# SEA LAMPREY CONTROL IN THE GREAT LAKES 2011

ANNUAL REPORT TO
THE GREAT LAKES FISHERY COMMISSION

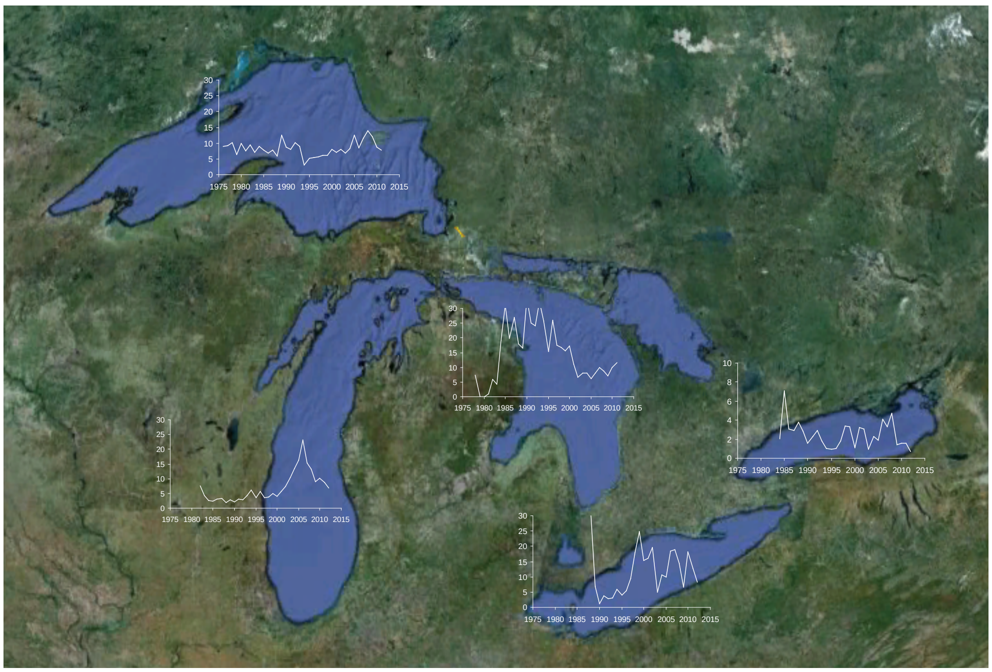


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*Photo by Chris Sierzputowski*

Brian Stephens, Fisheries and Oceans Canada, delivering TFM to the primary application site prior to the treatment of the Wanapitei River, Lake Huron.

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# SEA LAMPREY CONTROL IN THE GREAT LAKES 2011

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## *EXECUTIVE SUMMARY*

*This report summarizes activities in the integrated management of sea lampreys conducted by Fisheries and Oceans Canada (Department) and the United States Fish and Wildlife Service (Service) in the Great Lakes during 2011. These activities are consistent with the actions identified in the Great Lakes Sea Lamprey Control Plan (*In review*) to achieve sea lamprey abundance and wounding targets that was adopted by the Great Lakes Fishery Commission in 2011. Lampricide treatments were conducted on 105 tributaries and 18 lentic areas. Larval assessment crews surveyed 456 Great Lakes tributaries and 55 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 68 tributaries across the Great Lakes to estimate the spawning-phase population in each Great Lake.*

*We evaluate spawning-phase sea lamprey populations relative to fish-community objectives for each of the lakes. In Lake Superior, sea lamprey abundance (52,294, 95% CI: 43,556-76,704) was within target levels of 37,000 ± 19,000 for the fourth consecutive year. In Lake Michigan, sea lamprey abundance (74,464, 95% CI: 69,147-80,593) decreased from the 2010 abundance estimate but remains greater than target levels of 57,000 ± 13,000. In Lake Huron, sea lamprey abundance (117,222, 95% CI: 108,504-131,749) increased from the 2010 abundance estimate and remains greater than target levels of 73,000 ± 20,000. In Lake Erie, sea lamprey abundance (20,638, 95% CI: 17,298-24,471) decreased from the 2010 abundance estimate but remains greater than the target levels of 3,000 ± 1,000. In Lake Ontario, sea lamprey abundance (38,722, 95% CI: 32,699-48,805) increased from the 2010 abundance estimate and was within target levels of 31,000 ± 4,000.*

## INTRODUCTION

The sea lamprey (*Petromyzon marinus*) is a destructive invasive species in the Great Lakes that contributed to the collapse of lake trout (*Salvelinus namaycush*) and other native species in the mid-20$^{th}$ century and continues to affect efforts to restore and rehabilitate the fish-community. Sea lampreys attach to large bodied fish and extract blood and body fluids. It is estimated that about half of sea lamprey attacks result in the death of their prey and an estimated 18 kg (40 lbs) of fish are killed by every sea lamprey that reaches adulthood. The Sea Lamprey Control Program (SLCP) is administered by the Great Lakes Fishery Commission (Commission) and implemented by two control agents: Fisheries and Oceans Canada (Department) and the United States Fish and Wildlife Service (Service). The SLCP is a critical component of fisheries management in the Great Lakes because it facilitates the rehabilitation of important fish stocks by significantly reducing sea lamprey-induced mortality.

As part of the *Strategic Plan for Great Lakes Fishery Management,* the lake committees developed fish-community objectives for each of the Great Lakes. The fish-community objectives include goals for the SLCP that, if achieved, should establish and maintain self-sustaining stocks of lake trout and other salmonines by minimizing sea lamprey impacts on these stocks. The lake committees have agreed to sea lamprey abundance and lake trout wounding targets for each of the lakes. This report outlines the program conducted by the control agents and the Commission in 2011 to meet these targets.

## FISH-COMMUNITY OBJECTIVES

Each lake committee has published qualitative goals for sea lamprey control in their fish-community objective documents. During 2004, the lake committees agreed to explicit sea lamprey suppression targets designed to meet their fish-community objectives. In lakes Superior, Michigan and Erie the targets were developed from a 5-year period when wounding rates resulted in a tolerable annual rate of mortality on lake trout. A target and range of sea lamprey abundance was calculated for these lakes from the estimated abundance over a 5-year period when wounding rates were closest to 5 A1-3 marks per 100 lake trout >533 mm. Similarly, a target and range was developed for Lake Ontario from the estimated abundance of sea lampreys over a 5-year period when wounding rates were closest to 2 A1 marks per 100 lake trout >431 mm. In Lake Huron, the sea lamprey abundance target and range was calculated as 25% of the estimated average lake-wide population during the 5-year period prior to the completion of the fish-community objectives (1989–1993).

The performance of the SLCP is evaluated annually by contrasting spawning-phase sea lamprey abundance with the lake trout wounding rate against these targets. The lake-wide abundance is estimated by the control agents using a combination of mark-recapture and trapping efficiency estimates of spawning-phase migrants in streams with traps, and regression model-predicted estimates in streams without traps. Lake trout wounding rates are assessed and collected by the member agencies that comprise the lake committees and their technical committees.

For lakes Superior, Michigan, Erie and Ontario, a 5-year time period was selected during which wounding was at or near the target of 5 wounds per 100 lake trout (2 wounds per 100 lake trout for Lake Ontario). The spawning-phase abundance targets were then defined as the averages of the spawning-phase estimates for that 5-year time period. Since the model for estimating spawning-phase abundance is annually updated using all available data, the spawning-phase estimates for previous years can change, which in turn, can cause the spawning-phase targets to change. Because the Lake Huron Committee set a fixed number for the spawning-phase target, the target for Lake Huron does not change.

**Lake Superior**

The Lake Superior Committee established the following goal for sea lamprey control in Lake Superior:

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

The target and range of sea lamprey abundance for Lake Superior was calculated from the average abundance of sea lampreys estimated for the 5-year period, 1994-1998, when wounding rates were closest to 5 marks per 100 fish (5.2 A1-3 marks per 100 lake trout >533mm). The calculated target abundance in Lake Superior is 37,000 ± 19,000 sea lampreys**.**

During 2011, spawning-phase sea lamprey abundance in Lake Superior was estimated to be 54,294 (95% CI: 43,556 - 76,704), which was within the target range for the fourth consecutive year. The sea lamprey wounding rate on lake trout is currently at 8 A1-A3 wounds per 100 lake trout >533mm, which is greater than the target of 5 per 100 lake trout, but has been declining for the past 3 years.

Lake-wide estimates of spawning-phase sea lamprey exceeded the Lake Superior target during 1999-2007. The control agents responded by surveying all known and potential sources of sea lampreys during 2004-2006. Treatment effort has been increased and all significant sources have been treated.

## Lake Michigan

The Lake Michigan Committee established the following goal for sea lamprey control in Lake Michigan:

- *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 self-sustaining lake trout populations.*
- *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.*

The target and range of sea lamprey abundance for Lake Michigan was calculated from the average abundance of sea lampreys estimated for the 5-year period, 1988-1992, when wounding rates were closest to 5 marks per 100 fish (4.7 A1-3 marks per 100 lake trout >533mm). The calculated target abundance in Lake Michigan was 57,000 ± 13,000 sea lampreys.

During 2011, spawning-phase sea lamprey abundance was estimated to be 74,646 (95% CI: 69,147 – 80,593), which was greater than the target range. Populations were less than or within the target range prior to the 2000 spawning year, but had shown a significant trend upward to a peak abundance of 168,791 during 2007. Abundance declined markedly in 2008 and again in 2009, increased slightly during 2010, and has once again declined in 2011. The sea lamprey wounding rate on lake trout is currently at 7 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target of 5 per 100 lake trout for at least the last 10 years, but has been declining dramatically during recent years.

The trend of increasing sea lamprey abundance between 2000 and 2007 led the Commission to increase assessment and treatment effort in Lake Michigan. The causes of the increase in sea lamprey abundance may be due to reduced lampricide control effort, increased production of sea lampreys upstream of deteriorated barriers, and increased survival of juvenile lampreys due to changes in the fish-community. However, all known and likely sources of sea lampreys have been surveyed and control efforts have targeted all potential sources of sea lampreys in the lake.

Beginning in 2001, treatment effort increased with special emphasis on increasing suppression in Lake Michigan. The Manistique River was treated in 2003, 2004, 2007 and 2009. Treatments of smaller streams that were located near other streams scheduled for treatment (geographic efficiencies) increased the number of streams that were treated each year. Beginning in 2005, the states and tribes of Michigan and Wisconsin agreed to relax previous restrictions on TFM concentrations in select lake sturgeon (*Acipenser fulvescens*) streams to maximize treatment effectiveness. Treatments of streams where lake sturgeon reproduction exists were scheduled later during the year, when larval lake sturgeon exceed 100mm in length and may be less vulnerable.

## Lake Huron

The Lake Huron Committee established the following specific goal for sea lamprey control in Lake Huron:

- *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.*

This sea lamprey objective supports 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.*

The sea lamprey abundance target and range for Lake Huron were calculated as 25% of the estimated average lake-wide population during the 5-year period prior to the publication of the fish-community objectives (1989–1993). The target using these data was 73,000 ± 20,000 sea lampreys in Lake Huron. Unlike the other Great Lakes, this explicit target was not based on observed wounding rates that resulted in a tolerable annual lake trout mortality rate.

During 2011, the spawning-phase sea lamprey abundance was estimated at 117,222 (95% CI: 108,504 – 131,749), which was greater than the target range. Although the estimated abundance during 2011 was slightly greater than the previous 2 years, over the past 30 years only 2010, 2009 and 2002 have had lower estimated abundances. The sea lamprey wounding rate on lake trout is currently 12 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target of 5 per 100 lake trout for at least the last 10 years.

High sea lamprey abundance 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 parasitic-phase sea lampreys in the lake. The large discharge and complexity of the St. Marys River precludes traditional treatment applications. During 1997, an innovative control strategy was implemented on the river that integrated spot treatments with 3.2% granular Bayluscide (GB), a bottom-release formulation of lampricide, with the sterile-male-release technique (SMRT) and the operation of spawning-phase traps. During 1998-2001, approximately 850 hectares of larval habitat was treated, and along with SMRT and trapping, have contributed to a decline in larval sea lamprey abundance in the river and to reduced spawning-phase abundance and lake trout wounding rates in Lake Huron. To further reduce parasitic-phase sea lamprey abundance in Lake Huron, the Commission implemented a large-scale treatment strategy, involving the consecutive treatments of all infested streams tributary to the North Channel and St. Marys River, including GB treatment of all St. Marys River plots. Trapping of spawning-phase sea lampreys and release of sterilized males also continued during 2011 as part of the St. Marys River integrated control program.

## Lake Erie

The *Fish-Community Goals and Objectives for Lake Erie* does not include a specific sea lamprey objective, however it does acknowledge that effective sea lamprey control 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 salmonines; 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.

The target and range of sea lamprey abundance for Lake Erie were calculated from the average abundance estimated for the 5-year period, 1991-1995, when wounding rates were closest to 5 marks per 100 fish (4.4 A1-3 marks per 100 lake trout >533mm). The calculated target abundance in Lake Erie was 3,000 ± 1,000 sea lampreys.

During 2011, spawning-phase sea lamprey abundance in Lake Erie was estimated to be 20,638 (95% CI: 17,298 – 24,471). For the third consecutive year, this level of abundance exceeds pre-control estimates and is greater than the target range. The sea lamprey wounding rate on lake trout is currently 8 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target for 9 of the last 10 years.

The initial round of stream treatments during 1986 and continued control efforts during the following 8 years resulted in an annual sea lamprey population within the target range. During the late 1990s, sea lamprey abundance recovered 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 lower treatment efficacy resulting from measures designed to reduce lampricide use and protect non-target organisms. Beginning in 1999, the Commission responded to burgeoning sea lamprey abundance with the application of concerted control effort to the major sea lamprey producing streams in Lake Erie, resulting in suppression to target levels for 4 years. Spawning-phase sea lamprey abundance rebounded during the period from 2005 to 2007, once again exceeding pre-control levels. In response to the observed increases, a whole-lake treatment strategy was implemented and all known infested tributaries to Lake Erie were treated in 2 consecutive years, beginning in 2008. During 2009, a new infestation was found in South Otter Creek (tributary to the North Shore of Lake Erie) and the stream was treated in 2009 and 2010.

**Lake Ontario**

The Lake Ontario Committee established the following goal for sea lamprey control in Lake Ontario:

- *Suppression of sea lamprey populations to early 1990's levels.*

The Lake Ontario Committee recognized that continued control of sea lampreys is necessary for lake trout rehabilitation and specified a specific objective for sea lampreys:

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

This objective is intended to maintain the annual lake trout survival rate at 60% or greater to support 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.

The target for Lake Ontario sea lamprey abundance was first calculated using the same wounding statistics as the other lakes (A1-A3 marks). The target and range were revised during 2006, using A1 marks exclusively, which have been more consistently recorded on Lake Ontario. Also, the target wounding rate of less than 2 A1 marks per 100 fish was explicitly identified as producing tolerable mortality in the lake trout rehabilitation plan. The sea lamprey target and range were calculated from the average abundance during the 5-year period, 1993-1997, when wounding rates were closest to 2 marks per 100 fish (1.6 A1 marks per 100 lake trout >431mm). The calculated target abundance in Lake Ontario was 31,000 ± 4,000 sea lampreys.

During 2011, spawning-phase sea lamprey abundance was estimated to be 38,722 (95% CI: 32,699 – 48,805), which was within the target range. The sea lamprey wounding rate on lake trout is currently 1 A1 wound per 100 lake trout >431mm, which is lower than the target of 2 wounds per 100 lake trout >431mm, and has been for the last 4 years.

## LAMPRICIDE CONTROL

Tributaries harbouring sea lamprey larvae are periodically treated with lampricides to eliminate or reduce larval populations before they recruit to the lake as parasitic-phase lampreys. Treatment units administer and analyze TFM, or TFM/Niclosamide mixtures (TFM augmented with Bayluscide 70% wettable powder or 20% emulsifiable concentrate) during stream treatments, and apply 3.2% GB to control populations inhabiting lentic areas. Specialized equipment and techniques are employed to provide concentrations of lampricides that eliminate approximately 95% of the sea lamprey larvae, while minimizing the risk to non-target organisms.

The Lampricide Control Task Force (LCTF) 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 task force's report on the charges during 2011 is presented in the LCTF section of this report.

Since 2006, the control agents have employed strategies to maximize treatment efficacy, while continuing to protect non-target organisms. These strategies include: targeting lampricide concentrations at greater than minimum lethal concentrations (MLC) in all treated stream reaches; extending the duration of lampricide treatment blocks by one or two hours; conducting secondary lampricide applications to treat backwaters, springs, and small feeder streams that offer refuge to larvae from the primary treatment; and scheduling treatments during periods when favourable flow conditions are likely to exist.

**Table 1.** Summary of lampricide applications in tributaries of the Great Lakes, 2011.

| Lake | Number of Streams | Number of Lentic | Discharge ($m^3/s$) | TFM (kg) [1] | Bayluscide (kg) [1,2] | Distance Treated (km) |
|---|---|---|---|---|---|---|
| Superior | 32 | 13 | 58.1 | 8,788.0 | 606.9 | 519.5 |
| Michigan | 19 | 0 | 102.8 | 17,504.0 | 135.7 | 573.9 |
| Huron | 46 | 3 | 250.7 | 21,190.5 | 5,088.4 | 835.8 |
| Erie | 0 | --- | 0.0 | 0.0 | 0.0 | 0.0 |
| Ontario | 8 | 2 | 51.3 | 6,360.8 | 45.7 | 195.1 |
| **Total** | **105** | **18** | **462.9** | **53,843.3** | **5,876.7** | **2,124.3** |

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes 3.2% granular Bayluscide applied to lentic areas.

**Figure 1.** Location of tributaries treated with lampricide in 2011.

## Lake Superior

Lake Superior has 1,566 tributaries (833 Canada, 733 U.S.). One hundred fifty-nine tributaries (57 Canada, 102 U.S.) have historical records of larval sea lamprey production. Of these, 97 tributaries (41 Canada, 56 U.S.) have been treated with lampricides at least once during 2002-2011. Fifty-eight tributaries (18 Canada, 40 U.S.) are treated on a regular cycle. Table 2 provides details on the application of lampricides to Lake Superior tributaries and lentic areas treated during 2011.

- Lampricide treatments were completed in 32 tributaries (10 Canada, 22 U.S.) and in 13 lentic areas (8 Canada, 5 U.S.).

- Two tributaries to the Kaministiquia River, Oliver and Slate creeks, were treated in 2011 after being deferred in 2010 due to low flows.

- Treatments scheduled for the Agawa and White rivers and Corbett Creek (tributary to the Kaministiquia River) were not completed due to insufficient discharge. All three streams have been rescheduled for treatment in 2012.

- Sheppard Creek (a tributary to the Goulais River system) was treated after being deferred in 2010 due to time constraints.

- Sawmill Creek (a tributary to Haviland Bay) was treated for the first time since 1968.

- Lentic areas offshore of Ankodosh Creek and Anna River were treated with GB for the first time during 2011.

- Harlow Creek was treated for the second consecutive year due to the presence of residual lampreys that resulted from numerous beaver impoundments that hindered the 2010 treatment.

- Non-target mortality of several fish species occurred during and after the lentic treatments in August in Huron and Munising bays offshore from the Silver and Anna rivers, respectively. A 6(a)2 report was filed with the United States Environmental Protection Agency (EPA). Unusual environmental conditions, including relatively warm surface water temperatures and suspected low dissolved oxygen levels, likely contributed to the fish kills. As a precaution, to prevent additional non-target mortality, the lentic treatments scheduled offshore of the Little Garlic and Falls rivers were deferred until 2012.

- Effort was coordinated with the Bad River Band of Lake Superior Tribe of Chippewa Indians and the Red Cliff Band of Lake Superior Chippewa Indians during the lampricide treatments of the Bad River in Ashland County and Sand River and Red Cliff Creek in Bayfield County, WI.

- The Sand River (Bayfield County, WI) was treated in three segments under low water conditions with the upper river treatment conducted by hand spreading TFM. The treatment was also hindered by the remoteness of the area; transportation was mostly conducted by ATV and walking, while communications were limited with no cell phone service and minimal radio capability. The distribution of larval sea lampreys was the furthest upstream ever recorded for this river.

- Miners Lake, a lentic area of the Miners River (Alger County, MI), was treated for the first time in its entirety with GB and TFM, with the TFM entering the lake from an application site at Miners Falls in the upper river. Numerous large ammocoetes were observed throughout the lake. Effort was coordinated with the National Park Service, Pictured Rocks National Lakeshore.

- Significant rainfall occurred during the treatment of the Cranberry and Potato rivers and while it temporarily disrupted operations, the increased discharge resulted in more effective treatments, particularly in the Cranberry River estuary.

**Table 2.** Details on the application of lampricides to tributaries and lentic areas of Lake Superior during 2011 (letter in parentheses corresponds to location of stream in Figure 1).

| Tributary | Date | Discharge ($m^3/s$) | TFM (kg)[1,2] | Bayluscide (kg)[1,3] | Distance Treated (km) |
|---|---|---|---|---|---|
| **Canada** | | | | | |
| Kaministiquia R. lentic (A) | Oct 1 | --- | --- | 29.8[3] | --- |
| Slate R. | Jul 16 | 0.2 | 41.7 | 0.0 | 4.8 |
| Oliver Cr. | Jul 17 | 0.1 | 15.7 | 0.0 | 0.9 |
| MacKenzie R. lentic (B) | Oct 2 | --- | --- | 76.3[3] | --- |
| Wolf R. (C) | Jul 18 | 2.4 | 443.0 | 0.1[3] | 4.4 |
| Black Sturgeon R (D) | Aug 4 | 11.2 | 1,065.7 | 14.3[3] | 16.9 |
| Big Trout Cr. lentic (E) | Oct 4 | --- | --- | 28.3[3] | --- |
| Nipigon R. lentic (F) | Oct 4 | --- | --- | 42.9[3] | --- |
| Cash Cr. lentic | Oct 3 | --- | --- | 25.4[3] | --- |
| Cypress R. lentic (G) | Oct 5 | --- | --- | 68.3[3] | --- |
| Pays Plat R. (H) | Jul 13 | 1.7 | 161.2 | 0.0 | 9.8 |
| Little Pic R. (I) | Aug 8 | 4.8 | 1,040.6 | 0.1[3] | 33.4 |
| Batchawana R. (J) | Aug 17 | 4.2 | 385.4 | 0.0 | 12.4 |
| Chippewa R. lentic (K) | Aug 18 | --- | --- | 79.9[3] | --- |
| Sawmill Cr. (L) | Jul 6 | 0.1 | 1.0 | 0.0 | 0.7 |
| Stokely Cr. lentic (M) | Aug 17 | --- | --- | 29.1[3] | --- |
| Goulais R. (N) | | | | | |
| Sheppard Cr. | Oct 12 | 0.2 | 19.6 | 0.0 | 8.6 |
| Cranberry Cr. (O) | May 19 | 0.3 | 26.0 | 0.0 | 7.4 |
| West Davignon Cr. (P) | Jul 28 | 0.1 | 8.8 | 0.1[3] | 1.8 |
| **Total (Canada)** | | **25.3** | **3,208.7** | **394.6** | **101.1** |
| | | | | | |
| **United States** | | | | | |
| Ankodosh Cr. lentic (Q) | Jul 28 | --- | --- | 16.0[3] | --- |
| Miners R. (R) | Jun 10 | 0.8 | 123.3 | 0.0 | 4.1 |
| Miners Lake | Jun 10 | --- | --- | 23.2[3] | --- |
| Anna R. lentic (S) | Aug 8 | --- | --- | 9.4[3] | --- |

**Table 2.** *continued.*

| Tributary | Date | Discharge ($m^3/s$) | TFM (kg)[1,2] | Bayluscide (kg)[1,3] | Distance Treated (km) |
|---|---|---|---|---|---|
| Au Train R. (T) | May 27 | 10.1 | 1,926.3 | 7.7 | 25.9 |
| Laughing Whitefish R. (U) | Jun 10 | 0.7 | 86.0 | 0.0 | 8.1 |
| Harlow Cr. (V) | Jun 15 | 0.3 | 56.6 | 0.0 | 7.2 |
| Garlic R. (W) | Jun 13 | 1.4 | 142.4 | 0.0 | 12.1 |
| Pine R. (X) | Jun 9 | 1.1 | 83.1 | 0.0 | 3.5 |
| Mountain Stream | Jun 9 | 0.6 | 51.6 | 0.0 | 1.6 |
| Ravine R. (Y) | Sep 2 | 0.1 | 14.7 | 0.0 | 8.1 |
| Silver R. (Z) | Sep 1 | 0.4 | 63.6 | 0.0 | 7.6 |
| Silver R. lentic | Aug 4 | --- | --- | 143.7[3] | --- |
| Falls R. (AA) | Aug 31 | 0.7 | 99.1 | 0.0 | 0.6 |
| Trap Rock R. (BB) | Jul 25 | 0.6 | 90.3 | 0.0 | 17.7 |
| Eliza Cr. (CC) | Jul 21 | 0.1 | 5.8 | 0.0 | 1.1 |
| Gratiot R. (DD) | Jul 23 | 0.2 | 18.6 | 0.0 | 4.2 |
| Misery R. (EE) | Jul 24 | 0.8 | 150.4 | 0.0 | 2.9 |
| East Sleeping R. (FF) | May 26 | 0.9 | 101.4 | 0.0 | 4.8 |
| Firesteel R. (GG) | Oct 14 | 2.3 | 429.1 | 0.0 | 67.6 |
| Potato R. (HH) | May 27 | 0.4 | 103.2 | 0.0 | 29.0 |
| Cranberry R. (II) | May 29 | 1.6 | 139.8 | 0.0 | 25.8 |
| Black R. lentic (JJ) | Aug 3 | --- | --- | 12.3[3] | --- |
| Bad R. (KK) | Sep 16 | 9.2 | 1,714.4 | 0.0 | 143.3 |
| Red Cliff Cr. (LL) | Sep 15 | 0.1 | 20.0 | 0.0 | 5.6 |
| Sand R. (Bayfield Co.) (MM) | Sep 2 | 0.3 | 110.8 | 0.0 | 15.1 |
| Poplar R. (NN) | Sep 2 | 0.1 | 48.8 | 0.0 | 22.5 |
| **Total (United States)** | | **32.8** | **5,579.3** | **212.3** | **418.4** |
| | | | | | |
| **Total for Lake Superior** | | **58.1** | **8,788.0** | **606.9** | **519.5** |

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 187 TFM bars (38.9 kg active ingredient) applied in 11 streams.
[3] Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

## Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-three tributaries have historical records of larval sea lamprey production, and of these, 80 tributaries have been treated with lampricides at least once during 2002-2011. Thirty-eight tributaries are treated on a regular cycle. Table 3 provides details on the application of lampricides to tributaries treated during 2011 and Figure 1 shows the locations of the tributaries.

- Lampricide treatments were completed in 19 tributaries and 1 lentic area. The lentic application on the Jordan River was conducted in conjunction with the TFM treatment.

- The West Branch Ogontz River and Eighteen Mile Creek (Sturgeon River) were treated for the second consecutive year due to the presence of residual lampreys that resulted from low discharge and the occurrence of numerous beaver impoundments during the 2010 treatments.

- The Days River was treated upstream of the sea lamprey barrier due to the presence of residual lampreys from the 2010 treatment. In 2011, treatment of the upper segment resulted in sub-lethal concentrations at two sampling sites due to very low water discharges, while lethal concentrations were maintained from the barrier to the mouth.

- The Bark River was treated in three segments under low water conditions with high pH/alkalinity water chemistries. A 6(a)2 report was filed with the EPA due to non-target mortality of mudpuppies (*Necturus maculosus*) on the lower half mile of stream. Increased lethality due to pH suppression during the second day of treatment was suspected as the cause of this kill.

- After observing non-target mortality during lentic treatments in Huron and Munising bays in Lake Superior, the lentic treatment offshore of Rapid River was deferred until 2012.

- The Crystal River was treated for the first time since 1972. A legal decision that mandated a minimum flow from Glen Lake Dam, enacted in 2003, likely made the stream more hospitable to lampreys.

- Flower Creek was treated for the first time since 1981.

- The upper Boardman River was retreated during 2011 after residual lampreys were found following the 2010 treatment. A 6(a)2 report was filed with the EPA due to non-target mortality of round gobies *(Neogobius melanostomus)* that resulted from a malfunction of lampricide application equipment.

- The Jordan River was treated during mid-July, but treatment of its tributary, Deer Creek, was deferred until late September in order to support research on seasonality of TFM toxicity.

**Table 3.** Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2011 (letter in parentheses corresponds to location of stream in Figure 1).

| Tributary | Date | Discharge ($m^3/s$) | TFM (kg)[1,2] | Bayluscide (kg)[1,3] | Distance Treated (km) |
|---|---|---|---|---|---|
| Jordan R. (A) | Jul 9 | 7.2 | 1,475.3 | 14.6[3] | 29.6 |
| Elk Lake Outlet (B) | Jul 12 | 1.7 | 372.1 | 0.0 | 0.5 |
| Boardman R. (C) | Oct 2 | 7.4 | 1,158.5 | 13.4[3] | 3.5 |
| Crystal R. (D) | Nov 2 | 1.1 | 427.8 | 0.1[3] | 9.5 |
| Little Manistee R. (E) | Jul 24 | 5.0 | 1,213.3 | 10.1[3] | 66.0 |
| Pentwater R. (F) | Jun 9 | 1.8 | 498.5 | 0.0 | 26.6 |
| Flower Cr. (G) | Jun 28 | 0.6 | 147.9 | 0.0 | 12.2 |
| Muskegon R. (H) | Aug 18 | 39.6 | 6,843.8 | 76.2[3] | 104.6 |
| Black R. (I) | Jun 24 | 3.4 | 583.6 | 0.0 | 29.0 |
| Peshtigo R. (J) | Oct 2 | 15.0 | 1,309.7 | 14.1 | 19.3 |
| Bark R. (K) | Oct 1 | 0.1 | 126.0 | 0.0 | 26.7 |
| Days R. (L) | Oct 2 | 0.3 | 86.6 | 0.0 | 15.9 |
| Whitefish R. (M) | Jun 24 | 9.2 | 1,944.0 | 7.2 | 109.5 |
| Ogontz R. (N) | | | | | |
| West Branch | Sep 7 | 0.1 | 9.0 | 0.0 | 3.2 |
| Sturgeon R. (O) | | | | | |
| Eighteen Mile Cr. | Aug 18 | 0.2 | 50.7 | 0.0 | 4.8 |
| Fishdam R. (P) | Sep 1 | 0.4 | 139.4 | 0.0 | 35.4 |
| Milakokia R. (Q) | Jul 9 | 2.5 | 443.5 | 0.0 | 27.7 |
| Millecoquins R. (R) | | | | | |
| Upper and McAlpine Cr. | Apr 28 | 2.8 | 258.0 | 0.0 | 11.3 |
| Furlong Cr. | May 1 | 3.5 | 308.6 | 0.0 | 22.5 |
| Brevort R. (S) | Jun 12 | 0.9 | 107.7 | 0.0 | 16.1 |
| **Total for Lake Michigan** | | **102.8** | **17,504.0** | **135.7** | **573.9** |

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 557 TFM bars (116.2 kg active ingredient) applied in 11 streams.
[3]Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

## Lake Huron

Lake Huron has 1,761 tributaries (1,334 Canada, 427 U.S.). One hundred twenty tributaries (58 Canada, 62 U.S.) have historical records of larval sea lamprey production. Of these, 73 tributaries (36 Canada, 37 U.S.) have been treated with lampricide at least once during 2002 - 2011. Forty-nine tributaries (22 Canada, 27 U.S.) are treated on a regular cycle. Table 4 provides details on the application of lampricides to tributaries and lentic areas treated during 2011.

- Lampricide treatments were completed in 45 tributaries (24 Canada, 21 U.S.), the St. Marys River, and 3 lentic areas (3 Canada, 0 U.S.).

- This was the second year of a large-scale treatment strategy in the North Channel of Lake Huron, which was designed to suppress and maintain sea lamprey abundance at or below target in Lake Huron. Forty-one sea lamprey-producing tributaries and lentic areas (26 Canada, 14 U.S. and the St. Marys River) were treated, including the Echo River (Bar/Iron Creek), Serpent River (main), Lauzon Creek (lentic) and Manitou River (lentic) (Canada) and Martineau and Carlton creeks (U.S.), which were added to the North Channel strategy during 2011. These streams, as well as those deferred in 2010, will be treated in 2012.

- The treatment of 873 ha (274 Canada, 599 U.S.) of larval habitat in the St. Marys River with GB was made possible through the deployment of two spray boats. These state-of-the-art craft use technology adapted from agricultural applications and are equipped with real-time navigation and a delivery system that mixes GB with water before delivering it under high pressure to boom-mounted spray nozzles. Application rates are more than double those of conventional rotary spreaders and are automatically adjusted according to boat position and speed. The Chippewa-Ottawa Resource Authority assisted in the treatment of the St. Marys River by providing temporary storage for GB in preparation for delivery to the U.S. and Canadian spray boats.

- Treatments of the Garden and Mississagi rivers were completed in 2011 after deferral in 2010 due to low flows.

- Marl Creek (Nottawasaga River tributary) was treated for the first time in 2011. The treatment had been deferred for two consecutive years due to the presence of a large scale irrigation system operating within the stream. The treatment was completed in early spring, prior to the start-up of the irrigation pumps.

- Treatments of the Wanapitei and Magnetawan rivers were completed in 2011 after being deferred in 2010 due to lower than normal discharge.

- The Still River lentic area was treated with GB for the first time since 1981.

- A tributary to the Echo River (Bar/Iron Creek) was treated in numerous sections due to beaver impoundments and low discharge.

- Heavy rainfall compromised treatment effectiveness of the lower portion of the Bar River. Historically, larval lamprey density has been very low in the affected area.

- Significant snow melt and spring rains increased stream discharges during the treatments of Beavertail, Steeles, McKay, Prentiss, Mulligan, and Greene creeks and the Black Mallard River. Flow in the Black Mallard River, downstream of Black Mallard Lake, was so excessive that treatment had to be deferred until later in the season. Collectively, more than 1.4 times as much TFM was used on these streams during 2011 than in the previous two treatments.

- Carlton Creek was treated for the first time since 2001.

- Greene Creek was treated for the first time downstream from the stop-log barrier in the culvert at US-23. Previously, extensive beaver dams in a low gradient area upstream of US-23 made treatment very difficult and reduced effectiveness. The barrier has successfully prevented lamprey access to most of the stream and greatly simplified the treatment.

- The Rifle River was treated by the combined control crews from Ludington, Marquette and Sault Ste. Marie. This treatment was observed by staff of the National Institute of Safety and Occupational Health (NIOSH) who conducted a health hazard evaluation during lampricide application.

**Table 4.** Details on the application of lampricides to tributaries and lentic areas of Lake Huron during 2011 (letter in parentheses corresponds to location of stream in Figure 1).

| Tributary | Date | Discharge ($m^3/s$) | TFM (kg)[1,2] | Bayluscide (kg)[1,3] | Distance Treated (km) |
|---|---|---|---|---|---|
| **Canada** | | | | | |
| St Marys R. (A) | Jun 21 | --- | --- | 1,535.9[3] | --- |
| Whitefish Ch. | Oct 13 | 0.2 | 24.3 | 0.0 | 0.7 |
| Garden R. (B) | Jul 13 | 8.3 | 496.3 | 0.1 | 60.4 |
| Echo R. (C) | Jul 7 | 0.9 | 50.1 | 0.0 | 2.6 |
| Bar & Iron Cr. | Sep 7 | 0.2 | 30.1 | 0.0 | 13.3 |
| Bar R. (D) | Oct 19 | 1.0 | 91.8 | 0.3 | 6.1 |
| Richardson Cr. (E) | Aug 24 | 0.3 | 111.6 | 0.0 | 4.5 |
| Gordon Cr. (F) | Sep 29 | 0.1 | 4.1 | 0.0 | 1.5 |
| Browns Cr. (G) | Sep 29 | 0.1 | 6.7 | 0.0 | 3.7 |
| Thessalon R. (H) | | | | | |
| Upper Thessalon R. | Aug 22 | 1.6 | 213.9 | 0.0 | 40.5 |
| Mississagi R. (I) | Jul 20 | 65.8 | 3,249.3 | 37.6 | 48.6 |
| Lauzon Cr. (J) | Jun 9 | 0.6 | 24.3 | 0.0 | 0.9 |
| lentic | Jun 9 | --- | --- | 29.8[3] | --- |
| No Name (H-114) (K) | Jun 27 | 0.1 | 1.2 | 0.0 | 0.4 |
| Serpent R. (L) | May 4 | 15.7 | 525.5 | 0.1 | 10.8 |
| Spanish R. (M) | Sep 15 | 60.6 | 3,590.2 | 0.8 | 57.0 |
| Sand Cr. (N) | May 26 | 0.2 | 69.0 | 0.0 | 4.6 |
| Silver Cr. (O) | May 27 | 0.8 | 147.4 | 0.0 | 3.0 |
| No Name (H-267) (P) | May 26 | 0.2 | 62.1 | 0.1 | 4.2 |
| Mindemoya R. (Q) | Jun 1 | 0.5 | 164.5 | 0.0 | 8.5 |
| Timber Bay Cr. (R) | May 29 | 0.8 | 175.8 | 0.0 | 3.8 |

**Table 4.** *continued.*

| | | | | | |
|---|---|---|---|---|---|
| Manitou R. lentic (S) | Jun 2 | 2.0 | 408.2 | 0.1 | 9.1 |
| Blue Jay Cr. (T) | Sep 18 | --- | --- | 67.8[3] | --- |
| Wanapitei R. (U) | Jun 22 | 18.2 | 743.8 | 8.8 | 10.2 |
| Still R. lentic (V) | Jun 8 | --- | --- | 28.3[3] | --- |
| Magnetawan R. (W) | Jun 3 | 19.0 | 742.8 | 0.0 | 8.1 |
| Sturgeon R. (X) | Apr 16 | 1.9 | 329.9 | 0.0 | 1.9 |
| Nottawasaga R. (Y) | | | | | |
| Marl Cr. | Apr 14 | 1.2 | 336.4 | 0.0 | 14.5 |
| **Total (Canada)** | | **200.3** | **11,599.3** | **1,709.7** | **318.9** |
| | | | | | |
| Rifle R. (Z) | Aug 6 | 4.8 | 1,790.3 | 9.6[3] | 194.7 |
| Black R. (AA) | May 14 | 3.4 | 784.2 | 0.0 | 15.1 |
| Devils R. (BB) | May 27 | 2.5 | 729.6 | 0.0 | 16.3 |
| Trout R. (CC) | May 24 | 1.1 | 266.8 | 0.0 | 1.9 |
| | | | | | |
| Black Mallard Cr. (DD) | May 2 | 4.4 | 374.3 | 0.8[3] | 9.7 |
| Mulligan Cr. (EE) | Apr 30 | 1.0 | 43.0 | 0.0 | 1.6 |
| Greene Cr. (FF) | May 1 | 1.0 | 33.0 | 0.0 | 0.3 |
| Cheboygan R. (GG) | | | | | |
| Little Pigeon R. | Sep 4 | 0.3 | 58.5 | 0.0 | 2.7 |
| Pigeon R. | Sep 5 | 3.4 | 1,134.0 | 0.0 | 54.6 |
| Maple R. | Sep 15 | 2.0 | 546.5 | 0.0 | 12.2 |
| Sturgeon R. | Sep 20 | 6.5 | 1,189.4 | 13.4 | 39.7 |
| Martineau Cr. (HH) | May 13 | 0.5 | 47.1 | 0.0 | 4.0 |
| Carp R. (II) | May 14 | 9.2 | 1,272.6 | 0.0 | 98.2 |
| Steeles Cr. (JJ) | May 5 | 0.5 | 32.2 | 0.0 | 1.3 |
| Hessel Cr. (KK) | May 13 | 0.2 | 46.2 | 0.0 | 1.4 |
| McKay Cr. (LL) | Apr 30 | 2.8 | 247.8 | 0.0 | 8.9 |
| Prentiss Cr. (MM) | Apr 30 | 1.2 | 234.2 | 0.0 | 5.0 |
| Beavertail Cr. (NN) | May 3 | 1.1 | 320.9 | 0.0 | 7.6 |
| Albany Cr. (OO) | Apr 29 | 2.4 | 96.2 | 0.0 | 1.0 |
| Bear Lake Outlet (PP) | May 16 | 0.1 | 19.7 | 0.0 | 1.3 |
| Caribou Cr. (QQ) | Jun 1 | 0.1 | 7.4 | 0.0 | 1.0 |
| Carlton Cr. (RR) | May 16 | 0.2 | 18.9 | 0.0 | 1.3 |
| Munuscong R. (SS) | | | | | |
| Taylor Cr. | Oct 5 | 0.6 | 221.4 | 0.0 | 12.9 |
| Charlotte R. (TT) | Oct 25 | 1.1 | 77.0 | 0.0 | 24.2 |
| St Marys R. (A) | Jun 21 | --- | --- | 3354.9[3] | --- |
| **Total (United States)** | | **50.4** | **9,591.2** | **3378.7** | **516.9** |
| | | | | | |
| **Total for Lake Huron** | | **250.7** | **21,190.5** | **5,088.4** | **835.8** |

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 346 TFM bars (71.9 US kg active ingredient) applied in 22 streams.
[3] Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

## Lake Erie

Lake Erie has 842 tributaries (525 Canada, 317 U.S.). Twenty-two tributaries (11 Canada, 11 U.S.) have historical records of larval sea lamprey production. Of these, 11 tributaries (5 Canada, 6 U.S.) have been treated with lampricides at least once during 2002-2011. Eight tributaries (2 Canada, 6 U.S.) are treated on a regular cycle. In addition, larval production has been documented in the St. Clair River, three of its U.S. tributaries, and two tributaries to Lake St. Clair (one Canada, one U.S.), none of which have required treatment during 2002-2011.

A whole lake large-scale treatment strategy consisting of back to back treatments of 11 tributaries (5 Canada, 6 U.S.) was completed during the period of 2008 – 2010. Treatment evaluation surveys indicate that all 11 tributaries were treated with very high efficacy, and therefore, no Lake Erie streams were treated in 2011.

## Lake Ontario

Lake Ontario has 659 tributaries (405 Canada, 254 U.S.). Sixty-six tributaries (31 Canada, 35 U.S.) have historical records of larval sea lamprey production, and of these, 41 tributaries (20 Canada, 21 U.S.) have been treated with lampricides at least once during 2002-2011. Twenty-eight tributaries (13 Canada, 15 U.S.) are treated on a regular cycle. Table 5 provides details on the application of lampricides to Lake Ontario tributaries treated during 2011.

- Treatments were completed in 8 tributaries (3 Canada, 5 U.S.) plus lentic areas of the Trent and Moira rivers.

- Pretreatment assessments determined that larval sea lamprey distibution on the Little Rouge River extended further upstream than in any other year since 1983. As a result, an additional 9.8 km of this tributary required treatment.

- Orwell Brook was treated for the fifth consecutive year to address residual populations in numerous beaver impoundments. The stream is being treated annually, pending construction of a sea lamprey barrier.

- Salmon River was treated for the second successive year after post-treatment assessment surveys confirmed the presence of residual sea lampreys.

**Table 5.** Details on the application of lampricides to tributaries of Lake Ontario during 2011 (letter in parentheses corresponds to location of stream in Figure 1).

| Tributary | Date | Discharge ($m^3/s$) | TFM (kg)[1,2] | Bayluscide (kg)[1] | Distance Treated (km) |
|---|---|---|---|---|---|
| **Canada** | | | | | |
| Credit R. (A) | Jul 7 | 6.8 | 1,430.8 | 14.9[3] | 47.0 |
| Rouge R. (B) | Jun 6 | 2.9 | 947.2 | 0.1[3] | 33.7 |
| Bowmanville Cr. (C) | May 1 | 3.4 | 1,029.4 | 0.0 | 16.3 |
| Trent R lentic (D) | Oct 26 | --- | --- | 9.4[3] | --- |
| Moira R. lentic (E) | May 28 | --- | --- | 21.1[3] | --- |
| **Total (Canada)** | | **13.1** | **3,407.4** | **45.5** | **97.0** |
| | | | | | |
| **United States** | | | | | |
| South Sandy Cr. (F) | May 29 | 5.7 | 706.5 | 0.0 | 12.0 |
| Lindsey Cr. (G) | May 1 | 1.3 | 124.3 | 0.0 | 11.9 |
| Salmon R. (H) | Jun 3 | 28.4 | 1,610.2 | 0.1[3] | 31.3 |
| Orwell Br. | May 27 | 1.2 | 165.8 | 0.0 | 11.2 |
| Snake Cr. (I) | Apr 30 | 0.5 | 59.6 | 0.0 | 5.6 |
| Ninemile Cr. (J) | May 31 | 1.1 | 287.0 | 0.1[3] | 26.1 |
| **Total (United States)** | | **38.2** | **2,953.4** | **0.2** | **98.1** |
| | | | | | |
| **Total for Lake Ontario** | | **51.3** | **6,360.8** | **45.7** | **195.1** |

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 25 TFM bars (5.2 kg active ingredient) applied in 3 streams.
[3] Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

## ALTERNATIVE CONTROL

The Commission continues to research and develop alternatives to lampricide treatments to provide a broader spectrum of tactics to control sea lamprey populations. Alternative control methods used in 2011 include the SMRT in the St. Marys River, removal of spawning-phase sea lampreys using traps, and construction and maintenance of low-head barriers. Alternative control methods that are currently being investigated include the use of attractants (e.g. pheromones) and repellents (e.g. necromones), and new trapping designs.

### Sterile-Male-Release Technique

The SMRT involves capturing, sterilizing and releasing spawning-phase males to compete with resident males. Captured males are transported to the sterilization facility at the USGS Hammond Bay Biological Station. Sea lampreys are sterilized with the chemosterilant bisazir, marked with a fin clip and released into the St. Marys River. Laboratory and field studies have shown that treated male sea lampreys are sterile and sexually competitive (produce mating pheromones and exhibit typical spawning behaviours).

- During 2011, male sea lampreys were captured from 21 tributaries to lakes Superior, Michigan, Huron, and Ontario for use in the SMRT (Figure 2).

- A total of 26,408 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations in lakes Superior (372), Michigan (8,361), Huron (15,999) and Ontario (1,676).

- A total of 22,909 sterilized male sea lampreys were released in the St. Marys River from mid-May to mid-July. The estimated resident population of spawning-phase sea lampreys in the St. Marys River was 15,099. Assessment traps removed 4,755 sea lampreys, an estimated reduction in reproduction of 29% through trapping. The ratio of sterile to resident male sea lampreys remaining in the St. Marys River was estimated at 3.3:1 (22,909 sterile: 6,899 estimated resident after trapping).

- The theoretical reduction from trapping and enhanced sterile-male-release was estimated at 84% during 2011. The theoretical reduction in reproduction from trapping and the enhanced SMRT averaged 82% during 1997-2011 (Table 6). Prior to the enhanced program (1991-1996), the theoretical reduction in reproduction averaged 58%.

- The release of sterile males combined with the removal of sea lampreys by traps reduced the theoretical number of effective fertile females in the St. Marys River from 5,382 to 895 during 2011.

- In the St. Marys River rapids, 152 sea lampreys (48 sterile male, 73 fertile male, 19 female and 12 of unknown sex) were observed on nests. The ratio of sterile:normal males observed on nests was 0.6:1. Egg samples were obtained from 46 nests and the average egg viability in nests was 44.2% with a range from 0% to 97%. Average egg viability weighted by nests per year from 1997-2011 was 32.8%.

**Figure 2.** Locations of trapped tributaries that contributed spawning-phase sea lampreys for sterilization during 2011, release sites, and the sterilization facility.

**Table 6.** Theoretical effects of trapping and sterile male release, and theoretical suppression of reproduction in the estimated population of sea lampreys in the St. Marys River during 1997-2011.

| Year | Population estimate | 95% CI LL | 95% CI UL | Percent males | Percent removed by traps | Sterile males released | Estimated ratio sterile:normal males | Theoretical percent reduction in reproduction[1] | Theoretical reproducing females[2] |
|---|---|---|---|---|---|---|---|---|---|
| 1997 | 8,162 | 6,388 | 10,276 | 56 | 30 | 17,181 | 5.4:1 | 89 | 402 |
| 1998 | 20,235 | 17,683 | 23,050 | 57 | 35 | 16,743 | 2.2:1 | 80 | 1,771 |
| 1999 | 19,860 | 18,153 | 21,679 | 60 | 53 | 26,285 | 4.7:1 | 92 | 638 |
| 2000 | 38,829 | 35,029 | 42,926 | 64 | 48 | 43,184 | 3.3:1 | 88 | 1,670 |
| 2001 | 25,311 | 19,160 | 32,813 | 63 | 45 | 31,459 | 3.6:1 | 88 | 1,113 |
| 2002 | 13,619 | 5,658 | 27,797 | 63 | 59 | 22,684 | 6.4:1 | 94 | 289 |
| 2003 | 27,011 | 19,276 | 36,831 | 66 | 33 | 27,963 | 2.3:1 | 80 | 1,860 |
| 2004 | 19,864 | 14,489 | 26,588 | 70 | 27 | 26,472 | 2.6:1 | 80 | 1,203 |
| 2005 | 18,790 | 16,924 | 20,804 | 64 | 45 | 30,581 | 4.6:1 | 90 | 673 |
| 2006 | 24,836 | 21,999 | 27,935 | 65 | 41 | 25,879 | 3:1:1 | 84 | 1,389 |
| 2007 | 22,808 | 18,937 | 27,235 | 65 | 25 | 32,152 | 2.9:1 | 81 | 1,559 |
| 2008 | 17,513 | 15,494 | 19,721 | 64 | 41 | 22,072 | 3.3:1 | 86 | 875 |
| 2009 | 13,424 | 11,547 | 15,518 | 62 | 42 | 19,212 | 3.8:1 | 87 | 643 |
| 2010 | 25,234 | 21,596 | 29,306 | 63 | 28 | 19,392 | 1.7:1 | 74 | 2,498 |
| 2011 | 15,099 | 12,666 | 17,719 | 64 | 32 | 22,909 | 3.4:1 | 84 | 847 |

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

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

## Barriers

The sea lamprey barrier program priorities are:

1) Operate and maintain existing sea lamprey barriers.
2) Ensure sea lamprey migration is blocked at important barrier sites.
3) Construct structures in streams where they
   a. provide control where other options are impossible, excessively expensive, or ineffective;
   b. provide a cost-effective alternative to lampricide control;
   c. improve cost-effective control in conjunction with pheromone-based control methods, trapping, the sterile male program, and lampricide treatments; and
   d. are compatible with a system's watershed plan.

The Barrier Task Force (BTF) was established by the Commission during April 1991 to coordinate efforts of the Service, Department, and U.S. Army Corps of Engineers (USACOE) on the construction, operation, and maintenance of sea lamprey barriers. The task force's report on the charges during 2011 is presented in the BTF section of this report.

Beginning in 2007, an intensive effort to inventory and ground truth the information contained in the National Inventory of Dams was conducted to assess the sea lamprey blocking potential of barriers located on U.S. tributaries to the Great Lakes. This information is recorded in the SLCP's Barrier Inventory and Project Selection System (BIPSS). During 2011, sites were inspected that were either previously inaccessible or where additional information was needed. The initial inventory is complete, and in the future, barrier sites will be monitored on a rotating schedule.

During 2011, there were 65 sea lamprey barriers in the Great Lakes basin that were operated and maintained by the SLCP (Figure 3).

**Figure 3.** Locations of tributaries with sea lamprey barriers. Structures that have been modified or constructed by others that prevent the upstream migration of sea lampreys are indicated by an asterisk.

**Lake Superior**

There are 16 sea lamprey barriers on Lake Superior (Figure 3). Of these, 12 have been purpose-built by the Commission. The remainder consist of modifications to existing structures constructed by others to ensure sea lampreys remain blocked at those sites.

*Operation and Maintenance*

- Routine maintenance, spring start-up, and safety inspections were performed on 11 barriers (5 Canada, 6 U.S.).
- Repairs or improvements were conducted on three barriers (two Canada, one U.S.):
    - Big Carp River – A diagnostic check of the barrier's electrical components was completed. Damage to a fence at the site was also repaired.
    - Carp River – The maintenance and extension of the access road and culvert were completed.
    - Middle River – Large debris was removed from the crest of the barrier.

*Ensure Blockage to Sea Lamprey Migration*

- Consultations to ensure blockage at barriers were conducted with partner agencies on seven U.S. tributaries (Table 7).

**Table 7.** Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Superior tributaries.

| Mainstream | Tributary | Lead Agency | Project | SLCP Position | Comments |
|---|---|---|---|---|---|
| Eagle R. | | Local watershed association | Eagle River Dam | Concur | Falls prevent migration |
| Raspberry R. | | USFWS[2] | Culvert | Concur | Ineffective barrier |
| Brickyard Cr. | | USFWS[2] | Culvert | Pending | Perched culvert |
| Bad R. | Billy Creek | BRWA[3] | Culvert | Pending | Ineffective barrier |
| Bad R. | Sec. 27 Trib. | BRWA[3] | Culvert | Pending | Ineffective barrier |
| Saxine R. | | USFWS[2] | Culvert | Pending | Ineffective barrier |
| St. Louis R. | Unnamed Trib. | USFWS[2] | Culvert | Pending | Ineffective barrier |

[2] U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Ashland).
[3] Bad River Watershed Association.

- Black Sturgeon River – The Black Sturgeon Dam, located 17 km upstream of the mouth, serves a vital sea lamprey control function, protecting more than 2,500 km of watershed from larval sea lamprey infestation. However, it has been identified as an impediment to walleye rehabilitation in Black Bay in an Ontario Ministry of Natural Resources (Ministry) report. During 2011, the Ministry began consultations with Aboriginal groups in advance of a planned provincial environmental assessment (EA) to evaluate options to improve fish passage at the Black Sturgeon Dam. The EA process will evaluate the preferred option, as identified by the Fisheries Management Zone 9 Advisory Council, to construct a new sea lamprey barrier at the former Camp 1 site (67 km upstream of the mouth) and decommission the existing dam. Additionally, an alternate option to refurbish the existing dam and retrofit trap and sort fish passage will be evaluated in this process.

*New Construction*

- No new construction projects were initiated in 2011.

*Assessment of Candidate Streams*

- Flow monitoring and fish-community assessment surveys were conducted at the candidate site on the Whitefish River, a tributary to the Kaministiquia River:
    - The site for the barrier is approximately 1 km upstream from the confluence. Cross sections of the stream at this site were taken. Fish surveys were conducted in the watershed during 2011. These surveys are a continuation of a multiple year assessment study designed to describe the fish-community in the Whitefish River watershed. The cumulative results of these surveys have identified 40 fish species in the watershed (Table 8). No provincially- or federally-listed species at risk have been observed during the course of recent sampling.

**Table 8.** Fish species captured in the Whitefish River during 2011 and previous years.

| Common Name | Scientific Name | 2000 | 2002 | 2003 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| american brook lamprey | *Lampetra appendix* | | | | | | X |
| blackchin shiner | *Notropis heterodon* | | | | X | | |
| blacknose dace | *Rhinichthys atratulus* | X | X | X | X | X | X |
| blacknose shiner | *Notropis heterolepis* | | | X | | | |
| bluntnose minnow | *Pimephales notatus* | | | | X | | X |
| brassy minnow | *Hybognathus hankinsoni* | | | | X | | X |
| brook stickleback | *Culaea inconstans* | X | X | X | X | X | X |
| brook trout | *Salvelinus fontinalis* | | X | X | X | X | X |
| burbot | *Lota lota* | X | | | X | | |
| central mudminnow | *Umbra limi* | X | X | X | X | X | X |
| chinook salmon | *Oncorhynchus tshawytscha* | | | | X | | |
| coho salmon | *Oncorhynchus kisutch* | | | X | | | |
| common shiner | *Luxilus cornutus* | X | X | X | X | X | X |
| creek chub | *Semotilus atromaculatus* | X | X | X | X | X | X |
| emerald shiner | *Notropis atherinoides* | | | | X | | |
| fathead minnow | *Pimphales promelas* | X | | X | X | | X |
| finescale dace | *Chrosomus neogaeus* | X | | | X | | X |
| fourspine stickleback | *Apeltes quadracus* | | | | X | | |
| johnny darter | *Etheostoma nigrum* | X | X | X | X | X | X |
| lake chub | *Couesius plumbeus* | X | X | X | X | | X |
| logperch | *Percina caprodes* | X | X | X | X | X | X |
| longnose dace | *Rhinichthys cataractae* | X | X | X | X | X | X |
| longnose sucker | *Catostomus catostomus* | X | | X | X | | |
| mimic shiner | *Notropis volucellus* | | | | X | | X |
| mottled sculpin | *Cottus bairdii* | X | X | X | X | | X |
| northern pike | *Esox lucius* | | | | X | | |
| northern redbelly dace | *Chrosomus eos* | X | | X | X | | X |
| pearl dace | *Margariscus nachtriebi* | | | X | X | | |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X | X | | X |
| rock bass | *Ambloplites rupestris* | X | X | X | X | X | X |
| sea lamprey | *Petromyzon marinus* | X | X | X | X | X | X |
| shorthead redhorse | *Moxostoma macrolepidotum* | X | | X | X | | |
| silver redhorse | *Moxostoma anisurum* | | | | X | | |
| slimy sculpin | *Cottus cognatus* | X | | X | X | | X |
| smallmouth bass | *Micropterus dolomieu* | X | X | X | X | X | X |
| spotfin shiner | *Cyprinella spiloptera* | X | | | | | |
| trout-perch | *Percopsis omiscomaycus* | X | X | X | X | X | X |
| walleye | *Sander vitreus* | | X | X | X | | |
| white sucker | *Catostomus commersonii* | X | X | X | X | X | X |
| yellow perch | *Perca flavescens* | | X | | | | |

## Lake Michigan

There are 11 sea lamprey barriers on Lake Michigan (Figure 3). Five of these were purpose-built by the Commission to block sea lamprey spawning migrations and six were modifications to existing structures or barriers constructed by others that ensure sea lampreys remain blocked at those sites.

*Operation and Maintenance*

- Routine maintenance, spring start-up, and safety inspections were performed on seven barriers.

*Ensure Blockage to Sea Lamprey Migration*

- Kewaunee River - The Buzz Besadny Anadromous Fish Facility and low-head dam complex were inspected during December 2011. This facility was constructed in 1990 and consists of a low head barrier with a bypass channel to supply water to the facility. Three year classes of larvae were found upstream of the barrier in 2011, but the stream did not rank for treatment. Minor structural changes and operational protocols will be implemented in 2012 to reduce escapement.

- White River - Electrofishing surveys revealed recruitment of the 2011 year class upstream of the Hesperia Dam despite extensive repairs to the stop log bays in 2010. Further investigation is planned for 2012.

- Boardman River - The Service conducted an inspection of the Union Street dam revealing holes in several stop-logs. The bypass channel stop-logs were sealed with filter fabric as a temporary repair, and the stop logs in the main spillway were replaced down to the elevation of the streambed. A thorough inspection of the concrete sills, replacement of the remaining stop-logs, and a hydraulic analysis is planned for 2012. Removal of several dams upstream of Union Street is planned, including the Sabin Dam, which currently acts as a barrier to upstream migration of sea lampreys. The Service does not support removal of Sabin Dam until it is certain that Union Street Dam is an effective lamprey barrier.

- Fox River – Inspection of the Rapide Croche Dam on the Fox River by the U.S. Army Corps of Engineers (USACE) revealed significant deterioration of the steel mesh grating that lined the tainter gate aprons. The steel mesh grating prevented sea lampreys from attaching and migrating upstream of the dam when the gates are opened during periods of high flow. An Inter-Agency Agreement was developed with the USACE to incorporate the mesh repairs into their scheduled concrete pier repair work. Repair was initiated in fall 2011 and will be completed in summer 2012. Because of these repairs, the Rapide Croche Dam is now considered a barrier that has been modified to block sea lampreys and has been added to Figure 3.

- Consultations to ensure blockage at barriers were conducted with partner agencies on three sites in two tributaries (Table 9).

**Table 9.** Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Michigan tributaries.

| Mainstream | Tributary | Lead Agency | Project | SLCP Position | Comments |
|---|---|---|---|---|---|
| Sheboygan R. | | WIDNR[2] | River Bend Dam | Pending | On hold |
| Sheboygan R. | | WIDNR[2] | Walderhaus Dam | Pending | On hold |
| Milwaukee R. | | Ozaukee County | Newburg Dam | Concur | Ineffective barrier |

[2]Wisconsin Department of Natural Resources.

*New Construction*

- Manistique River - The USACE is the lead agency administering a project to construct a sea lamprey barrier to replace a deteriorated structure in the Manistique River. Project partners include the Great Lakes Fishery Commission, U.S. Fish and Wildlife Service, Michigan Department of Natural Resources, City of Manistique, and Manistique Papers, Inc. Conceptual barrier and trap design plans have been provided for review in the USACE Detailed Project Report. Construction is scheduled to begin in 2013 and be completed in 2014.

- Trail Creek – Barrier and fishway construction was completed in December 2011 and operation is scheduled for spring 2012.

- Days River - The Hydrologic and Hydraulic Report for the Days River was completed in March 2011. During the spring months, analysis indicated that the existing structure maintained an 18” drop only 5% of the time. It was determined that the current structure could support an increase in crest elevation up to two feet; any additional increase would require a complete rebuild of the barrier. Completion of this project has been deferred to address higher priority barrier projects.

## Lake Huron

There are 17 sea lamprey barriers on Lake Huron (Figure 3). Thirteen of these were purpose-built by the Commission to block sea lamprey spawning migrations and four were modifications to existing structures or barriers constructed by others that ensure sea lampreys remain blocked at those sites.

*Operation and Maintenance*

- Routine maintenance, spring start-up, and safety inspections were performed on 10 barriers (4 Canada, 6 U.S.).
- Repairs or improvements were conducted on three barriers (two Canada, one U.S.):
    - Echo River –Scouring of the river bed was observed downstream of the barrier. Restoration of this area was carried out.
    - Browns Creek – Both downstream banks were damaged and restoration work was completed.
    - East Au Gres River - Repairs were completed to the access road on state-owned property.
- The electrical field of the combination low-head/electrical barrier in the Ocqueoc River operated continuously from early March through mid-August.

*Ensure Blockage to Sea Lamprey Migration*

- Consultations to ensure blockage at barriers were conducted with partner agencies on 10 U.S. tributaries (Table 10).

**Table 10.** Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Huron tributaries.

| Mainstream | Tributary | Lead Agency | Project | SLCP Position | Comments |
|---|---|---|---|---|---|
| Cheboygan R. | Pigeon R. | MDEQ[2] | Lansing Club Dam | Concur | |
| Cheboygan R. | Pigeon R. | USFWS/EPA[3] | Culvert modification | Pending | |
| Cheboygan R. | Sturgeon R. | USFWS/EPA[3] | Culvert modification | Pending | |
| Cheboygan R. | Maple R. | MIDNR[4] | Lake Kathleen Dam | Do not concur | |
| Thunder Bay R. | | USFWS/EPA[3] | Culvert modification | Pending | Primary barrier |
| Au Sable R. | Van Etten Cr. | MIDNR[4] | Van Etten Dam | Conditional | |
| Rifle R. | | NWF[5] | Culvert modification | Pending | Fish passage modification |
| Saginaw R. | Shiawassee R. | USFWS[6] | Shiatown Dam | Do not concur | Primary barrier |
| Saginaw R. | Shiawassee R. | USFWS[6] | Corunna Dam | Concur | Ineffective barrier |
| Saginaw R. | Shiawassee R. | USFWS[6] | Owosso Dam | Pending | Ineffective barrier |

[2] Michigan Department of Environmental Quality.
[3] U.S. Fish & Wildlife Service, Liaison to the Great Lakes National Program Office – U.S. Environmental Protection Agency.
[4] Michigan Department of Natural Resources.
[5] National Wildlife Federation.
[6] U.S. Fish & Wildlife Service, Fish & Wildlife Conservation Office (Alpena).

- Saugeen River – Denny's Dam serves a crucial sea lamprey control function in Lake Huron, and reconstruction to address structural deterioration and instability has been planned since 2007. During 2011, the Ontario Ministry of Natural Resources (Ministry), with input from their consulting engineer, revised the estimated cost of rehabilitation to $2.3M from $1.6M in 2006. Planned as a 2-year project, the Commission has agreed to commit Canada's share of the rehabilitation costs (approximately $1.1M) in Year 1 to expedite construction. A memorandum of understanding between the Ministry, the Commission, and Department will formalize the agreement, and pending approval in provincial parliament, construction is anticipated to commence in 2012. Expedience of this project is critical, as approval for the project under the provincial class EA expires in 2013.

*New Construction*

- Construction projects were completed on one Canadian tributary:
    - Still River – All major construction work was completed in the winter of 2010/2011. The new barrier was operational by early spring 2011, prior to the sea lamprey migration period. Fencing and safety signs were installed around the barrier site and the barrier integrated sea lamprey trap is ready for operation.

*Assessment of Candidate Streams*

- Barrier site and fish-community assessment surveys of barrier candidate streams were conducted on three Canadian tributaries.
    - Bighead River – A candidate barrier site has been identified on the Bighead River in the Town of Meaford. Field data collection for hydrological and hydraulic analysis is ongoing. Discussions with OMNR regarding the compatibility of a new sea lamprey barrier with watershed management plans will be initiated in 2012. Fish surveys were conducted in the watershed during 2011. These surveys are a continuation of a multiple year assessment study designed to describe the fish-community in the Bighead River. The cumulative results of these surveys have identified 42 fish species in the watershed (Table 11). Round goby (*Neogobius melanostomus*) have been observed in the lower stem of the main river.
    - Pine River (Tributary to the Nottawasaga River) – Fish surveys were conducted in the watershed during 2011. These surveys are a continuation of a multiple year assessment study designed to describe the fish-community in the Pine River. The cumulative results of these surveys have identified 39 fish species in the watershed (Table 12). Round goby have been observed in the lower stem of the main river. No provincially- or federally-listed species at risk have been observed during the course of recent sampling.
    - Root River - Fish surveys were conducted in the watershed during 2011. These surveys are a continuation of a multiple year assessment study designed to describe the fish-community in the Root River. The cumulative results of these surveys have identified 36 fish species in the watershed (Table 13). No provincially or federally listed species at risk have been observed during the course of recent sampling.

**Table 11.** Fish species caught during surveys on the Bighead River in 2011 and previous years.

| Common Name | Scientific Name | 2006 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| blackchin shiner | *Notropis heterodon* | | X | | |
| blacknose dace | *Rhinichthys atratulus* | X | X | X | X |
| blacknose shiner | *Notropis heterolepis* | X | X | X | X |
| blackside darter | *Percina maculata* | | | X | |
| bluntnose minnow | *Pimephales notatus* | X | X | X | X |
| brassy minnow | *Hybognathus hankinsoni* | | X | | X |
| brook stickleback | *Culaea inconstans* | X | X | X | X |
| brook trout | *Salvelinus fontinalis* | X | X | X | X |
| brown trout | *Salmo trutta* | X | X | X | X |
| burbot | *Lota lota* | X | X | | X |
| central mudminnow | *Umbra limi* | X | X | X | X |
| chinook salmon | *Oncorhynchus tshawytscha* | X | X | X | X |
| coho salmon | *Oncorhynchus kisutch* | X | | | |
| common carp | *Cyprinus carpio* | X | | | |
| common shiner | *Luxilus cornutus* | X | X | X | X |
| creek chub | *Semotilus atromaculatus* | X | X | X | X |
| emerald shiner | *Notropis atherinoides* | | X | X | X |
| fathead minnow | *Pimephales promelas* | X | X | X | X |
| golden shiner | *Notemigonus crysoleucas* | | X | X | X |
| green sunfish | *Lepomis cyanellus* | | X | | X |
| hornyhead chub | *Nocomis biguttatus* | X | X | X | X |
| ichthyomyzon ammocete | *Ichthyomyzon sp.* | | | | X |
| johnny darter | *Etheostoma nigrum* | X | X | X | X |
| largemouth bass | *Micropterus salmoides* | | | | X |
| longnose dace | *Rhinichthys cataractae* | X | X | X | X |
| mimic shiner | *Notropis volucellus* | | | X | X |
| mottled sculpin | *Cottus bairdii* | X | X | X | X |
| northern redbelly dace | *Chrosomus eos* | X | X | X | X |
| pearl dace | *Margariscus nachtriebi* | X | X | X | X |
| pumpkinseed | *Lepomis gibbosus* | X | X | X | X |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X | X |
| river chub | *Nocomis micropogon* | X | X | X | X |
| rock bass | *Ambloplites rupestris* | X | X | X | X |
| rosyface shiner | *Notropis rubellus* | X | X | X | X |
| round goby | *Neogobius melanostomus* | | X | X | X |
| sand shiner | *Notropis stramineus* | | | X | |
| sea lamprey | *Petromyzon marinus* | | X | X | X |
| shorthead redhorse | *Moxostoma macrolepidotum* | | X | | |
| silver redhorse | *Moxostoma anisurum* | | X | | |
| slimy sculpin | *Cottus cognatus* | | X | | X |
| smallmouth bass | *Micropterus dolomieu* | X | X | X | X |
| white sucker | *Catostomus commersonii* | X | X | | X |

**Table 12.** Fish species caught during surveys on the Pine River in 2011 and previous years.

| Common Name | Scientific Name | 2002 | 2009 | 2011 |
|---|---|---|---|---|
| american brook lamprey | *Lampetra appendix* | | | X |
| blackchin shiner | *Notropis heterodon* | | X | |
| blacknose dace | *Rhinichthys atratulus* | X | X | X |
| blacknose shiner | *Notropis heterolepis* | | | X |
| bluntnose minnow | *Pimephales notatus* | X | X | X |
| bowfin | *Amia calva* | X | | |
| brassy minnow | *Hybognathus hankinsoni* | X | X | |
| brook stickleback | *Culaea inconstans* | | X | X |
| brook trout | *Salvelinus fontinalis* | X | X* | X |
| brown trout | *Salmo trutta* | X | X | X |
| burbot | *Lota lota* | | X | X |
| central mudminnow | *Umbra limi* | | X | X |
| central stoneroller | *Campostoma anomalum* | | X | |
| chinook salmon | *Oncorhynchus tshawytscha* | X | X | X |
| common shiner | *Luxilus cornutus* | | X | X |
| creek chub | *Semotilus atromaculatus* | X | X | X |
| fathead minnow | *Pimphales promelas* | X | X | X |
| finescale dace | *Chrosomus neognaeus* | | X | |
| hornyhead chub | *Nocomis biguttatus* | | X | X |
| Iowa darter | *Etheostoma exile* | | X | |
| johnny darter | *Etheostoma nigrum* | | X | X |
| logperch | *Percina caprodes* | | X | |
| longnose dace | *Rhinichthys cataractae* | X | X | X |
| mottled sculpin | *Cottus bairdii* | X | X | X |
| northern hog sucker | *Hypentelium nigricans* | | X | |
| northern pike | *Esox lucius* | | | X |
| northern redbelly dace | *Chrosomus eos* | X | X | X |
| pearl dace | *Margariscus nachtriebi* | X | X | X |
| pumpkinseed | *Lepomis gibbosus* | X | X | X |
| rainbow darter | *Etheostoma caeruleum* | | X | X |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X |
| rock bass | *Ambloplites rupestris* | | | X |
| round goby | *Neogobius melanostomus* | | | X |
| sea lamprey | *Petromyzon marinus* | | X | X |
| slimy sculpin | *Cottus cognatus* | | X | X |
| smallmouth bass | *Micropterus dolomieu* | | | X |
| spottail shiner | *Notropis hudsonius* | X | | |
| white sucker | *Catostomus commersonii* | X | X | X |
| yellow perch | *Perca flavescens* | | X | |

* In addition to brook trout, a tiger trout was observed in 2009.

**Table 13.** Fish species caught during surveys on the Root River in 2011 and previous years.

| Common Name | Scientific Name | 1998 | 2000 | 2002 | 2003 | 2004 | 2005 | 2009 | 2011 |
|---|---|---|---|---|---|---|---|---|---|
| american brook lamprey | *Lampetra appendix* | X | | X | | X | | X | |
| blackchin shiner | *Notropis heterodon* | | | | | X | | X | |
| blacknose dace | *Rhinichthys atratulus* | X | X | X | X | X | X | X | X |
| blacknose shiner | *Notropis heterolepis* | | | | | | X | X | X |
| bluntnose minnow | *Pimephales notatus* | | | | | | | X | |
| brassy minnow | *Hybognhathus hankinsoni* | | | | | X | X | X | X |
| brook stickleback | *Culaea inconstans* | | | | | X | X | X | X |
| brook trout | *Salvelinus fontinalus* | X | | | | X | X | X | X |
| brown bullhead | *Ameirus nebulosus* | | | | | | | X | |
| brown trout | *Salmo trutta* | | | | | | | | |
| central mudminnow | *Umbra limi* | X | X | X | | X | X | X | X |
| chinook salmon | *Oncorhynchus tshawytscha* | X | X | X | X | X | X | X | X |
| coho salmon | *Oncorhynchus kisutch* | X | X | X | X | | X | X | X |
| common shiner | *Luxilus coirnutus* | | X | X | X | | X | X | |
| creek chub | *Semotilus atromaculatus* | X | X | X | X | X | X | X | X |
| fathead minnow | *Pimephales promelas* | X | | | | | X | X | |
| finescale dace | *Chrosomus neogaeus* | | | | | | X | X | |
| golden shiner | *Notemigonus crysoleucas* | | | X | | | X | X | |
| johnny darter | *Etheostoma nigrum* | | | X | | | X | X | X |
| lake chub | *Couesius plumbeus* | | | | | | | | |
| log perch | *Percina caprodes* | | | | | | | X | |
| longnose dace | *Rhinichthys cataractae* | X | X | X | | | X | X | X |
| mimic shiner | *Notropis volucellus* | | | | | | X | X | |
| mottled sculpin | *Cottus bairdii* | X | X | X | X | X | X | X | X |
| northern hog sucker | *Hypentelium nigricans* | | | | | | X | | |
| northern redbelly dace | *Chrosomus eos* | X | X | | | X | X | X | |
| pearl dace | *Margariscus nachtriebi* | | | | | | X | X | |
| pumpkinseed | *Lepomis gibbosus* | | | | | | | X | |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X | X | X | X | X | X |
| rock bass | *Ambloplites rupestris* | X | X | X | | | X | X | X |
| sea lamprey | *Petromyzon marinus* | X | | X | | | X | X | |
| slimy sculpin | *Cottus cognatus* | X | | | | | X | X | X |
| smallmouth bass | *Micropterus dolomieu* | | X | | | | | | |
| trout perch | *Percopsis omiscomaycus* | | | | | | | | |
| white sucker | *Catostomus commersonii* | X | X | | X | X | | X | X |
| yellow perch | *Perca flavescens* | | X | | | | | X | X |

## Lake Erie

There are seven sea lamprey barriers on Lake Erie (Figure 3) that were purpose-built by the Commission to block sea lamprey spawning migrations.

*Operation and Maintenance*

- Routine maintenance, spring start-up, and safety inspections were performed on all Canadian barriers.

- Repairs or improvements were conducted on two Canadian barriers and a feasibility study was approved to prepare for repairing or rebuilding one U.S. barrier:

    - Big Creek – Due to malfunctioning operating software and components of the remote control system, a steel beam was temporarily installed to maintain crest height during sea lamprey spawning migration period. The remote control system was restored in July 2011.

    - Forestville Creek – The vertical drop at the crest was found to be theoretically insufficient to block sea lamprey passage due to accumulation of sediments immediately downstream of the barrier. Although no escapement has been detected during larval assessments, an additional stop-log has been fabricated to raise the crest height of the barrier to ensure that a sufficient drop is maintained.

    - Grand River – The USACE is the lead agency administering this project. The Harpersfield Dam currently blocks approximately 60 miles of suitable habitat for spawning and larval sea lampreys, but the condition of the dam is deteriorating. A feasibility study will be completed during 2012 to outline the alternatives for repair or rebuild of the dam. Construction is anticipated during 2013.

*Ensure Blockage to Sea Lamprey Migration*

- Water level data were collected at the Kirtland Country Club Dam on the East Branch of Chagrin River to monitor barrier effectiveness.

- Field crews visited 534 structures on tributaries to Lake Erie to assess their sea lamprey blocking potential, and to improve the information in the BIPSS.

- Consultations to ensure blockage at barriers were conducted with partner agencies on one tributary (Table 14).

**Table 14.** Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Erie tributaries.

| Mainstream | Tributary | Lead Agency | Project | SLCP Position | Comments |
|---|---|---|---|---|---|
| Rouge R. | | NOAA [1] | Wayne Road Dam | Concur | Ineffective barrier |

[1]National Oceanic and Atmospheric Administration, Great Lakes Habitat Restoration Program.

*New Construction*

- No new construction projects were initiated in 2011.

*Assessment of Candidate Streams*

- Barrier site and fish-community assessment surveys of barrier candidate streams were conducted on one Canadian tributary.
    - Big Otter Creek – Recent removal of the *de facto* sea lamprey barrier, Rock's Mill Dam, has allowed upstream access to sea lamprey spawning and nursery habitat. Identification of a future barrier site has been initiated. Fish surveys were conducted in the watershed during 2011. These surveys are a continuation of a multiple year assessment study designed to describe the fish-community of Big Otter Creek. The cumulative results of these surveys have identified 49 fish species in the watershed (Table 15). Round goby have been observed in a tributary to the main creek in the lower portion of the watershed. Grass pickerel (*Esox americanus vermiculatus)*, a federally and provincially listed species, was collected during 2009 and 2011 sampling. *Ichthyomyzon* larvae have been documented in the Big Otter watershed.

**Table 15.** Fish species caught during surveys on Big Otter Creek 2011 and previous years.

| Common Name | Scientific Name | 2005 | 2009 | 2011 |
|---|---|---|---|---|
| american brook lamprey | *Lampetra appendix* | | | X |
| blackchin shiner | *Notropis heterodon* | | X | X |
| blacknose dace | *Rhinichthys atratulus* | X | X | X |
| blacknose shiner | *Notropis heterolepis* | | X | X |
| blackside darter | *Percina maculata* | X | X | X |
| bluegill | *Lepomis macrochirus* | | X | X |
| bluntnose minnow | *Pimephales notatus* | X | X | X |
| brassy minnow | *Hybognathus hankinsoni* | X | X | X |
| brook stickleback | *Culaea inconstans* | X | X | X |
| brown bullhead | *Ameirus nebulosus* | | X | |
| brown trout | *Salmo trutta* | X | | |
| central mudminnow | *Umbra limi* | | X | |
| central stoneroller | *Campostoma anomalum* | | X | X |
| common carp | *Cyprinus carpio* | | X | X |
| common shiner | *Luxilus cornutus* | X | X | X |
| creek chub | *Semotilus atromaculatus* | X | X | X |
| emerald shiner | *Notropis atherinoides* | X | X | |
| fathead minnow | *Pimphales promelas* | X | X | X |
| finescale dace | *Chrosomus neogaeus* | | X | |
| freshwater drum | *Aplodinotus grunniens* | | | X |
| golden shiner | *Notemigonus crysoleucas* | X | | X |
| grass pickerel | *Esox americanus vermiculatus* | | X | X |
| green sunfish | *Lepomis cyanellus* | | X | X |
| hornyhead chub | *Nocomis biguttatus* | | X | |
| Iowa darter | *Etheostoma exile* | | X | |
| johnny darter | *Etheostoma nigrum* | X | X | X |
| largemouth bass | *Micropterus salmoides* | | | X |
| least darter | *Etheostoma microperca* | X | | |
| longnose dace | *Rhinichthys cataractae* | X | | X |
| mimic shiner | *Notropis volucellus* | | X | |
| northern hog sucker | *Hypentelium nigricans* | X | X | X |
| northern logperch | *Percina caprodes* | | X | |
| northern redbelly dace | *Chrosomus eos* | X | X | |
| pearl dace | *Margariscus nachtriebi* | X | | X |
| pumpkinseed | *Lepomis gibbosus* | X | X | X |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X |
| river chub | *Nocomis micropogon* | X | X | X |
| rock bass | *Ambloplites rupestris* | X | X | X |
| rosyface shiner | *Notropis rubellus* | | X | |
| round goby | *Neogobius melanostomus* | | X | X |
| sand shiner | *Notropis stramineus* | | X | |
| sea lamprey | *Petromyzon marinus* | X | X | |
| smallmouth bass | *Micropterus dolomieu* | | X | X |
| spotfin shiner | *Cyprinella spiloptera* | X | X | X |
| stonecat | *Noturus flavus* | X | X | X |
| white crappie | *Pomoxis annularis* | | X | |
| white perch | *Morone americana* | | X | |
| white sucker | *Catostomus commersonii* | X | X | X |
| yellow perch | *Perca flavenscens* | X | | |

## Lake Ontario

There are 15 sea lamprey barriers on Lake Ontario (Figure 3). Nine of these were purpose-built by the Commission to block sea lamprey spawning migrations and six were modifications to existing structures or barriers constructed by others that ensure sea lampreys remain blocked at those sites.

*Operation and Maintenance*

- Routine maintenance, spring start-up, and safety inspections were performed on 11 Canadian barriers.

- Repairs or improvements were conducted on four Canadian barriers:

    - Humber River – Cracks observed in the sea lamprey trap were repaired.

    - Cobourg Creek – Bank repair was completed at the barrier site.

    - Port Britain Creek – The east side bank of the barrier site was restored.

    - Wesleyville Creek – Stop-logs were installed in the spring and removed in late summer 2011. Erosion was observed along both banks at the barrier site and repairs were completed in early fall 2011. New safety signs were also installed.

*Ensure Blockage to Sea Lamprey Migration*

- Duffins Creek - The centre portion of the barrier crest (4.8 metre length) is approximately 15 cm lower than the rest of the crest. Based on a Department led telemetry study conducted in 2010 this lower portion of the crest is the probable location of sea lamprey escapement. Escapement may be controlled by raising the height of the centre portion so that the crest has uniform height. A review of the original barrier design to assess the feasibility of raising the central portion of the barrier determined that it would be structurally safe to do so. However, the site is within a park in a heavily urbanized area and increased risk to public safety has to be considered as part of any plan. The Barrier Task Force plans to evaluate several options, including renovation, relocation, and removal of the barrier.

- Credit River – A Commission-sponsored PIT tagging study was conducted by the Department's Great Lakes Laboratory for Fisheries and Aquatic Science (GLLFAS) staff in 2010 to identify pathways of escapement at the Kraft Dam on the Credit River in Streetsville, Ontario, a *de facto* barrier that was repaired in 2004 to block sea lampreys. No lamprey were recorded breaching the dam or fishway, however, the antennae signal was lost on two separate occasions due to high water velocity and debris loading. The study was put on hold in 2011, but is scheduled for completion in 2012.

*New Construction*

- Construction projects were initiated on one U.S. tributary.

    - Orwell Brook – Construction was tendered in the spring of 2011, however, all bids exceeded the set budget. An attempt to negotiate with the lowest bidder to establish a contract was ultimately unsuccessful. Changes to the barrier design are anticipated to lower construction costs. The revised design drawings and construction documents will be re-tendered in the spring of 2012, and pending an acceptable bid, construction work will commence in early summer 2012.

*Assessment of Candidate Streams*

- Fish-community assessment surveys were conducted on one Canadian tributary.

    - Rouge River - The Toronto and Region Conservation Authority (TRCA) has completed draft Fisheries Management Plan (FMP) to complement the 2007 Rouge River Watershed Management Plan, which identifies the evaluation of "*the installation or maintenance of barriers to partition species or to exclude invasive species"* as a priority for the watershed. The FMP recommends a sea lamprey barrier feasibility study. TRCA has provided a floodplain map for the proposed site and fisheries data from the upper portion of the watershed. The Department has augmented this data with fish-community assessment surveys from the lower parts of the watershed completed in 2009, 2010, and 2011. A total of 45 species have been identified by these fish-community assessment surveys (Table 16). The watershed is currently in transition to become an Urban National Park. Parks Canada has been kept up to date on the Department's investigations into barrier feasibility for this watershed.

**Table 16.** Fish species caught during surveys on the Rouge River in 2011 and previous years.

| Common Name | Scientific Name | 2009 | 2010 | 2011 |
|---|---|---|---|---|
| american eel | *Anguilla rostrata* | X | X | |
| blackchin shiner | *Notropis heterodon* | X | X | |
| black crappie | *Pomoxis nigromaculatus* | | | X |
| blacknose dace | *Rhinichthys atratulus* | X | X | X |
| bluegill | *Lepomis macrochirus* | X | X | |
| bluntnose minnow | *Pimephales notatus* | X | X | X |
| bowfin | *Amia calva* | | | X |
| brassy minnow | *Hybognathus hankinsoni* | | X | |
| brook stickleback | *Culaea inconstans* | X | X | X |
| brown bullhead | *Ameiurus nebulosus* | X | X | X |
| central mudminnow | *Umbra limi* | X | | |
| central stoneroller | *Campostoma anomalum* | X | X | X |
| chinook salmon | *Oncorhynchus tshawytscha* | X | X | X |
| common carp | *Cyprinus carpio* | X | | X |
| common shiner | *Luxilus cornutus* | X | X | X |
| creek chub | *Semotilus atromaculatus* | X | X | X |
| emerald shiner | *Notropis atherinoides* | | X | X |
| fathead minnow | *Pimepahles promelas* | X | X | X |
| gizzard shad | *Dorosoma cepedianum* | | | X |
| golden shiner | *Notemigonus crysoleucas* | X | | |
| guppy | *Polecilia reticulata* | X | | |
| hornyhead chub | *Nocomis biuttatus* | X | X | X |
| Iowa darter | *Etheostoma exile* | X | X | X |
| johnny darter | *Etheostoma nigrum* | X | X | X |
| lake chub | *Couesius plumbeus* | | X | |
| largemouth bass | *Micropterus salmoides* | X | | X |
| logperch | *Percina caprodes* | X | X | X |
| longnose dace | *Rhinichthys cataractae* | X | X | X |
| northern pike | *Esox lucius* | X | | |
| northern redbelly dace | *Chrosomus eos* | | X | X |
| pumpkinseed | *Lepomis gibbosus* | X | X | X |
| rainbow darter | *Etheostoma caeruleum* | X | X | X |
| rainbow trout | *Oncorhynchus mykiss* | X | X | X |
| river chub | *Nocomis micropogon* | | | X |
| rock bass | *Amblopites rupestris* | X | X | X |
| rosyface shiner | *Notropis rubellus* | X | X | X |
| round goby | *Neogobius melanostomus* | X | X | X |
| sand shiner | *Notropis stramineus* | | X | X |
| sea lamprey | *Petromyzon marinus* | X | X | |
| smallmouth bass | *Micropterus dolomieu* | X | X | X |
| spotfin shiner | *Cyprinella spiloptera* | | | X |
| stonecat | *Noturus flavus* | X | X | X |
| white crappie | *Pomoxis annularis* | X | | |
| white sucker | *Catostomus commersonii* | X | X | X |
| yellow perch | *Perca flavescens* | X | X | X |

## ASSESSMENT

The SLCP has three assessment components that target the larval, spawning, and parasitic phases of the life cycle:

1. The larval-phase component assesses the relative abundance and distribution of larval sea lampreys in streams and lentic zones. These data are used to predict the streams and lentic zones most likely to contain larvae greater than 100 mm total length at the end of the growing season during the year of sampling. These predictions are used to establish the priorities for the lampricide treatment program in the next year.

2. The spawning-phase component annually assesses the stock size of spawning-phase sea lampreys in each lake. Because this life-phase is comprised of individuals that have evaded control efforts, the time series of spawning-phase abundance is used to evaluate the effectiveness of the SLCP.

3. The parasitic-phase component annually assesses the rates of lake trout wounding inflicted by sea lamprey in each of the lakes. Time series data are used to assess the effectiveness of the SLCP for each lake. In addition, several indices of relative abundance of parasitic-phase sea lampreys are used to monitor sea lamprey populations over time.

The Assessment Task Force (ATF) was established by the Commission during 1996 to rank streams and lentic areas for sea lamprey control options and to optimize long-term measures of success of the sea lamprey control program. The task force's report on the charges during 2011 is presented in the ATF section of this report.

## Larval Assessment

Tributaries considered for lampricide treatment during 2012 were assessed during 2011 to estimate the density and size structure of larval sea lamprey populations. Assessments were conducted with backpack electrofishers in waters <0.8m deep. Waters ≥0.8m in depth were surveyed with GB or deepwater electrofishers. Survey sites were randomly selected in each tributary, larval sea lamprey catches were adjusted for gear efficiency, and lamprey lengths were forecast to the estimated end of the growing season. The number of large sea lamprey larvae in each infested area was estimated by multiplying the mean density of larvae ≥100mm (number per $m^2$) by an estimated area of suitable habitat ($m^2$). Infested areas were ranked for treatment during 2012 based on a cost per kill of larval sea lampreys ≥100mm, as estimated using this index of abundance and average treatment costs. Additional surveys are used to define the distribution of sea lampreys within a stream, detect new populations, evaluate lampricide treatments, and to establish the sites for lampricide application. Lentic areas <2.0 hectares are monitored for relative abundance and spatial distribution of larvae.

### Lake Superior

- Larval assessments were conducted on a total of 136 tributaries (48 Canada, 88 U.S.) and offshore of 27 tributaries (10 Canada, 17 U.S.). The status of larval sea lamprey populations in historically infested Lake Superior tributaries and lentic areas is presented in Tables 17 and 18.

- Surveys to estimate abundance of larval sea lampreys were conducted in 31 tributaries (11 Canada, 20 U.S.) and offshore of 6 tributaries (3 Canada, 3 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 39 tributaries (17 Canada, 22 U.S.). New infestations were discovered in the Little Carp River and Kelsey, Halfaday, and Pikes creeks (U.S.) and in the lentic area adjacent to the mouth of the Steel River (Canada).

- Post-treatment assessments were conducted in 43 tributaries (14 Canada, 29 U.S.) and 10 lentic areas (3 Canada, 7 U.S.) to determine the effectiveness of lampricide treatments conducted during 2010 and 2011.

- Surveys to evaluate barrier effectiveness were conducted in six tributaries (five Canada, one U.S.).

- Biological collections for researchers or training purposes were conducted in four U.S. tributaries.

**Table 17.** Status of larval sea lampreys in Lake Superior tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2011.

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| **<u>Canada</u>** | | | | | | | |
| East Davignon Cr. | May-72 | Jun-11 | --- | No | --- | --- | Unknown |
| West Davignon Cr. | Jul-11 | Sep-11 | No | --- | --- | --- | Unknown |
| Little Carp R. | May-08 | Aug-11 | No | Yes | --- | --- | Unknown |
| Big Carp R. | Sep-07 | Sep-11 | No | No | --- | --- | Unknown |
| Cranberry Cr. | May-11 | Jul-11 | No | No | --- | --- | Unknown |
| Goulais R. | Jun-09 | Sep-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Boston's Cr. | Never | Jun-09 | --- | No | --- | --- | Unknown |
| Horseshoe Cr. | Never | Jun 11 | --- | No | --- | --- | Unknown |
| Havilland Cr. | Never | Jul-10 | --- | Yes | --- | --- | Unknown |
| Stokely Cr. | Jun-08 | Jul-10 | No | Yes | --- | --- | Unknown |
| Tier Cr. | Never | Jul-09 | --- | No | --- | --- | Unknown |
| Harmony R. | Jun-09 | Jul-09 | Yes | --- | --- | --- | ***2012***[5] |
| Sawmill Cr. | Jul-11 | Sep-11 | Yes | No | --- | --- | Unknown |
| Jones Landing Cr. | Never | Jun-08 | --- | No | --- | --- | Unknown |
| Tiny Cr. | Never | Jul-09 | --- | Yes | --- | --- | Unknown |
| Chippewa R. | Jul-10 | Sep-11 | No | No | --- | --- | Unknown |
| Unger Cr. | Jul-10 | Jun-11 | Yes | No | --- | --- | Unknown |
| Batchawana R. | Aug-11 | Oct-11 | Yes | No | --- | --- | Unknown |
| Digby Cr. | Never | Oct-10 | --- | Yes | --- | --- | Unknown |
| Carp R. | Jun-09 | Jul-09 | No | --- | --- | --- | 2013 |
| Pancake R. | Jun-08 | Sep-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Westman Cr. | Never | Aug-07 | --- | No | --- | --- | Unknown |
| Agawa R. | Oct-08 | Jun-09 | Yes | Yes | --- | --- | ***2012*** |
| Sand R. | Sep-71 | Jul-11 | --- | Yes | --- | --- | Unknown |
| Baldhead R. | Never | Jun-09 | --- | No | --- | --- | Unknown |
| Gargantua R. | Jul-09 | Aug-09 | No | --- | --- | --- | 2013 |
| Old Woman R. | Never | Aug-11 | --- | Yes | --- | --- | ***2012***[1] |
| Michipicoten R. | Aug-08 | Jul-11 | Yes | Yes | --- | --- | ***2012***[2] |
| Dog R. | Jun-10 | Jul-11 | Yes | Yes | --- | --- | Unknown |
| White R. | Aug-05 | Sep-09 | Yes | Yes | --- | --- | ***2012*** |
| Pic R. | Jul-06 | Jul-11 | No | Yes | --- | --- | ***2012***[1] |
| Little Pic R. | Aug-11 | Aug-11 | Yes | --- | --- | --- | Unknown |
| Prairie R. | Jul-94 | Jun-09 | --- | No | --- | --- | Unknown |
| Steel R. | Jul-08 | Jul-11 | No | Yes | --- | --- | ***2012***[1] |
| Pays Plat R. | Jul-11 | Jul-11 | Yes | --- | --- | --- | Unknown |
| Little Pays Plat Cr. | Jul-07 | Aug-11 | No | Yes | 13,503 | --- | Unknown |
| Gravel R. | Jul-08 | Aug-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Little Gravel R. | Jul-08 | Aug-09 | Yes | Yes | --- | --- | Unknown |
| Cypress R. | Jul-09 | Aug-09 | Yes | --- | --- | --- | 2013 |
| Jackpine R. | Never | Jun-09 | --- | No | --- | --- | Unknown |
| Jackfish R. | Jul-08 | Aug-11 | Yes | Yes | --- | --- | ***2012***[1] |

**Table 17.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Nipigon R. | | | | | | | |
| Upper Nipigon R. | Aug-09 | Jun-10 | Yes | --- | --- | --- | Unknown |
| Lower Nipigon R. | Oct-11[3] | Aug-10 | --- | --- | --- | --- | Unknown |
| Cash Cr. | Jul-09 | Aug-09 | No | --- | --- | --- | Unknown |
| Polly Cr. | Jul-87 | Aug-09 | No | No | --- | --- | Unknown |
| Stillwater Cr. | Jul-09 | Jun-10 | Yes | Yes | --- | --- | 2013[1] |
| Big Trout Cr. | Jul-10 | Aug-10 | No | --- | --- | --- | Unknown |
| Otter Cove Cr. | Aug-71 | Jul-02 | No | No | --- | --- | Unknown |
| Black Sturgeon R. | Aug-11 | Aug-11 | No | --- | --- | --- | Unknown |
| Big Squaw Cr. | Jun-72 | Jun-09 | --- | No | --- | --- | Unknown |
| Wolf R. | Jul-11 | Aug-11 | Yes | --- | --- | --- | Unknown |
| Coldwater Cr. | Jul-07 | Aug-11 | Yes | Yes | 20,601 | 11,093 | ***2012*** |
| Pearl R. | Jul-10 | Aug-10 | Yes | --- | --- | --- | Unknown |
| D'Arcy Cr. | Jul-10 | Sep-10 | No | --- | --- | --- | Unknown |
| Blende Cr. | Aug-64 | Aug-10 | --- | No | --- | --- | Unknown |
| MacKenzie R. | Jul-08 | Aug-11 | No | Yes | 353 | 86 | ***2012***[5] |
| Neebing-McIntyre FW | Jul-08 | Aug-11 | Yes | Yes | 486,390 | 273,998 | ***2012*** |
| Kaministiquia R. | Sep-10 | Aug-11 | Yes | Yes | --- | --- | ***2012***[4] |
| Cloud R. | Jul-08 | Aug-11 | No | Yes | 26,254 | 15,002 | ***2012*** |
| Pine R. | Jul-73 | Aug-11 | --- | Yes | --- | --- | Unknown |
| Pigeon R. | Jul-07 | Aug-11 | Yes | Yes | 122,023 | 58,572 | Unknown |
| **United States** | | | | | | | |
| Waiska R. | Jul-07 | Sep-11 | No | No | --- | --- | Unknown |
| Pendills Cr. | Sep-88 | May-11 | --- | Yes | 6,261 | 2,935 | ***2012***[5] |
| Grants Cr. | Jun-08 | Sep-11 | No | Yes | 1,583 | 0 | Unknown |
| Halfaday Cr. | Never | Jun-11 | Never | Yes | 2,746 | 1,610 | ***2012***[5] |
| Naomikong Cr. | Jul-63 | Jul-10 | --- | No | --- | --- | Unknown |
| Ankodosh Cr. | Jun-08 | Sep-11 | No | Yes | 6,421 | 0 | Unknown |
| Roxbury Cr. | Jun-08 | Sep-11 | No | Yes | 2,378 | 529 | Unknown |
| Galloway Cr. | Jul-07 | Jul-10 | No | Yes | --- | --- | Unknown |
| Tahquamenon R. | Oct-10 | Sep-11 | --- | Yes | --- | --- | Unknown |
| Betsy R. | Oct-10 | Jun-11 | --- | No | --- | --- | Unknown |
| Three Mile Cr. | Jun-62 | Jun-11 | --- | No | --- | --- | Unknown |
| Little Two Hearted R. | Jun-08 | Sep-11 | No | Yes | 73,120 | 14,624 | ***2012*** |
| Two Hearted R. | Aug-10 | Sep-11 | Yes | Yes | --- | --- | Unknown |
| Dead Sucker R. | Jul-75 | Sep-09 | --- | No | --- | --- | Unknown |
| Sucker R. (Alger Co.) | Sep-10 | Jun-11 | Yes | --- | --- | --- | Unknown |
| Chipmunk Cr. | Sep-62 | Jul-10 | --- | No | --- | --- | Unknown |
| Carpenter Cr. | Aug-05 | Aug-11 | Yes | Yes | 374 | 0 | Unknown |
| Sable Cr. | Sep-89 | Sep-10 | --- | Yes | --- | --- | Unknown |
| Hurricane R. | Never | Sep-10 | --- | Yes | --- | --- | Unknown |
| Sullivans Cr. | Sep-10 | Jun-11 | --- | No | --- | --- | Unknown |

**Table 17.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| Seven Mile Cr. | Jul-67 | Sep-09 | --- | No | --- | --- | Unknown |
| Beaver Lake Cr. | | | | | | | |
| Lowney Cr. | Sep-10 | Aug-11 | Yes | Yes | --- | --- | Unknown |
| Mosquito R. | Jun-73 | Aug-08 | --- | No | --- | --- | Unknown |
| Miners R. | | | | | | | |
| Barrier downstream | Sep-09 | Oct-09 | No | No | --- | --- | 2013 |
| Barrier upstream | Sep-09 | Oct-09 | No | No | --- | --- | Unknown |
| Munising Falls Cr. | Sep-64 | Jun-09 | --- | Yes | --- | --- | Unknown |
| Anna R. | Sep-65 | Sep-11 | --- | Yes | 14,265 | 2,161 | Unknown |
| Tourist Park Cr. | Never | Jul-10 | --- | --- | --- | --- | Unknown |
| Furnace Cr. | Sep-10 | Sep-11 | --- | Yes | --- | --- | Unknown |
| Five Mile Cr. | Jul-07 | Aug-11 | No | Yes | 2,879 | 320 | Unknown |
| Au Train R. | | | | | | | |
| Upper | Jun-11 | Aug-11 | Yes | No | --- | --- | Unknown |
| Buck Bay Cr. | Jun-11 | Aug-11 | No | No | --- | --- | Unknown |
| Lower | Jun-11 | Aug-11 | --- | No | --- | --- | Unknown |
| Rock R. | Jul-02 | May-09 | --- | No | --- | --- | Unknown |
| Deer Lake Cr. | Aug-70 | May-09 | --- | No | --- | --- | Unknown |
| Laughing Whitefish R. | Jun-11 | Aug-11 | No | No | --- | --- | Unknown |
| Sand R. | Jul-85 | Jul-11 | --- | Yes | 40,848 | 12,518 | ***2012*** |
| Chocolay R. | Jul-09 | Aug-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Carp R. | Sep-09 | Oct-11 | Yes | Yes | 19,245 | 2,467 | ***2012*** |
| Dead R. | Aug-10 | Jul-11 | --- | --- | 45,453 | 7,905 | ***2012*** |
| Harlow Cr. | Jun-11 | Aug-11 | No | No | --- | --- | Unknown |
| Little Garlic R. | Oct-10 | Sep-11 | --- | Yes | --- | --- | Unknown |
| Garlic R. | Jun-11 | Aug-11 | Yes | Yes | --- | --- | Unknown |
| Iron R. | Sep-09 | Jul-10 | No | No | --- | --- | Unknown |
| Salmon Trout R. (Marquette Co.) | Sep-09 | Jul-11 | Yes | Yes | 270,614 | 10,638 | ***2012*** |
| Pine R. | Jun-11 | Aug-11 | Yes | No | --- | --- | Unknown |
| Huron R. | Oct-09 | Jul-10 | Yes | --- | --- | --- | 2013 |
| Ravine R. | Sep-11 | Oct-11 | No | Yes | --- | --- | ***2012***[1] |
| Slate R. | Aug-09 | Oct-09 | No | No | --- | --- | *2013* |
| Silver R. | Sep-11 | Oct-11 | No | No | --- | --- | ***2012***[1] |
| Falls R. | Aug-11 | Aug-11 | --- | --- | --- | --- | ***2012***[1] |
| Six Mile Cr. | May-63 | Aug-11 | --- | Yes | 0 | 0 | Unknown |
| Little Carp R. | Never | Aug-11 | --- | Yes | 86,270 | 70,474 | ***2012*** |
| Kelsey Cr. | Never | Aug-11 | --- | Yes | --- | --- | Unknown |
| Sturgeon R. | Oct-10 | Aug-11 | Yes | No | --- | --- | Unknown |
| Pilgrim R. | Aug-62 | Jun-09 | --- | No | --- | --- | Unknown |
| Trap Rock R. | Jul-11 | Oct-11 | No | Yes | --- | --- | Unknown |
| McCallum Cr. | Aug-63 | Jul-10 | --- | No | --- | --- | Unknown |
| Traverse R. | May-09 | Oct-11 | No | Yes | --- | --- | ***2012***[1] |

**Table 17.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Little Gratiot R. | Aug-72 | Jun-08 | --- | No | --- | --- | Unknown |
| Eliza Cr. | Jul-11 | Sep-10 | --- | --- | --- | --- | Unknown |
| Gratiot R. | Jul-11 | Sep-10 | --- | --- | --- | --- | Unknown |
| Smiths Cr. | May-64 | Jul-11 | --- | No | --- | --- | Unknown |
| Boston-Lily Cr. | Aug-62 | Aug-11 | --- | Yes | 15,506 | 2,549 | ***2012*** |
| Salmon Trout R. (Houghton Co.) | Jul-08 | Aug-11 | No | Yes | 1,903 | 714 | Unknown |
| Mud Lake Outlet | Oct-73 | Jul-10 | --- | No | --- | --- | Unknown |
| Graveraet R. | Aug-63 | Aug-09 | --- | No | --- | --- | Unknown |
| Elm R. | Jul-07 | Aug-09 | No | No | --- | --- | Unknown |
| Misery R. | | | | | | | |
| Barrier downstream | Jul-11 | Aug-11 | No | No | --- | --- | Unknown |
| Barrier upstream | Sep-00 | Aug-09 | --- | No | --- | --- | Unknown |
| East Sleeping R. | May-11 | Oct-11 | No | No | --- | --- | Unknown |
| West Sleeping R. | Aug-09 | Aug-10 | No | No | --- | --- | 2013 |
| Firesteel R. | Oct-11 | Aug-10 | --- | --- | --- | --- | Unknown |
| Ontonagon R. | Oct-08 | Oct-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Potato R. | May-11 | Oct-11 | No | Yes | --- | --- | 2014 |
| Floodwood R. | Never | Aug-10 | --- | No | --- | --- | Unknown |
| Cranberry R. | May-11 | Oct-11 | Yes | Yes | --- | --- | 2014 |
| Mineral R. | Oct-10 | Aug-11 | No | No | --- | --- | Unknown |
| Little Iron R. | Sep-75 | Jul-08 | --- | No | --- | --- | Unknown |
| Union R. | May-64 | Aug-09 | --- | No | --- | --- | Unknown |
| Black R. | Jul-10 | Jul-11 | No | --- | --- | --- | Unknown |
| Montreal R. | Jul-75 | Aug-07 | --- | No | --- | --- | Unknown |
| Washington Cr. | Jun-80 | Aug-09 | --- | No | --- | --- | Unknown |
| Bad R. | Sep-11 | Oct-11 | No | --- | --- | --- | *Unknown* |
| Fish Cr. (Eileen Twp.) | Jul-10 | Jul-11 | --- | Yes | --- | --- | Unknown |
| Sioux R. | Never | Aug-11 | --- | Yes | --- | --- | Unknown |
| Pikes Cr. | Never | Aug-11 | --- | Yes | 1,093 | 957 | Unknown |
| Red Cliff Cr. | Sep-11 | Oct-11 | No | --- | --- | --- | Unknown |
| Raspberry R. | Jun-63 | Aug-08 | --- | No | --- | --- | Unknown |
| Sand R. | Sep-11 | Oct-11 | Yes | --- | --- | --- | Unknown |
| Cranberry R. | Never | Sep-11 | --- | Yes | 5,870 | 5,870 | ***2012*** |
| Iron R. | | | | | | | |
| Barrier downstream | Aug-07 | Jun-10 | No | Yes | --- | --- | Unknown |
| Barrier upstream | Oct-64 | Aug-08 | --- | No | --- | --- | Unknown |
| Reefer Cr. | Oct-64 | Aug-08 | --- | No | --- | --- | Unknown |
| Fish Cr. (Orienta Twp.) | Oct-64 | Aug-08 | --- | No | --- | --- | Unknown |
| Brule R. | Jul-09 | Jul-11 | No | Yes | --- | --- | ***2012***[1] |
| Poplar R. | Sep-11 | Oct-11 | No | --- | --- | --- | 2014 |
| Middle R. | | | | | | | |
| Barrier downstream | May-08 | Sep-11 | Yes | Yes | 10,921 | 1,658 | 2013 |
| Amnicon R. | Oct-09 | Jul-11 | --- | Yes | --- | --- | ***2012*** |

**Table 17.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| Nemadji R. | Jun-09 | Oct-11 | Yes | Yes | 295,569 | 19,222 | 2013 |
| St. Louis R. | Sep-87 | Sep-11 | --- | No | --- | --- | Unknown |
| Sucker R. (St. Louis Co.) | Never | Jun-10 | --- | No | --- | --- | Unknown |
| Gooseberry R. | Aug-76 | Jun-10 | --- | Yes | --- | --- | Unknown |
| Splitrock R. | Aug-76 | Jun-10 | --- | No | --- | --- | Unknown |
| Poplar R. | Jul-77 | Jun-10 | --- | Yes | --- | --- | Unknown |
| Arrowhead R. | Jun-09 | Jun-10 | No | Yes | --- | --- | 2013 |

[1] Stream being treated based on expert judgment.
[2] Michipicoten River estuary only.
[3] Nipigon River Lower –treatment limited to granular Bayluscide plots only.
[4] Kaministiquia River Corbett Creek only.
[5] Stream being treated based on geographic efficiency

**Table 18.** Status of larval sea lampreys in historically infested lentic areas of Lake Superior during 2011.

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| **Canada** | | | | |
| Goulais R. | Goulais Bay | Jul-08 | Jul-08 | Aug-85 |
| Havilland Cr. | Havilland Bay | Jul-10 | Jul-10 | Aug-11 |
| Stokely Cr. | Havilland Bay | Jul-11 | Jul-09 | Aug-10 |
| Harmony R. | Batchawana Bay | Sep-11 | Sep-11 | Aug-87 |
| Chippewa R. | Batchawana Bay | Sep-11 | Sep-11 | Aug-11 |
| Batchawana R. | Batchawana Bay | Sep-11 | Sep-11 | Oct-07 |
| Carp R. | Batchawana Bay | Sep-11 | Sep-11 | Aug-07 |
| Agawa R. | Agawa Bay | Jul-11 | Jul-11 | Aug-10 |
| Michipicoten R. | Marina Area | Jul-11 | Jul-11 | Aug-10 |
| Gravel R. | Mountain Bay | Aug-11 | Aug-11 | Jul-10 |
| Little Gravel R. | Mountain Bay | Aug-08 | Aug-08 | Jul-10 |
| Little Cypress R. | Cypress Bay | Aug-78 | Aug-78 | Never |
| Cypress R. | Cypress Bay | Sep-10 | Sep-10 | Oct-11 |
| Jackpine R. | Nipigon Bay | Jul-02 | Jul-89 | Never |
| Jackfish R. | Nipigon Bay | Jul-07 | Aug-05 | Never |
| Nipigon R. | Helen Lake | Aug-11 | Aug-11 | Oct-11[1] |
| Nipigon R. | Nipigon Bay | Jun-10 | Jul-03 | Aug-05 |
| Nipigon R. | Polly Lake | Aug-05 | Jul-90 | Jul-87 |
| Big Trout Cr. | Nipigon Bay | Jun-10 | Jun-10 | Oct-11 |
| Black Sturgeon R. | Black Bay | Aug-11 | Jul-04 | Never |
| Wolf R. | Black Bay | Aug-09 | Aug-09 | Never |
| MacKenzie R. | MacKenzie Bay | Aug-10 | Aug-10 | Oct-11 |
| Current R. | Thunder Bay | Aug-10 | Aug-09 | Aug-10 |
| Neebing-McIntyre Floodway | Thunder Bay | Aug-05 | Jul-90 | Never |
| Kaministiquia R. (lower) | Thunder Bay | Aug-11 | Aug-11 | Oct-11 |
| Pigeon R. | Pigeon Bay | Sep-10 | Sep-09 | Aug-10 |
| **United States** | | | | |
| Grants Cr. | Tahquamenon Bay | Jul-11 | Jul-11 | Never[2] |
| Ankodosh Cr. | Tahquamenon Bay | Jul-11 | Jul-11 | Jul-11 |
| Roxbury Cr. | Tahquamenon Bay | Jul-10 | Jul-10 | Never[2] |
| Dead Sucker R. | Offshore Dead Sucker R. | Sep-09 | --- | Never |
| Galloway Cr. | Tahquamenon Bay | Jul-10 | Jul-88 | Never |
| Sucker R. | Grand Marais Harbor | Sep-09 | Aug-90 | Never |
| Carpenter Cr. | West Bay | Aug-11 | Aug-11 | Aug-10 |
| Beaver Lake Cr. | Beaver Lake | Sep-10 | Sep-10 | Never[2] |
| Anna R. | Munising Bay | Jul-10 | Jul-10 | Aug-11 |
| Miners R. | Miners Lake | Aug-11 | Aug-11 | Jun-11 |
| Furnace Cr. | Furnace Bay | Jul-11 | Jul-11 | Aug-10 |
| | Furnace Lake – Offshore Hanson Cr. | Aug-09 | Aug-09 | Never[2] |
| | Furnace Lake – Offshore Gongeau Cr. | Aug-09 | Aug-09 | Never[2] |
| Five Mile Cr. | Offshore mouth | Aug-11 | Aug-11 | Never[2] |
| Carp R. | Offshore mouth | Aug-11 | Aug-11 | Never[2] |
| Dead R. | Presque Isle Harbor | Jul-11 | Jul-11 | Aug-10[1] |

**Table 18**. *continued.*

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| Harlow Cr. | Harlow Lake – | | | |
| | Offshore Bismark Cr. | Aug-11 | Aug-11 | Never[2] |
| Little Garlic R. | Little Garlic R. | Sep-11 | Sep-11 | Never[1] |
| Garlic R. | Garlic R. offshore mouth | Sep-05 | Sep-05 | Never[2] |
| | Saux Head Lake | Aug-11 | Jul-10 | Never[2] |
| Ravine R. | Huron Bay | Jul-06 | Jul-06 | Aug-10[1] |
| Slate R. | Huron Bay | Jul-11 | Jul-10 | Never[2] |
| Silver R. | Huron Bay | Jul-10 | Jul-10 | Aug-11 |
| Falls R. | Huron Bay | Jul-08 | Jul-08 | Aug-10[1] |
| Trap Rock R. | Torch Lake | Aug-11 | Aug-11 | Aug-10 |
| Eliza Cr. | Eagle Harbor | Jul-03 | Sep-78 | Never |
| Mineral R. | Offshore mouth | Sep-11 | Sep-11 | Never[2] |
| Black R. | Black River Harbor | Jul-10 | Jul-10 | Aug-11 |
| Fish Cr. (Eileen Twp.) | Chequamegon Bay | Jun-10 | Aug-06 | Never[2] |
| Red Cliff Cr. | Buffalo Bay | Aug-11 | Jun-97 | Never |
| Sand R. (Bayfield Twp.) | Sand Bay | Aug-11 | Aug-11 | Aug-10[2] |
| Amnicon R. | Superior Bay | Sep-09 | Sep-09 | Never |

[1] Scheduled for treatment during 2012.
[2]Low-density larval population monitored with 3,2% granular Bayluscide surveys.

**Lake Michigan**

- Larval assessment surveys were conducted on a total of 89 tributaries and offshore of 15 tributaries. The status of larval sea lamprey populations in historically infested Lake Michigan tributaries and lentic areas is presented in Tables 19 and 20.

- Surveys to estimate the abundance of larval sea lampreys were conducted in 25 tributaries and offshore of 5 tributaries.

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 19 tributaries. A new population was discovered in Shivering Sands Creek, Door County, Wisconsin.

- Post-treatment assessments were conducted in 14 tributaries to determine the effectiveness of lampricide treatments during 2010 and 2011.

- Surveys to evaluate barrier effectiveness were conducted in eight tributaries. Adult sea lampreys were observed spawning upstream of the Union Street Dam on the Boardman River in June and collections during the October 2011 treatment confirmed recruitment of this year class upstream of the barrier. The 2011 year class of larval sea lampreys also re-established upstream of the Hesperia Dam on the White River.

- Collections of larval lampreys for pheromone extraction and additional Commission funded research were conducted in the Jordan, Platte, Manistee, and Muskegon rivers.

**Table 19.** Status of larval sea lampreys in Lake Michigan tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2011.

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| Brevort R. | | | | | | | |
| Lower | Oct-06 | Oct-11 | No | Yes | --- | --- | ***2012***[2] |
| Little Brevort R. | Jun-11 | Oct-11 | Yes | No | --- | --- | ***2012***[2] |
| Silver Cr. | Jun-11 | Oct-11 | No | No | --- | --- | ***2012***[2] |
| Paquin Cr. | Oct-87 | Jun-09 | --- | No | --- | --- | Unknown |
| Davenport Cr. | Aug-63 | Aug-11 | --- | Yes | --- | --- | ***2012***[2] |
| Hog Island Cr. | Jun-09 | Sep-11 | No | Yes | --- | --- | ***2012***[1] |
| Sucker R. | Jun-61 | Aug-11 | --- | No | --- | --- | ***2012***[2] |
| Black R. | Jun-09 | Sep-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Mattix Cr. | Aug-10 | Aug-11 | Yes | Yes | 744 | 425 | Unknown |
| Mile Cr. | Sep-72 | Aug-11 | --- | Yes | --- | --- | Unknown |
| Millecoquins R. | | | | | | | |
| Lower | Aug-10 | Oct-10 | No | --- | --- | --- | Unknown |
| Upper | May-11 | Aug-11 | No | No | --- | --- | Unknown |
| McAlpine Cr. | May-11 | Aug-11 | No | No | --- | --- | Unknown |
| Furlong Cr. | May-11 | Aug-11 | Yes | No | --- | --- | Unknown |
| Cold Cr. | Jul-09 | Sep-09 | No | No | --- | --- | Unknown |
| Rock R. | Aug-10 | Oct-10 | Yes | --- | --- | --- | Unknown |
| Crow R. | Jun-09 | Aug-11 | No | Yes | 7,453 | 532 | Unknown |
| Cataract R. | Aug-10 | Oct-10 | No | No | --- | --- | Unknown |
| Pt. Patterson Cr. | Sep-83 | Aug-11 | --- | Yes | 1,904 | 91 | Unknown |
| Hudson Cr. | Aug-10 | Oct-10 | No | --- | --- | --- | Unknown |
| Swan Cr. | Jul-92 | May-10 | No | No | --- | --- | Unknown |
| Seiners Cr. | May-84 | May-10 | No | No | --- | --- | Unknown |
| Milakokia R. | Jul-11 | Aug-11 | No | No | --- | --- | Unknown |
| Huntspur Cr. | Jul-11 | Aug-11 | No | No | --- | --- | Unknown |
| Bulldog Cr. | Jul-08 | Aug-10 | No | No | --- | --- | Unknown |
| Gulliver Lake Outlet | Oct-07 | Aug-11 | No | Yes | 4,825 | 3,699 | ***2012*** |
| Marblehead Cr. | Aug-10 | Jul-11 | Yes | --- | 634 | 634 | Unknown |
| Manistique R. | | | | | | | |
| Barrier upstream | Sep-09 | Jun-11 | Yes | Yes | 222,246 | 42,326 | ***2012***[1] |
| Barrier downstream | Sep-09 | Jul-11 | --- | Yes | --- | --- | ***2012***[1] |
| Estuary | Sep-09 | Jul-11 | --- | Yes | | --- | Unknown |
| Southtown Cr. | Jun-77 | May-11 | --- | Yes | --- | --- | Unknown |
| Thompson Cr. | Never | May-10 | --- | Yes | --- | --- | Unknown |
| Johnson Cr. | Aug-81 | Sep-11 | --- | Yes | 203 | 0 | 2013 |
| Deadhorse Cr. | Jun-09 | Jul-11 | Yes | Yes | 820 | 137 | 2013 |
| Gierke Cr. | Never | May-10 | --- | No | --- | --- | Unknown |
| Bursaw Cr. | Aug-10 | Oct-10 | No | --- | --- | --- | Unknown |
| Parent Cr. | Jun-91 | Jul-11 | --- | Yes | --- | --- | Unknown |
| Poodle Pete Cr. | Aug-01 | Sep-11 | No | Yes | 379 | 27 | 2013 |
| Valentine Cr. | Jul-08 | Sep-11 | Yes | Yes | 17,494 | 1,346 | ***2012***[3] |

**Table 19.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Little Fishdam R. | May-01 | Jul-11 | No | No | --- | --- | Unknown |
| Big Fishdam R. | Sep-11 | Aug-11 | --- | --- | --- | --- | Unknown |
| Sturgeon R. | Sep-10 | May-11 | --- | --- | --- | --- | Unknown |
| Ogontz R. | Oct-09 | May-11 | No | --- | --- | --- | Unknown |
| Squaw Cr. | Aug-00 | Sep-11 | --- | Yes | 12,068 | 4,951 | ***2012*** |
| Whitefish R. | Jun-11 | Sep-11 | Yes | Yes | --- | --- | 2013 |
| Rapid R. | Oct-09 | Aug-11 | No | Yes | 89,598 | 14,231 | ***2012***[1] |
| Tacoosh R. | May-07 | Jul-11 | No | Yes | 2,278 | 2,278 | 2013 |
| Days R. | | | | | | | |
| Barrier downstream | Oct-11 | Aug-11 | --- | --- | --- | --- | ***2012***[1] |
| Barrier upstream | Oct-11 | Aug-11 | Yes | No | --- | --- | Unknown |
| Portage Cr. | Oct-09 | May-10 | No | --- | --- | --- | 2013 |
| Ford R. | May-10 | Jun-11 | Yes | Yes | --- | --- | 2013 |
| Sunnybrook Cr. | May-71 | Jul-09 | --- | No | --- | --- | Unknown |
| Bark R. | Oct-11 | Sep-11 | --- | --- | --- | --- | Unknown |
| Cedar R. | May-10 | Jun-11 | --- | Yes | --- | --- | 2013[1] |
| Sugar Cr. | May-08 | Jul-10 | No | No | --- | --- | Unknown |
| Arthur Bay Cr. | Jun-10 | Jun-11 | Yes | --- | --- | --- | Unknown |
| Rochereau Cr. | Apr-63 | Aug-10 | --- | No | --- | --- | Unknown |
| Johnson Cr. | May-10 | Oct-10 | No | No | --- | --- | Unknown |
| Bailey Cr. | May-09 | Jun-11 | Yes | Yes | --- | --- | Unknown |
| Beattie Cr. | Apr-09 | Jul-09 | Yes | Yes | --- | --- | Unknown |
| Springer Cr. | May-08 | Oct-10 | Yes | No | --- | --- | 2013 |
| Menominee R. | Jun-07 | Aug-11 | No | Yes | --- | --- | Unknown |
| Little R. | Aug-87 | Jun-11 | --- | No | --- | --- | Unknown |
| Peshtigo R. | Oct-11 | Oct-10 | --- | --- | --- | --- | Unknown |
| Oconto R. | May-09 | Sep-11 | No | Yes | 60,165 | 57,005 | ***2012***[1] |
| Pensaukee R. | Nov-77 | Jun-09 | --- | No | --- | --- | Unknown |
| Suamico R. | Never | Jun-09 | --- | No | --- | --- | Unknown |
| Ephraim Cr. | Apr-63 | Jun-11 | --- | No | --- | --- | Unknown |
| Shivering Sands Cr. | Never | Jun-11 | --- | Yes | 1,850 | 1,357 | ***2012***[3] |
| Hibbards Cr. | May-07 | Aug-10 | No | No | --- | --- | Unknown |
| Whitefish Bay Cr. | May-87 | Jun-09 | --- | No | --- | --- | Unknown |
| Lilly Bay Cr. | Apr-63 | Jun-11 | --- | No | --- | --- | Unknown |
| Bear Cr. | May-75 | Jun-11 | --- | No | --- | --- | Unknown |
| Door Co. 23 Cr. | May-07 | Jun-11 | No | Yes | --- | --- | Unknown |
| Ahnapee R. | Apr-64 | Jun-11 | --- | No | --- | --- | Unknown |
| Three Mile Cr. | Sep-08 | Jun-11 | No | Yes | --- | --- | 2013 |
| Kewaunee R. | | | | | | | |
| Barrier downstream | May-75 | Aug-08 | --- | No | --- | --- | Unknown |
| Barrier upstream | May-75 | Sep-11 | --- | Yes | 1,542 | 1,028 | Unknown |
| Casco Cr. | May-07 | Sep-11 | No | Yes | 591 | 0 | Unknown |
| Scarboro Cr. | May-75 | Sep-11 | --- | No | --- | --- | Unknown |

**Table 19.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| East Twin R. | Oct-08 | Sep-11 | No | Yes | --- | --- | Unknown |
| Fischer Cr. | May-87 | Aug-08 | --- | No | --- | --- | Unknown |
| French Farm Cr. | Never | Jun-11 | --- | No | --- | --- | Unknown |
| Carp Lake R. | Apr-09 | June-11 | No | Yes | --- | --- | ***2012***[2] |
| Big Stone Cr. | Oct-07 | Aug-11 | No | Yes | --- | --- | ***2012***[2] |
| Big Sucker R. | Oct-07 | Aug-11 | No | Yes | --- | --- | ***2012***[2] |
| Wycamp Lake Outlet | May-08 | Aug-11 | No | Yes | --- | --- | ***2012***[2] |
| Bear R. | Never | May-09 | --- | No | --- | --- | Unknown |
| Horton Cr. | Oct-09 | Aug-11 | No | Yes | --- | --- | 2013 |
| Boyne R. | May-10 | Sep-10 | No | Yes | --- | --- | 2013[1] |
| Porter Cr. | Oct-09 | Sep-11 | Yes | Yes | 867 | 0 | 2013 |
| Jordan R. | Jul-11 | Aug-11 | Yes | Yes | --- | --- | 2014[1] |
| Monroe Cr. | Sep-07 | Sep-10 | No | Yes | 5,780 | 175 | ***2012***[3] |
| Loeb Cr. | Oct-08 | Sep-11 | No | Yes | 354 | 354 | 2013 |
| McGeach Cr. | Oct-99 | May-11 | --- | No | --- | --- | Unknown |
| Elk Lake Outlet | Sep-04 | Oct-11 | --- | No | --- | --- | Unknown |
| Yuba Cr. | May-06 | Jun-11 | --- | No | --- | --- | Unknown |
| Acme Cr. | Aug-63 | Jun-09 | --- | No | --- | --- | Unknown |
| Mitchell Cr. | Oct-08 | Aug-11 | No | Yes | --- | --- | Unknown |
| Boardman R. | | | | | | | |
| (Lower) | Jun-09 | Jun-11 | Yes | Yes | 4,273 | 2,154 | 2013 |
| (Mid.) | Oct-11 | Jun-11 | --- | --- | --- | --- | Unknown |
| Leo Cr. | Never | Sep-10 | --- | No | --- | --- | Unknown |
| Good Harbor Cr. | Jul-10 | Oct-11 | No | No | --- | --- | Unknown |
| Crystal R. | Nov-11 | Sep-10 | --- | --- | --- | --- | Unknown |
| Platte R. | Jun-09 | Oct-11 | Yes | Yes | 582,948 | 55,297 | ***2012*** |
| Betsie R. | Jul-10 | Oct-11 | Yes | Yes | 140,847 | 18,960 | 2013 |
| Bowen Cr. | Jun-09 | Oct-09 | No | --- | --- | --- | Unknown |
| Big Manistee R. | Aug-09 | Aug-11 | No | Yes | --- | --- | ***2012***[1] |
| Bear Cr. | Aug-09 | Aug-11 | No | Yes | --- | --- | ***2012***[1] |
| L. Manistee R. | Jul-11 | Oct-11 | No | No | --- | --- | 2014[1] |
| Gurney Cr. | Aug-09 | Oct-09 | No | --- | --- | --- | Unknown |
| Cooper Cr. | Jul-08 | Jun-11 | No | No | --- | --- | Unknown |
| Lincoln R. | Aug-10 | Oct-10 | No | No | --- | --- | 2014 |
| Pere Marquette R. | Jul-09 | Aug-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Bass Lake Outlet | Aug-78 | Jul-09 | --- | No | --- | --- | Unknown |
| Pentwater R. | | | | | | | |
| North Br. | Jun-11 | Oct-11 | Yes | Yes | --- | --- | 2014[1] |
| South Br. | Never | Oct-09 | --- | No | --- | --- | Unknown |
| Lambricks Cr. | Sep-84 | Oct-09 | --- | No | --- | --- | Unknown |
| Stony Cr. | Jun-10 | Aug-10 | No | No | --- | --- | Unknown |
| Flower Cr. | Jun-11 | Sep-10 | --- | --- | --- | --- | Unknown |

**Table 19**. *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| White R. | | | | | | | |
| Below barrier | Jul-10 | Oct-11 | Yes | Yes | --- | --- | 2013 |
| Above barrier | Jul-10 | Oct-11 | Yes | Yes | --- | --- | 2013 |
| Duck Cr. | Jul-84 | Jun-09 | --- | No | --- | --- | Unknown |
| Muskegon R. | Aug-11 | Oct-11 | No | No | --- | --- | 2014[1] |
| Brooks Cr. | Aug-10 | Sep-10 | No | No | --- | --- | Unknown |
| Cedar Cr. | Aug-10 | Sep-10 | No | No | --- | --- | Unknown |
| Bridgeton Cr. | Aug-11 | Oct-11 | No | No | --- | --- | Unknown |
| Minnie Cr. | Aug-11 | Oct-11 | No | No | --- | --- | Unknown |
| Bigelow Cr. | Aug-11 | Oct-11 | No | No | --- | --- | Unknown |
| Big Bear Cr. | Aug-70 | Jun-06 | --- | No | --- | --- | Unknown |
| Mosquito Cr. | Sep-68 | Sep-10 | --- | No | --- | --- | Unknown |
| Black Cr. | Aug-08 | Oct-11 | No | No | --- | --- | Unknown |
| Grand R. | Never | Jul-07 | --- | No | --- | --- | Unknown |
| Norris Cr. | Aug-08 | Sep-11 | No | No | --- | --- | Unknown |
| Lowell Cr | Sep-65 | Aug-05 | --- | No | --- | --- | Unknown |
| Buck Cr. | Sep-65 | Oct-08 | --- | No | --- | --- | Unknown |
| Rush Cr. | Sep-65 | Oct-08 | --- | No | --- | --- | Unknown |
| Sand Cr. | Jun-07 | Sept-11 | --- | No | --- | --- | Unknown |
| Crockery Cr. | Sep-09 | Sept-11 | No | Yes | 142,842 | 28,006 | ***2012*** |
| Bass R. | Aug-04 | Oct-10 | --- | No | --- | --- | Unknown |
| Rogue R. | Sep-09 | Sep-11 | No | No | --- | --- | Unknown |
| Pigeon R. | Oct-64 | Oct-10 | --- | No | --- | --- | Unknown |
| Pine Cr. | Oct-64 | Oct-10 | --- | No | --- | --- | Unknown |
| Gibson Cr. | Jul-84 | Oct-10 | --- | No | --- | --- | Unknown |
| Kalamazoo R. | Never | Jul-07 | --- | Yes | --- | --- | Unknown |
| Bear Cr. | Sep-10 | Oct-11 | Yes | No | --- | --- | Unknown |
| Sand Cr. | Sep-10 | Oct-11 | No | No | --- | --- | Unknown |
| Mann Cr. | Aug-10 | Sep-10 | No | No | --- | --- | Unknown |
| Rabbit R. | Aug-08 | Oct-11 | No | Yes | --- | --- | Unknown |
| Swan Cr. | Jul-77 | Jun-11 | --- | Yes | --- | --- | Unknown |
| Allegan 3 Cr. | Sep-65 | Jun-10 | --- | No | --- | --- | Unknown |
| Allegan 4 Cr. | Oct-78 | Jul-09 | --- | No | --- | --- | Unknown |
| Allegan 5 Cr. | Never | Jun-10 | --- | No | --- | --- | Unknown |
| Black R. | | | | | | | |
| North Br. | Jun-77 | Sep-11 | --- | No | --- | --- | Unknown |
| Middle Br. | Jun-11 | Sep-11 | No | No | --- | --- | Unknown |
| South Br. | Never | Sep-11 | --- | Yes | 14,203 | 12,428 | 2013 |
| Brandywine Cr. | Oct-85 | Sep-11 | --- | No | --- | --- | Unknown |
| Rogers Cr. | May-98 | Jun-09 | --- | No | --- | --- | Unknown |
| St. Joseph R. | Never | Jul-10 | --- | No | --- | --- | Unknown |
| Lemon Cr. | Oct-65 | Sep-11 | --- | No | --- | --- | Unknown |
| Pipestone Cr. | Sep-10 | Sep-10 | No | No | --- | --- | Unknown |

**Table 19**. *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| Meadow Dr. | Oct-65 | Sep-11 | --- | No | --- | --- | Unknown |
| Hickory Cr. | Oct-65 | Sep-11 | --- | Yes | --- | --- | Unknown |
| Paw Paw R. | May-09 | Sep-11 | No | Yes | 122,023 | 58,572 | ***2012*** |
| Blue Cr. | May-01 | Sep-11 | --- | Yes | --- | --- | ***2012*** |
| Mill Cr. | May-09 | Sep-11 | No | Yes | --- | --- | ***2012*** |
| Brandywine Cr. | May-05 | Sep-11 | No | Yes | --- | --- | ***2012*** |
| Brush Cr. | May-09 | Sep-11 | No | Yes | --- | --- | ***2012*** |
| Hayden Cr. | May-09 | Sep-11 | No | Yes | --- | --- | ***2012*** |
| Campbell Cr. | Sep-09 | Sep-11 | No | Yes | --- | --- | ***2012*** |
| Galien R. | | | | | | | |
| North Br. | Oct-10 | Oct-11 | No | No | --- | --- | Unknown |
| East Br, | Oct-10 | Oct-10 | No | No | --- | --- | Uknown |
| South Br, | Jun-09 | Oct-11 | No | Yes | 8,122 | 1,799 | 2013 |
| State Cr. | May-86 | Aug-10 | --- | No | --- | --- | Unknown |
| Trail Cr. | Oct-10 | Oct-11 | No | No | --- | --- | Unknown |
| Donns Cr. | May-66 | Sep-09 | --- | No | --- | --- | Unknown |

[1] Stream being treated based on expert judgment
[2] Stream being treated based on next large scale treatment.
[3] Stream being treated based on geographic efficiency

**Table 20.** Status of larval sea lampreys in historically infested lentic areas of Lake Michigan during 2011.

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| Brevort R. | Brevort Lake (Silver Cr. – Offshore) | Jul-08 | Jul-08 | Never[1] |
| | Brevort Lake (L. Brevort R.. – Offshore) | Jul-08 | Aug-74 | Never |
| Paquin Cr. | Paquin Cr. (Offshore) | Jul-08 | Jul-08 | Never[1] |
| Hog Island Cr. | Hog Island Cr. (Offshore) | Aug-11 | Aug-11 | Jun-07[1] |
| Black R. | Black R. (Offshore) | Aug-11 | Aug-11 | Never[1] |
| Mile Cr. | Mile Cr. (Offshore) | Jun-08 | Jun-08 | Never[1] |
| Millecoquins | Millecoquins Lake (Cold Cr. – Offshore) | Sep-10 | Sep-10 | Never[1] |
| Cataract R. | Cataract R. (Offshore) | Aug-09 | Aug-09 | Never[1] |
| Milakokia R. | Seul Choix Bay | Sep-07 | Aug-80 | Never |
| Manistique R. | Manistique R. (Offshore) | Jul-11 | Jul-11 | Aug-08[1] |
| Bursaw Cr. | Bursaw Cr. (Offshore) | Jul-11 | Jul-11 | Never[1] |
| Ogontz R. | Ogontz R. (Offshore) | Jul-11 | Jul-11 | Never[2] |
| Whitefish R. | Big Bay De Noc | Jul-11 | Jul-11 | Never[1] |
| Rapid R. | Little Bay De Noc | Jul-10 | Jul-10 | Never[2] |
| Days R. | Little Bay De Noc | Aug-11 | Aug-11 | Never[1] |
| Escanaba R. | Little Bay De Noc | Aug-10 | Jul-06 | Never[1] |
| Portage Cr. | Portage Bay | Jul-84 | Jul-77 | Never |
| Ford R. | Green Bay | Jul-11 | Jul-11 | Never[2] |
| Cedar R. | Green Bay | Aug-10 | Jul-09 | May-10 |
| Beattie Cr. | Green Bay | Jul-08 | Jul-85 | Never |
| Menominee R. | Green Bay | Aug-10 | Sep-06 | Never[1] |
| Carp Lake R. | Cecil Bay | Sep-09 | Sep-09 | Never[1] |
| Bear R. | Little Traverse Bay | Sep-10 | Jun-08 | May-07 |
| Horton Cr. | Horton Bay (Lake Charlevoix) | Sep-10 | Sep-10 | Oct-09 |
| Boyne R. | Boyne Harbor (Lake Charlevoix) | Jun-11 | Jun-11 | May-10 |
| Porter Cr. | Lake Charlevoix | Jun-11 | Jun-11 | Never[1] |
| Jordan R. | Lake Charlevoix | Sep-10 | Sep-10 | Jul-11 |
| Monroe Cr. | Lake Charlevoix | Jul-08 | Jul-06 | Never[1] |
| Mitchell Cr. | Grand Traverse Bay (East Arm) | May-04 | May-04 | Never[1] |
| Boardman R. | Grand Traverse Bay (West Arm) | Jun-11 | Jun-11 | Never[2] |
| Leland R. | Leland R. (Offshore) | Jun-09 | Jun-09 | Never[1] |
| Platte R. | Loon Lake | Sep-08 | Sep-08 | Never[1] |
| | Platte Lake | Sep-08 | Jul-03 | Never[1] |
| Betsie R. | Betsie Lake | May-08 | Aug-83 | Never[1] |
| Big Manistee | Manistee Lake (Big Manistee - Offshore) | Jul-08 | Jul-08 | Never[1] |
| | Manistee Lake (Little Manistee – Offshore) | Jul-08 | Jul-08 | Jul-08 |

[1] Low-density larval population monitored with 3.2% granular Bayluscide surveys.
[2] Scheduled for treatment in 2012

## Lake Huron

- Larval assessments were conducted on a total of 109 tributaries (52 Canada, 57 U.S.) and offshore of 11 tributaries (6 Canada, 5 U.S.). The status of larval sea lamprey populations in historically infested Lake Huron tributaries and lentic areas are presented in Tables 21 and 22.

- Surveys to estimate abundance of larval sea lampreys were conducted in 20 tributaries (6 Canada, 14 U.S.) and offshore of 2 tributaries in Canada.

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 25 tributaries (18 Canada, 7 U.S) and offshore of 2 tributaries in Canada. New infestations were discovered in Hughson Creek (Canada) and Hoban Creek (U.S).

- Post-treatment assessments were conducted in 42 tributaries (21 Canada, 21 U.S.) to determine the effectiveness of lampricide treatments during 2010 and 2011.

- Surveys to evaluate barrier effectiveness were conducted in eight tributaries (three Canada, five U.S.).

- Monitoring of larval sea lampreys in the St. Marys River continued during 2011. Approximately 541 geo-referenced sites were sampled using deepwater electrofishing gear. Surveys were conducted according to a stratified, systematic sampling design. The larval sea lamprey population for the entire St. Marys River is estimated to be 0.6 million (95% confidence limits 0.3 –1.0 million), which represents the lowest estimate in the time series.

- Additional pre-treatment deep water electrofishing (DWEF) surveys were conducted in the St. Marys River in support of the Wilberg et al. Commission-funded research project. This project is exploring the use of historical data to inform the selection of lampricide plots. Approximately 600 samples were completed extending across 14 GB plots in the river.

- A study designed to evaluate the ability to detect low density larval sea lamprey populations with backpack electrofishers was conducted in six Canadian Lake Huron streams (Garden, Echo , H-114, and Mindemoya rivers and Silver and Timber Bay creeks). Preliminary results indicate that current electrofishing techniques are reliable for detecting low densities of lampreys. Final results will be presented in next year's annual report.

**Table 21.** Status of larval sea lampreys in Lake Huron tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2011.

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | |
| St Marys R. | | | | | | | |
| Whitefish Channel | Oct-11 | Aug-11 | --- | --- | --- | --- | Unknown |
| Root R. | Aug. 10 | Jul-11 | Yes | Yes | --- | --- | 2013 |
| Garden R. | Jul-11 | Jul-11 | --- | --- | 3,599,785 | --- | ***2012***[1] |
| Echo R. | | | | | | | |
| Upper | Oct-99 | Sep-09 | --- | No | --- | --- | Unknown |
| Lower | Jul-11 | Aug-11 | No | --- | --- | --- | Unknown |
| Bar & Iron Cr. | Oct-11 | Aug-11 | --- | --- | 124 | --- | ***2012***[1] |
| Bar R. | Oct-11 | Aug-11 | --- | --- | --- | --- | Unknown |
| Sucker Cr. | May-10 | Jul-11 | No | Yes | 11 | --- | ***2012***[1] |
| Two Tree R. | May-10 | Aug-10 | No | --- | --- | --- | Unknown |
| Richardson Cr. | Aug-11 | Jul-11 | --- | --- | --- | --- | Unknown |
| Watson Cr. | Sep-10 | Jul-11 | No | Yes | --- | --- | 2014 |
| Gordon Cr. | Sep-11 | Sep-08 | --- | --- | --- | --- | Unknown |
| Browns Cr. | Sep-11 | May-10 | --- | --- | --- | --- | Unknown |
| Koshkawong R. | May-10 | Jul-11 | No | No | --- | --- | ***2012***[1] |
| Unnamed | Aug-75 | Sep-11 | --- | Yes | 7,024 | 1,098 | ***2012***[1] |
| Unnamed | Sep-75 | Sept-11 | --- | Yes | --- | --- | ***2012***[1] |
| MacBeth Cr. | Jun-67 | Jul-11 | --- | No | --- | --- | Unknown |
| Thessalon R. | | | | | | | |
| Upper | Aug-11 | Aug-11 | No | --- | --- | --- | Unknown |
| Lower | Jul-10 | Jul-09 | Yes | Yes | --- | --- | 2013 |
| Livingstone Cr. | Jun-00 | Aug-11 | --- | Yes | 4 | --- | ***2012***[1] |
| Mississagi R. | Jul-11 | Sep-11 | Yes | --- | --- | --- | ***2012***[1] |
| Blind R. | May-84 | Jun-07 | --- | No | --- | --- | Unknown |
| Lauzon R. | Jun-11 | Sep-11 | No | Yes | --- | --- | Unknown |
| Spragge Cr. | Oct-95 | May-09 | --- | No | --- | --- | Unknown |
| No Name | Jun-11 | Sep-11 | Yes | --- | --- | --- | Unknown |
| Marcellus Cr. | Never | Sep-11 | --- | Yes | --- | --- | ***2012***[1] |
| Serpent R. | | | | | | | |
| Main | Jun-11 | Sep-11 | No | --- | --- | --- | ***2012***[1] |
| Grassy Cr. | Jun-11 | Sep-11 | No | --- | --- | --- | Unknown |
| Spanish R. | Sep-11 | Oct-08 | --- | --- | --- | --- | Unknown |
| Kagawong R. | Aug-67 | May-09 | --- | No | --- | --- | Unknown |
| Unnamed | May-11 | Sep-11 | No | --- | --- | --- | Unknown |
| Silver Cr. | May-11 | Sep-11 | No | Yes | --- | --- | Unknown |
| Sand Cr. | Oct-11 | Oct-10 | --- | --- | --- | --- | Unknown |
| Mindemoya R. | Jun-11 | Sep-11 | No | Yes | --- | --- | 2015 |
| Timber Bay Cr. | May-11 | Sep-11 | No | --- | --- | --- | Unknown |
| Hughson Cr. | Never | Sep-11 | --- | Yes | 8,951 | 176 | ***2012***[1] |
| Manitou R. | Oct-07 | Sep-11 | --- | Yes | 4,977 | 404 | ***2012***[1] |
| Blue Jay Cr. | Jun-11 | Sep-11 | No | --- | --- | --- | Unknown |
| Kaboni Cr. | Oct-78 | May-09 | --- | No | --- | --- | Unknown |

**Table 21.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Chikanishing R. | Jun-03 | Jul-11 | No | No | --- | --- | Unknown |
| French R. System | | | | | | | |
| O.V. Channel | Jun-06 | Jul-09 | No | Yes | 4,192 | --- | ***2012*** [1] |
| Wanapitei R. | Jun-11 | Jun-08 | No | Yes | 1,929 | --- | ***2012*** [1] |
| Key R. (Nesbit Cr.) | Sep-72 | Jun-07 | --- | No | --- | --- | Unknown |
| Still R. | Jun-96 | Jun-10 | --- | Yes | --- | --- | Unknown |
| Magnetawan R. | Jun-11 | Jul-09 | No | Yes | 67,123 | --- | ***2012*** [1] |
| Naiscoot R. | Jun-08 | Jun-11 | --- | Yes | --- | --- | ***2012*** [2] |
| Shebeshekong R. | Never | Jul-11 | --- | No | --- | --- | Unknown |
| Boyne R. | Jun-08 | Jun-11 | No | Yes | --- | --- | ***2012*** [2] |
| Musquash R. | Sep-05 | Jul-11 | No | No | --- | --- | ***2012*** [1] |
| McDonald Cr. | Never | Jul-09 | --- | No | --- | --- | Unknown |
| Simcoe/Severn System | Never | Jul-09 | --- | Yes | --- | --- | Unknown |
| Coldwater R. | Never | May-11 | --- | No | --- | --- | Unknown |
| Sturgeon R. | Apr-11 | May-11 | No | --- | --- | --- | ***2012*** [1] |
| Hog Cr. | Sep-78 | May-11 | --- | No | --- | --- | Unknown |
| Lafontaine Cr. | Jun-68 | May-11 | --- | No | --- | --- | Unknown |
| Nottawasaga R. | | | | | | | |
| Main | May-02 | Jul-11 | --- | Yes | 313,443 | --- | ***2012*** [1] |
| Bear Cr. | Jun-09 | Arp-11 | No | Yes | --- | --- | Unknown |
| Pine R. | Jun-09 | Jul-11 | No | Yes | --- | --- | ***2012*** [1] |
| Pretty R. | May-72 | Apr-11 | --- | No | --- | --- | Unknown |
| Silver Cr. | Sep-82 | Jul-09 | --- | No | --- | --- | Unknown |
| Bighead R. | Jun-10 | Jul-11 | Yes | Yes | 198,799 | --- | ***2012*** [1] |
| Bothwells Cr. | Jun-79 | May-10 | --- | No | --- | --- | Unknown |
| Sydenham R. | Jun-72 | Jun-11 | No | No | --- | --- | Unknown |
| Sauble R. | Jun-04 | Jun-11 | No | Yes | --- | --- | Unknown |
| Saugeen R. | Jun-71 | May-10 | No | No | --- | --- | Unknown |
| Bayfield R. | Jun-70 | Jun-10 | No | No | --- | --- | Unknown |
| **United States** | | | | | | | |
| Mission Cr. | Never | Jun-09 | --- | No | --- | --- | Unknown |
| Frenchette Cr. | Never | Sep-08 | --- | No | --- | --- | Unknown |
| Ermatinger Cr. | Never | Sep-08 | --- | No | --- | --- | Unknown |
| Charlotte R. | Oct-11 | Aug-11 | --- | --- | --- | --- | Unknown |
| Little Munuscong R. | Oct-10 | Jun-11 | --- | --- | --- | --- | Unknown |
| Big Munuscong R. | Jun-99 | Jun-10 | --- | No | --- | --- | Unknown |
| Taylor Cr. | Oct-11 | Jul-11 | --- | --- | --- | --- | Unknown |
| Carlton Cr. | May-11 | Jul-11 | Yes | --- | --- | --- | Unknown |
| Canoe Lake Outlet | May-70 | May-10 | --- | No | --- | --- | Unknown |
| Caribou Cr. | Jun-11 | Jul-11 | No | --- | --- | --- | Unknown |
| Bear Lake Outlet | Jun-11 | Jul-11 | No | --- | --- | --- | Unknown |
| Carr Cr. | May-78 | Jul-11 | --- | Yes | --- | --- | Unknown |
| Joe Straw Cr. | May-75 | Jul-11 | --- | No | --- | --- | Unknown |

**Table 21.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) | | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| | | | Residuals Present | Recruitment Evident | | | |
| Huron Point Cr. | Never | May-11 | --- | Yes | 129 | 43 | ***2012[1]*** |
| Saddle Cr. | Never | May-10 | --- | No | --- | --- | Unknown |
| Albany Cr. | Apr-11 | Jul-11 | --- | Yes | --- | --- | Unknown |
| Barrier upstream | Jul-07 | Sep-10 | No | No | --- | --- | Unknown |
| Boiling Springs Cr. | Never | Apr-10 | --- | No | --- | --- | Unknown |
| Trout Cr. | Oct-10 | Apr-11 | --- | --- | --- | --- | Unknown |
| Beavertail Cr. | May-11 | Jul-11 | No | --- | --- | --- | Unknown |
| Prentiss Cr. | May-11 | Jul-11 | Yes | --- | --- | --- | Unknown |
| McKay Cr. | May-11 | Jul-11 | Yes | --- | --- | --- | Unknown |
| Susan Cr. | Never | Apr-10 | --- | No | --- | --- | Unknown |
| Flowers Cr. | Sep-83 | May-11 | --- | Yes | --- | --- | ***2012[3]*** |
| Ceville Cr. | Sep-05 | Jul-11 | No | Yes | 15,548 | 6,019 | ***2012*** |
| Hessel Cr. | May-11 | Jul-11 | No | --- | --- | --- | Unknown |
| Law Cr. | Never | Oct-10 | --- | No | --- | --- | Unknown |
| Steeles Cr. | May-11 | Jul-11 | No | Yes | --- | --- | Unknown |
| Nunns Cr. | Sep-01 | Jul-11 | --- | Yes | --- | --- | ***2012[1]*** |
| Pine R. | Jun-10 | Oct-10 | Yes | Yes | --- | --- | 2013 |
| McCloud Cr. | Oct-72 | May-11 | --- | No | --- | --- | Unknown |
| Carp R. | May-11 | Oct-11 | No | Yes | --- | --- | Unknown |
| Martineau Cr. | May-11 | Oct-11 | No | No | --- | --- | ***2012[1]*** |
| Hoban Cr. | Never | May-11 | --- | Yes | 2,397 | 935 | ***2012[3]*** |
| Rogers Cr. | Never | May-10 | --- | No | --- | --- | Unknown |
| Sec. 7 Cr. | Never | May-10 | --- | No | --- | --- | Unknown |
| 266-20 Cr. | Aug-76 | Jun-09 | --- | No | --- | --- | Unknown |
| Beaugrand Cr. | Never | May-07 | --- | No | --- | --- | Unknown |
| Little Black R. | May-67 | May-11 | --- | No | --- | --- | Unknown |
| Cheboygan R. | Oct-83 | Aug-11 | --- | Yes | --- | --- | Unknown |
| Mullett Cr. | Never | Jun-10 | --- | No | --- | --- | Unknown |
| Laperell Cr. | May-00 | Jul-11 | --- | No | --- | --- | Unknown |
| Meyers Cr. | Sep-99 | Jul-11 | --- | No | --- | --- | Unknown |
| Maple R. | Sep-11 | Sep-10 | --- | --- | --- | --- | ***2012[1]*** |
| Pigeon R. | Aug-11 | Oct-11 | --- | --- | --- | --- | ***2012[1]*** |
| Little Pigeon R. | Aug-11 | Jun-10 | --- | --- | --- | --- | ***2012[1]*** |
| Sturgeon R. | Sep-11 | Oct-11 | --- | --- | --- | --- | ***2012[1]*** |
| Little Sturgeon R. | Never | Sep-10 | --- | No | --- | --- | Unknown |
| Elliot Cr. | Oct-08 | Oct-11 | No | Yes | 26,015 | 0 | ***2012[1]*** |
| Grass Cr. | May-78 | Apr-11 | --- | No | --- | --- | Unknown |
| Greene Cr. | May-11 | Jul-11 | No | No | --- | --- | ***2012[1]*** |
| Barrier upstream | Jun-07 | Sep-10 | --- | --- | --- | --- | Unknown |
| Mulligan Cr. | May-11 | Jul-11 | Yes | Yes | 3,645 | 1.692 | ***2012[1]*** |
| Grace Cr. | May-09 | Oct-11 | No | Yes | 4,053 | --- | ***2012[1]*** |
| Black Mallard Cr. | | | | | | | |
| Lower | May-11 | Jul-11 | Yes | Yes | --- | --- | ***2012[1]*** |
| Upper | May-11 | Jul-11 | Yes | Yes | --- | --- | ***2012[1]*** |

**Table 21.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Seventeen Cr. | May-67 | Aug-11 | --- | No | 44 | 44 | ***2012***[1] |
| Ocqueoc R. | | | | | | | |
| Barrier downstream | Oct-08 | Aug-11 | No | Yes | 67,319 | 2,274 | ***2012***[2] |
| Barrier upstream | Aug-09 | Jul-11 | No | No | --- | --- | Unknown |
| Johnny Cr. | Sep-70 | May-11 | --- | Yes | --- | --- | Unknown |
| Schmidt Cr. | May-08 | Oct-11 | No | Yes | 1,451 | 907 | ***2012***[2] |
| Trout R. | May-11 | Jul-11 | Yes | Yes | --- | --- | Unknown |
| Swan R. | Jun-10 | Oct-11 | No | No | --- | --- | Unknown |
| Grand Lake Outlet | Never | Oct-11 | --- | No | --- | --- | Unknown |
| Middle Lake Outlet | Jun-67 | Oct-11 | --- | No | --- | --- | Unknown |
| Long Lake Outlet | May-08 | Oct-11 | No | Yes | 11,635 | 1,039 | 2013 |
| Squaw Cr. | Jun-10 | Oct-11 | No | Yes | --- | --- | Unknown |
| Devils R. | May-11 | Aug-11 | No | Yes | --- | --- | 2014 |
| Black R. | May-11 | Aug-11 | Yes | No | --- | --- | 2014 |
| Butternut Cr. | May-11 | Aug-11 | No | No | --- | --- | 2014 |
| Au Sable R. | Jun-10 | Aug-11 | Yes | Yes | --- | --- | 2013 |
| Pine R. | May-87 | Jun-09 | --- | No | --- | --- | Unknown |
| Tawas Lake Outlet | Jul-09 | Aug-09 | No | No | --- | --- | 2013 |
| Cold Cr. | Jul-09 | Jul-11 | No | Yes | 3,150 | 1,350 | 2013 |
| Sims Cr. | Jul-09 | Jul-11 | No | No | --- | --- | 2013 |
| Grays Cr. | Sep-05 | Jun-10 | --- | No | --- | --- | Unknown |
| Silver Cr. | Jul-09 | Sep-11 | No | Yes | 72,713 | 4,298 | 2013 |
| East Au Gres R. | Jul-09 | Oct-11 | No | Yes | 46,906 | 1,020 | 2013 |
| Au Gres R. | May-10 | Aug-10 | Yes | No | --- | --- | 2013 |
| Rifle R. | Aug-11 | Oct-11 | Yes | No | --- | --- | 2014 |
| Saginaw R. | | | | | | | |
| Cass R. | Jun-08 | Aug-11 | No | Yes | 81,076 | 47,858 | ***2012*** |
| Juniata Cr. | Jun-08 | Aug-11 | No | Yes | --- | --- | ***2012*** |
| Scott Drain | Jun-08 | Aug-11 | No | No | --- | --- | ***2012*** |
| Goodings Cr. | Jun-08 | Aug-11 | No | Yes | --- | --- | ***2012*** |
| Tittabawasse R. | Never | Sep-08 | --- | No | --- | --- | Unknown |
| Chippewa R. | Jun-09 | Sep-11 | No | Yes | 1,012,534 | 919,077 | ***2012*** |
| Coldwater R. | Jun-09 | Aug-11 | No | Yes | --- | --- | ***2012*** |
| Pine R. | Jun-08 | Sep-11 | Yes | Yes | 258,238 | 172,158 | ***2012*** |
| Little Salt Cr. | May-02 | Aug-11 | --- | No | --- | --- | Unknown |
| Big Salt Cr. | Jun-09 | Aug-11 | --- | No | --- | --- | Unknown |
| North Br. | Never | Sep-11 | --- | No | --- | --- | Unknown |
| Carroll Cr. | May-07 | Aug-11 | --- | No | --- | --- | 2014 |
| Big Salt R. | May-10 | Aug-10 | No | No | --- | --- | 2013 |
| Bluff Cr. | May-10 | Aug-10 | No | No | --- | --- | 2013 |
| Shiawassee R. | Jun-10 | Aug-10 | No | No | --- | --- | 2013 |
| Rock Falls Cr. | Never | Jun-07 | --- | No | --- | --- | Unknown |
| Sucker Cr. | Never | Jun-07 | --- | No | --- | --- | Unknown |
| Cherry Cr. | Never | Jun-07 | --- | No | --- | --- | Unknown |
| Mill Cr. | May-85 | Aug-11 | --- | Yes | 371 | 247 | 2013 |

[1] Stream being treated based on North Channel scenario
[2] Stream being treated based on expert judgment
[3] Stream being treated based on geographic efficiency

**Table 22.** Status of larval sea lampreys in historically infested lentic areas of Lake Huron during 2011.

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| **Canada** | | | | |
| Echo R. | Solar Lake | Jul-06 | Sep-93 | Jul-87 |
| | Stuart Lake | May-90 | May-90 | Jul-80 |
| Sucker Cr. | Desjardins Bay | Jul-11 | Jul-11 | Jul-84 |
| Two Tree R. | North Channel | Aug-81 | Aug-81 | Never |
| Gordons Cr. | North Channel | Aug-91 | Aug-91 | Jul-84 |
| Browns Cr. | North Channel | Aug-91 | Aug-91 | Aug-87 |
| Koshkawong R. | North Channel | Aug-91 | Aug-91 | Never |
| Unnamed Cr. | North Channel | Jun-00 | May-95 | Never |
| Mississagi R. | North Channel | Aug-90 | Aug-90 | Jul-81 |
| Lauzon R. | North Channel | Sep-11 | Jul-10 | Jun-11 |
| Unnamed | North Channel | Sep-11 | Sep-11 | Jul-10 |
| Kagawong R. | Mudge Bay | May-11 | Jul-90 | Aug-87 |
| Mindemoya R. | Providence Bay | Jun-08 | Jul-88 | Jul-81 |
| Manitou R. | Michael's Bay | Jul-10 | Jul-10 | Sep-11 |
| Blue Jay Cr. | Michael's Bay | Jul-10 | Jul-10 | Aug-87 |
| Still R. | Bying Inlet | Jun-10 | Jun-10 | Jun-11 |
| **United States** | | | | |
| Caribou Cr. | Caribou Cr. (Offshore) | Aug-09 | Aug-10 | Jun-10 |
| Albany Cr. | Albany Bay (Offshore) | Jul-11 | Jul-11 | Never[1] |
| Trout Cr. | Trout Cr. (Offshore) | Jul-11 | Jul-11 | Never[1] |
| Beavertail Cr. | Beavertail Bay | Aug-07 | Aug-07 | Never[1] |
| McKay Cr. | McKay Bay | Jul-11 | Jul-11 | Jul-07[1] |
| Flowers Cr. | Flowers Bay | Jul-81 | Jul-80 | Never |
| Nunns Cr. | St. Martin Bay | Jun-09 | Aug-87 | Never |
| Pine R. | St. Martin Bay | Jun-09 | Jun-09 | Never[1] |
| McCloud Cr. | St. Martin Bay | Jul-10 | Jul-10 | Never |
| Carp R. | St. Martin Bay | Sep-10 | Oct-09 | Jun-10 |
| Martineau Cr. | Horseshoe Bay | Sep-10 | Sep-10 | Never[1] |
| Cheboygan R. | Straits of Mackinac | Sep-03 | Aug-93 | Never |
| | Burt Lake (Sturgeon R.) | Aug-11 | Aug-98 | Never |
| Elliot Cr. | Duncan Bay | Jun-09 | Aug-86 | Never |
| Black Mallard R. | Black Mallard Lake | Jun-10 | Jun-10 | Never |
| Hammond Bay Cr. | Hammond Bay | Aug-11 | Aug-11 | Never[1] |
| Mulligan Cr. | Mulligan Cr. (offshore) | Jun-09 | Jun-09 | Never[1] |
| Ocqueoc R. | Hammond Bay | Jun-09 | Sep-86 | Never |
| Devils R. | Thunder Bay | Jun-09 | Aug-76 | Never |
| Au Sable R. | Au Sable R. (offshore) | Aug-09 | Aug-09 | Never[1] |
| East Au Gres R. | East Au Gres R. | May-07 | Jun-86 | Never |

[1] Low-density larval population monitored with 3.2% granular Bayluscide surveys.

## Lake Erie

- Larval assessments were conducted on a total of 72 tributaries (11 Canada, 61 U.S.) and offshore of 1 U.S. tributary. The status of larval sea lampreys in historically infested Lake Erie tributaries and lentic areas is presented in Tables 23 and 24.

- Surveys to detect new larval populations were conducted in 54 Lake Erie tributaries (49 U.S., 5 Canada) and a new sea lamprey infestation was discovered in Chautauqua Creek, a New York tributary to Lake Erie. Based on the size structure of larvae captured, sea lampreys recruited to the stream in 2011.

- Portions of the St. Clair River substrate were mapped using RoxAnn seabed classification sonar. GB was applied to estimate larval sea lamprey density. Approximately 150,000 sea lamprey larvae were estimated to be in the area mapped by the RoxAnn seabed classification method. A total of 2,650 ha in the upper and lower St. Clair were mapped, however some areas were excluded due to shallow depth and time restrictions.

- Bottom substrate was mapped using RoxAnn seabed classification sonar in the outflow area in the lower Detroit River.

- No larval populations were detected using GB in lotic surveys conducted in the Detroit, Huron, Sandusky, Maumee, Portage and Tousaint rivers, and Muddy Creek.

- The Huron-Erie Corridor Work Group was established to develop strategies and plans to determine the contribution of sea lampreys to Lake Erie from the St. Clair and Detroit rivers.

- A sampling protocol designed to monitor trends in larval sea lamprey abundance and evaluate the spatial distribution and density of larval sea lampreys is being developed for the St. Clair River.

**Table 23.** Status of larval sea lampreys in Lake Erie tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed during 2011.

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | |
| Big Cr. | Never | Aug-11 | --- | No | --- | --- | Unknown |
| Kettle Cr. | Never | Aug-11 | --- | No | --- | --- | Unknown |
| East Cr. | Jun-87 | Aug-10 | No | No | --- | --- | Unknown |
| Catfish Cr. | Jun-87 | Aug-10 | No | No | --- | --- | Unknown |
| Silver Cr. | Oct-09 | Aug-11 | No | No | --- | --- | Unknown |
| Big Otter Cr. | Sep-09 | Aug-11 | No | Yes | 19,997 | 6,666 | 2013 |
| South Otter Cr. | Aug-10 | Aug-11 | No | No | --- | --- | Unknown |
| Clear Cr. | May-91 | Sep-09 | No | No | --- | --- | Unknown |
| Big Cr. | Sep-09 | Aug-11 | No | Yes | 12,812 | 0 | 2013 |
| Forestville Cr. | May-89 | Aug-10 | No | No | --- | --- | Unknown |
| Normandale Cr. | Jun-87 | Aug-10 | No | No | --- | --- | Unknown |
| Fishers Cr. | Jun-87 | Aug-10 | No | No | --- | --- | Unknown |
| Young's Cr. | Sep-09 | Aug-11 | No | No | --- | --- | Unknown |
| Grand R. | Never | Jul-11 | --- | No | --- | --- | Unknown |
| Frenchman Cr. | Never | Jul-11 | --- | No | --- | --- | Unknown |
| **United States** | | | | | | | |
| Buffalo R. | Never | Jul-10 | --- | --- | --- | --- | Unknown |
| Delaware Cr. | Sep-05 | Jun-10 | --- | --- | --- | --- | Unknown |
| Cattaraugus Cr. | Oct-09 | Sep-11 | Yes | Yes | 2,657 | 553 | 2013 |
| Halfway Br. | Oct-86 | Jun-10 | --- | --- | --- | --- | Unknown |
| Canadaway Cr. | Oct-86 | Jun-11 | --- | No | --- | --- | Unknown |
| Chautauqua Cr. | Never | Sep-11 | --- | Yes | --- | --- | Unknown |
| Crooked Cr. | Oct-09 | Jul-11 | No | Yes | 1,444 | 481 | 2013 |
| Raccoon Cr. | Oct-09 | Sep-11 | No | No | --- | --- | Unknown |
| Conneaut Cr. | Oct-09 | Jul-11 | Yes | Yes | 15,479 | 4,622 | 2013 |
| Wheeler Cr. | Never | Jul-11 | --- | No | --- | --- | Unknown |
| Grand R. | Oct-09 | Jul-11 | Yes | No | --- | --- | Unknown |
| Chagrin R. | Never | Jun-10 | --- | --- | --- | --- | Unknown |
| **St. Clair River/Lake St. Clair Tributaries** | | | | | | | |
| Black R. | Never | Jun-11 | --- | No | --- | --- | Unknown |
| Mill Cr. | Never | Jun-11 | --- | No | --- | --- | Unknown |
| Pine R. | Apr-88 | Jun-11 | --- | No | --- | --- | Unknown |
| Belle R. | Never | Jun-11 | --- | No | --- | --- | Unknown |
| Clinton R. | Never | Aug-11 | --- | Yes | 712 | 712 | 2013 |
| St. Clair R. | Never | Jun-11 | --- | Yes | --- | --- | Unknown |
| Thames R. | Never | Aug-10 | --- | No | --- | --- | Unknown |
| Detroit R. | Never | Aug-11 | --- | No | --- | --- | Unknown |

**Table 24**. Status of larval sea lampreys in historically infested lentic areas of Lake Erie during 2011.

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| **United States** | | | | |
| Cattaraugus Cr. | Sunset Bay | Aug-10 | Jul-09 | Never[1] |
| Conneaut Cr. | Conneaut Harbor | Jul-10 | Jul-06 | Never[1] |
| Grand R. | Fairport Harbor | Jul-10 | Jun-87 | Never[1] |

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

## Lake Ontario

- Larval assessments were conducted on a total of 50 tributaries (28 Canada, 22 U.S.) and offshore of 1 Canadian tributary. The status of larval sea lampreys in historically infested Lake Ontario tributaries and lentic areas is presented in Tables 25 and 26.

- Surveys to estimate abundance of larval sea lampreys were conducted in nine tributaries (five Canada, four U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in six tributaries (five Canada, one U.S.). No new populations were detected.

- Post-treatment assessments were conducted in nine tributaries (three Canada, six U.S.) to determine the effectiveness of lampricide treatments conducted during 2010 and 2011.

- Detection surveys in the upper St. Lawrence River produced no sea lamprey larvae from 12-500m$^2$ plots.

**Table 25.** Status of larval sea lampreys in Lake Ontario tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2011.

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | |
| Niagara R. | Never | Jul-10 | --- | Yes | --- | --- | Unknown |
| Twelvemile Cr. | Never | Sep-11 | --- | No | --- | --- | Unknown |
| Ancaster Cr. | May-03 | Sep-11 | No | No | --- | --- | Unknown |
| Grindstone Cr. | Never | Sep-11 | --- | No | --- | --- | Unknown |
| Bronte Cr. | Apr-10 | Sep-11 | Yes | Yes | 56,412 | 2,440 | 2013 |
| Sixteen Mile Cr. | Jun-82 | Sep-11 | No | No | --- | --- | Unknown |
| Credit R. | Jul-11 | Sep-11 | Yes | No | --- | --- | 2014 |
| Humber R. | Never | Sep-11 | --- | No | --- | --- | Unknown |
| Rouge R. | Jun-11 | Jul-11 | No | No | --- | --- | 2014 |
| Petticoat Cr. | Sep-04 | Jul-11 | No | No | --- | --- | Unknown |
| Duffins Cr. | May-09 | Aug-11 | No | Yes | --- | --- | ***2012[1]*** |
| Carruthers Cr. | Sep-76 | Apr-09 | No | No | --- | --- | Unknown |
| Lynde Cr. | May-09 | Aug-11 | No | Yes | --- | --- | ***2012[1]*** |
| Oshawa Cr. | May-09 | Aug-11 | No | Yes | --- | --- | ***2012[1]*** |
| Farewell Cr. | Jul-10 | Jul-11 | No | Yes | --- | --- | ***2012[1]*** |
| Bowmanville Cr. | May-11 | Jul-11 | No | Yes | --- | --- | 2014 |
| Wilmot Cr. | May-09 | Aug-11 | No | Yes | --- | --- | ***2012[1]*** |
| Graham Cr. | May-96 | May-10 | No | No | --- | --- | Unknown |
| Unnamed (O-135) | Never | Jul-11 | --- | No | --- | --- | Unknown |
| Port Granby Cr. | Never | Jul-11 | --- | No | --- | --- | Unknown |
| Wesleyville Cr. | Oct-02 | May-10 | No | No | --- | --- | Unknown |
| Port Britain Cr. | Oct-07 | Aug-11 | No | Yes | 661 | 620 | ***2012[2]*** |
| Gage Cr. | May-71 | Aug-09 | No | No | --- | --- | Unknown |
| Cobourg Br. | Oct-96 | Aug-11 | No | Yes | 5 | 5 | Unknown |
| Covert Cr. | Jul-10 | Aug-10 | No | No | --- | --- | 2013 |
| Grafton Cr. | Oct-07 | Aug-11 | No | Yes | --- | --- | Unknown |
| Shelter Valley Cr. | Sep-03 | Aug-11 | No | No | --- | --- | Unknown |
| Colborne Cr. | May-09 | Aug-11 | No | No | --- | --- | Unknown |
| Salem Cr. | Apr-09 | Aug-11 | No | Yes | --- | --- | ***2012[1]*** |
| Proctor Cr. | May-09 | Aug-11 | No | Yes | 7,318 | 4,150 | ***2012*** |
| Smithfield Cr. | Sep-86 | May-09 | No | No | --- | --- | Unknown |
| Consecon Cr. | Never | Jun-11 | --- | No | --- | --- | Unknown |
| Trent R. (Canal System) | Sep-11 | May-11 | No | No | --- | --- | Unknown |
| Mayhew Cr. | Apr-09 | Jun-11 | No | Yes | --- | --- | ***2012[1]*** |
| Moira R. | Jun-11 | May-10 | --- | --- | --- | --- | Unknown |
| Salmon R. | Jun-00 | May-10 | No | Yes | 0 | 0 | Unknown |
| Napanee R. | Never | May-11 | --- | No | --- | --- | Unknown |
| **United States** | | | | | | | |
| Black R. | Sep-08 | May-11 | No | Yes | --- | --- | ***2012[1]*** |
| Stony Cr. | Sep-82 | May-11 | No | No | --- | --- | Unknown |
| Sandy Cr. | Never | Apr-10 | --- | No | --- | --- | Unknown |
| South Sandy Cr. | May-11 | Jul-11 | No | Yes | --- | --- | 2014 |

**Table 25.** *continued.*

| Tributary | Last Treated | Last Surveyed | Status of Larval Lamprey Population (surveys since last treatment) Residuals Present | Recruitment Evident | Estimate of Overall Larval Population | Abundance Estimate of Larvae >100mm | Expected Year of Next Treatment |
|---|---|---|---|---|---|---|---|
| Skinner Cr. | Apr-05 | Jul-11 | No | No | --- | --- | Unknown |
| Lindsey Cr. | May-11 | Jull-11 | Yes | No | --- | --- | 2014 |
| Blind Cr. | May-76 | Jul-10 | No | No | --- | --- | Unknown |
| Little Sandy Cr. | Jun-10 | Jul-11 | Yes | Yes | 20,772 | 1,160 | 2013 |
| Deer Cr. | Apr-04 | Apr-10 | No | No | --- | --- | Unknown |
| Salmon R. | May-11 | Jul-11 | No | --- | --- | --- | ***2012*** |
| Grindstone Cr. | Apr-10 | Jul-10 | Yes | Yes | --- | --- | 2013 |
| Snake Cr. | May-11 | Jul-11 | No | No | --- | --- | 2014 |
| Sage Cr. | May-78 | Apr-10 | No | No | --- | --- | Unknown |
| Little Salmon R. | Apr-09 | Jul-11 | No | Yes | --- | --- | ***2012***[1] |
| Butterfly Cr. | May-72 | Jul-08 | No | No | --- | --- | Unknown |
| Catfish Cr. | Apr-09 | Jul-11 | No | Yes | --- | --- | ***2012***[1] |
| Oswego R. | | | | | | | |
| Black Cr. | May-81 | Jun-11 | No | No | --- | --- | Unknown |
| Big Bay Cr. | Sep-93 | April-09 | No | No | --- | --- | Unknown |
| Scriba Cr. | Jun-10 | Sep-09 | --- | --- | --- | --- | Unknown |
| Fish Cr. | Jun-10 | Jun-11 | No | No | --- | --- | 2013 |
| Carpenter Br. | May-94 | Apr-09 | No | No | --- | --- | Unknown |
| Putnam Br./ Coldsprings Cr. | May-96 | Oct-10 | No | No | --- | --- | Unknown |
| Hall Br. | Never | Oct-10 | --- | No | --- | --- | Unknown |
| Crane Br. | Never | Jul-06 | --- | No | --- | --- | Unknown |
| Skaneateles Cr. | Never | Oct-10 | --- | No | --- | --- | Unknown |
| Rice Cr. | May-72 | Apr-10 | No | No | --- | --- | Unknown |
| Eight Mile Cr. | Apr-07 | Apr-10 | No | No | --- | --- | Unknown |
| Nine Mile Cr. | May-11 | Jul-11 | No | No | --- | --- | 2014 |
| Sterling Cr. | Apr-09 | Jul-11 | Yes | Yes | --- | --- | ***2012***[1] |
| Blind Sodus Cr. | May-78 | Apr-09 | No | No | --- | --- | Unknown |
| Red Cr. | Apr-10 | Apr-11 | Yes | Yes | --- | --- | 2013 |
| Wolcott Cr. | May-79 | Apr-11 | No | No | --- | --- | Unknown |
| Sodus Cr. | May-10 | Apr-11 | No | Yes | --- | --- | 2013 |
| Forest Lawn Cr. | Never | Jul-11 | --- | Yes | 49 | 49 | Unknown |
| Irondequoit Cr. | Never | Apr-09 | --- | No | --- | --- | Unknown |
| Larkin Cr. | Never | Jul-09 | --- | No | --- | --- | Unknown |
| Northrup Cr. | Never | Apr-08 | --- | No | --- | --- | Unknown |
| Salmon Cr. | Apr-05 | Sep-10 | No | Yes | --- | --- | Unknown |
| Sandy Cr. | Apr-09 | Jul-11 | No | Yes | 780 | 780 | Unknown |
| Oak Orchard Cr. | | | | | | | |
| Marsh Cr. | May-08 | Jul-11 | No | Yes | 0 | 0 | Unknown |
| Johnson Cr. | Apr-10 | Jul-11 | No | No | --- | --- | Unknown |
| Third Cr. | May-72 | Oct-11 | No | No | --- | --- | Unknown |
| First Cr. | May-95 | Apr-11 | No | No | --- | --- | Unknown |

[1]Stream is being treated based on expert knowledge.
[2]Stream is being treated based on geographical efficiency.

**Table 26.** Status of larval sea lampreys in historically infested lentic areas of Lake Ontario during 2011.

| Tributary | Lentic Area | Last Surveyed | Last Survey Showing Infestation | Last Treated |
|---|---|---|---|---|
| **Canada** | | | | |
| Duffins Cr. | Duffins Cr. - lentic | May-06 | May-06 | Never[1] |
| Oshawa Cr. | Oshawa Cr. - lentic | Oct–81 | Oct–81 | Never |
| Wilmot Cr. | Wilmot Cr. - lentic | Aug-11 | Aug-11 | Never[1] |
| | | | | |
| **United States** | | | | |
| Black R. | Black River Bay | Oct-10 | Jul-10 | Never[1] |

[1] Low-density larval population monitored with 3.2% granular Bayluscide surveys.

## Spawning-Phase Assessment

The long-term effectiveness of the SLCP is measured by the annual estimation of the lake-wide populations of spawning-phase sea lampreys. Traps and nets are operated to capture migrating spawning-phase sea lampreys during the spring and early summer. Abundance is estimated using a combination of mark-recapture and trap efficiency estimates of spawning-phase migrants in streams with traps, and regression model-predicted estimates in streams without traps.

### Lake Superior

- A total of 4,063 sea lampreys were trapped in 22 tributaries during 2011 (Table 27, Figure 9).

- The estimated population of spawning-phase sea lampreys during 2011 was 54,294 (95% CI; 43,556-76,704) and was within the fish-community objective target range of 37,000 ± 19,000 for the fourth consecutive year (Figure 4).

- Spawning-phase sea lamprey migrations were monitored in the Amnicon, Poplar, 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 Chippewa Indians; 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.

- A total of 372 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Bad (100) and Brule (272) rivers.

- A 3-year field-scale management experiment using the mating pheromone to enhance trap captures was conducted in 19 Great Lakes tributaries, including the Tahquamenon, Betsy, Miners, Rock, Misery, and Carp rivers and Stokely Creek in Lake Superior.

**Table 27.** Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Superior during 2011 (letter in parentheses corresponds to location of stream in Figure 4).

| Tributary | Number Caught | Spawner Estimate | Trap Efficiency | Number Sampled[1] | Percent Males[2] | Mean Length (mm) Males | Mean Length (mm) Females | Mean Weight (g) Males | Mean Weight (g) Females |
|---|---|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | | | |
| Neebing-McIntyre Floodway (A) | | | | | | | | | |
| - Neebing R. | 347 | 1,973 | 16.9 | --- | --- | --- | --- | --- | --- |
| Wolf R. (B) | 58 | --- | --- | --- | --- | --- | --- | --- | --- |
| Carp R. (C) | 78 | 111 | 22.6 | 68 | 69 | --- | --- | --- | --- |
| Stokely Cr. (D) | 80 | 122 | 16.3 | 25 | 72 | --- | --- | --- | --- |
| Big Carp R. (E) | 15 | 27 | 55.6 | 13 | 77 | --- | --- | --- | --- |
| **Total or Mean (Canada)** | **578** | **---** | **---** | **106** | **71** | **---** | **---** | **---** | **---** |
| **United States** | | | | | | | | | |
| Tahquamenon R. (F) | 1,321 | 3,325 | 40 | 195 | 78 | 470 | 470 | 222 | 236 |
| Betsy R. (G) | 404 | 639 | 63 | 115 | 60 | 463 | 454 | 226 | 224 |
| Miners R. (H) | 118 | 315 | 37 | 23 | 30 | 438 | 436 | 203 | 207 |
| Furnace Bay Cr. (I) | 59 | 177 | 33 | 16 | 25 | 456 | 406 | 238 | 208 |
| Rock R. (J) | 225 | 439 | 51 | 98 | 47 | 412 | 434 | 193 | 190 |
| Laughing Whitefish R. (K) | 0 | --- | --- | --- | --- | --- | --- | --- | --- |
| Chocolay R.(L) | 0 | --- | --- | --- | --- | --- | --- | --- | --- |
| Big Garlic R. (M) | 11 | --- | --- | --- | --- | --- | --- | --- | --- |
| Silver R. (N) | 5 | --- | --- | --- | --- | --- | --- | --- | --- |
| Misery R. (O) | 123 | 281 | 44 | 21 | 43 | 442 | 395 | 171 | 163 |
| Firesteel R. (P) | 19 | --- | --- | --- | --- | --- | --- | --- | --- |
| Bad R. (Q) | 256 | --- | --- | --- | --- | --- | --- | --- | --- |
| Red Cliff Cr. (R) | 34 | --- | 0 | 34 | 47 | 459 | 450 | 216 | 168 |
| Brule R. (S) | 186 | 592 | 31 | 38 | 89 | 435 | 436 | 224 | 206 |
| Poplar R. (T) | 51 | 323 | 16 | 2 | 50 | 402 | 492 | 198 | 295 |
| Middle R. (U) | 671 | 1,177 | 57 | 73 | 49 | 447 | 428 | 224 | 215 |
| Amnicon R. (V) | 2 | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total or Mean (U.S.)** | **3,485** | **---** | **---** | **615** | **61** | **454** | **441** | **218** | **208** |
| **Total or Mean for lake** | **4,063** | **---** | **---** | **721** | **62** | **454** | **441** | **218** | **208** |

[1] The number of sea lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.

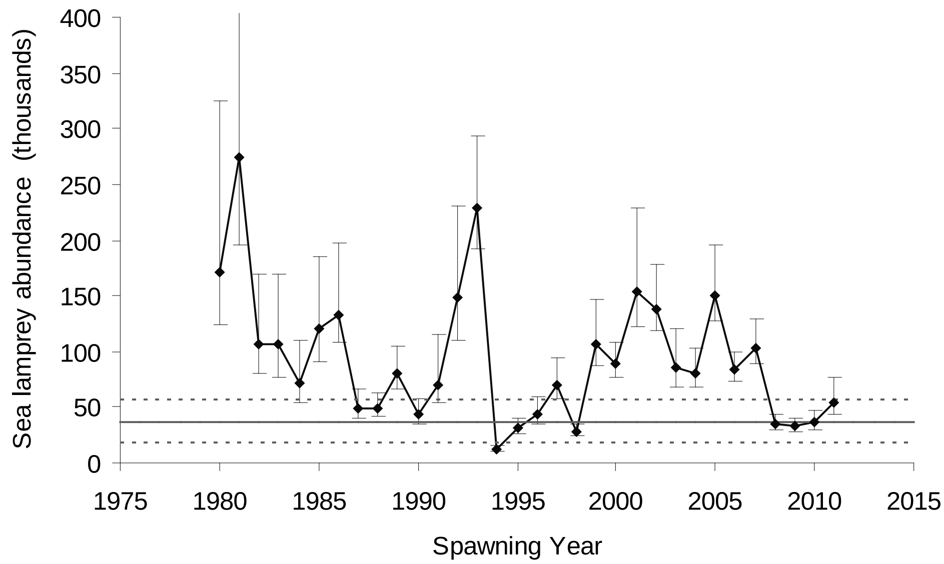


**Figure 4.** Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Superior, 1980 – 2011 with 95% confidence intervals (vertical error bars). The target range is indicated by the solid horizontal line with 95% confidence interval

**Lake Michigan**

- A total of 20,544 sea lampreys were trapped at 17 sites in 16 tributaries during 2011 (Table 28, Figure 9).

- The estimated population of spawning-phase sea lampreys during 2011 was 74,464 (95% CI; 69,147 – 80,593), which was greater than the fish-community objective target of 57,000 ± 13,000 (Figure 5).

- Spawning-phase sea lamprey migrations were monitored in the Boardman and Betsie rivers through a cooperative agreement with the Grand Traverse Band of Ottawa and Chippewa Indians.

- A total of 8,361 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Manistique (5,365), Peshtigo (1,160), Carp Lake Outlet (722), Boardman (63), Betsie (352), Manistee (393), Muskegon (171), and St. Joseph (132) rivers; and 3 lampreys from an unknown source.

- A 3-year field-scale management experiment using the mating pheromone to enhance trap captures was conducted in 19 Great Lakes tributaries, including the Carp Lake Outlet, Betsie and Manistee rivers on Lake Michigan.

**Table 28.** Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of spawning-phase sea lampreys captured in assessment traps or nets in tributaries of Lake Michigan during 2011 (letter in parentheses corresponds to location of stream in Figure 4).

| Tributary | Number Caught | Spawner Estimate | Trap Efficiency | Number Sampled[1] | Percent Males[2] | Mean Length (mm) | | Mean Weight (g) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Males | Females | Males | Females |
| Carp Lake Outlet (A) | 1,332 | 1,557 | 86 | 226 | 54 | 476 | 473 | 217 | 223 |
| Jordan R. (B) | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Deer Cr. | 110 | 237 | 46 | 44 | 55 | 479 | 481 | 270 | 292 |
| Elk Lake Outlet (C) | 35 | --- | --- | --- | --- | --- | --- | --- | --- |
| Boardman R. (D) | 314 | 756 | 42 | 23 | 57 | 480 | 471 | 238 | 228 |
| Betsie R. (E) | 964 | 1,344 | 72 | 133 | 53 | 498 | 498 | 259 | 267 |
| Big Manistee R. (F) | 747 | 5,105 | 15 | 20 | 45 | 493 | 481 | 265 | 246 |
| Little Manistee R. (G) | 71 | 141 | 50 | 15 | 27 | 486 | 448 | 272 | 267 |
| Muskegon R. (H) | 367 | 1,566 | 23 | 11 | 27 | 447 | 494 | 347 | 277 |
| St. Joseph R. (I) | 484 | 1,191 | 41 | 32 | 44 | 447 | 462 | 264 | 247 |
| East Twin R. (J) | 170 | 503 | 34 | 43 | 37 | 471 | 475 | 241 | 243 |
| Oconto R. (K) | 56 | 157 | 36 | 8 | 50 | 516 | 510 | 276 | 301 |
| Peshtigo R. (L) | 3,003 | 4,531 | 66 | 284 | 57 | 502 | 499 | 259 | 267 |
| Menominee R. (M) | 320 | 2,255 | 14 | 21 | 71 | 500 | 517 | 252 | 281 |
| Ogontz R. (N) | 8 | --- | --- | 1 | --- | --- | 510 | --- | 315 |
| Manistique R. (O) | 12,535 | 26,118 | 48 | 404 | 53 | 502 | 512 | 258 | 283 |
| Hog Island Cr. (P) | 28 | 49 | 57 | 1 | 100 | 510 | --- | 290 | --- |
| **Total or Mean for lake** | **20,544** | **---** | **---** | **1,266** | **53** | **493** | **494** | **251** | **263** |

[1] The number of sea lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.

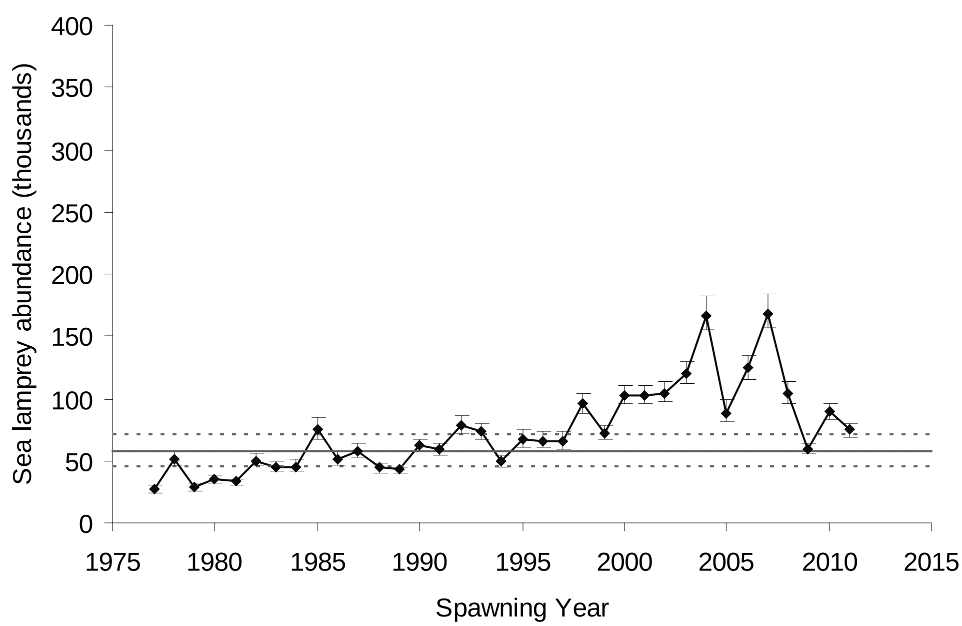


**Figure 5.** Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Michigan during 1977-2011 with 95% confidence intervals (vertical error bars). The target range is indicated by the solid horizontal line with 95% confidence intervals (horizontal dashed lines).

**Lake Huron**

- A total of 29,783 sea lampreys were trapped at 17 sites in 16 tributaries during 2011 (Table 29, Figure 9).

- The estimated population of spawning-phase sea lampreys during 2011 was 117,222 (95% CI; 108,504 – 131,749), which was greater than the fish-community objective target of 73,000 ± 20,000 (Figure 6).

- A total of 4,755 spawning-phase sea lampreys were captured in traps operated in the St. Marys River at the Clergue Generating Station in Canada and the U.S. Army Corps of Engineers and Cloverland Electric plants in the U.S. The estimated population in the river was 15,099 sea lampreys and trapping efficiency was 32%.

- A field experiment to increase trap efficiency by manipulating flow at the compensating gates, Cloverland Electric Cooperative, and Brookfield Renewable Power was conducted on the St. Marys River. Flow was also manipulated to increase the searchable area in the St. Marys Rapids to complete expanded nest surveys. Divers were contracted to explore the tailrace area of the Brookfield Renewable Power plant for sea lamprey activity.

- A population estimate was obtained in the Mississagi River during 2011 for the first in the river's 20-year trapping time series. A total of 92 sea lampreys were captured, of which all were marked, and 6 were recaptured for a population estimate of 1,190. This is dramatically lower than previous estimates obtained by regression. However, this estimate represents only the upstream portion of the river.

- A total of 15,999 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations (Figure 2) on the Lake Huron tributaries Au Sable (122), Cheboygan (8,302), East AuGres (286), Echo/Thessalon (1,821), Trout (7), Ocqueoc (2,411), and St. Marys (2,241) rivers. The total includes 809 lampreys that were grouped for transport from a combination of Lake Huron tributaries.

- A 3-year field-scale management experiment using the mating pheromone to enhance trap captures was conducted in 19 Great Lakes tributaries, including the East AuGres, Echo, Thessalon, and Little Thessalon rivers on Lake Huron.

**Table 29.** Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Huron during 2011 (letter in parentheses corresponds to location of stream in Figure 4).

| Tributary | Number Caught | Spawner Estimate | Trap Efficiency | Number Sampled[1] | Percent Males[2] | Mean Length (mm) | | Mean Weight (g) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Males | Females | Males | Females |
| **<u>Canada</u>** | | | | | | | | | |
| St. Marys R. (A) | 3,506 | 15,099 | 32 | 3,506 | 64 | --- | --- | --- | --- |
| Echo R. (B) | 2,558 | 8,466 | 15 | 2,417 | 68 | --- | --- | --- | --- |
| Koshkawong R. (C) | 97 | --- | --- | --- | --- | --- | --- | --- | --- |
| Thessalon R. (D) | | | | | | | | | |
| Little Thessalon R. | 2,439 | 8,199 | 30 | 2,391 | 54 | --- | --- | --- | --- |
| Main at Rydal Bank | 87 | 1,102 | 8 | 86 | 72 | --- | --- | --- | --- |
| Mississagi R. (E ) | 92 | 1,190 | 8 | 92 | 74 | --- | --- | --- | --- |
| **Total or Mean (Canada)** | **8,779** | **---** | **---** | **8,492** | **63** | **---** | **---** | **---** | **---** |
| **<u>United States</u>** | | | | | | | | | |
| Tittabawassee R. (F) | 4 | --- | --- | --- | --- | --- | --- | --- | --- |
| East Au Gres R. (G) | 642 | 4,020 | 16 | 8 | 50 | 472 | 468 | 243 | 218 |
| Au Sable R. (H) | 240 | --- | --- | 3 | 67 | 490 | 470 | 242 | 245 |
| Devils R. (I) | 7 | --- | --- | 1 | 100 | 509 | --- | 264 | --- |
| Trout R. (J) | 23 | --- | --- | --- | --- | --- | --- | --- | --- |
| Ocqueoc R. (K) | 4,869 | 6,738 | 72 | 398 | 47 | 475 | 475 | 237 | 236 |
| Greene Cr. (L) | 4 | --- | --- | --- | --- | --- | --- | --- | --- |
| Cheboygan R. (M) | 13,580 | 21,986 | 62 | 624 | 54 | 485 | 481 | 231 | 237 |
| Carp R. (N) | 21 | --- | --- | --- | --- | --- | --- | --- | --- |
| Trout Cr. (O) | 0 | --- | --- | --- | --- | --- | --- | --- | --- |
| Albany Cr. (P) | 365 | 687 | 53 | 99 | 55 | 477 | 469 | 226 | 216 |
| St. Marys R. (A) | 1,249 | See Canada | See Canada | 21 | 86 | 481 | 497 | 233 | 262 |
| **Total or Mean (U.S.)** | **21,004** | **---** | **---** | **1,154** | **52** | **481** | **478** | **232** | **235** |
| **Total or Mean for lake** | **29,783** | **---** | **---** | **9,646** | **61** | **481** | **478** | **232** | **235** |

[1] The number of sea lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.

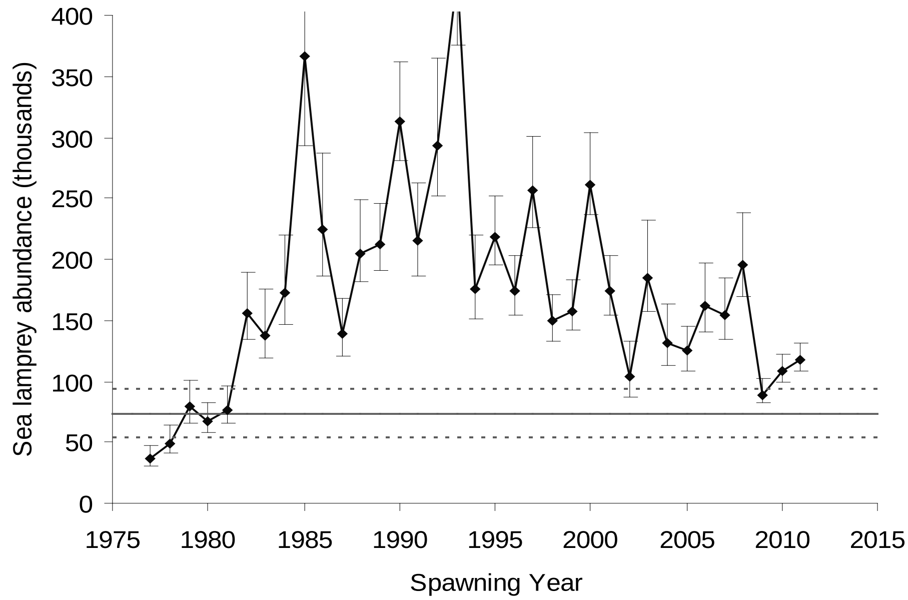


**Figure 6.** Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Huron during 1977-2011 with 95% confidence intervals (vertical error bars). The target range is indicated by the solid horizontal line with 95% confidence intervals (horizontal dashed lines).

**Lake Erie**

- A total of 3,281 spawning-phase sea lampreys were trapped at 5 sites in 4 tributaries during 2011 (Table 30, Figure 9).

- The estimated population of spawning-phase sea lampreys during 2011 was 20,638 (95% CI; 17,298-24,471), which was greater than the fish-community objective target range of 3,000 ± 1,000 (Figure 7).

- Traps were fished in the Huron River by Commission staff to determine feasibility of monitoring traps at the Flat Rock Dam. Two traps were set and four sea lampreys were captured.

**Table 30.** Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Erie during 2011 (letter in parentheses corresponds to location of stream in Figure 2).

| Tributary | Number Caught | Spawner Estimate | Trap Efficiency | Number Sampled[1] | Percent Males[2] | Mean Length (mm) Males | Mean Length (mm) Females | Mean Weight (g) Males | Mean Weight (g) Females |
|---|---|---|---|---|---|---|---|---|---|
| **Canada** | | | | | | | | | |
| Big Cr. (A) | 2,213 | 6,278 | 35 | --- | --- | --- | --- | --- | --- |
| Young's Cr. (B) | 341 | 520 | 66 | --- | --- | --- | --- | --- | --- |
| **Total or Mean (Canada)** | **2,554** | **---** | **---** | **---** | **---** | **---** | **---** | **---** | **---** |
| **United States** | | | | | | | | | |
| Cattaraugus Cr. (C) | 206 | 4,212 | 5 | 1 | 100 | 440 | --- | 225 | --- |
| Spooner Cr. | 322 | 5,170 | 6 | 10 | 70 | 457 | 465 | 257 | 268 |
| Grand R. (D) | 199 | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total or Mean (U.S.)** | **727** | **---** | **---** | **11** | **73** | **455** | **465** | **253** | **268** |
| **Total or Mean for lake** | **3,281** | **---** | **---** | **11** | **73** | **455** | **465** | **253** | **268** |

[1] The number of sea lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.

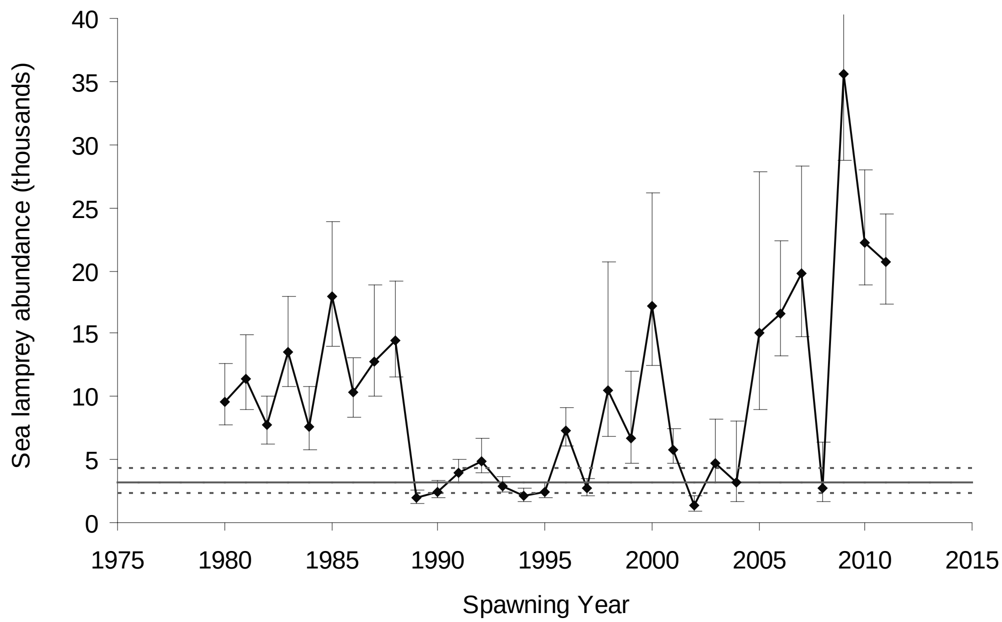


**Figure 7.** Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Erie during 1980-2011 with 95% confidence intervals (vertical error bars). The target range is indicated by the solid horizontal line with 95% confidence intervals (horizontal dashed lines).

**Lake Ontario**

- A total of 5,584 spawning-phase sea lampreys were trapped at 11 sites on 10 tributaries during 2011 (Table 31, Figure 9).

- The estimated population of spawning-phase sea lampreys during 2011 was 38,722 (95% CI; 32,699-48,805), which was within the fish-community objective target of 31,000 ± 4,000 (Figure 8).

- The Humber River and Duffins Creek traps were jointly operated through a partnership with the Toronto and Region Conservation Authority, the Cobourg Brook fishway and trap through a partnership with the Ganaraska River Conservation Authority, and the Salmon River trap through a partnership with the Mohawks of the Bay of Quinte.

- To investigate the lack of sea lamprey recruitment in the Humber River, nest surveys were conducted downstream of the Old Mill weir. This is the location of the Department's sea lamprey traps, which catch thousands of spawning-phase sea lampreys annually. Many sea lampreys were observed spawning throughout June 2011, and egg samples were obtained from nests. In some cases, sea lamprey had developed to stage 17 (burrowing prolarvae). Despite surviving to this stage, electrofishing surveys later in the summer were all negative for sea lampreys. No larval sea lampreys have ever been captured in the Humber River.

- A total of 1,676 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on Duffins Creek (465) and Humber River (1,211).

- A 3-year field-scale management experiment using the mating pheromone to enhance trap captures was conducted in 19 Great Lakes tributaries, including the Humber River and Duffins, Bowmanville, Graham, and Cobourg creeks in Lake Ontario.

**Table 31.** Stream name, number caught, spawner estimate, trap efficiency, number sampled, percent males, and biological characteristics of spawning-phase sea lampreys captured in assessment traps or nets in tributaries of Lake Ontario during 2011 (letter in parentheses corresponds to location of stream in Figure 4).

| Tributary | Number Caught | Spawner Estimate | Trap Efficiency | Number Sampled[1] | Percent Males[2] | Mean Length (mm) | | Mean Weight (g) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Males | Females | Males | Females |
| **Canada** | | | | | | | | | |
| Humber R. (A) | 2,531 | 3,935 | 64 | 125 | 54 | 503 | 503 | 262 | 259 |
| Duffins Cr. (B) | 1,205 | 2,230 | 54 | 71 | 51 | 510 | 489 | 274 | 267 |
| Bowmanville Cr. (C) | 235 | 403 | 58 | 74 | 55 | 476 | 482 | 235 | 260 |
| Graham Cr. (D) | 122 | 237 | 52 | 37 | 54 | 495 | 497 | 250 | 256 |
| Cobourg Cr. (E) | 178 | 267 | 67 | 52 | 55 | 476 | 482 | 235 | 260 |
| Salmon R. (F) | 9 | --- | --- | 3 | 33 | 428 | 520 | 227 | 303 |
| **Total or Mean (Canada)** | **4,280** | **---** | **---** | **362** | **54** | **494** | **492** | **253** | **261** |
| **United States** | | | | | | | | | |
| Black R. (G) | 885 | 17,537 | 5 | 26 | 58 | 475 | 467 | 268 | 289 |
| Grindstone Cr. (H) | 125 | 787 | 16 | 14 | 71 | 504 | 466 | 294 | 241 |
| Little Salmon R. (I) | 82 | 826 | 10 | 4 | 100 | 477 | --- | 255 | --- |
| Sterling Cr. (J) | 85 | 703 | 12 | 7 | 86 | 506 | 488 | 282 | 271 |
| Sterling Valley Cr. | 127 | 1,244 | 10 | 7 | 71 | 518 | 477 | 300 | 274 |
| **Total or Mean (U.S.)** | **1,304** | **---** | **---** | **58** | **69** | **491** | **471** | **279** | **272** |
| **Total or Mean (for lake)** | **5,584** | --- | --- | **420** | **56** | **493** | **490** | **257** | **262** |

[1] The number of sea lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.

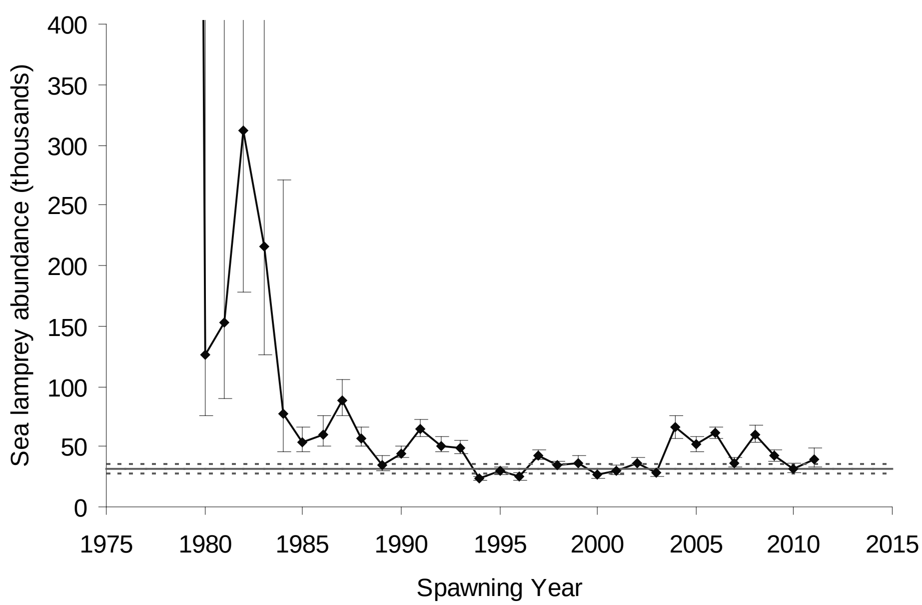


**Figure 8.** Annual lake-wide population estimates of spawning-phase sea lampreys in Lake Ontario during 1977-2011 with 95% confidence intervals (vertical error bars). The target range is indicated by the solid horizontal line with 95% confidence intervals (horizontal dashed lines).

**Figure 9.** Locations of tributaries where assessment traps were operated during 2011.

## Parasitic Phase Assessment

In addition to spawning-phase sea lamprey abundance, performance of the SLCP is evaluated annually by contrasting lake trout wounding rates against the targets set for each lake. Wounding target thresholds are 5 A1-A3 wounds per 100 lake trout on all lakes except Ontario where a target of 2 A1 wounds per 100 lake trout is used. Lake trout wounding rates are estimated from assessment operations conducted by state, provincial, tribal and federal fishery management agencies associated with each lake, and are updated when wounding data from assessment surveys becomes available.

Recently, the Commission began a process to create an updated lake trout wounding database that incorporates the most recent data and regenerates the lake-wide wounding rate graphs. The most recent results of these efforts are presented in Figures 10-11 and 13-14 below and are calculated from un-weighted data for the whole lake (average number of wounds calculated from all lake trout captured of a specific length class). Previous wounding rate graphs may not have incorporated all available data and may have been generated using analyses that weighted the data to better allow for inter-lake comparison of wounding rates. Therefore, the most recent graphs presented here may differ from those presented in previous reports. Discussions are still ongoing on whether or not to use weighted or un-weighted methods to analyze the data and a decision on the approach is forthcoming.

Additional data on parasitic-phase sea lamprey populations, collected by the Department and the Service as well as other agencies, are useful in evaluating the effectiveness of the SLCP. The Michigan Department of Natural Resources (MDNR), Wisconsin Department of Natural Resources (WDNR) and New York State Department of Environmental Conservation (NYSDEC) collect data on the frequency of sea lamprey attached to fish caught by charter boats. The Department collects data on incidental catches of parasitic-phase sea lamprey, including specimens, from cooperating commercial fisheries in northern Lake Huron. These data are used as an index of relative abundance in this region. The Department also collects data on out-migrating, recently metamorphosed sea lampreys in fyke nets on the St. Marys River that are used as an index of relative abundance.

**Lake Superior**

- Based on standardized spring assessment data, the sea lamprey wounding rate on lake trout is currently 8 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target of 5 per 100 lake trout for at least the last 10 years, but has declined for 3 consecutive years (Figure 10).

- The MDNR provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by charter boats during 2011.

    - A total of 35 parasitic-phase sea lampreys attached to lake trout were collected from 5 management districts. Attachment rate during 2011 was 0.96 per 100 lake trout (n = 3,651), which was similar to attachment rates on lake trout during 2010 (0.9 per 100 lake trout) and 2009 (1.1 per 100 lake trout).

- Transformer trapping was conducted in the Bad River during October and November. A combination of three fyke nets and one rotary screw trap were deployed in the mainstream. No sea lampreys were captured.

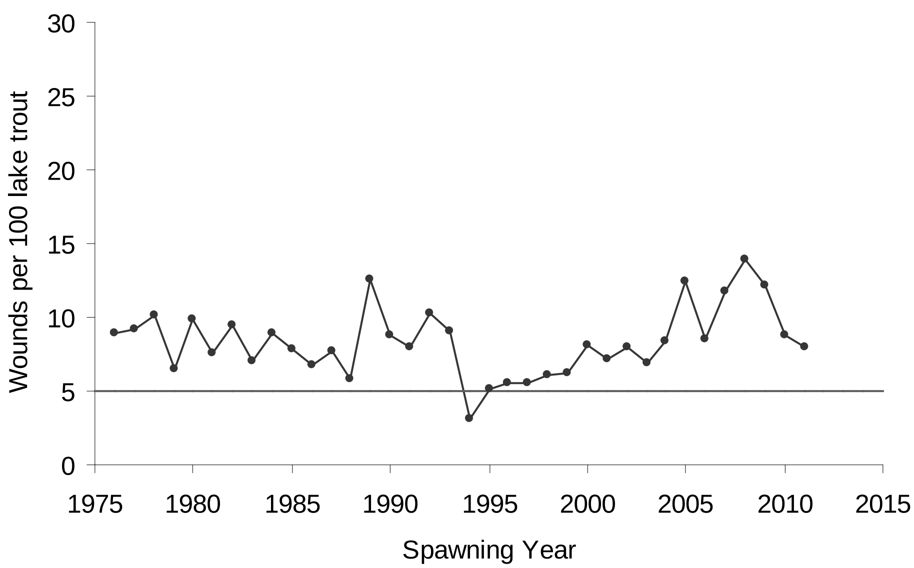


**Figure 10.** Average number of A1-A3 wounds per 100 lake trout >533mm caught during April-June assessments in Lake Superior, by sea lamprey spawning year (wounding recorded in the spring is inflicted by the cohort of sea lampreys that spawned that year). Horizontal line represents the fish-community objective target of 5 wounds per 100 fish.

**Lake Michigan**

- Based on standardized fall assessment data, the sea lamprey wounding rate on lake trout is currently at 7 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target of 5 per 100 lake trout for at least the last 10 years, but has declined dramatically since 2006 (Figure 11).

- The MDNR and WDNR provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats during 2011.

    - A total of 705 parasitic-phase sea lampreys were collected from 14 management districts; 227 were attached to lake trout and 478 were attached to Chinook salmon. Attachment rates during 2011 were 0.91 per 100 lake trout (n = 24,921) and 0.43 per 100 Chinook salmon (n = 110,255). This represents a decrease compare to 2010 (1.07 per 100 lake trout and 0.69 per 100 Chinook salmon) and 2009 (1.43 per 100 lake trout and 0.88 per 100 Chinook salmon), which is consistent with lake trout wounding data shown in Figure 11.

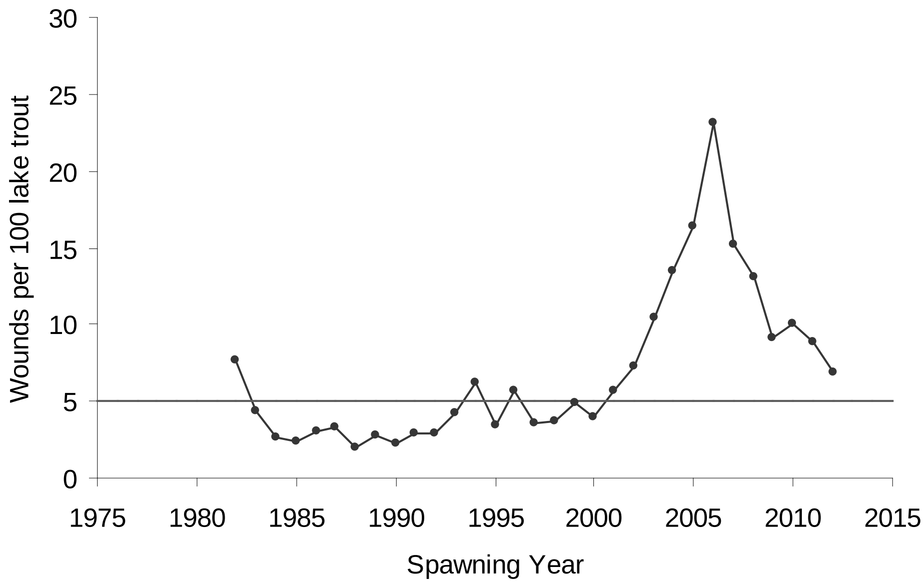


**Figure 11.** Average number of A1-A3 wounds per 100 lake trout >533mm from standardized fall assessments in Lake Michigan, by sea lamprey spawning year (wounding recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). Horizontal line represents the fish-community objective target of 5 wounds per 100 fish.

## Lake Huron

- Based on standardized spring assessment data, the sea lamprey wounding rate on lake trout is currently 12 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target of 5 per 100 lake trout since 1983 (Figure 12).

- The MDNR provided data on the frequency of parasitic-phase sea lampreys attached to fishes caught by sport charter fishers during 2011.

    - A total of 146 parasitic-phase sea lampreys were collected from 6 management districts; 89 were attached to lake trout and 57 were attached to Chinook salmon. Attachment rates during 2011 were 2.4 per 100 lake trout (n = 3,712) and 5.8 per 100 Chinook salmon (n = 977). This represents an increase compared to lake trout attachment rates in 2010 and 2009 (1.57 and 1.3 per 100 lake trout), which is consistent with the lake trout wounding data shown in Figure 12.

- Canadian commercial fisheries in northern Lake Huron continued to provide parasitic-phase sea lampreys along with associated catch information such as date, location and host species. These data are used as an index of the parasitic population in this area.

    - The 2010 collections have been processed, and a total of 1,341 parasitic-phase sea lampreys were collected (Main Basin – 719, North Channel - 622, Georgian Bay - 0). An additional 210 were kept alive and used for research and public outreach.

    - The 2011 collections have been obtained, and a preliminary total of 1,166 parasitic-phase sea lampreys were collected (Main Basin – 472, North Channel - 694, Georgian Bay - 0). And additional 177 were kept alive and used for research and public outreach.

- Since 1998, standardized transformer trapping has been conducted in the St Marys River as an index of relative sea lamprey abundance produced in this system. Approximately 11 floating fyke nets are deployed each fall in October and November. They are temporarily attached to US Coast Guard navigational buoys in the Munuscong, Sailor's Encampment, and Middle Neebish channels. The level of effort has ranged from 325 to 477 net days per year and water temperatures have ranged from 5.3 to 10.7 degrees C. Total annual transformer catch has ranged from 9 to 75 individuals, and catch-per-unit-effort (CPUE) has ranged from 0.020 to 0.199 transformers per net day. In 2011, fyke nets were opaterated for a total of 418 net days, resulting in the capture of 25 transformers, and a CPUE of 0.060 (Figure 13).

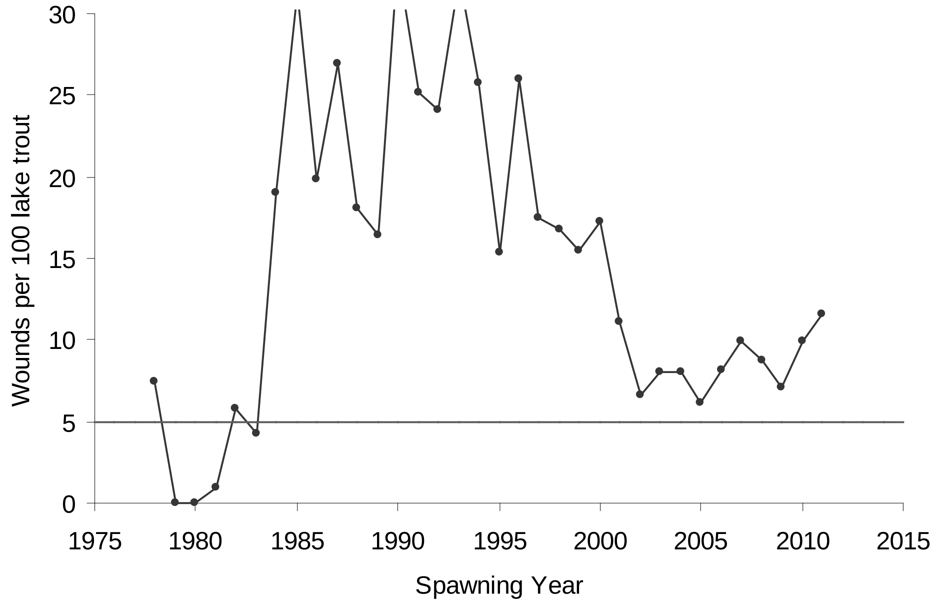


**Figure 12.** Average number of A1-A3 wounds per 100 lake trout >533mm caught during April-June assessments in Lake Huron, by sea lamprey spawning year (wounding recorded in the spring is inflicted by the cohort of sea lampreys that spawned that year). Horizontal line represents the fish-community objective target of 5 wounds per 100 fish.

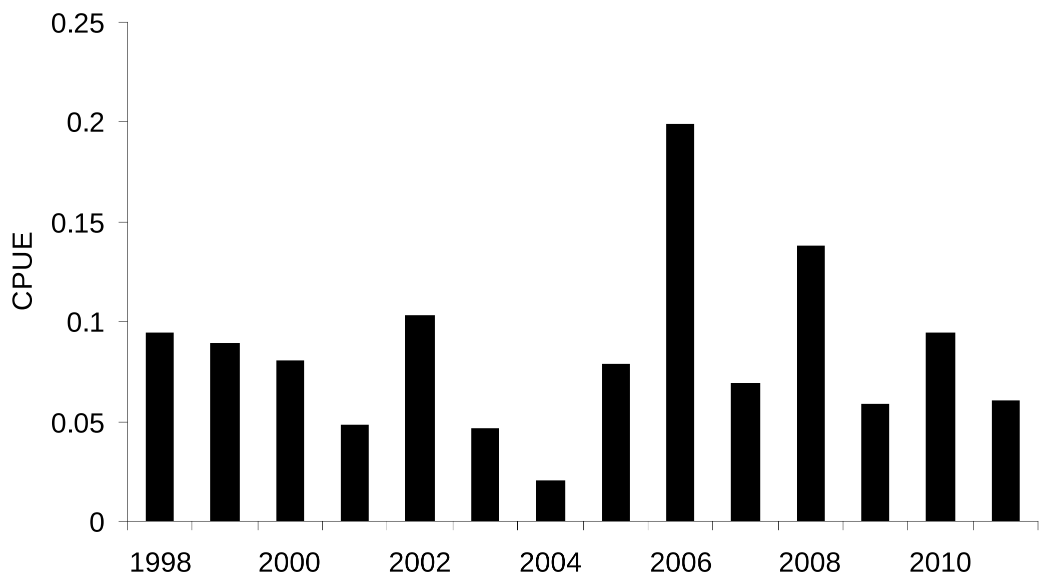


**Figure 13.** CPUE (number of transformers per net day) of fall fyke netting for transformers in the St. Marys River during 1998-2011.

## Lake Erie

- Based on standardized fall assessment data, the sea lamprey wounding rate on lake trout is currently 8 A1-A3 wounds per 100 lake trout >533mm. The wounding rate has been greater than the target for 9 of the last 10 years (Figure 14), but has declined over the past two years.

- No data are collected in Lake Erie to determine the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats.

- Transformer trapping was conducted in the lower Detroit River in an effort to determine if transformers from the Huron-Erie corridor migrate into Lake Erie. A combination of floating fyke nets and stationary trawls were deployed at 20 sites in U.S. and Canadian waters between November 21$^{st}$ and December 22$^{nd}$. Sampling in Canadian waters was limited to trawling only due to access restrictions. Nets were typically deployed each morning and allowed to fish overnight. Nearly 2,500 hrs of sampling effort resulted in four sea lamprey transformers captured. All four captures occurred in fyke net sets in the Livingstone (1) and Fighting Island (3) channels.

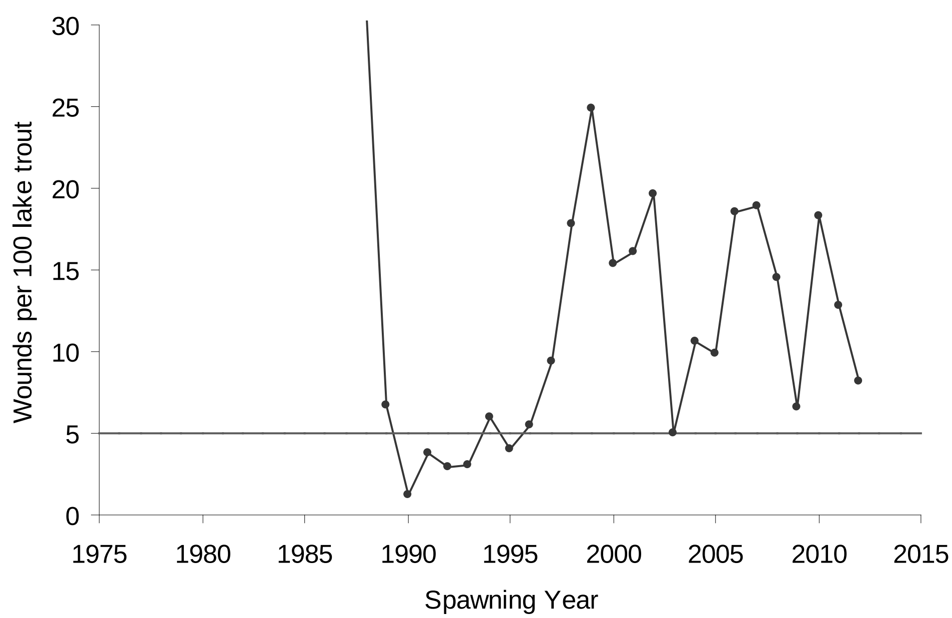


**Figure 14.** Average number of A1-A3 wounds per 100 lake trout >533mm from standardized fall assessments in Lake Erie, by sea lamprey spawning year (wounding recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). Horizontal line represents the fish-community objective target of 5 wounds per 100 fish.

## Lake Ontario

- Based on standardized fall assessment data, the sea lamprey wounding rate on lake trout is currently 1 A1 wound per 100 lake trout >431mm. The wounding rate has been less than target during the last 4 years (Figure 15).

- The NYSDEC provided data on the frequency of parasitic-phase sea lampreys attached to fish caught by sport charter boats during 2011.

    - 5,125 parasitic-phase sea lampreys were sampled; the percent composition of salmonine host species to which lampreys were attached was coho salmon (3%), Chinook salmon (37%), rainbow trout (6%), brown trout (48%), and lake trout (6%). Attachment rates during 2011 were 1.24 per 100 trout and salmon in the west region, 2.56 in the west central region, 2.69 in the east central region and 4.08 in the east region. In comparison to 2010 and 2009, attachment rates during 2011 were lower in the west region (1.31 in 2010 and 1.98 in 2009), but higher in the west central region (1.53 in 2010 and 1.79 in 2009), and in the east region (2.41 in 2010 and 1.73 in 2009). In the east central region, the 2011 value was higher than it was in 2010 (1.55) but lower than 2009 (3.30).

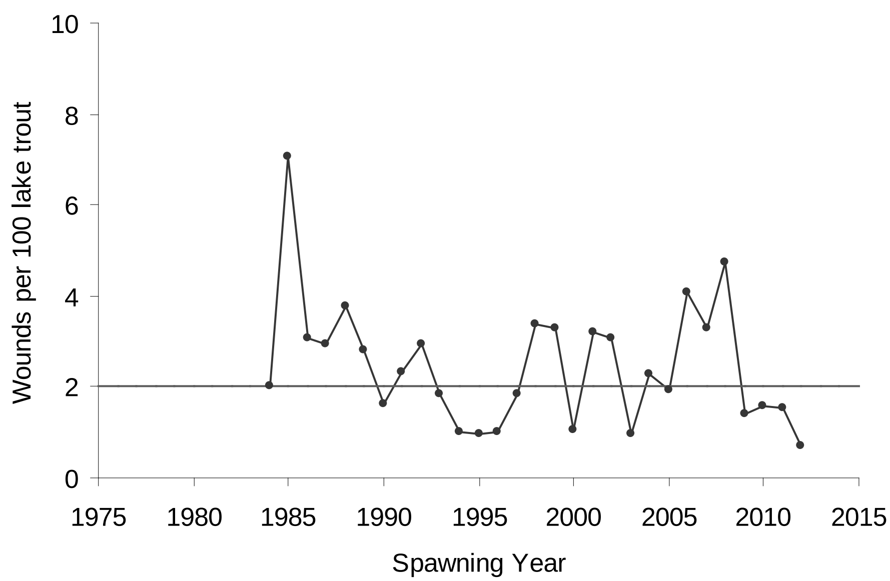


**Figure 15.** Average number of A1 wounds per 100 lake trout >431mm from standardized fall assessments in Lake Ontario, by sea lamprey spawning year (wounding recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). Horizontal line represents the fish-community objective target of 2 wounds per 100 fish.

## RISK MANAGEMENT

Risk management addresses environmental and non-target issues related to the implementation of the SLCP in the United States. This involves coordination with many federal, state and tribal agencies, and working with others to minimize risk to non-target organisms.

### Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires all U.S. federal agencies to consult with the Service's Ecological Services (ES) to ensure that actions that are federally funded, authorized, permitted, or otherwise carried out will not jeopardize the continued existence of any federally listed (endangered, threatened and candidate) species or adversely modify designated critical habitats.

*Annual Reviews*

Endangered species reviews are conducted annually with ES to discuss proposed lampricide applications, assess the potential risk of these applications to federally listed species, and develop procedures to protect and avoid disturbance for each listed species.

During 2011, the following ES offices reviewed the effect of scheduled lampricide applications on endangered species within their jurisdiction. Concurrence with proposed conservation measures and determinations of "no effect" or "not likely to adversely affect" was received by:

- East Lansing Field Office
- Green Bay Field Office
- Ohio Field Office
- Twin Cities Field Office

*Programmatic Review*

Because of the broad scope of the SLCP, consultation under Section 7 of the ESA involves several states, many listed species, and hundreds of streams. In an effort to streamline the consultation process and to add predictability for project planning, an informal, draft, SLCP-wide (programmatic) Section 7 Review was prepared in coordination with the East Lansing Field Office and submitted to the Midwest Region ES Program for consideration during 2007. The programmatic review evaluates all SLCP activities, identifies potential impacts to protected species and critical habitats, and specifies conservation measures to eliminate or minimize disturbance. No further action has been taken on the SLCP programmatic review due to limited availability of staffing within the ES Program.

*Species or Stream-specific Investigations*

- Piping Plover - A Biological Assessment (BA) that evaluated the toxicity of TFM to the federally-listed piping plover (*Charadrius melodus*) was accepted by ES. The BA's "not likely to adversely affect" determination means that streams with nesting plovers can now be scheduled for treatment at any time during the field season rather than restricted to after September 1. To provide field support to the determination, the Risk Management team attempted to observe adult and chick behaviour at the mouth of the Milakokia River before, during, and after the treatment. Observations were made of one adult and one chick the day before the treatment. The birds were not near the mouth to observe during the treatment, and therefore, post-treatment observations were not attempted.

- Snuffbox Mussel – The snuffbox mussel (*Epioblasma triquetra*) was proposed for listing as endangered during 2010. The mussels are found in several streams that are currently treated for sea lampreys, including the Grand River in Ohio and Michigan. Bioassays were conducted to determine the toxicity of TFM to snuffbox mussel glochidia and 1 week old juveniles, adult ellipse mussels (*Venustaconcha ellipsiformis*), and logperch (*Percina caprodes*). The adult ellipse mussel was used as a surrogate for the adult snuffbox due to the snuffbox's status and logperch are the primary host fish for the snuffbox mussel.

## State-Listed Species

*Annual Reviews*

Reviews are conducted annually with state agencies to fulfill regulatory agency permit requirements, assess the potential risk to state listed (endangered, threatened, and special concern) species, and develop procedures that protect and avoid disturbance for each listed species.

During 2011, the following state regulatory offices reviewed endangered species within their jurisdiction and issued permits to conduct lampricide applications:

- Michigan Department of Natural Resources and Environment
- Minnesota Department of Natural Resources
- Ohio Environmental Protection Agency (EPA)
- Wisconsin Department of Natural Resources

*Species or Stream-specific Investigations*

- Lake sturgeon – The lake sturgeon (*Acipenser fulvescens*) is state listed as endangered in Illinois, Indiana, Ohio and Pennsylvania, threatened in Michigan and New York, and of special concern in Minnesota and Wisconsin. In Canadian waters of the Great Lakes, the lake sturgeon is listed under Ontario's Endangered Species Act as threatened.

    - During 2011 the SLCP treated six state-designated lake sturgeon streams (Bad, Peshtigo, Rifle, Muskegon, Whitefish and St. Mary's rivers). The Bad, Peshtigo, Rifle, and Muskegon rivers were treated after August 1 to minimize potential adverse effects to age-0 lake sturgeon. The Whitefish River was treated during June to avoid low water conditions later in the year and because there is no known natural recruitment of lake sturgeon in the system. The St. Marys River was treated before August 1 in order to avoid weed growth, which prevents GB from reaching the stream substrate. No lake sturgeon mortality was observed during non-target assessments conducted after the treatments.

  - Cage and bioassay studies were conducted in two streams (Rifle and Pigeon rivers) to evaluate the toxicity of TFM to age-0 (<100mm) lake sturgeon in year 2 of a 2-year study.

- Mudpuppy – The mudpuppy is a species sensitive to TFM and a species of concern to the Ohio EPA. A cage study was conducted on the Sturgeon River (Delta County, Michigan) to evaluate the toxicity of TFM to young-of-year mudpuppies. A project report was completed during 2011. Total mudpuppy mortality for all treatment sites combined was 3 of 63 individuals or 4.8%, and mortality was not significantly related to TFM concentration or cage location.

- Stonecat – The stonecat (*Noturus flavus*) is sometimes vulnerable to lampricide treatments and is one of Ohio EPA's species of concern. A cage study was conducted on the Two Hearted River (Luce County, Michigan) to evaluate the toxicity of TFM to the fish during the stream treatment. A project report was completed during 2011. Total stonecat mortality for all treatment sites combined was 5 of 58 individuals or 8.6%, and mortality was not significantly related to TFM concentration, cage location, or stonecat length.

## Field Protocols

Both federal and state listed species are considered in protocols that are annually developed by the risk assessment unit for field staff. The protocols detail conservation measures to be followed where sea lamprey management activities are scheduled. During 2011, 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 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 2011.*

- *Protocol to protect and avoid disturbance to federal- and 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 2011*.

The protocols provided field personnel with a list of protected federal and state listed species, their known locations, and measures to avoid and protect. No mortality or disturbance was observed during 2011 for the 38 federal and state listed species and the de-listed bald eagle *(Haliaeetus leucocephalus)* identified in the protocols.

**National Environmental Policy Act**

Title I and section 102 of the National Environmental Policy Act (NEPA) requires U.S. federal agencies to incorporate environmental considerations in their planning and decision making, which includes the details of the environmental impact of, and alternatives to, major federal actions significantly affecting the environment. There were no projects that required NEPA compliance during 2011.

**Federal Insecticide, Fungicide and Rodenticide Act**

Reports were prepared to comply with the U.S. EPA June 16, 1998 ruling of Section 6(a)(2) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). This section of the FIFRA requires pesticide registrants to report unreasonable adverse effects of their products to the EPA. The Service is the registrant for lampricides and must report unreasonable adverse effects on humans, domestic animals, fish, wildlife, plants, other non-target organisms, water, and damage to property. Incident reports are required with the observed mortality of a single federally-listed endangered, threatened, or candidate species and with observed mortalities of 50 or more individuals of any non-target species or taxa during a lampricide application (Table 32).

**Table 32.** Table 32. Summary of 6(a)(2) incidents on non-target organisms during 2011.

| Lake | Tributary | Mortality | Freq | Comments |
|---|---|---|---|---|
| Seneca | Catherine Cr. | eastern blacknose dace (*Rhinichthys atratulus*)<br>spottail shiner (*Luxilus cornutus*) | 102<br>59 | Unexpected pH drop |
| Michigan | Boardman R. | round goby (*Neogobius melanostomus*) | 150 | Problem with pump |
| | Bark R. | mudpuppies (*Catostomus commersonii*) | 201 | low discharge, high pH and alkalinity |
| Superior | Huron Bay | white sucker (*Catostomus commersonnii*)<br>brown bullhead (*Ameiurus nebulosus*) | 383<br>667 | High water temp., vegetation, still water, possible low dissolved oxygen. |
| | Munising Bay | round whitefish (*Prosopium cylindraceum*) | 153 | Ingested granular Baylucide |

## TASK FORCE REPORTS

Task forces were established to provide expertise, guidance and coordination for the four key program areas of lampricide control, assessment, reproduction reduction, and barriers. The task forces include agents with expertise in specific program areas, researchers and academics, outside experts, Lake Committee representatives, Commission staff, and other experts as needed. The task forces report to the Commission's Sea Lamprey Integration Committee (SLIC) which establishes their terms of reference and works with them to recommend program direction and funding to the Commission.

The following sections report the purpose, membership, and progress on objectives as charged to each task force by the SLIC.

## Lampricide Control Task Force

### Purpose

Maximize the number of sea lampreys killed in individual streams and lentic areas while minimizing costs and impacts on aquatic ecosystems.

### 2011 Membership

Brian Stephens (Chair – appointed April 2010), Barry Scotland, (Department); Dorance Brege, Mike Fodale, Cheryl Kaye, Ellie Koon, Shawn Nowicki, Jeff Slade, Tim Sullivan (Service); Jean Adams, Mike Boogaard, Terry Hubert, Karen Slaght (USGS); Michael Wilkie (Wilfred Laurier University); and Dale Burkett, Mike Steeves (Commission Secretariat).

The Task Force met February 9-10 and September 12-13, 2011.

### Progress towards goals described in the GLFC Vision:

### Goal 1: Suppress sea lamprey populations to target levels.

**Strategy 1:** Implement lampricide treatment strategies to suppress sea lamprey populations to target levels in each Great Lake.

**2011 Outcomes:**

1. Treatment enhancement strategies (which include treating at greater than MLC, treating for longer durations, increasing secondary application effort and/or treating during optimal time periods) were reviewed and revised for all streams ranked for treatment in 2011. The success of the enhancements were evaluated based on post-treatment surveys.
2. Additional staff were deployed in the spring in order to treat more streams and to take advantage of seasonal susceptibility and optimal stream discharges and water chemistries.
3. By utilizing the new GB application technology, GB plots were treated in a single application to reduce the escapement potential of activated sea lamprey larvae.
4. Treated streams listed under the 'Geographical Efficiencies' category in order to realize savings in travel and to increase efficiencies in utilizing personnel.
5. Nets were utilized to capture larvae activated during treatment of a tributary to a larger untreated portion of the watershed.
6. Conducted on-stream observations during treatments to identify other potential sources of lamprey and communicated information to larval assessment crews to direct future survey work.

**2012 Objectives:**

1. The same strategies used in the 2011 field season will be implemented during 2012. In addition, the purchase of the larger GB transport boat is expected to free up other boats and personnel within the program to conduct TFM treatments and surveys as normally required and increase the efficiency of treating lentic areas.

**Strategy 2:** Measure the effectiveness of lampricide application and account for its variation among streams.

**2011 Outcomes:**

1. Lampricide analysis and water chemistry data are reviewed to identify potential areas that did not receive theoretical lethal TFM concentration during stream treatments.
2. Treatment evaluation surveys are reviewed to identify deficiencies in the treatment effectiveness.
3. On-stream observations were made during lampricide treatments included in the Lake Huron – North Shore back to back treatment strategy to determine presence of residual larvae and identify possible sources.

**2012 Objectives:**

Continue to review treatment generated data and treatment evaluation survey information to refine treatment enhancement strategies for future treatments.

**Goal 2: Increase the effectiveness and efficiency of sea lamprey control to maximize reductions in sea lamprey populations in each Great Lake.**

**Strategy 5:** Implement integrated strategies for sea lamprey control for each lake and evaluate their effectiveness.

**2011 Outcomes:**

1. The LCTF was involved in the development of the Lake-specific Sea Lamprey Control Plan. Lampricide control strategies identified in the plan (such as identifying treatment enhancement strategies, identifying and inventorying geographical features where treatment effectiveness can be increased, and using nets to capture and remove larvae activated during treatments) were implemented in 2011.

**2012 Objectives:**

1. Continue, where possible, implementation of lampricide control strategies as described in the Lake-specific Sea Lamprey Control Plan for all the Great Lakes.

## Assessment Task Force

**Purpose:** Rank streams and lentic areas for sea lamprey control options and optimize long-term measures of success of the sea lamprey control program.

### 2011 Membership

Michael Fodale (Chair), Jessica Barber, Joe Genovese, and Alex Gonzalez (SERVICE); Fraser Neave, Rod McDonald, Gale Bravener and Brian Stephens (DEPARTMENT); Jean Adams, Nicholas Johnson, and Chris Holbrook (USGS), Michael Jones (Michigan State University); Shawn Sitar (MDNR); and Dale Burkett, Michael Siefkes (Commission Secretariat).

### Progress towards goals described in the GLFC Vision:

### Goal 1: Suppress sea lamprey populations to target levels.

**Strategy 1:** Implement lampricide treatment strategies to suppress sea lamprey populations to target levels in each Great Lake.

**2011 Outcomes:**

1. Fully participated in discussions and planning to evaluate the effects of the 2008-2009 Lake Erie large scale treatment strategy, provided key updates during semi-annual meetings of the SLIC, and drew conclusions from these interactions.
2. Implemented the second year of the Lake Huron North Channel large scale treatment strategy during 2011.
3. Planned the next large scale treatment strategy for 2012-2013 as an extension of the Lake Huron large scale treatment strategy. Participation included providing data and evaluating population reductions from multiple scenarios for the consideration of the SLIC.

**2012 Objectives:**

1. Implement the 1st year of the 2012-2013 large scale treatment strategy in the northern Lake Huron/Lake Michigan.
2. Gather field and other data to report the effects of the 2010-2011 large scale treatment strategy in the North Channel of Lake Huron.
3. Develop a new treatment strategy to maintain the low larval abundance in the St. Marys River that resulted from the 2010-2011 North Channel Lake Huron large scale treatment strategy.

**Strategy 2:** Conduct detection and distribution surveys to identify all sources of larval sea lampreys.

**2011 Outcomes:**

1. Conducted detection surveys on 129 streams (64 Canada, 65 US) to detect new populations of sea lampreys. Surveys in these streams identified 5 newly infested streams (1 Canada, 4 US).
2. Conducted distribution surveys on 144 streams (74 Canada, 70 US) to define the in-stream geographic limits of sea lamprey infestations in preparation for lampricide treatments in 2011 and 2012.

**2012 Objectives:**

1. Continue to plan and conduct assessments to find new infestations of sea lamprey populations as well as prepare streams for lampricide treatment during 2012 for lampricide treatment during 2013.

**Strategy 3:** Measure the effectiveness of lampricide application and account for its variation among streams.

**2011 Outcomes:**

1. Conducted post-treatment assessments to determine relative treatment effectiveness on more than 70 streams treated during the 2010 and 2011 field seasons and directed remedial treatment actions on at least two river systems.
2. Conducted 2$^{nd}$ year of short-term study to detect low-density larval populations via electrofishing, and compared data to fyke net captures, indicating that electrofishers successfully identified low-density larval lamprey populations. Low-density larval populations are a natural outcome of effective lampricide treatments and it is critical that the agents can effectively identify them.

**2012 Objectives:**

1. Continue to conduct post-treatment assessments on virtually all treated river systems.
2. At the direction of the SLIC, work with other task forces to plan work that will measure the effectiveness of lampricide applications.

**Strategy 4:** Quantify the relationship between the abundance of spawning-phase sea lampreys, lake trout abundance, and wounding rates on lake trout.

**2011 Outcomes:**

1. Participated in email discussions with Dr. Jim Bence of Michigan State University to investigate the usefulness of a community-based wounding index for sea lamprey attacks.

2. Provided data, support, and a forum for Ted Treska (Service) to acquire and assemble lake trout wounding data from several management agencies into lake-wide estimates of lake trout abundance for each lake as well as estimates of relative abundance.

**2012 Objectives:**

1. Work further with Dr. Jim Bence in the development of a community-based wounding index for sea lamprey attacks.

**Strategy 5:** Deploy trapping methods to increase capture of spawning-phase and recently metamorphosed sea lampreys.

**2011 Outcomes:**

1. Deployed tube traps in five streams to capture early run migrating spawning-phase sea lampreys.
2. Negotiated flow manipulations on the St. Marys River to test whether an increase in discharge during overnight hours would increase trap catch or efficiency.
3. Negotiated flow re-allocation at the Compensating Gates in the St. Marys River to provide attractant flow to portable traps.
4. Deployed DIDSON units in the St. Marys River to observe sea lamprey approach behaviour at traps.
5. Deployed a new trap design (attachment trap) at Muskegon and St. Marys rivers.
6. Requested funding to operate rotary screw trap and nets to capture recently metamorphosed sea lampreys, but funding not approved.
7. Completed year 3 of 3 of mating pheromone experiment to increase trap efficiency.
8. Conducted trawling and operated fyke nets in the Detroit River capturing four migrating recently metamorphosed sea lampreys.

**2012 Objectives:**

1. Modify design of attachment trap to increase trap captures.
2. Repeat St. Marys River flow manipulations.
3. Deploy DIDSON units in an effort to enumerate spawning run in one stream.
4. Deploy acoustic telemetry equipment and experimental traps in the Ontonagon River to determine movement pathways.
5. Complete trawling and fyke-netting efforts on the Detroit River to assess the downstream migration of recently metamorphosed sea lampreys.
6. Deploy a rotary screw trap in the Bad River to capture newly metamorphosed sea lampreys.
7. Complete year 3 of 3 at the Canadian pheromone trap sites and implement a reduced level of effort using the mating pheromone at select U.S. trap sites.
8. Work closely with newly hired trapping biologist at HBBS and develop new trapping designs and technologies.
9. Complete construction of attractant water trap at trap site on Cattaraugus Creek.

**Goal 2: Increase the effectiveness and efficiency of sea lamprey control to maximize reductions in sea lamprey populations in each Great Lake.**

**Strategy 1:** Evaluate effectiveness of the sterile-male-release technique.

**2011 Outcomes:**

1. Continued to work with the RRTF and the QFC to understand the effectiveness of the sterile male release technique through participation at meetings and workshops for the ongoing St. Marys River Decision Analysis research.

**2012 Objectives:**

1. None planned.

**Strategy 4:** Improve existing and develop new rapid assessment methods to determine the distribution and relative abundance of larval sea lamprey populations.

**2011 Outcomes:**

1. Implemented digital RoxAnn technology in the Detroit River to ascertain the feasibility of the delta area as a nursery for sea lamprey larvae.
2. Worked with Jean Adams and others to provide data and feedback for the development of StreamShot, an electronic data tool to bring multiple types of data to one medium for any particular sea lamprey producing stream.
3. Evaluated proposed new technique using GIS tools to make treatment area selection more efficient in the St. Marys River.

**2012 Objectives:**

1. Focus on conducting an integrated training session for larval assessment personnel across borders to improve agreement on larval habitat identification and rapid assessment sampling techniques. The training session will be led by the chair of the LAWG.
2. Evaluate whether treatment rotation for expert judgment streams should be accelerated because of the new focus on ranking streams for treatment based on 100mm sea lamprey larvae rather than transformers.

**Strategy 5:** Develop integrated strategies for sea lamprey control for each lake and evaluate their effectiveness.

**2011 Outcomes:**

1. Fully participated in the completion of the Lake-Specific Sea Lamprey Control Plan.
2. Fully participated and provided data and feedback on the St. Marys River Decision Analysis research being led by the Quantitative Fisheries Center.

3. Planned, re-directed effort and implemented additional stream and lentic surveys to determine sources of elevated sea lamprey abundance in Lake Erie.

**2012 Objectives:**

1. Investigate the effectiveness of the 2010-2011 North Channel Lake Huron back-to-back treatment strategy.
2. Develop a new strategy and rationale to increase the amount of lampricide control on the St. Marys River.
3. Direct survey of full St. Marys River during 2012.
4. Develop an integrated detection plan for larval production and parasitic contribution to Lake Erie, including the St. Clair and Detroit rivers which may include conducting a transformer M/R in the two rivers and other tributaries of Lake Erie proper.
5. Determine contribution of the St. Clair River/Detroit River corridor to the Lake Erie parasitic population by partnering with others to operate fyke nets and conduct mid-water trawling.

## Reproduction Reduction Task Force

The task force was established in 2003 and combined the former sterile-male-release technique task force and the 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.

### 2011 Membership

Lisa Walter (Chair) and Jessica Barber (SERVICE); Rod McDonald, Gale Bravener and Lisa O'Connor (DEPARTMENT); Jean Adams, Nick Johnson and Jane Rivera (USGS); Weiming Li and Michael Wagner, (Michigan State University); Rob McLaughlin (University of Guelph); Neal Godby (MDNR); Alex Haro (Conte Lab); and Michael Siefkes, Dale Burkett (Commission Secretariat).

### Progress towards goals described in the GLFC Vision:

### Goal 1: Suppress sea lamprey populations to target levels.

**Strategy 6:** Deploy trapping methods to increase capture of spawning-phase and recently metamorphosed sea lampreys.

**2011 Outcomes:**

1. The Manistee River permanent trap was operational during the 2011 spawning season and provided 393 male lampreys to SMRT.
2. Portable traps were fished for the second year at compensating gate 16 in the St. Marys River. Flow through the gates was altered to create attractant flow around gates 15/16 and 112 lampreys were captured there, a noticeable increase from the 10 that were captured in these traps during 2010. Fine-scale acoustic telemetry data suggests alterations in behaviour of animals based on changes in flow without changes in trapping success.
3. An attachment trap consisting of an artificial substrate with an attached basket was operated in the Muskegon and St. Marys rivers as a pilot study. The trap did not capture any lamprey and a full TAP was not submitted.
4. Laboratory experiments of the NEPTUN low voltage electric fish barrier investigated appropriate settings for sea lampreys and showed that the barrier was effective at blocking lamprey and deflecting them towards traps, although capture rate at the trap was low.
5. Sixty French traps were set in the St. Marys River to capture lampreys for use in the acoustic telemetry project. The traps captured 10 animals during the five weeks they were fished. Servicing the traps was labor intensive.
6. Fall transformer trapping was attempted in the Bad River with fyke nets and a screw trap in support of the Bad River Management Plan. No sea lampreys were captured.

Fall transforming trapping was conducted in the Little Carp River, a stream that was discovered to be infested with multiple year classes of sea lamprey larvae late in the 2011 field season. A total of 372 transformers were captured.

7. Spring transformer trapping was conducted in the Chippewa River, a stream that was discovered to have metamorphosing-sized sea lampreys during the middle of the 2011 field season. Twenty five transformers have been captured as of April 2012, and will be used for the HEC mark/recapture study or other research.

**2012 Objectives:**

1. Agents will continue to refine St. Marys River trap placement and flow configuration. To do this, a workplan and flow manipulation protocol will be drafted and presented to the Lake Superior Board of Control. Nighttime trap checks will be discontinued. Agents will attempt manual removal of spawning-phase lampreys using contracted divers.
2. The Hammond Bay Biological Station will be investigating the use of a low-voltage NEPTUN fish barrier to block and direct spawning-phase sea lampreys in the Ocqueoc River.
3. SERVICE will conduct fall transformer trapping in the Bad River during fall 2012 in support of the Bad River management plan.
4. Use ongoing acoustic telemetry work to evaluate lamprey movement throughout the St. Marys River and lamprey behaviour near traps. Evaluate tag effects and tag loss through data processing and by comparing results from telemetry tagged and coded wire tagged lamprey.
5. Identify potential sites for fishwheel deployment.

**Goal 2: Increase the effectiveness and efficiency of sea lamprey control to maximize reductions in sea lamprey populations in each Great Lake.**

**Strategy 1:** Evaluate the effectiveness of the sterile-male-release technique.

**2011 Outcomes:**

1. Injection dose quality assurance data was collected on 99% of injected lamprey during 2011 and 98% were injected at or above expected dosage volumes. Under-injections were observed when injector valves were faulty or clogged or when bisazir stock solution bottles became depleted and needed to be changed.
2. Bisazir solution concentration was analyzed for half of the injection solutions mixed during 2011 (N=18). Solutions were compared to standards prepared from two different lots of bisazir (2008 and 2010 shipments). Inconsistencies were noted between the lots. The 2010 bisazir, while determined to be >95% pure, is more crystalline in nature and is difficult to dissolve completely in saline. Injection solutions mixed with the 2010 bisazir tended to be of an adequate concentration when compared to standards from that lot, but of a lower (but adequate) concentration when compared to standards prepared from the 2008 lot.
3. Nest surveys were conducted on the St. Marys River; 101 nests were observed and egg samples were recovered from 46 nests. Average nest viability was 44%. Areas

outside the normal survey area were explored for nests, including the Clergue tailrace, the south rapids, and around Sugar Island, but only two nests containing eggs were discovered in these expanded surveys.

4. The expected ratio of sterile:normal males was 3.4:1 based on the St. Marys River spawning-phase estimate. The observed ratio of sterile:normal males on nests was 0.6:1 based on 104 male sea lampreys observed on nests during nest evaluations.

**2012 Objectives:**

1. St. Marys River nest evaluations will be conducted using base funds to evaluate potential changes in nest viability that coincide with the discontinuation of the SMRT and the North Channel large-scale treatment scenario. A TAP has been submitted for consideration during 2013 to continue collection of this information.

**Strategy 2:** Increase the capture of sea lampreys by developing cost-effective trapping methods including those based on release of pheromones.

**2011 Outcomes:**

1. In paired trapping scenarios over three years, baiting traps with 3kPZS resulted in a 30% increase in catch in the baited trap but varied on a stream- and lake-specific level. Trap efficiency increased by 11% over all the lakes and trap sites. Video was collected on Carp Lake Outlet for further analysis. In single trap scenarios when 3kPZS was applied every other night, trap efficiency significantly increased by 10% in 2010, and 11% in 2011. Application of 3kPZS through the trap was more successful in drawing lamprey to the traps, whereas upstream application through the trap so the entire river is included in the plume resulted in no significant increase in efficiency.
2. St. Marys River traps were baited with spermiating males. Data from the work is still being processed.
3. Field testing of polyethylene glycol as a pheromone emitter was conducted. The 3kPZS polymer drew lamprey towards it and not the polymer blank; lamprey showed no response to the polymer itself.
4. Investigation of pheromone release by native lamprey showed that immature American brook males released measureable amounts of 3kPZS, but females and mature males released less. Mature northern brook and chestnut males release 3kPZS. Silver lampreys do not appear to release 3kPZS in the same manner as sea and American brook lampreys, but washings from silver lampreys suggest that they release 3kPZS as a metabolic product.
5. Fractions of spermiated male washings were used to determine the compound that best attracted females. The most successful mating fractions did not contain 3kPZS. The DkPES compound was identified; the ration of this compound to 3kPZS is unknown. The compound is only released by spermiating males. When DkPES was increased to a ration of 3kPZS it was more successful in drawing animals to nests to a point, but that draw subsided when the ration was doubled. DkPES alone is not sufficient at influencing nest entry of ovulating females.

6. The most successful pool of larval extract compounds was fractured into 3 subpools (9 fractions) and field trials were conducted. A pool of 3 fractions that contained 3 - 4 compounds that were different from PADS was the most effective. The whole blend of the compound seems to elicit the strongest reaction.

**2012 Objectives:**

1. Complete Year 3 of 3kPZS field trials in Canadian streams.
2. Complete EPA registration for 3kPZS. Define ideal configuration of pheromone emitter polyethylene glycol (PEG) and include in registration.
3. Test application of 3kPZS PEG on three U.S. tributaries (Tahquamenon, Manistique, Muskegon rivers).
4. Continue evaluation of lamprey behaviour near traps baited with 3kPZS using video collected at the Carp Lake Outlet during 2011.
5. Investigate the efficacy of baiting traps with the whole mating pheromone in the Miners River. Use video to evaluate associated behaviour.
6. Complete a river plume model to demonstrate the hydrodynamics of pheromone plume behaviour. Associate this with tracked lamprey behaviour.
7. Test open-water navigation of spawning-phase sea lampreys in association with a pheromone plume taking into account physical variables including current, sunlight and bottom contours.
8. Continue evaluation of pheromone release by native lampreys, specifically chestnut lampreys.
9. Test larval compounds that were isolated during 2011 field trials.

**Strategy 3:** Evaluate a repellent-based control method to deter sea lampreys from spawning areas.

**2011 Outcomes:**

1. Raceway experiments show that lamprey deliberately attempt to escape or avoid applied necromones (rather than simply showing signs of stress). Maturity, sex effects, and conspecific and heterospecific odors were considered in the study. Immature males, mature males, and immature females responded to necromones by avoiding and attempting to escape. Mature females did not show a response.

**2012 Objectives:**

1. Identify additional properties of the alarm response hormone including dose response, tissue of origin, habituation tendencies, and response of the larval, metamorphosing, or parasitic life stages.
2. Investigate a push-pull response in a natural stream setting, the Lincoln River, using 3kPZS and the alarm response hormones.

**Strategy 5:** Implement integrated strategies for sea lamprey control for each lake and evaluate their effectiveness.

**2011 Outcomes:**

1. The Lake-Specific Sea Lamprey Control Plan was edited by Mike Hansen, Jim Peck and Bob O'Gorman and will be published on the GLFC website.

2. Work on the updated St. Marys River decision analysis continues. A workshop was held in Marquette during August, where Brian Irwin and Mike Jones requested input on the data sets that are being used in the model and on the parameters that had been estimated up to that point. A second workshop was held in February 2012 where agents viewed preliminary results and worked with Jones and Irwin to refine parameters for trapping efficiency, Bayluscide usage, and transformer contribution to the lake-wide estimate.

**2012 Objectives:**

1. Results up to this point will be presented to SLIC during the spring 2012 meeting. A final model will be presented at the fall 2012 SLIC meeting.

## Barrier Task Force

### Purpose

The task force was established during April 1991 to coordinate efforts of the Department, the Service, and the USACOE on the construction, operation, and maintenance of sea lamprey barriers.

### 2011 Membership

Jessica Barber (Chair), Cheryl Kaye, Rob Elliott (Service); Brian Stephens, Tonia Van Kempen, Bhuwani Paudel, Tom Pratt, and Kelly Withers (Department); Jim Galloway (USACOE); Steve Sutton (MIDNR); Steve Bobrowicz (OMNR); Scott Miehls and Alex Haro (USGS); Rob McLaughlin (University of Guelph); and Dale Burkett, Michael Siefkes (Commission Secretariat).

### Progress towards goals described in the GLFC Vision:

### Goal 1: Suppress sea lamprey populations to target levels.

**Strategy 5:** Construct and maintain a network of barriers to limit sea lamprey access to spawning habitats.

**2011 Outcomes:**

1. Construction of the Still River sea lamprey barrier was completed.
2. Construction of the Trail Creek sea lamprey barrier was completed.
3. Routine maintenance completed at purpose-built sea lamprey barriers.
4. Ground-truthed and assessed the blocking potential of 4,000 barriers in the Great Lakes.
5. Initiated 12 sea lamprey barrier or trap projects with the U.S. Army Corps of Engineers using Great Lakes Fishery Ecosystem Restoration (GLFER) funds.
6. Replaced deteriorated stoplogs at the Union Street Dam, Boardman River to address escapement issues.
7. Initiated repair work at the Rapide Croche Lock, Fox River.

**2012 Objectives:**

1. Initiate construction of the Manistique River sea lamprey barrier.
2. Initiate design and repair of the Grand River sea lamprey barrier.
3. Complete construction of the Orwell Brook sea lamprey barrier.
4. Initiate rebuild of Denny’s Dam on the Saugeen River, subject to OMNR approval.
5. Continue working on priority GLFER projects with the USACE: Cheboygan River (barrier), Bad River (barrier), St. Marys River (trap), White River (barrier), Muskegon River (trap), Little Manistee (barrier), AuSable River (trap), and the Saginaw system (barrier).
6. Inspect and repair/replace stoplogs at Hesperia Dam.

7. Inspect and repair Union Street Dam.
8. Investigate options for modifying the Sand River barrier to prevent upstream migration.
9. Complete repair work at the Rapide Croche Lock, Fox River.
10. Investigate repair/rebuild alternatives of sea lamprey barrier on Duffin's Creek.
11. Conduct barrier operation and maintenance.
12. Periodically inspect existing, purpose built and modified barriers to ensure blockage to spawning habitat.

**Goal 2: Increase the effectiveness and efficiency of sea lamprey control to maximize reductions in sea lamprey populations in each Great Lake.**

**Strategy 5:** Implement integrated strategies for sea lamprey control for each lake and evaluate their effectiveness.

**2011 Outcomes:**

1. Re-allocated barrier inspection effort to conduct additional inspections to determine sources of elevated sea lamprey abundance in Lake Erie.
2. Participated in review of lake-specific sea lamprey control plans.
3. Initiated work on barrier database that incorporates treatment and larval information to assist in scheduling work and assigning priority to barrier repair projects.
4. Reviewed research proposals for relevance to task force and program priorities.
5. Several Barrier Task Force members and participants were involved in the decision analysis of management options on the Black Sturgeon River.
6. Reviewed nine barrier removal or modification proposals to determine effects to the Program.

**2012 Objectives:**

1. Combine Department and Service data in the barrier database.
2. Continue work on barrier database that incorporates treatment and larval information to assist in scheduling work and prioritizing barrier repair projects.
3. Barrier Task Force members and participants are involved in research regarding use of chemo-sensory techniques to prevent access to suitable habitat.
4. Several Barrier Task Force members and participants are involved in technical sub-groups to investigate management and engineering options on the Black Sturgeon River.
5. Engage partner agencies in barrier removal discussions and request notification of project proposals.

## OUTREACH

The Service and Department are involved in outreach activities to inform the public of the benefits and operations of the SLCP. These efforts educate the public about sea lampreys and the devastating effect they have on Great Lakes fishes. The primary tool used during outreach events is an interactive display with graphics and an aquarium that houses live larval and spawning-phase lampreys for visitors to experience the sea lampreys first-hand. During 2011, this display was in attendance at ten large capacity events (Table 33).

**Table 33.** Dates and locations of public outreach performed by agents of the sea lamprey control program in 2011.

| Date | Location | Venue | Lead Agency |
|---|---|---|---|
| January 13-16 | St. Paul, MN | Sportsmen's Show | Service |
| January 14-23 | Cleveland, OH | Mid-America Boat & Fishing Show | Service |
| February 16-20 | Duluth, MN | Duluth Boat, Sport & Travel | Service |
| February 24-27 | Novi, MI | Outdoorama | Service |
| March 4-6 | Green Bay, WI | NE Wisconsin Sport & Fishing Show | Service |
| March 16-20 | Toronto, ON | Toronto Sportsmen's Show | Department |
| March 17-20 | Grand Rapids, MI | Ultimate Sport Show | Service |
| March 26-28 | Marquette, MI | Superior Dome Boat & RV Show | Service |
| June 18 | Buffalo, NY | 2011 Great Lakes Experience Festival | Service |
| August 14-21 | Escanaba, MI | U. P. State Fair | Service |

# PERMANENT EMPLOYEES OF THE SEA LAMPREY CONTROL PROGRAM

## FISHERIES AND OCEANS CANADA

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

Paul Sullivan, Division Manager

**Section Head, Control**: Brian Stephens

**Lampricide Control Biologists:**
- Vacant: Control Supervisor
- Barry Scotland: Assistant Control Supervisor
- Tonia Van Kempen: Environmental Supervisor

**Lampricide Control Technicians**:

| | |
|---|---|
| Charlie Boudreau | Chris Sierzputowski |
| Peter Grey | Jamie Smith |
| Adam Loubert | Randy Stewart |
| Jerome Keen | Jamie Storozuk |
| Mike MacKenna | John Tibbles |
| Shawn Robertson | Sarah Woods |
| Paul Kyostia | Richard Middaugh |

**Administrative Support**:
- Lisa Vine: Finance and Administrative Officer
- Christine Reid: Receptionist
- Melanie McCaig: Accounts Clerk
- John Graham: Informatics

**Barriers:**
Bhuwani Paudel: Barriers Engineer
Joe Hodgson: Barrier Technician

**Section Head, Assessment**: Rod McDonald

**Assessment Biologists**:
- Gale Bravener: Adult Unit Supervisor
- Andrew Treble: Larval Supervisor (Upper Lakes)
- Fraser Neave: Larval Supervisor (Lower Lakes)

**Assessment Technicians**:

| | |
|---|---|
| Jeff Rantamaki | Ryan Booth |
| Kevin Tallon | Andrea Phippen |
| Thomas Voigt | Sarah Larden |
| Sean Morrison | |

**Barriers:**
- Bhuwani Paudel: Barrier Engineer
- Joe Hodgson: Barrier Technician

**Maintenance:**
- Brian Greene: Supervisor
- Chad Hill: Assistant

## UNITED STATES FISH AND WILDLIFE SERVICE

Robert Adair, Program Manager

### Ludington Biological Station – Ludington Michigan

Jeff Slade, Station Supervisor

**Lampricide Control Fish Biologists**:
- Timothy Sullivan: Treatment Supervisor
- Ellie Koon: Treatment Supervisor
- Rebecca Gannon
- Matt Lipps
- Jenna Tews

**Lampricide Control Lead Physical Science Technician**:
- Vacant

**Lampricicde Control Physical Science Technicians**:
- Kevin Butterfield
- Jeffrey Sartor

**Lampricide Control Biological Science Technicians:**

| | |
|---|---|
| Margie Shaffer (CS) | John Ewalt (CS) |
| Bobbie Halchishak (CS) | Gena Long (CS) |
| Tim Falconer (CS) | Dan McGarry (CS) |

**Larval Assessment Fish Biologists**:
- Alex Gonzalez: Larval Assessment Supervisor
- Dave Keffer
- Aaron Jubar

**Larval Assessment Biological Science Technicians:**
- Lois Mishler
- Jason Krebill
- John Stegmeier (CS)
- Gary Haiss (CS)
- Timothy Granger (CS)
- Vacant (CS)

**Maintenance Worker**: Michael Sell

**Administrative Support**:
- Joe Tyron
- Danya Sanders

## Marquette Biological Station – Marquette, Michigan

Katherine Mullett, Station Supervisor

**Administrative Support:**
- Tracy Demeny: Adminstrative Officer
- Michael LeMay
- Casey Piton
- Barbara Poirier
- Alana Kiple (CS)

**Information Technology Support:**
- Larry Carmack, Supervisor
- Deborah Larson

**Larval Unit Supervisor**: Michael Fodale

**Lampricide Control Fish Biologists**:
- Dorance Brege, Treatment Supervisor
- Shawn Nowicki, Treatment Supervisor
- Lori Criger
- Kathy Hahka

**Lampricide Control Lead Physical Science Technician**:
- Robert Wootke

**Lampricide Control Physical Science Technicians**:
- Jamie Criger
- Michael St. Ours
- Kelley Stanley

**Lampricide Control Biological Science Technicians:**

| | |
|---|---|
| Susan Becker (CS) | Janet McConnell (CS) |
| James Criger (CS) | Justin Oster (CS) |
| Thomas Elliott (CS) | Daniel Suhonen (CS) |
| Jesse Haavisto(CS) | Patrick Wick (CS) |
| Stephen Healy (CS) | |

**Larval Assessment Fish Biologists:**
- Joseph Genovese, Larval Assessment Supervisor
- Jacob Cunha
- Lynn Kanieski

**Larval Assessment Biological Science Technicians:**

| | |
|---|---|
| Kyle Krysiak | Chris Gagnon (CS) |
| Mary Wilson | Rachael Guth (CS) |
| Jarvis Applekamp (CS) | Robert Wollney (CS) |
| Michael Blohm (CS) | |

**Chemist:**
- Vacant

**Risk Management:**
- Cheryl Kaye: Risk Management Supervisor
- Mary Henson: Fish Biologist
- Gregg Baldwin: Biological Science Technician

**Maintenance Worker:**
- David Magno

**Adult Unit Supervisor** : Michael Twohey

**Fish Biologists**:
- Jessica Barber: Adult Assessment /Barrier Supervisor
- Lisa Walter: Sterile-Male-Release Supervisor
- Pete Hrodey
- Gregory Klingler
- Matthew Symbal

**Biological Science Technicians:**

| | |
|---|---|
| Daniel Kochanski | Bruce Eldridge (CS) |
| Nikolas Rewald | John Ewalt (CS) |
| Dennis Smith | Michael Greiner (CS) |
| Deborah Winkler | Kevin Letson (CS) |
| Jason VanEffen | Sara Ruiter (CS) |
| Chad Andresen (CS) | |

In Memory of John W. Graham

April 11, 1970 – October 6, 2011