, recurring sea lamprey populations are

treated every three to five years on a rotating basis. Negative streams are periodically surveyed. In addition, SLM traps about 50 streams during the spawning run to estimate adult sea lamprey populations.

The programmatic review (Review) evaluates all SLM activities, identifies potential impacts to protected species and critical habitats, and suggests conservation measures to eliminate or minimize disturbance to listed species and habitat. For the majority of the Federally-listed and candidate species and critical habitats in the action area, SLM activities will have either a "no effect" or "not likely to adversely affect" determination.

Due to this determination of effects and the number of streams surveyed, treated, and trapped annually, a streamlined review process is being developed. A formal consultation will be initiated for species and habitats that SLM is "likely to adversely affect". Site specific and project specific information will be provided with these formal consultation requests; the Review will provide the background and preliminary analysis of potential impacts to a species. The analysis will be updated or modified as site-specific conditions warrant. If the analysis in the Review does not require modification, the formal consultation request will simply reference the Review document.

The initial draft of the Review confined the action area to the State of Michigan. This Draft will be distributed and reviewed by Region 3 Endangered Species offices in the SLM action area. Each office will review the document, add species that are missing for their respective jurisdictions, and provide information on the biology, preferred habitat, and geographic location of protected species and any identified critical habitats. The Review will be implemented during 2007.

TASK FORCE REPORTS

The Commission, through its Sea Lamprey Integration Committee, has established task forces to recommend direction and coordinate actions in several focus areas: Lampricide Control, Sterile Male Release Technique, Sea Lamprey Barriers, Pheromones, Trapping, and Assessment. The progress and major actions of the task forces for 2006 are outlined below.

Lampricide Control Task Force

The Lampricide Control Task Force was established during December 1995.

Purpose:

To improve the efficiency of lampricide control to maximize the numbers of sea lampreys killed during 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.

2006 Members:

Terry Morse (Chair), Dorance Brege, David Johnson, Dennis Lavis, Alex Gonzalez, Ellie Koon, Jeff Slade, and John Weisser, Service; Rob Young, Brian Stephens, and Paul Sullivan, Department; Gavin Christie and Dale Burkett, Commission; Jean Adams, Mike Boogaard, and Ron Scholefield, U.S. Geological Survey.

Progress:

1. ***Achieve economic injury levels by suppressing sea lamprey populations to economic-injury levels (maximize net benefits of sea lamprey and fishery management by the year 2005.*** Sea lamprey numbers continued to be greater than target levels in all Great Lakes during 2006. Actions taken during 2006 to counter the increase in lamprey numbers in the lakes were:
   - Four streams were added to the treatment schedule as a result of geographic decisions.
   - Forty-two stream treatments were modified (e.g. longer banks, higher concentrations, increased use of secondary treatments) to improve effectiveness and suppression.
   - Eight people were added to the Department treatment crew, and four people were added to the Marquette treatment crew.
   - Seventeen streams were treated in addition to those streams in the 2006 base program.

2. ***Control the St Marys River by suppressing sea lamprey populations in the St Marys River to a level that allows rehabilitation of lake trout in northern Lake Huron.*** Lampricide control efforts continued in the St Marys River during 2006. A total of 130 ha were treated with Bayluscide 3.2% Granular Sea Lamprey Larvicide. The river has been treated annually since 1999, when over 800 ha were treated, removing over one half of the larval sea lamprey population. The annual treatments combined with successful

alternative control efforts have continued to reduce the reproduction potential of sea lampreys in the river. The marking rate in Lake Huron, although slightly greater than the target level, is low enough to allow natural reproduction of lake trout. This is evidenced by young-of-year and yearling lake trout captured during lake trout assessments.

Tactical/Operational:

- A total of 76 Great Lakes tributaries was treated
- Treatments of three streams were deferred until 2007 and treatment of one stream with a large residual population was substituted for treatment of one with a smaller population of larvae.
- Two small streams were treated as a result of recent detection of larval sea lamprey populations.
- Bayluscide 3.2% Granular Sea Lamprey Larvicide was applied to 130 ha of the St Marys River.
- A total of seven lentic areas were treated in lakes Superior and Michigan.
- Data were collected from seven streams for a study on suppression of pH by lampricides.

Long-term:

Lampricide delivered during 2006

TFM (Liquid)	24,428 kg AI
TFM Bars	0
Bayluscide 3.2% Granular Sea Lamprey Larvicide	17,161 kg
Bayluscide 70% Wettable Powder	0 kg

- Additional treatment effectiveness measures (higher concentrations, longer banks, and increased use of secondary treatment staff) were conducted in 42 streams during 2006.
- A study of issues related to stream pH and lampricide toxicity continued during 2006.
- The pursuit of registration for H&S TFM in Canada continued.
- Investigation continued on the dual-labeling of products to increase the efficiency of transportation of lampricides between the U.S. and Canada.
- Program efficiencies for 2007 include:
    - The Department will conduct all St Marys River treatment operations.
    - The Department and Service will minimize travel related to treatments.
    - The number of Service staff will be reduced by two people. Compensation for the reduction of personnel will be made through the cross-training of assessment personnel.
- The proposed efficiencies will not impact achievement of objectives or add to sea lamprey populations in the Great Lakes.

Control Ranking and Evaluation Task Force

Purpose:

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

2006 Membership:

Mike Steeves (Chair), Rod McDonald, Fraser Neave and Brian Stephens, Department; Jessica Doemel, Michael Fodale, Katherine Mullett, and Jeffrey Slade, Service; Jean Adams, Roger Bergstedt, and Bill Swink, U.S. Geological Survey, Biological Resources Division; Shawn Sitar, Michigan Department of Natural Resources; Michael Jones, Michigan State University; Gavin Christie and Dale Burkett, Commission.

The task force met during February and September 2006, and the larval workgroup met during January. CRETF continues to work closely with all of the other Sea Lamprey Integration Committee task forces.

Progress:

1. ***Annually rank streams and lentic areas for lampricide control through use of the ESTR model.*** In cooperation with the Secretariat and an Integrated Management of Sea Lamprey contractor, CRETF used transformer production estimates and treatment costs generated by the Empirical Stream Treatment Ranking model (ESTR) to prioritize for treatment all streams expected to produce metamorphosed sea lampreys during 2007. Included in this ranking were the St. Marys River and lentic areas off the mouths of producing streams in lakes Superior and Huron.

2. ***Upon receiving sea lamprey abundance targets from the Sea Lamprey Target Setting Work Group, to annually activate the targets into the control ranking that uses the ESTR model.*** Additional treatment effort for 2007 is being weighted towards those lakes exhibiting the greatest sea lamprey wounding rates. All lakes are receiving some level of additional treatment effort during 2007.

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

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 during 2006 included ranking streams for treatment using "expert judgment", validating Quantitative Assessment Survey estimates using mark-recapture during treatment, and examining potential differences in larval lamprey density and size structure in deep- and

shallow-water habitats. A rapid assessment methodology is also being examined as part of a study to optimize the allocation of resources between assessment and control of sea lamprey populations.

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. Wounding rates were used in allocating additional control effort for 2007. Updated models of growth and metamorphosis are being evaluated for inclusion in the ESTR model.

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

7. ***Refine and implement the recommendations of the adult assessment review of 1997.*** Following the recommendations of the adult assessment review panel:
   - Annual estimates of lake-wide spawner abundance are made for each lake.
   - A rationalization of which streams to trap is ongoing; this process uses a value-added approach.
   - CRETF and the working group of the Reproduction Reduction Task Force continue to work on assessments of the size of spawning runs in large rivers and in Georgian Bay tributaries.

8. ***Develop annual border-blind schedules that maximize efficiency.*** Cross-border larval assessment schedules are the norm for work on lakes Erie and Ontario. Cost efficiencies were realized when Canada completed nearly all larval assessment work on the St. Marys River during 2006. Cost-benefit analyses are being completed on other aspects of the assessment programs for the upper lakes in an attempt to improve efficiencies through cross-border cooperation.

9. ***Annually update Standard Operating Procedures (SOPs).*** Larval assessment SOPs are reviewed annually and updated as procedural changes are made.

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. Several program efficiencies were realized during the development of the program budget.

11. ***Assist in the development and refinement of the assessment research theme paper.*** The assessment theme paper has been peer-reviewed and submitted to the Journal of Great Lakes Research for publication. CRETF continues to review the theme paper for relevancy to current and future needs, and to publish up-to-date versions online at www.glfc.org.

12. ***Working with internal and external researchers, develop proposals and participate in field research of studies consistent with the assessment research theme paper.*** CRETF 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 program needs is evaluated. This evaluation is then passed on to the Sea Lamprey Research Board for consideration during their deliberation process.

Connecting Channel and Lentic Area Task Force

The Connecting Channel and Lentic Area Task Force (CCLATF) continued to coordinate with other task forces regarding the combined activities conducted on the St. Marys River and plans for lentic area investigations of Lakes Michigan and Superior during 2006. The task force submitted budget recommendations for continued assessment and control actions for 2007.

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

Purpose:

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

2006 Membership:

Michael Fodale (Chair), Michael Twohey, and Kasia Mullett, Service; Paul Sullivan and Mike Steeves, Department; Jean Adams and Roger Bergstedt, U.S. Geological Survey, Biological Resources Division; Michael Jones, Michigan State University; James Markham, New York Department of Environmental Conservation; Gavin Christie and Dale Burkett, Commission.

Task force meetings were held on March 2-3 and September 8, 2006

Progress:

1. ***Coordinate St. Marys control and assessment strategies, provide summary reports, and ensure all tasks are appropriately addressed.*** A report of 2006 activities and results was provided to the Sea Lamprey Integration Committee (SLIC) and summarized for the Commission annual report. Assessment and alternate control activities for 2007 were planned; details are provided in respective task force reports. Lampricide treatment plans included treatment of 96 ha (134 ha were originally targeted; substantial savings in Bayluscide 3.2% Granular Sea Lamprey Larvicide (granular Bayluscide) were realized by selectively targeting and treating only larval habitat within full plots). The construction of a new trap at Sault Edison has been completed and the Great Lakes Power trap construction project is proceeding, both under auspices of the Reproduction Reduction Task Force. The trap working group under the RRTF will experimentally examine the relationship between physical conditions and trap efficiency from an historical perspective.

2. ***Address assessment precision levels needed for the St. Clair, Detroit, and Niagara rivers.*** Discussion has been limited so far; however, summaries of previous work are being assembled. The immediate focus has been upon assessment and treatment of lentic areas in lakes Huron and Superior.

3. ***Using existing data, inventory infested lentic areas and estimate contribution of transformers; where needed, coordinate the development of proposals for consistent, comparable, and efficient assessment of their contribution.*** Inventories were completed and estimates of potential larval production based upon historical data were compiled during 2004. A plan was developed and implemented during 2005 for systematic sampling of lentic areas based upon the above, and using RoxAnn and granular Bayluscide. However, only a subset of the total lentic area was completed. Areas surveyed with the RoxAnn during 2005 but not surveyed with granular Bayluscide were surveyed during 2006. Funding shortfalls in the program will delay additional work until FY2007.

4. ***Identify specific research questions or hypothesis on population dynamics to define the contribution to recruitment of lentic areas and connecting channels; advance specific proposals to refine knowledge relating to control of sea lampreys in connecting channels and lentic areas.*** The Task Force supports the specific pre-proposal by Swink to determine lentic parasitic contribution to lakes, and the pre-proposal is supported by the task force for full proposal solicitation by the Sea Lamprey Research Board.

5. ***Evaluate current assessment methodologies/technologies toward the development of a "rapid" assessment technique.*** A draft sampling protocol was tested during 2005 that uses published information to allow "rapid" assessment of lentic area habitat with RoxAnn. Use of the protocol will continue during FY2007.

6. ***Identify treatment options and costs.*** Lentic area habitat and production estimates continue to be budgeted as an add-on for 2007 and include totals of about 52 staff days and $156,000 (Table 24) for the Great Lakes and the Niagara River. This is based upon historical inventories of infested lentic areas, potential for production, and assessments completed during 2005. Investigations during 2006 provided data that prompted consideration of 6 Lake Superior lentic areas for granular Bayluscide treatment, 4 of these (13 ha) will be treated during 2007. St. Marys River 2007 funding was recommended at an estimated cost of $1,921,700:
   - Larval Assessment and Lampricide Control activities included in respective program targets provides for about 130 staff days (at ~$500/day, $65,000) of larval assessment effort to estimate population and delineate treatment areas, and treatment of 130 ha with granular Bayluscide (at ~$5,000/ha, $650,000).
   - SMRT and trapping activities included in respective program targets of SMRT ($473,400) and Pheromone and Trapping ($483,300 - trapping for SMRT in and outside of the St. Marys River and trapping for control) provide for collection and release of sterile males, a spawning run estimate, and removal of female lampreys.
   - Cheboygan River trap improvements attributable to trapping for SMRT are estimated to be $250,000. This is a one time cost.

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

Table 24. Lentic area and connecting channel investigations planned for 2007 at the recommended funding level of $156,000.

Lake	Source Stream	Lentic Area	Potential Infested Area (ha)	RoxAnn Complete	Bayluscide Sampling Complete
Huron	Carp R.	Carp R.	12.5	No	No
Huron	Mindemoya R.	Providence Bay	20	No	No
Huron	Manitou R.	Michael's Bay	5	No	No
Ontario – Canada	Duffins Cr.	Duffins Cr. Lentic	7.5	No	No
Ontario – NY	Black R.	Black River Bay	14.3	No	No
Ontario	Niagara R.	Upper	4231.062	No	No
Ontario	Niagara R.	Lower	760.5833	No	No
Superior	Goulais R.	Goulais Bay	310	No	No
Superior	Steel R.	Santoy Bay	14	No	No
Superior	Black Sturgeon R.	Black Bay	54.4	No	No
Superior	Wolf R.	Black Bay	68.4086	No	No
Huron	Mississagi R.	North Channel	128.9	Yes	No

Sea Lamprey Barrier Task Force

Purpose:

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

Supporting Commission Strategic Vision Milestones:

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

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

2006 Membership:

Kasia Mullett (Chair) Cheryl Kaye, Service; Paul Sullivan, Department; David Wright, USACE; Sharon Hanshue, Michigan Department of Natural Resources; Bill Swink, U.S. Geological Survey; Rob McLaughlin, University of Guelph; and Dale Burkett and Gavin Christie, Commission.

Progress:

1. ***Coordinate the construction of new sea lamprey barriers that annually eliminates 1% of available habitat for sea lamprey larvae.*** During 2006, progress continued toward the construction of barriers in the Cedar (Service) and Galien (USACE) rivers and Trail, Black Mallard, and Schmidt creeks (USACE). The barrier project in Bronte Creek was terminated because the project was not cost-effective. It was projected to cost over $1M to construct due to fractured bedrock at the site. Progress the Bowmanville Creek barrier also ceased when the owner of a de facto dam decided not to remove the existing barrier. An inflatable barrier project proposed for the Paw Paw River was terminated because the task force could not justify spending $1.3M on an experimental technology. Operation of the proposed barrier was tied to operation of a flood control structure that would require the barrier to be lowered below the recommended crest height about five times during the migration season. The USACE continued to experience funding constraints that only allowed sufficient resources for the projects listed previously. Work on the remaining five USACE barrier projects (Manistique, Sucker, and Au Gres rivers, and Harlow and Kids creeks) was postponed during 2006.

2. ***Coordinate the operation of all existing barriers so that they are 100 % effective in blocking spawning-phase sea lampreys.*** The list of barriers that are operated each year includes those barriers that have adjustable components that need to be set/removed/adjusted at the beginning/end of the sea lamprey migration period or that have permanent traps or fishways associated with them that require regular servicing. During 2006, 10 barriers were operated (Canada – Big Carp and Little Carp Rivers, Big and Wesleyville Creeks, and Cobourg Brook; U.S. – Pere Marquette and Ocqueoc Rivers, and Albany, Furnace, and Greene Creeks). The Jordan River barrier was not operated during 2006.

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.*** Pre-migration, safety and maintenance inspections were conducted at sea lamprey barrier sites during 2006. The results of the inspections led to immediate minor repairs or an engineered inspection and remediation plan for major repairs. Progress continued during 2006 to repair a breach in the Miners River barrier. While the project qualifies for a federal Environmental Assessment categorical exclusion, the U.S. Park Service is requiring one be completed prior to

construction. This has delayed construction from 2006 until 2007 or 2008. Bracing and a "lip" were installed on the barrier in the West Branch of the Whitefish River. Funds were received to rebuild the Stokely Creek barrier which had rust-out deterioration. Design of the repairs was completed and the rebuild is scheduled for 2007. Negotiations with the landowner regarding the fate of the Shelter Valley Creek barrier continue and will likely result in decommissioning the structure. A back-up system for the Big Creek inflatable barrier was installed during 2006 and worked without incident throughout power failures that would have produced 16 hours of down time if the back-up system not been in place. Installation of an upgrade to the controller is expected during 2007; this is the final component for the back-up system. Other maintenance projects during 2006 include the decommissioning of Shephards Creek barrier, bank stabilization at the Browns Creek barrier, and safety fencing at the Salmon River barrier.

4. ***In consultation with the control ranking task force, annually select new construction projects from the ranked barrier list.*** A new barrier was proposed for Pekin Brook, tributary to Lake Ontario, because the ability to treat the stream has been jeopardized by a resistant landowner. The need to rebuild the de facto barrier on the Manistique River was discussed and elevated to a high priority. The project was submitted to the USACE under Section 1135 several years ago and continues to be delayed due to lack of USACE funds for the project. The task force again recommended it be pursued as a Service project until the USACE obtains sufficient funds. The project was submitted in the Service FY07 budget request.

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 2006, Service and Department staffs consulted and provided mitigation advice on fish passage or dam/perched culvert removal projects for 11 de facto barriers (9 U.S., 2 Canada).

6. ***Develop protocol to identify and recommend withdrawal of existing nonfunctional barriers from the Commission barrier network.*** The criteria for considering withdrawal of existing non-functional barriers will be determined after the completion of the Barrier Review and subsequent revision of the Barrier Strategy and Implementation Plan. The definition of a successful barrier in the plan will guide the decision making process for barrier removal.

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

8. ***Develop annual border-blind schedules that maximize efficiency.*** Annual border-blind schedules continued to be developed during 2006.

9. ***Annually develop estimates of costs for effort and construction for upcoming fiscal year.*** The task force developed and recommended a fiscal year 2006 budget of $1,621,000 for barrier coordinators and technical staff support, barrier operations, maintenance, Big Creek barrier back-up system, and Stokely Creek barrier repair.

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 during 2003 to handle policy issues related to the sea lamprey barrier program. The policy team was charged with revising both the Barrier Strategy and Implementation Plan and the Ranked List of Barrier Candidate Streams. Completion of the ranked list indicated that barriers were substantially less cost-effective than previously predicted. During 2006, SLIC and the Commission called for a review of the sea lamprey barrier program in response to the decreased cost-effectiveness of new barriers and to the complexity in construction and operation of sea lamprey barriers. The barrier review was to include demonstrating the potential suppression and benefits from future sea lamprey barrier construction, quantifying and documenting the performance of existing barriers, evaluating the economics and effectiveness of project selection, and evaluating cooperator stream and lake ecosystem connectivity policy conflicts. A draft of the review was presented to SLIC during the fall 2006 meeting. SLIC Core supported the conclusions of the review in principle, agreeing to a new barrier program that: 1) Considers new barriers only in streams where other control options are not viable, where they are a cost-effective alternatives to lampricide control, and where they are compatible with a system's watershed plan; 2) Ensures sea lampreys remain blocked at existing dams that are de facto barriers; 3) Operates and maintains existing structures; and 4) Develops barrier-like devices to support trapping and pheromone-based control methods. Once the review document is in final draft form, the Barrier Strategy will be updated to address this change in priorities.

11. ***Annually update SOPs.*** Several of the protocols in the Barrier Life Cycle and Operational Protocols document still require revision. There is no schedule to complete these revisions until the Barrier Review and Barrier Strategy documents are completed.

12. ***Assist in the development and refinement of the barrier research theme paper.*** Complete.

13. ***Work with internal and external researchers to develop proposals and participate in field research of studies consistent with barrier research theme paper.*** The task force continued to work with researchers and to develop proposals consistent with the barrier research theme paper.

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 during 2003 and incorporated the former sterile-male-release-technique (SMRT) task force, and pheromone and trapping task force.

Purpose:

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

Supporting Great Lakes Fishery Commission Strategic Vision Milestones:

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

2006 Membership:

Michael Twohey (chair), Kasia Mullett, and Jessica Richards, Service; Weiming Li, Mike Jones, Mike Wagner, and Larry Gut, Michigan State University; Gavin Christie and Dale Burkett, Commission; Rod McDonald, Department; Jane Rivera and Roger Bergstedt, U.S. Geological Survey; Rob McLaughlin, University of Guelph; Ellen Marsden, University of Vermont; and Greg Wright, Chippewa/Ottawa Resource Management Authority.

Progress:

1. ***Develop and periodically refine the pheromone, sterility, and trapping for control research theme papers.*** Themes for SMRT, Pheromones, and Trapping (in the Barrier theme) were peer reviewed and were being prepared for publication. The task force was considering the best means to keep the themes updated after publication.

2. ***Identify application strategies. Solicit or develop field evaluation of the most promising strategies.*** The task force believes the pheromone research program is progressing well and that the 2010 milestone is attainable. Implementation during 2010 should be a pilot study that is designed to contribute to control and to be amenable to evaluation. The pilot study will likely involve few streams, and will require evaluation to ascertain the effect over many years. Reduction in lampricide use would not be immediate. The current inventory of pheromone is not impeding progress. A workshop was scheduled for 2007 to further refine the implementation strategy.

A field evaluation of the sterile-female-release-technique was scheduled to begin during 2007.

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

   New trapping efforts progressed in the St. Marys River. A trap at the Edison Sault hydro plant was operated during 2006, and modifications were completed that should enhance its operation during 2007. Planning and permitting continued for a trap on the south side of the Great Lakes Power - Francis H. Clergue hydro plant which should be operational during 2007. A pilot trapping project was being developed for the Mississagi River, a large river in the North Channel of Lake Huron with potential to provide thousands of males for SMRT.

   The Task Force continued to evaluate variables that affect trap efficiency and new and existing trapping technologies. Experimental manipulation of individual traps in the St. Marys River was implemented during 2006 and will continue during 2007. Issues of trap retention and funnel design were paramount. Several new research proposals resulted from requests for additional research on subjects identified at a trapping workshop during 2006. An experimental fish-wheel was tested in the Cheboygan River with positive results. Movement studies using hydro-acoustic technologies were proposed for 2008-10. A study of rules for transport of sea lampreys progressed into a second year. Finally, another trap workshop was proposed for 2007.

4. ***Evaluate results of laboratory and field research and revise application strategies accordingly.*** The task force, with leadership provided by Dr. Michael Wagner, continued to develop a strategic plan for implementation of a pheromone control technique by 2010 that incorporated recent results of laboratory and field studies. See item **2** for additional details.

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

   The task force worked 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 continued to be screened for diseases before transfer to the upper Great Lakes. No diseases were found that would curtail releases. A proposal for risk assessment was reviewed, and a transmission study for VHS was being pursued.

Trapping technologies continued to be evaluated in the Cheboygan and St. Marys rivers and results were being used to optimize operations for 2007. Results of St. Marys River telemetry studies during 2001-2002 were used to identify new trapping sites on the St. Marys River.

Results of SMRT and trapping in the St. Marys River during 1997–2006 are presented in Table 7.

5. ***Mediate a collaborative link between control agencies and research institutions, such that the best available resources are used and the transition from laboratory to field is adequately facilitated.*** Pheromone field experiments were continued by investigators from Michigan State University, the Department, and the Service. The control agents' expertise in trapping was integral to the field studies. Good Laboratory Practices (GLP) training was provided by the UMESC and they continued to coordinate registration issues. Extraction of larval (migratory) pheromone continued at the Hammond Bay Biological Station with support from both control agents. This approach provided a strong interdisciplinary team and built critical expertise for future implementation of a pheromone control strategy.

   The task force was collaborating with the agents and internal and external researchers to advance strategies for suppression of reproduction. A workshop was held during February 2006 to advance innovation in trap design and operation. The task force continued to monitor developments of Jones' compensatory mechanism studies. The Hammond Bay Biological Station continued to provide support for SMRT related field activities.

6. ***Identify chemical/biochemical registration requirements, coordinate appropriate registration research, and facilitate the registration process with U.S. Environmental Protection Agency and Health Canada through appropriate Commission and U.S. Geological Survey personnel.*** An amendment to the sex pheromone Experimental Use Permit (EUP) was submitted to include all compounds isolated from adult male washings. GLP training continued to be coordinated by UMESC for field trial workers. Data were reviewed for compliance with GLP. A report on field trial results was submitted to the State of Michigan. The USEPA requires no interim reports as long as work continues under the same EUPs. Future registration strategies continued to be evaluated by UMESC. A plan for joint registration under North American Free Trade Agreement was advanced. Timelines and cost projections were updated.

7. ***Work with control ranking task force on issues of compensatory response of sea lampreys to reduced abundance and behavioral responses to pheromones, sterile-male release, and trapping.*** Results of compensatory mechanisms investigations and subsequent modeling exercises suggest that strategies to reduce reproduction can be effective in an integrated strategy that aggressively reduces recruitment to very low larval densities. Recent work by Jones and Dawson suggests that a target of 0.2 females $\cdot 100\ m^{-2}$ is a general reference point that could be applied to all streams to reduce high recruitment events, though high recruitment occurs at all spawner abundances. It is worth noting that female density in the St. Marys River is 0.002 females $\cdot 100\ m^{-2}$.

8. ***Develop annual border-blind schedules that maximize efficiency.*** Service and Department personnel worked on both sides of the border to facilitate effective trapping, processing, and transport of sea lampreys, and are considering options to increase these efficiencies. The Service and Department both provided staffing for pheromone field experiments near Hammond Bay. Effective protocols were used for screening and moving sea lampreys from the lower to upper Great Lakes using facilities on both sides of the border. An effort to use Department personnel at USACE traps was hindered by security issues.

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

10. ***Annually develop estimates of costs for effort for upcoming fiscal year.*** Budgets were proposed for 2007 for control trapping, sterilization, and pheromones and presented to the Sea Lamprey Integration Committee. Program efficiencies of about $23K were identified for the 2007 budget. The task force continued to develop costs and timelines for strategic development and implementation of pheromone strategies by 2010.

11. ***Working with internal and external researchers, develop proposals and participate in field research consistent with pheromone, sterility, and trapping for control research theme papers.*** Task force members were engaged in development of research proposals for trapping, SMRT, and pheromones. The task force continued to refine a research strategy to support implementation of a pheromone control technique by 2010. A pheromone strategy workshop was held, and another was proposed for 2007. Control agents, internal researchers, and external researchers collaborated on planning of pheromone field trials through 2010. New applications of technology were investigated to improve trapping efficiencies. A trapping workshop, attended by internal and external researchers, was held during 2006 to synthesize trapping information (formal and informal), identify information needs, design experiments, and to identify new technologies and strategies that may help in such areas as trapping in unconventional locations, improving trap retention, and optimizing traps for use with pheromones. The workshop resulted in many new proposals, and another workshop was planned for 2007. Efficacy of sterilization, quality assurance, and potential for sterile female release continued to be investigated with help from agents, internal research, and external research. The task force continued to consider recommendations of the SMRT Expert Review Panel in formulating research plans. Additional detail is provided in items **3**, **4**, and **5**.

12. ***Annually review pheromone, sterility, and trapping for control research proposals for relevance to pheromone, sterility, and trapping for control research theme papers.*** Task force input into research priorities was provided through the research themes and reliance on task force members who serve on the Sea Lamprey Research Board.

OUTREACH

The Service and Department routinely are involved in outreach activities to inform the public of the benefits and operations of the sea lamprey management program. These activities range from group participation in sports shows in metropolitan areas to individual contacts with landowners or the media. A summary of these activities for 2006 is presented in Table 25.

Table 25. Service and Department outreach effort during 2006

Activity or Event	Number of Occurrences		Staff Days	
	Canada	U.S.	Canada	U.S.
School Presentations	2	30	2	20
Sports Shows	5	9	35	40
Youth Fishing	---	1	---	2
Civic Groups	1	5	0.5	3
Media Interviews	9	12	3	2
Media Mailings/E-mail	77	1200	2	13
Station Public Displays	---	19	---	32
SLCC Public Aquarium	160	---	12	---
Landowner Notification	500	90	20	2
Employment Outreach	---	3	---	3
Total Outreach	**754**	**1,369**	**74.5**	**117**

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 Biologists:
- Dorance Brege, Treatment Supervisor
- Darrian Davis
- Joseph Genovese

Lead Physical Science Technician: Robert Wootke
Physical Science Technicians:
- Timothy Peiffer
- Michael St. Ours
- Kelley Stanley

Administration Support:
- Tracy Demeny, Supervisor
- Pauline Hogan,
- Gloria Hoog
- Barbara Poirier

Automated Data Processing:
- Larry Carmack, Supervisor
- Robert Kahl
- Deborah Larson

Maintenance Worker: Steven Dagenais

Assessment Supervisor: Katherine Mullett
Fishery Biologists:
- Michael Fodale, Larval Supervisor
- Jessica Doemel, Adult Supervisor
- Michael Twohey, Sterile Male Supervisor
- John Weisser, Risk Assessment Supervisor
- Cheryl Kaye, Barrier Supervisor
- Lisa Corradin
- Mary Henson
- Gregory Klingler
- Shawn Nowicki
- Dale Ollila
- Michael Siefkes

Biological Science Technicians:
- Gregg Baldwin
- Robert Katona
- Daniel Kochanski
- Kyle Krysiak
- Dennis Smith
- Mary Wilson
- Deborah Winkler

Ludington Biological Station

Ludington Station Supervisor, Dennis Lavis

Lead Treatment Biologist: Ellie Koon
Control Fishery Biologists:
- Alex Gonzalez, Treatment Supervisor
- Kathy Hahka

Lead Physical Science Technician: Jeffrey Sartor
Physical Science Technicians:
- Kevin Butterfield
- Tim Sullivan

Assessment Fishery Biologists:
- Jeff Slade
- Lynn Kanieski

Biological Science Technicians:
- Lois Mishler

Administration Support:
- Joe Tyron
- Tana Reimer

Department of Fisheries and Oceans Canada

Sea Lamprey Control Centre – Sault Ste. Marie, Ontario Canada

Robert Young, Division Manager

Section Head Control: Paul Sullivan
Control Fisheries Biologists:
- Brian Stephens, Treatment Supervisor
- Barry Scotland

Control Technicians:
- Randy Stewart
- Peter Grey
- Glenn Goulay
- Jamie Storozuk
- Charlie Boudreau
- John Tibbles
- Michael MacKenna
- Shawn Robertson
- Jamie Smith
- Jerome Keen
- Chris Sierzputowski

Administration Support:
- A/Property & Contract Manager: Lisa Vine
- Clerk-Receptionist: Christine Reid
- Accounts Clerk: Melanie McCaig

Assessment Fisheries Biologists:
- Adult Supervisor: Rod McDonald
- Larval Supervisor (upper lakes): Todd Steves
- Larval Supervisor (lower lakes): Fraser Neave

Assessment Technicians:
- Ed Achtemichuk
- Gale Bravener
- Chris Cowper
- Andy Treble
- Jeff Rantamaki
- James Richard
- Thomas Voigt
- Sean Morrison
- Kevin Tallon
- Richard Middaugh
- Scott Cressey

Barrier Technologist: Joseph Hodgson
Maintenance Supervisor: Brian Greene
Maintenance Assistant: Chad Hill
Informatics: John Graham