SEA LAMPREY CONTROL IN THE GREAT LAKES 2013

ANNUAL REPORT TO
THE GREAT LAKES FISHERY COMMISSION

Paul Sullivan
Fisheries and Oceans Canada
Sault Ste. Marie, Ontario
Canada

Robert Adair
U.S. Fish and Wildlife Service
Marquette, Michigan
United States

GLFC Annual Meeting
Chicago, Illinois
June 3-4, 2014

Cover: Sea Lamprey Barrier on Orwell Brook, tributary to the Salmon River, near Altmar, New York (*Photo by Bhuwani Paudel, DFO*).

Chad Hill (Fisheries and Oceans Canada) and Jason Krebill (U.S. Fish and Wildlife Service) conducting a lampricide feed rate check during the 2013 lampricide treatment of Bear Creek, tributary to the Big Manistee River, Manistee, Michigan (*Photo by Ted Lawrence, GLFC*)

Table of Contents

Tables

Figures

SEA LAMPREY CONTROL IN THE GREAT LAKES 2013

Paul Sullivan
Fisheries and Oceans Canada
Sault Ste. Marie, Ontario P6A 2E5

Robert Adair
United States Fish and Wildlife Service
Marquette, Michigan 49855

EXECUTIVE SUMMARY

This report summarizes sea lamprey control activities conducted by Fisheries and Oceans Canada (Department) and the United States Fish and Wildlife Service (Service) in the Great Lakes during 2013. These activities are consistent with the actions identified in the Great Lakes Sea Lamprey Control Plan to achieve sea lamprey abundance and marking targets that were adopted by the Great Lakes Fishery Commission in 2011. Lampricide treatments were conducted on 121 tributaries and 10 lentic areas. Larval assessment crews surveyed 527 Great Lakes tributaries and 48 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 67 tributaries across the Great Lakes to estimate the adult sea lamprey populations in each Great Lake.

Adult sea lamprey populations were evaluated relative to fish-community objectives for each of the lakes. In Lake Superior, adult abundance (53,871, 95% CI: 44,920-68,896) was within the target level of 39,209 ± 21,083 for the sixth consecutive year. In Lake Michigan, abundance (57,596, 95% CI: 52,971-63,469) was within the target level of 59,331 ± 13,557 after being greater than target during the previous three years. In Lake Huron, abundance (126,421, 95% CI: 115,644-156,881) showed a significant decrease from 2012, but remains greater than target level of 76,396 ± 20,260. In Lake Erie, abundance (16,641, 95% CI: 14,716-19,654) decreased for the fourth consecutive year, but remains greater than the target level of 3,536 ± 1,079. In Lake Ontario, abundance (29,098, 95% CI: 26,352-32,357) was within the target level of 31,427 ± 3,927 for the third time in four years.

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-20th 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 *A Joint Strategic Plan for Management of Great Lakes Fisheries,* 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 marking targets for each of the lakes. This report outlines the program conducted by the control agents and the Commission in 2013 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 marking rates resulted in a tolerable annual rate of mortality on lake trout. A target and range of adult sea lamprey abundance was calculated for these lakes from the estimated average abundance over a 5-year period when marking 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 average abundance over a 5-year period when marking rates were closest to 2 A1 marks per 100 lake trout >431 mm. In Lake Huron, the abundance target and range was calculated as 25% of the estimated average 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 adult sea lamprey abundance with the lake trout marking rate against these targets. Lake-wide adult abundance is estimated by the Service and Department using a combination of mark-recapture and trapping efficiency estimates of adults in streams with traps, and regression model-predicted estimates in streams without traps. Since the model for estimating adult abundance is updated annually using all available data, the adult estimates for previous years can change, which in turn, can cause the adult targets to change. Lake trout marking rates are assessed and collected by the member agencies that comprise the lake committees and their technical committees.

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 adult sea lamprey abundance for Lake Superior was calculated from the average abundance estimated for the 5-year period, 1994-1998, when marking rates were closest to 5 marks per 100 lake trout (5.2 A1-3 marks per 100 fish >533mm). The calculated target adult abundance in Lake Superior is 39,209 ± 21,083 sea lampreys.

During 2013, the marking rate was 5.7 A1-A3 marks per 100 lake trout>533mm, slightly greater than the target of 5 marks per 100 fish. Adult sea lamprey abundance in Lake Superior was estimated to be 53,871 (95% CI; 44,920-68,896). Abundance estimates were within the fish-community target range during the previous six years, including 2013.

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 adult sea lamprey abundance for Lake Michigan was calculated from the average abundance estimated for the 5-year period, 1988-1992, when marking rates were closest to 5 marks per 100 lake trout (4.7 A1-3 marks per 100 fish >533mm). The calculated target adult abundance in Lake Michigan is 59,331 ± 13,557 sea lampreys. .

During 2013, the marking rate was 8.0 A1-A3 marks per 100 lake trout>533mm, greater than the target of 5 marks per 100 fish. Adult sea lamprey abundance in Lake Michigan was estimated to be 57,596 (95% CI; 52,971-63,496), which was within the target range.

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 target and range of adult sea lamprey abundance for Lake Huron was 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). Unlike the other Great Lakes, this explicit target was not based on observed marking rates that resulted in a tolerable annual lake trout mortality rate. The calculated target adult abundance in Lake Huron is 76,396 ± 20,260 sea lampreys.

During 2013, the marking rate was 12.0 A1-A3 marks per 100 lake trout>533mm, greater than the target of 5 marks per 100 fish. Adult sea lamprey abundance in Lake Huron was estimated to be 126,421 (95% CI; 115,644-156,881), which represents a significant reduction from the 2012 estimate. However, adult abundance remains greater than the target, despite substantial increases in control efforts since 2010, including the implementation of large-scale treatment strategies in the St. Marys River and tributaries to the North Channel and northern Lake Michigan.

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 salmonids; restore a self-sustaining population of lake trout to historical levels of abundance.*

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

The target and range of adult sea lamprey abundance for Lake Erie was calculated from the average abundance estimated for the 5-year period, 1991-1995, when marking rates were closest to 5 marks per 100 lake trout (4.4 A1-3 marks per 100 fish >533 mm). The calculated target adult abundance in Lake Erie is 3,536 ± 1,079 sea lampreys.

During 2013, the marking rate was 5.7 A1-A3 marks per 100 lake trout>533mm, greater than the target of 5 per 100 fish. Adult sea lamprey abundance in Lake Erie was estimated to be 16,641 (95% CI; 14,716-19,654) and was greater than the fish-community objective target range. The control agents continue to delineate the distribution and abundance of the larval sea lamprey population in the St. Clair River, hypothesized to be the primary source of parasitic juveniles in Lake Erie.

Results of these efforts are currently being evaluated and formulated into a plan that will identify further actions and strategies for sea lamprey control in this important interconnecting waterway.

Lake Ontario

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

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

The Lake Ontario Committee recognized that continued control of sea lampreys is necessary for lake trout rehabilitation and stated 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 of 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 marking statistics as the other lakes (A1-A3 marks). During 2006, the target and range were revised using A1 marks exclusively, which have been more consistently recorded on Lake Ontario. Also, the target marking rate of less than 2 A1 marks per 100 fish was explicitly identified as producing tolerable mortality in the lake trout rehabilitation plan. The target and range of adult sea lamprey for Lake Ontario was calculated from the average abundance estimated for the 5-year period, 1993-1997, when marking rates were closest to 2 marks per 100 lake trout (1.6 A1 marks per fish >431 mm). The calculated target adult abundance in Lake Ontario is 31,427 ± 3,927 sea lampreys.

During 2013, the marking rate was 2.2 A1-A3 marks per 100 lake trout>533mm, greater than the target of 2.0 A1 marks per 100 fish. Adult sea lamprey abundance in Lake Ontario was estimated to be 29,098 (95% CI; 26,352-32,357), which was within the fish-community objective target range.

LAMPRICIDE CONTROL

Tributaries harboring larval sea lampreys are treated periodically with lampricides to eliminate or reduce larval populations before they recruit to the lake as feeding juveniles. Service and Department treatment staff 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% granular Bayluscide (GB) to control populations inhabiting lentic areas. Specialized equipment and techniques are employed to provide concentrations of lampricides that eliminate about 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 2013 is presented in the LCTF section of this report.

During 2013, lampricide treatments were conducted on 121 tributaries and 11 lentic areas of the Great Lakes (Table 1).

Table 1. Summary of lampricide applications in tributaries of the Great Lakes, 2013.

Lake	Number of Streams	Number of Lentic	Discharge (m^3/s)	TFM (kg) [1]	Bayluscide (kg) [1,2]	Distance Treated (km)
Superior	28	6	107.3	12,011.6	537.9	611.3
Michigan	45	2	109.4	28,964.1	233.9	1,123.5
Huron	28	3	177.8	13,227.8	2,312.2	384.2
Erie	12	0	78.9	13,200.4	32.7	569.9
Ontario	8	0	26.6	4,327.4	4.8	222.3
Total	**121**	**11**	**500.0**	**71,731.3**	**3,121.5**	**2,911.2**

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

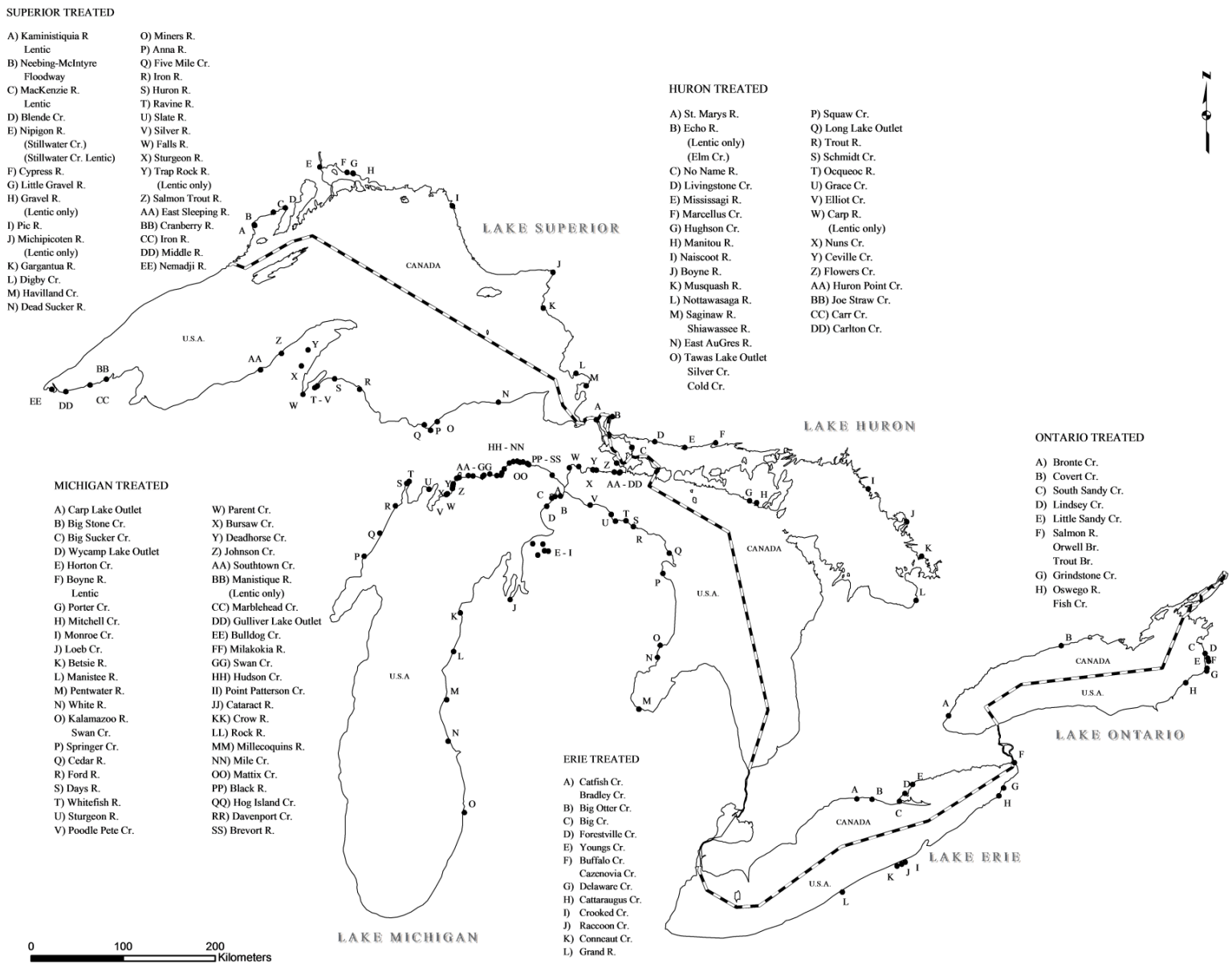

Figure 1. Location of tributaries treated with lampricide in 2013.

Lake Superior

Lake Superior has 1,566 tributaries (833 Canada, 733 U.S.). One hundred sixty-two tributaries (58 Canada, 104 U.S.) have historical records of larval sea lamprey production. Of these, 113 tributaries (45 Canada, 68 U.S.) have been treated with lampricides at least once during 2004-2013. Fifty-nine tributaries (19 Canada, 40 U.S.) are treated on a regular cycle. Table 2 and Figure 1 provide details on the application of lampricides to Lake Superior tributaries and lentic areas during 2013. Highlights of 2013 lampricide treatments on Lake Superior include the following:

- Lampricide treatments were completed in 28 tributaries (11 Canada, 17 U.S.) and in 6 lentic areas (5 Canada, 1 U.S.).

- The Anna and Dead Sucker rivers were treated for the first time since 1965 and 1975, respectively.

- The Cranberry River (Bayfield County) was treated for the first time since 1965 after sea lampreys were discovered in the stream in 2010. Moderate densities of multiple year classes were observed during treatment.

- The Trap Rock lentic treatment was postponed from June until September due to extremely low dissolved oxygen levels measured in the proposed treatment area. Conditions for treatment did not improve in September rendering a portion of the scheduled treatment area untreatable.

- The Nemadji River lampricide treatment was rescheduled for October due to abnormally high stream discharge during its original May time slot. The distribution of sea lamprey larvae was further upstream than historically recorded, making it challenging to complete the treatment in the time allotted. Significant rainfall near the end of the treatment resulted in sub-lethal lampricide concentrations in the lower portion of the stream.

- Immediately prior to the treatment of the Sturgeon River (Baraga County) county officials removed the stop logs impounding Otter Lake to make repairs to the Otter River Dam. The construction resulted in unpredictable discharges for several days in the Otter River, which is a significant tributary to the Sturgeon River, making the delivery of an effective treatment challenging.

- Blende Creek was treated for the first time since 1964. Multiple age classes of sea lamprey larvae were observed during treatment.

- Havilland and Digby creeks were treated for the first time.

- Corbett Creek (Kaministiquia River tributary), the Neebing-McIntyre Floodway, and the MacKenzie and Pic rivers were treated after being deferred in 2012.

- Treatments scheduled for the Michipicoten River and Nama Creek (Pic River tributary) were not completed due to high discharge. The two streams have been rescheduled for treatment in 2014.

Table 2. Details on the application of lampricides to tributaries and lentic areas of Lake Superior during 2013 (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. (A)	Jul 7	44.9	3,605.2	34.4[3]	117.6
Kaministiquia R. lentic	Oct 2	---	---	68.2[3]	---
Neebing-McIntyre Fl. (B)	Jul 13	3.7	588.4	0.1[3]	19.5
MacKenzie R. (C)	Aug 12	2.1	104.1	0.0	1.1
MacKenzie R. lentic	Aug 12	---	---	81.3[3]	---
Blende Cr. (D)	Jul 12	0.2	29.6	0.0	2.8
Nipigon R. (E)					
Stillwater Cr.	Aug 9	0.3	38.5	0.1[3]	1.2
Stillwater Cr. lentic	Aug 9	---	---	39.2[3]	---
Cypress R. (F)	Jul 16	0.7	44.6	0.0	5.5
Little Gravel R. (G)	Jul 17	0.1	16.7	0.0	5.6
Gravel R. lentic (H)	Aug 10	---	---	206.1[3]	---
Pic R. (I)	Jul 20	29.6	3,379.5	61.0[3]	102.8
Michipicoten R. lentic (J)	Sep-27	---	---	37.0[3]	---
Gargantua R. (K)	Aug-07	0.4	27.1	0.0	1.4
Digby Cr. (L)	Jun 23	0.1	1.9	0.0	0.2
Havilland Cr. (M)	Jul 25	0.2	10.3	0.0	2.7
Total (Canada)		**82.3**	**7,845.9**	**527.4[3]**	**260.4**
United States					
Dead Sucker R. (N)	Aug 7	1.1	129.4	0.0	6.1
Miners R. (O)	Jul 11	0.6	166.8	0.0	3.5
Anna R. (P)	Jul 10	1.1	213.6	0.0	8.5
Five Mile Cr. (Q)	Jul 9	0.1	1.5	0.0	1.1
Iron R. (R)	Aug 14	1.6	148.2	0.0	4.8
Huron R. (S)	Aug 30	1.3	257.1	0.0	11.6
Ravine R. (T)	Sep 13	0.1	26.3	0.0	9.8
Slate R. (U)	Sep 3	0.2	19.9	0.0	1.1
Silver R. (V)	Sep 16	0.5	83.1	0.0	5.6
Falls R. (W)	Sep 12	0.9	220.1	0.0	0.5
Sturgeon R. (X)	Aug 31	8.5	851.1	8.0	75.7
Trap Rock R. lentic (Y)	Aug 28	---	---	2.5[3]	---
Salmon Trout R. (Z)	Jul 24	0.8	80.5	0.0	0.6
East Sleeping R. (AA)	Jul 22	0.7	144.4	0.0	11.9
Cranberry R. (BB)	Jul 22	0.7	82.4	0.0	10.5
Iron R. (CC)	Jul 21	1.7	330.3	0.0	2.7
Middle R. (DD)	Jul 19	0.6	104.5	0.0	8.5
Nemadji R. (EE)	Oct 10	4.5	1,306.6	0.0	188.4
Total (United States)		**25.0**	**4,165.8**	**10.5[3]**	**350.9**
Total for Lake		**107.3**	**12,011.6**	**537.9[3]**	**611.3**

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 132.5 TFM bars (27.6 kg active ingredient) applied in 12 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-six tributaries have historical records of larval sea lamprey production, and of these, 90 tributaries have been treated with lampricides at least once during 2004-2013. Forty tributaries are treated on a regular cycle. Table 3 and Figure 1 provide details on the application of lampricides to Lake Michigan tributaries and lentic areas during 2013. Highlights of 2013 lampricide treatments on Lake Michigan include the following:

- Lampricide treatments were completed in 45 tributaries and 2 lentic areas.

- This was the second year of an expanded large-scale treatment strategy in northern Lake Michigan. Thirty-one sea lamprey producing tributaries were treated as part of this continuing effort and the following nine tributaries were treated for the second consecutive year: Brevort and Black rivers, Davenport, Hog Island, Big Stone and Big Sucker creeks, Carp Lake, Gulliver Lake, and Wycamp Lake outlets.

- Four streams were treated for the first time in over 20 years: Mile, Swan (Kalamazoo River tributary), Southtown, and Point Patterson creeks.

- The Ford River treatment was postponed due to high-water conditions in late April through early May. The upper Ford River and its tributaries along with tributaries to the Cedar River were treated during mid-May. The mainstream treatments of both rivers were conducted during late May when stream discharge fell within normal limits.

- Bursaw, Marblehead, Swan, Parent, and Southtown creeks were treated with lampricide under extremely low discharge conditions.

- The lower portion of the Manistique River (harbor area within the break walls) was treated with GB. Based on collections and observations during treatment, a high larval sea lamprey density consisting of large larvae was evident.

- Bulldog Creek was retreated in September due to sea lamprey larvae that survived (residuals) the first treatment in June.

- The Manistee River was treated for the second consecutive year due to the presence of residual lampreys. Treatment of the Manistee River was delayed until early August, due to non-target species concerns.

- Upstream distribution of sea lampreys in the North Branch of the Pentwater River significantly increased the distance of stream that required treatment compared to distribution during 2011.

Table 3. Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2013 (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)
Carp Lake Outlet (A)	Sep 28	0.1	29.6	0.0	0.5
Big Stone Cr. (B)	Sep 26	0.1	5.9	0.0	1.4
Big Sucker Cr. (C)	Sep 27	0.1	45.9	0.0	3.5
Wycamp Lake Outlet (D)	Sep 26	0.2	59.2	0.0	2.3
Horton Cr. (E)	Sep 3	0.3	145.1	2.5[3]	1.3
Boyne R. (F)	Sep 2	2.2	850.5	0.0	3.2
Boyne R. lentic	Jun 18	---	---	16.5[3]	---
Porter Cr. (G)	Sep 3	0.2	176.9	1.8[3]	6.1
Mitchell Cr. (H)	Jun 7	0.3	98.8	0.0	6.8
Monroe Cr. (I)	Aug 31	0.1	64.7	0.0	1.8
Loeb Cr. (J)	Aug 31	0.1	22.2	0.0	3.1
Betsie R. (K)	Jun 19	8.5	2,351.2	0.0	18.7
Manistee R. (L)	Jul 17	42.5	9,023.9	106.3[3]	93.2
Pentwater R. (M)	Jul 9	1.8	675.6	0.0	40.1
White R. (N)	Aug 16	7.6	4,201.8	0.1[3]	156.2
Kalamazoo R. (O)					
Swan Cr.	Jul 18	1.5	263.7	0.0	6.3
Springer Cr. (P)	Apr 26	0.6	79.3	0.0	5.2
Cedar R. (Q)	May 14	8.5	2,504.1	9.5	133.6
Ford R. (R)	May 11	14.2	3,257.0	14.3	225.4
Days R. (S)	Sep 11	0.1	70.2	0.0	6.9
Whitefish R. (T)	Jun 7	5.7	1,662.9	9.8	109.5
Sturgeon R. (U)	Aug 2	4.2	707.5	0.0	124.0
Poodle Pete Cr. (V)	Sep 12	0.1	5.9	0.0	0.6
Parent Cr. (W)	Jul 13	0.1	21.1	0.0	2.3
Bursaw Cr. (X)	Sep 15	0.1	26.8	0.0	4.3
Deadhorse Cr. (Y)	Sep 13	0.1	8.7	0.0	2.7
Johnson Cr. (Z)	Jun 29	0.1	3.7	0.0	1.1
Southtown Cr. (AA)	Jul 9	0.1	1.5	0.0	0.7
Manistique R. lentic (BB)	Jul 2	---	---	72.9[3]	---
Marblehead Cr. (CC)	Sep 17	0.1	9.1	0.0	3.7
Gulliver Lake Outlet (DD)	Sep 15	0.1	13.6	0.0	2.3
Bulldog Cr. (EE)	Jun 27	0.2	43.5	0.0	2.6
Milakokia R. (FF)	Jun 27	0.8	499.1	0.0	25.3
Swan Cr. (GG)	Jul 11	0.1	1.7	0.0	1.1
Hudson Cr. (HH)	Jun 28	0.1	22.0	0.0	3.5
Point Patterson Cr. (II)	Jul 11	0.2	46.7	0.0	0.5
Cataract R. (JJ)	Sep 28	0.1	20.0	0.0	1.4
Crow R. (KK)	Aug 31	0.7	157.0	0.2[3]	5.0
Rock R. (LL)	Sep 28	0.1	45.9	0.0	4.2

Table 3 continued.

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
Millecoquins R. (MM)	Sep 26	4.8	1,086.6	0.0	58.6
Mile Cr. (NN)	Oct 1	0.1	8.2	0.0	1.8
Mattix Cr. (OO)	Sep 2	0.1	8.9	0.0	1.9
Black R. (PP)	Jun 7	0.4	305.9	0.0	27.4
Hog Island Cr. (QQ)	Sep 29	0.1	41.9	0.0	6.8
Davenport Cr. (RR)	Sep 2	0.5	83.7	0.0	1.8
Brevort R. (SS)	Aug 29	1.4	206.6	0.0	14.8
Total for Lake		**109.4**	**28,964.1**	**233.9**	**1,123.5**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 582.3 TFM bars (121.3)kg active ingredient) applied in 16 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 one tributaries (59 Canada, 62 U.S.) have historical records of larval sea lamprey production. Of these, 83 tributaries (39 Canada, 44 U.S.) have been treated with lampricide at least once during 2004 - 2013. Forty-nine tributaries (22 Canada, 27 U.S.) are treated on a regular cycle. Table 4 and Figure 1 provide details on the application of lampricides to Lake Huron tributaries and lentic areas during 2013. Highlights of 2013 lampricide treatments on Lake Huron include the following:

- Lampricide applications were conducted in 28 tributaries (11 Canada, 17 U.S.), 2 lentic areas (1 Canada, 1 U.S.) and 383 ha of the St. Marys River (Table 1). This includes the 24 tributaries and 2 lentic areas that were treated as part of the continued large-scale treatment strategy.

- The second year of a large-scale treatment strategy that treated infested streams in northern lakes Huron and Michigan was completed during 2013. Consecutive year treatments were conducted on 16 Lake Huron streams during 2012 and 2013; an additional 8 Lake Huron streams were treated a single time during 2013.

- Joe Straw and Carr creeks were treated for the first time since 1975 and 1978, respectively.

- Joe Straw, Carr, Huron Point, Ceville, and Flowers creeks were treated under extremely low discharge conditions.

- The Shiawassee River was treated from the remaining dam abutments at the Shiatown dam, which was removed in the summer of 2013. Larval surveys upstream from the old dam were negative.

- Due to excessive discharge and/or time constraints, lampricide treatments of the Wanapitei River and Old Voyageur Channel (French River tributaries) and the Magnetawan River were not completed. All of these streams were scheduled for a second treatment as part of the large-scale treatment strategy. The next treatment of these streams will be scheduled based on their normal treatment cycle.

Table 4. Details on the application of lampricides to tributaries and lentic areas of Lake Huron during 2013 (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)	Jul 8	---	---	872.7[3]	
Echo R. (B)					
Lentic	Sep 12	---	---	57.3[3]	
Elm Cr.	May 15	0.3	30.4	0.0	3.3
No name (H-65) (C)	Jun 23	0.2	30.7	0.0	0.9
Livingstone Cr. (D)	Jun 26	0.1	2.5	0.0	1.5
Mississagi R. (E)	Aug 24	65.3	3,100.5	44.8	44.1
Marcellus Cr. (F)	Jun 26	0.1	0.9	0.0	0.4
Hughson Cr. (G)	Aug 9	0.1	7.4	0.0	4.1
Manitou R. (H)	Aug 8	0.7	163.7	0.0	0.7
Naiscoot R. (I)	May 23	12.6	345.5	0.6[3]	17.8
Boyne R. (J)	May 24	1.3	42.7	0.0	1.9
Musquash R. (K)	Aug 12	11.4	598.2	0.0	3.2
Nottawasaga R. (L)	Apr 5	20.6	3,629.8	32.8[3]	132.6
Total (Canada)		**112.7**	**7,952.3**	**1,008.2[3]**	**210.5**
United States					
Saginaw R. (M)					
Shiawassee R.	May 26	56.6	3,067.7	0.0	101.9
East AuGres R. (N)	Jul 21	1.4	421.7	0.0	21.9
Tawas Lake Outlet (O)					
Silver Cr.	Jul 22	1.2	322.0	0.2[3]	9.8
Cold Cr.	Jul 20	0.2	61.7	0.0	9.2
Squaw Cr. (P)	Jun 27	0.2	28.5	0.0	1.9
Long Lake Outlet (Q)	Jun 30	1.7	460.9	0.0	5.3
Trout R. (R)	Jun 29	0.2	48.0	0.0	1.9
Schmidt Cr. (S)	Jun 28	0.1	22.5	0.0	1.8
Ocqueoc R. (T)	Jun 30	2.2	666.0	0.0	5.8
Grace Cr. (U)	Jun 28	0.1	9.7	0.2[3]	2.6
Elliot Cr. (V)	Jun 27	0.2	66.7	0.0	4.2
Carp R. lentic (W)	Jun 20	---	---	32.5[3]	---
Nuns Cr. (X)	Aug 30	0.3	34.1	0.0	0.2
Ceville Cr. (Y)	Jun 18	0.1	11.0	0.0	2.8
Flowers Cr. (Z)	Jun 18	0.1	12.4	0.0	0.8
Huron Point Cr. (AA)	Jun 19	0.1	8.3	0.0	0.7
Joe Straw Cr. (BB)	Jun 19	0.1	3.1	0.0	0.7
Carr Cr. (CC)	Jun 20	0.1	2.0	0.0	0.2
Carlton Cr. (DD)	Jun 21	0.2	29.2	0.0	2.0
St. Marys R. (A)	Jul 8	---	---	1271.1[3]	---
Total (United States)		**65.1**	**5,275.5**	**1,304.0[3]**	**173.7**
Total for Lake		**177.8**	**13,227.8**	**2,312.2[3]**	**384.2**

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 69 TFM bars (14.4 kg active ingredient) applied in 6 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-three tributaries (11 Canada, 12 U.S.) have historical records of larval sea lamprey production. Of these, 13 tributaries (7 Canada, 6 U.S.) have been treated with lampricides at least once during 2004-2013. Eight tributaries (three Canada, five 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 2004-2013. Table 5 and Figure 1 provide details on the application of lampricides to Lake Erie tributaries and lentic areas during 2013. Highlights of 2013 lampricide treatments on Lake Erie include the following:

- Lampricide treatments were completed in 12 tributaries (5 Canada, 7 U.S.)

- Cattaraugus Creek was treated in late March by a combined crew of Department and Service personnel.

- Buffalo Creek was treated for the first time. Two tributaries, Cazenovia and Cayuga creeks, were also positive for sea lamprey larvae, but the latter was not treated due to insufficient flow. Cayuga Creek will be re-evaluated in 2014 to determine if it requires treatment.

- Bradley Creek (Catfish Creek tributary) was treated for the first time since 1987.

- Forestville Creek was treated as a result of assessment surveys in 2013 that indicated the presence of larvae upstream of the sea lamprey barrier. It was last treated in 1989.

- North and South creeks, (Big Creek tributaries) were treated upstream of Lehman Dam for the first time. However, due to low flows and issues with irrigators, the upper portion of North Creek was not treated. This section of stream has been deferred until 2014.

- The upper portion of Spittler Creek, tributary to Big Otter Creek, was not treated due to low flows and has been deferred until 2014.

Table 5. Details on the application of lampricides to tributaries and lentic areas of Lake Erie during 2013 (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					
Catfish Cr. (A)					
Bradley Cr.	Jun 5	0.4	75.0	0.0	1.0
Big Otter Cr. (B)	Sep 6	3.7	2,516.3	0.5[3]	129.5
Big Cr. (C)	Aug 20	4.9	1,594.8	0.3[3]	102.0
Forestville Cr. (D)	Aug 19	0.1	27.9	0.0	3.3
Youngs Cr. (E)	Aug 21	0.7	132.8	0.0	0.4
Total (Canada)		**9.8**	**4,346.8**	**0.8[3]**	**236.2**
United States					
Buffalo Cr. (F)	Jun 1	3.1	495.3	0.0	9.3
Cazenovia Cr.	Sep 15	0.4	325.7	0.0	35.4
Delaware Cr. (G)	Jun 3	0.3	37.5	0.0	9.3
Cattaraugus Cr. (H)	Mar 29	42.5	5,093.0	31.9	112.1
Crooked Cr. (I)	May 3	0.5	166.4	0.0	12.4
Raccoon Cr. (J)	Apr 26	0.3	56.1	0.0	2.4
Conneaut Cr. (K)	May 7	4.2	872.2	0.0	102.4
Grand R. (L)	Apr 29	17.8	1,807.4	0.0	50.4
Total (United States)		**69.1**	**8,853.6**	**31.9**	**333.7**
Total for Lake		**78.9**	**13,200.4**	**32.7**	**569.9**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 43.5 TFM bars (9.1 kg active ingredient) applied in 4 streams.
[3]Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

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, 38 tributaries (17 Canada, 21 U.S.) have been treated with lampricides at least once during 2004-2013. Twenty-eight tributaries (14 Canada, 14 U.S.) are treated on a regular cycle. Table 6 and Figure 1 provide details on the application of lampricides to Lake Ontario tributaries and lentic areas during 2013. Highlights of 2013 lampricide treatments on Lake Ontario include the following:

- Lampricide applications were conducted in eight streams (two Canada, six U.S.).
- Larval sea lamprey were detected upstream of the dam at Cedar Springs on Bronte Creek necessitating a treatment from Carlisle, Ontario.
- Covert and Grindstone creeks and Trout Brook were treated upstream ofthe historical upper distribution of larvae, based on the results of larval distibution surveys.

- Orwell Brook was treated for the first time since construction of the sea lamprey barrier was completed in 2012. This stream will be treated again in 2014 due to concerns of residual populations resulting from beaver impoundments located upstream from the barrier.

Table 6. Details on the application of lampricides to tributaries of Lake Ontario during 2013 (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					
Bronte Cr. (A)	May 31	3.6	1,377.5	0.0	41.4
Covert Cr. (B)	Jun 5	0.1	59.7	0.0	6.1
Total (Canada)		**3.7**	**1,437.2**	**0.0**	**47.5**
United States					
South Sandy Cr. (C)	Apr 29	5.8	366.4	4.7	13.5
Lindsey Cr. (D)	Apr 23	0.7	131.1	0.0	18.4
Little Sandy Cr. (E)	May 26	1.0	91.3	0.0	10.3
Salmon R. (F)					
Orwell Br.	Apr 25	2.0	220.2	0.0	11.2
Trout Br.	Apr 27	1.5	139.4	0.0	20.4
Grindstone Cr. (G)	Apr 18	3.2	384.6	0.0	43.6
Oswego R. (H)					
Fish Cr.	May 27	8.7	1,557.2	0.1	57.4
Total (United States)		**22.9**	**2,890.2**	**4.8**	**174.8**
Total for Lake		**26.6**	**4327.4**	**4.8**	**222.3**

[1] Lampricide quantities are reported in kg of active ingredient.
[2] Includes a total of 45 TFM bars (9.4 kg active ingredient) applied in 7 streams.
[3] Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

ALTERNATIVE CONTROL

The Commission and its partners continue to research and develop alternatives to lampricide treatments to provide a broader spectrum of strategies to control sea lampreys. During 2013, barriers were the only operational alternative control method. Alternative control methods that are currently being investigated include the use of attractants (e.g. pheromones), repellents (e.g. necromones), juvenile trapping, and new trapping designs.

Sterile-Male-Release Technique

The Commission discontinued the Sterile-Male-Release Technique (SMRT) in the St. Marys River beginning in 2012. Long-term monitoring of egg viability and larval populations are used to assess changes that may be attributable to termination of the SMRT.

- In 2013, the average egg viability from 11 nests was 79%. This was similar to the average egg viability in 2012 (74%), and much higher than the average egg viabilities from 1997-2011 when SMRT was ongoing (29%; range 4% – 48%).

- In 2013, 100 larval sea lampreys were collected from the St. Marys River by deep water electrofishing (DWEF). Eighty five percent of the total catch was estimated to be age-1 (17-47mm) and is an indication of recruitment from the 2012 spawning year class. This is the highest proportion of age-1 larvae since 1993 when DWEF assessments began, and may be linked to higher egg viability as a result of the discontinuation of SMRT.

Barriers

The Sea Lamprey Barrier Program priorities are to:

1) Operate and maintain existing sea lamprey barriers that were built or modified by the SLCP.
2) Ensure sea lamprey migration is blocked at important non-SLCP barrier sites.
3) Construct new structures in streams where they:
    a. provide a cost-effective alternative to lampricide control;
    b. provide control where other options are impossible, excessively expensive, or ineffective;
    c. improve cost-effective control in conjunction with attractant and repellent based control, trapping, 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 2013 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) and barrier sites are monitored on a rotating schedule. The data contained in BIPSS are used to select barrier projects, monitor the frequency of inspections and schedule upstream larval assessments. Further, the information can be used to assess the effects of barrier removal or modification requests on sea lamprey populations and identify structures that are important in controlling sea lampreys.

During 2013, there were 68 structures in the Great Lakes basin, that were either purpose-built to block sea lampreys (49), or constructed for other purposes (19), but modified to serve a sea lamprey control function (Figure 2).

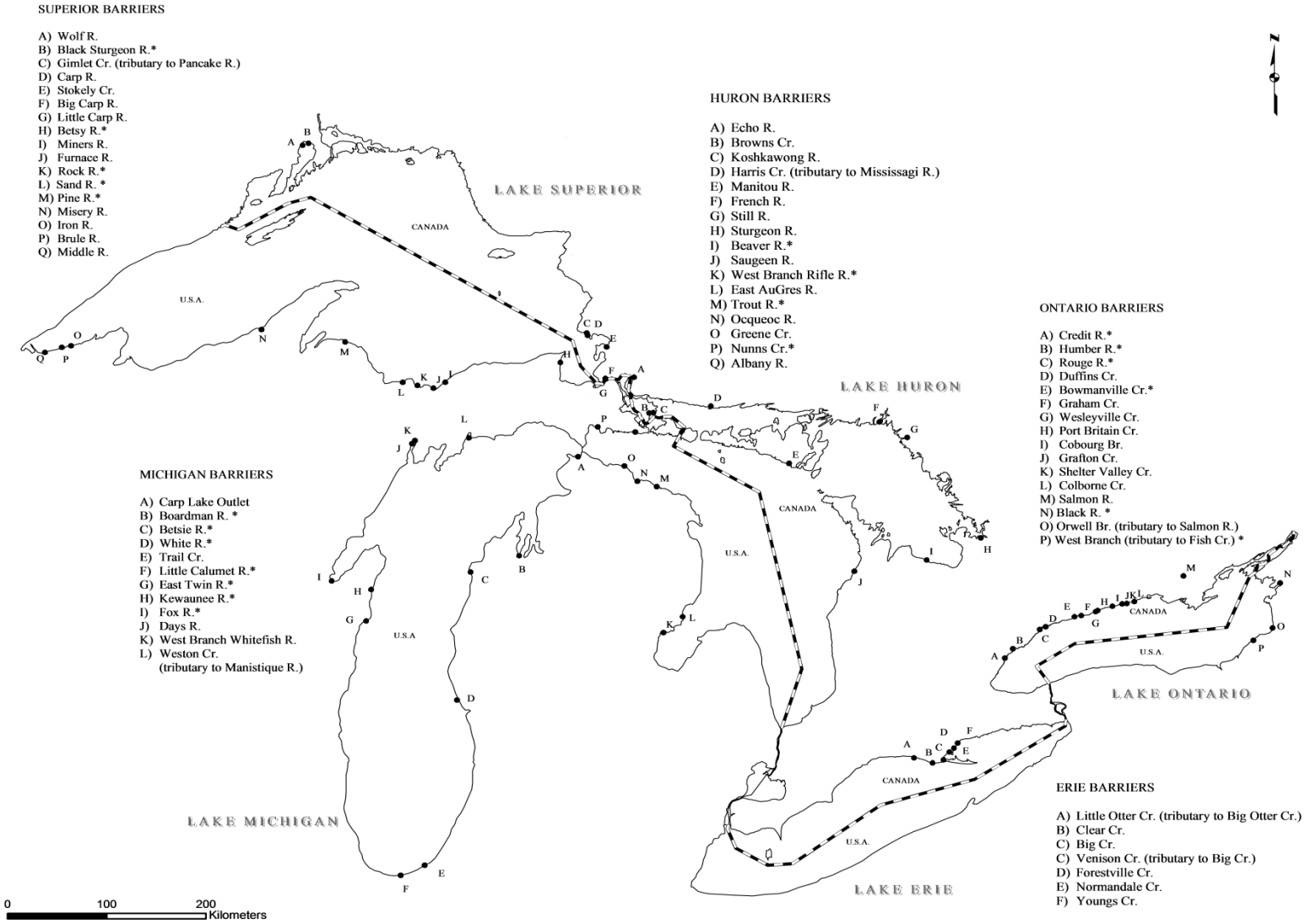

Figure 2. Locations of tributaries with sea lamprey barriers. Structures constructed for other purposes, but have been modified to prevent the upstream migration of sea lampreys, are indicated by an asterisk.

Lake Superior

The Commission has invested in 16 barriers on Lake Superior (Figure 2). Of these, 11 were purpose-built as sea lamprey barriers and 5 were constructed for other purposes, but have been modified to block sea lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited nine structures on tributaries to Lake Superior to assess sea lamprey blocking potential and to improve the information in the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 12 barriers (6 Canada, 6 U.S.).

- Repairs or improvements were conducted on one Canadian barrier (Little Carp River).

Ensure Blockage to Sea Lamprey Migration

- Poplar River – The abandonment application submitted by the owners of the Poplar Dam was approved. Initial drawdown activities were initiated during fall 2012 and the barrier was removed during August 2013.

- Sand River - The Service completed modifications to the Michigan Department of Natural Resources (MIDNR) James Jeske Flooding Dam to reinstate its blocking function.

- Consultations to ensure blockage at barriers in six tributaries were completed with partner agencies (Table 7).

- Ontario is progressing with a provincial Environmental Assessment (EA) to evaluate its proposal to remove the Camp 43 Dam on the Black Sturgeon River and construct a new sea lamprey barrier 50 km upstream. Recently, the Ontario Ministry of Natural Resources (OMNR) and the Commission co-sponsored a series of Strategic Decision Making workshops, moderated by Dr. Mike Jones, Michigan State University, to evaluate all options for the Black Sturgeon River, including refurbishment of the existing dam. Dr. Jones' report will be used to inform the EA process.

Table 7. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Superior tributaries during 2013.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Two Hearted R.	Johns Cr.	USFWS[1]	Burma Rd. culvert	Concur	Ineffective barrier
Huron R.	South Fork Chinks C.	USFWS[1]	#213, 217 road crossing culverts	Concur	Ineffective barrier
Ontonagon R.	East Br.	Trout Unlimited	Lower Dam	Do not concur	Blocking barrier
Bad R.	City Cr.	USFWS[1]	Upper Lake Rd., Kulic Dr., snowmobile trail culverts (3)	Concur	Upstream of blocking falls
Bad R.	White R.	USFWS[1]	Don O. Johnson Dam	Concur	Upstream of blocking barrier
Bad R.	Kepsel's Cr.	USFWS[1]	Wildcat Rd. culvert	In process	
Middle R.		Douglas County	Sea lamprey barrier	Do not concur	Blocking barrier
Baptism R.	Sawmill Cr.	USFWS[1]	Cranberry Rd. culvert	Concur	Upstream of blocking falls

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Ashland).

New Construction

- Bad River – The U.S. Army Corps of Engineers approved the Preliminary Restoration Plan (PRP) to review potential barrier sites on the Bad River under the Great Lakes Fishery Ecosystem Restoration program. The PRP outlines a project's merit to seek approval for further federal expenditure. Barrier sites were reviewed for suitability in collaboration with the Bad River Band of Lake Superior Chippewa Indians.

- Whitefish River – Engineering staff at the Department continue to analyze flow data collected by level loggers over several years. The results of the analysis will determine whether construction of a sea lamprey barrier is feasible in this tributary to the Kaministiquia River.

Lake Michigan

The Commission has invested in 12 barriers on Lake Michigan (Figure 2). Of these, five were purpose-built as sea lamprey control barriers and seven were constructed for other purposes, but have been modified to block sea lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited 128 structures on tributaries to Lake Michigan to assess sea lamprey blocking potential and to improve the information in the BIPSS.

Operation and Maintenance

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

- Pere Marquette River – Planning for decommissioning of the electrical barrier continued. Custer Township, Pere Marquette Watershed Council, Conservation Resource Alliance, Michigan Department of Natural Resources (MIDNR) and the Spicer group partnered with the Service and Commission on the decommission, which is expected to be completed during 2014.

Ensure Blockage to Sea Lamprey Migration

- Boardman River – Surveys were conducted upstream from the Union St. Dam to ensure there was no escapement after dam repairs were made in 2012-2013. No spawning activity was noted and no young-of-year larvae were collected upstream from the dam. Results of the inspection report completed during 2012 indicated that the dam is structurally sound with no major defects or obvious paths for escapement. The report provided optimal elevations for the stoplogs for all spillways and the fish ladder to effectively block sea lampreys. The Service coordinated with Traverse City Parks and Recreation Department to place an additional stoplog in each section of the south spillway to increase the crest elevation by six inches.

- White River – During fall 2012, with the cooperation of the City of Hesperia Department of Public Works, stoplogs were replaced in four bays and sealed with hydraulic cement at the wood-concrete interface. A lip was installed on the face of the top stop logs in each of the four bays. No young-of-year lampreys were found upstream of the Hesperia Dam during 2013 fall electrofishing surveys.

- Grand River – The City of Grand Rapids along with several citizens groups have proposed removal of the 6th Street Dam on the Grand River to provide for more varied use of the downtown rapids area. The plan called for removal of the existing structure and creation of an artificial rapids complex that can be used by kayakers and fishermen. A new inflatable crest structure has been proposed one mile upstream of the current location. A stakeholder meeting was held in Grand Rapids to clarify technical details of the proposed inflatable crest/velocity sea lamprey barrier. Attendees from the Commission and the control agencies provided input on the utility of these technologies for sea lamprey control, based on research and experience in field applications within the SLCP.

- Dr. Michael Wagner (Michigan State University) conducted EPA-funded sea lamprey alarm substance field trials on the Carp Lake River Outlet (Lake Michigan tributary). The control agents assisted with initial capture, tag and release, and subsequent recapture. When adults were released into the river prior to application, the alarm cue application motivated upstream movements and vigorous attempts to pass the barrier (the source of the odor). There was also evidence of increased trap captures as a consequence of the increased activity.

- Consultations to ensure blockage at barriers were conducted with partner agencies in 10 streams during 2013 (Table 8).

Table 8. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Michigan tributaries.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Sauk Cr.	Mineral Springs	Ozaukee County	Mineral Springs Dam	Concur	Ineffective barrier
Sauk Cr.	Mineral Springs	Ozaukee County	Park St. culverts	Concur	Ineffective barrier
Boardman R.	Bancroft Cr.	USFWS[1]	Rawlings culvert	Concur	Upstream of blocking barrier
Platte R.	North Br.	USFWS[1]	Hwy. 677 culvert	Concur	Located in headwaters
Bowen Cr.		NOAA[2]	Arcadia Marsh culvert	Concur	Ineffective barrier
White R.	North Br.	USFWS[1]	176th Ave. culvert	Concur	Ineffective barrier
White R.	Brayton Cr.	USFWS[1]	Cleveland Rd. culvert	Concur	Ineffective barrier
Grand R.	Coldwater R.	USFWS[1]	Messer Rd. culvert	Concur	Upstream of blocking barrier
Grand R.	Coldwater R.	USFWS[1]	Brown Rd. culvert	Concur	Upstream of blocking barrier
Grand R.	Coldwater R.	USFWS[1]	Freeport Dam	Concur	Upstream of blocking barrier
Kalamazoo R.		USFWS[1]	Ceresco Dam	Concur	Upstream of blocking barrier
St. Joseph R.	Christiana Cr.	USFWS[1]	Pipeline, concrete slab, lowhead, culvert (2)	Concur	Upstream of blocking barrier
Dunes Cr.		NOAA[2]	Mouth culvert (daylighting)	Concur	No increase to available habitat
Burns Ditch	Deep R.	USFWS[1]	Three Rivers Park Dam	Concur	Ineffective barrier

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Green Bay).
[2]National Oceanic and Atmospheric Administration.

New Construction

- Manistique River – The U.S. Army Corps of Engineers (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 Commission, Service, MIDNR, City of Manistique, and Manistique Papers, Inc. The existing dam location was identified as the most feasible site for a new barrier. The project is currently on hold while the Michigan Department of Environmental Quality completes a permit review and potential wetland mitigation requirements.

- White River - The USACE is the lead agency administering a project to construct a sea lamprey barrier on the White River. Project partners include the Commission, Service, and MIDNR. Service staff met with the USACE and MIDNR to discuss location and design of a new barrier.

- Little Manistee River - The USACE is the lead agency administering a project to construct a new sea lamprey barrier or to modify the current dam at the MIDNR egg taking facility. Project partners include the Commission, Service, and MIDNR. Service staff met with the USACE and MIDNR to discuss location and design of a new barrier.

Lake Huron

The Commission has invested in 17 barriers on Lake Huron (Figure 2). Of these, 13 were purpose-built as sea lamprey barriers and 4 were constructed for other purposes, but have been modified to block sea lampreys migrations.

Barrier Inventory and Project Selection System

- Field crews visited 56 structures on tributaries to Lake Huron to assess sea lamprey blocking potential and to improve the information in the BIPSS.

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 one Canadian barrier:

    - Still River – One stop log in each bay was added to increase crest height in the barrier to ensure blockage of migrating sea lamprey.

- The electrical field of the combination low-head/electrical barrier in the Ocqueoc River was activated March 12, 2013. From March 12 through May 29 the barrier was electrified 58 days.

Ensure Blockage to Sea Lamprey Migration

- Cheboygan River – Planning to block adult sea lampreys at the Cheboygan lock and dam complex and to eradicate lampreys from the upper river continued:

    - Control and research agents met with the USACE and MIDNR to discuss alternatives for preventing escapement at the Cheboygan River lock. The MIDNR is pursuing a refurbishment of the aging structure and the federal partners are interested in making the lock "lamprey proof" using Great Lakes Fishery and Ecosystem Restoration funding through the USACE.

    - A pilot study was conducted in the Upper Cheboygan River to provide evidence of a landlocked sea lamprey population and to inform lock refurbishment plans. Fyke nets were used to determine run timing and obtain morphology and statolith microchemistry data on adult lampreys in the upper river. Adult sea lamprey abundance in the upper river was also estimated by weekly fin clipping (marking) male sea lampreys captured in the lower river (Lake Huron source) and released in the upper river (Schaefer method). Collective results provided evidence that a small landlocked population of adult sea lampreys inhabited the upper Cheboygan River during 2013 and that escapement through the lock was minimal. Details are available in the Commission 2013 project completion report: *Determine the origin of sea lampreys in the upper Cheboygan River* (Johnson et al.).

- Saugeen River – The Denny's Dam Reconstruction Project is currently on hold pending consultation between the Saugeen Ojibway Nation and OMNR.

- Consultations to ensure blockage at barriers were completed with partner agencies for 11 sites in 4 tributaries (Table 9).

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

Mainstream	Tributary	Agency	Project	SLCP Position	Comments
Cheboygan R.	Milligan Cr.	USFWS[1]	Waveland Rd. culvert	Concur	Upstream of blocking barrier
Cheboygan R.	Mullett Cr.	USFWS[1]	Budzinski, Wendell, Birchwood, Crump, Indian Trail Rd. culverts	Concur	Ineffective barrier
Black R.	South Br.	USFWS[1]	Beaton, Quick, Poor Farm Rd. culverts	Concur	Ineffective barrier
Rifle R.	Crow Cr.	USFWS[1]	Townline Rd. culvert	Concur	Ineffective barrier
Saginaw R.	Tittabawassee R.	USFWS[2]	Dow Dam	Do not concur	Intermittent barrier

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Alpena).
[2]U.S. Fish and Wildlife Service, Ecological Services (East Lansing).

New Construction

- No new construction projects were initiated or underway.

Assessment of Candidate Streams

- Bighead River–Department staff met with OMNR personnel during April, 2013 to discuss a proposal to construct sea lamprey barriers on the Bighead and Pine rivers. Although the reception was generally positive, concerns were raised about impacts to fish passage, and to some extent, the proposed sites. The Department is still awaiting feedback from the OMNR. To avoid potential safety concerns related to a previously proposed site in the town of Meaford, an alternative site has been identified on private land a few kilometers upstream. Data collection commenced in 2013 and will continue during 2014.

- Pine River (Nottawasaga River tributary) – During the aforementioned meeting, the Department proposed a barrier site on the Pine River in the Town of Angus. OMNR staff indicated that a site within Canadian Forces Base Borden would be preferable from a public safety perspective. Two prospective sites have been identified within the confines of the base and data collection will continue in 2014.

Lake Erie

The Commission has invested in seven barriers on Lake Erie (Figure 2), all of which were purpose-built as sea lamprey barriers.

Barrier Inventory and Project Selection System

- Field crews visited 217 structures on tributaries to Lake Erie to assess sea lamprey blocking potential and to improve the information in the BIPSS.

Operation and Maintenance

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

- Repairs or improvements were conducted on one Canadian barrier:

    - Little Otter Creek – Maintenance was completed on an access road that was damaged by rain and erosion.

Ensure Blockage to Sea Lamprey Migration

- Consultations to ensure blockage at barriers in two tributaries were completed with partner agencies (Table 10).

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

Mainstream	Tributary	Agency	Project	SLCP Position	Comments
Toussaint R.		USFWS[1]	Install water control structure at dike	Concur	Will not affect SLCP operations
Raisin R.	South Br.	USFWS[1]	Tecumseh Dam	Concur	Upstream of blocking barrier

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Alpena).

New Construction

- Grand River – The USACE developed several alternatives for construction, including: status quo, rebuild onsite, or rebuild further downstream. The USACE selected an onsite rebuild as the preferred alternative and delivered the Detailed Project Report to USACE District Headquarters for approval. During fall 2013, Service staff completed electrofishing and larval habitat surveys in the upstream reaches of the Grand River and developed stream production estimates using two methods, both of which have caveats. The population estimate, when using native lamprey density upstream of the Harpersfield Dam, was 1,052,879 sea lamprey larvae; the estimate when using sea lamprey density downstream of the Harpersfied Dam was 280,875 sea lamprey larvae.

Assessment of Candidate Streams

- Big Otter Creek – Discussion was initiated with the Township of Tillsonburg, OMNR, and Long Point Regional Conservation Authority concerning the potential to retrofit the Black Water Dam in Tillsonburg to block sea lampreys. Collection of hydrologic and hydraulic data continued.

Lake Ontario

The Commission has invested in 16 barriers on Lake Ontario (Figure 2). Of these, 10 were purpose-built as sea lamprey barriers and 6 were constructed for other purposes, but have been modified to block sea lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited 136 structures on tributaries to Lake Ontario to assess sea lamprey blocking potential and to improve the information in the BIPPS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 11 barriers (9 Canada, 2 U.S.).

- Duffins Creek – An investigation is underway to improve safety around the dam while restoring the sea lamprey control function of the barrier.

- Repairs or improvements were conducted on five Canadian barriers:

    - Humber River –Handrails were fabricated and installed around the working platform in spring 2013. They were removed following the sea lamprey migration period to avoid damage from early spring flood debris and ice.

    - Duffin's Creek – The downstream flow monitoring gauge was repaired in October 2013.

    - Shelter Valley – A deteriorating concrete toe wall of unknown origin, located approximately 30m downstream from the sea lamprey barrier, has been removed and the stream bed restored to a natural state.

    - Credit River – Efforts are underway to address sea lamprey escapement at the Kraft Mill Dam and through the fishway. An overhanging lip that had been damaged previously by ice was redesigned and replaced. Consultation with the OMNR to address escapement at the fishway is underway.

- Cobourg Creek – Efforts were undertaken to correct hydrological patterns that resulted in chronic clogging of the water intake screen and insufficient flow through the fishway that has existed for several years. In early spring 2013, this problem became more serious, and was likely having a negative effect on trapping and fish passage. Remedial work included the placement of boulders to fill in the scour located along the west bank and the removal of sediments that had accumulated along the east bank adjacent to the fishway. The channel cross-section was returned to the more uniform shape that existed after the barrier was first constructed so that flow is evenly distributed across the stream bed and sufficient water is provided through the fishway. The screen will be monitored for blockage in the future, and replaced with a self-cleaning Johnson screen, if required.

New Construction

- Orwell Brook – Construction of the sea lamprey barrier and trap on Orwell Brook was completed. Trapping operations began in spring 2013 and a total of 435 sea lampreys were captured, the most from any trap operated on the U.S. side of Lake Ontario. Level loggers have been installed upstream and downstream of the dam to monitor flow characteristics and evaluate the hydraulic performance of the barrier. Larval assessment surveys conducted during August 2013 revealed no young-of-year upstream of the dam.

ASSESSMENT

The Assessment Program has three components, which are described as follows:

1. Larval Assessment determines the relative abundance and distribution of sea lamprey larvae in streams and lentic areas. These data are used to predict where larvae greater than 100 mm total length will most likely be found by the end of the growing season during the year of sampling. These predictions are used to prioritize lampricide treatments for the following year.

2. Juvenile Assessment evaluates the lake-specific rate of lake trout marking inflicted by sea lamprey. These time series data are used in conjunction with adult assessment data to assess the effectiveness of the SLCP for each lake. In addition, several indices of relative abundance of feeding juveniles are used to monitor sea lamprey populations over time.

3. Adult Assessment annually estimates the stock size of adult sea lampreys in each lake. Because this life stage is comprised of individuals that have either survived or avoided control efforts, the time series of adult abundance is useful in evaluating the effectiveness of the SLCP.

The Larval Assessment Task Force (LATF) and the Trapping Task Force (TTF) were created by the Commission in 2012. The LATF is responsible for ranking streams and lentic areas for sea lamprey control options and evaluating the success of lampricide treatments through assessment of residual larvae.The TTF is responsible for optimizing trapping techniques for assessing adult sea lamprey populations and removing adults and juveniles. The task force reports on their charges during 2013 are presented in the LATF and TTF sections of this report.

Larval Assessment

Tributaries considered for lampricide treatment during 2014 were assessed during 2013 to define the distribution and estimate the density and size structure of larval sea lamprey populations. Assessments were conducted with backpack electrofishers in waters <0.8 m deep, while waters ≥0.8 m 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 larval sea lampreys in each infested area was estimated by multiplying the mean density of larvae ≥100 mm (number per m^2) by an estimated area of suitable habitat (m^2). Infested areas were ranked for treatment during 2014 based on the lowest cost per kill of larval sea lampreys ≥100 mm, as estimated using this index of abundance and average treatment costs. However, in response to increased sea lamprey abundance in Lake Erie, any infested areas in that lake where surveys indicate the presence of larvae >100 mm are scheduled for treatment in 2014. 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.

Lake Superior

- Larval assessments were conducted on a total of 177 tributaries (54 Canada, 123 U.S.) and offshore of 21 tributaries (7 Canada, 14 U.S.). The status of larval sea lamprey populations in historically infested Lake Superior tributaries and lentic areas is listed in Tables 11 and 12.

- Surveys to estimate larval abundance were conducted in 35 tributaries (5 Canada, 30 U.S.) and in lentic areas offshore of 7 tributaries (3 Canada, 4 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 80 tributaries (25 Canada, 55 U.S.). A new infestation was discovered in Schlotz Creek (U.S.).

- Post-treatment assessments were conducted in 34 tributaries (14 Canada, 20 U.S.) and 5 lentic areas (1 Canada, 4 U.S.) to determine the effectiveness of lampricide treatments conducted during 2012 and 2013.

- Surveys to evaluate barrier effectiveness were conducted in eight tributaries (four Canada, four U.S.). No upstream infestations were discovered.

- Biological collections for research or training purposes were conducted in three U.S. tributaries.

Table 11. Status of larval sea lampreys in Lake Superior tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2013.

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			
Canada							
East Davignon Cr.	May-72	Jun-13	---	No	---	---	Unknown
West Davignon Cr.	Jul-11	Jun-13	Yes	Yes	1,184	1,184	***2014***
Little Carp R.	May-08	Jul-12	---	No	---	---	Unknown
Big Carp R.	Sep-07	Jun-13	---	No	---	---	Unknown
Cranberry Cr.	May-11	Jul-13	No	No	---	---	Unknown
Goulais R.	Oct-12	Jul-13	Yes	---	---	---	2016
Boston's Cr.	Never	Jun-12	---	No	---	---	Unknown
Horseshoe Cr.	Never	Jun-11	---	No	---	---	Unknown
Havilland Cr.	Jul-13	Aug-12	---	---	---	---	Unknown
Stokely Cr.	Jun-08	Aug-12	---	No	---	---	Unknown
Tier Cr.	Never	Jun-12	---	No	---	---	Unknown
Harmony R.	Jun-09	Sep-13	---	Yes	19,173	9,116	***2014***
Sawmill Cr.	Jul-11	Jun-12	Yes	No	---	---	Unknown
Jones Landing Cr.	Never	Jul-13	---	No	---	---	Unknown
Tiny Cr.	Never	Aug-12	---	No	---	---	Unknown
Chippewa R.	Jul-10	Jul-13	No	Yes	---	---	Unknown
Unger Cr.	Jul-10	Jul-12	Yes	No	---	---	Unknown
Batchawana R.	Aug-11	Sep-12	Yes	Yes	195,738	35,815	***2014***
Digby Cr.	Jun-13	Jul-13	No	---	---	---	Unknown

Table 11 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
Carp R.	Jun-09	Jun-13	---	Yes	---	---	2015
Pancake R.	Jun-12	Jul-12	No	---	---	---	2016
Westman Cr.	Never	Aug-12	---	Yes	---	---	Unknown
Agawa R.	Sep-12	Sep-12	---	---	---	---	Unknown
Sand R.	Sep-71	Aug-12	---	No	---	---	Unknown
Baldhead R.	Never	Aug-12	---	No	---	---	Unknown
Gargantua R.	Aug-13	Aug-13	No	---	---	---	2017
Old Woman R.	Jul-12	Aug-13	Yes	Yes	6,513	388	Unknown
Michipicoten R.	Aug-08	Aug-12	---	Yes	---	---	***2014***[2]
Dog R.	Aug-63	Aug-12	---	Yes	---	---	Unknown
White R.	Jul-12	Jul-13	Yes	Yes	---	---	Unknown
Pic R.	Jul-13	Jul-11	---	---	---	---	2019
Nama Cr.	Jul-06	Jul-11	---	Yes			***2014***[2]
Little Pic R.	Aug-11	Aug-13	No	No	---	---	Unknown
Prairie R.	Jul-94	Aug-12	---	No	---	---	Unknown
Steel R.	Jul-12	Aug-12	Yes	---	---	---	2016
Pays Plat R.	Jul-11	Aug-12	Yes	Yes	---	---	2016
Little Pays Plat Cr.	Jul-07	Aug-12	---	Yes	---	---	Unknown
Gravel R.	Jul-12	Aug-13	Yes	Yes	---	---	2016
Little Gravel R.	Jul-13	Aug-13	Yes	---	---	---	Unknown
Little Cypress	Never	Aug-13	---	Yes	1,199	1,199	***2014***
Cypress R.	Jul-13	Aug-13	Yes	---	---	---	2017
Jackpine R.	Never	Aug-13	---	No	---	---	Unknown
Jackfish R.	Jul-12	Aug-13	No	No	---	---	2016
Nipigon R.							
Upper Nipigon R.	Aug-09	Aug-12	Yes	Yes	---	---	***2014***[1]
Lower Nipigon R.	Aug-06	Jun-12	---	Yes	---	---	Unknown
Cash Cr.	Jul-09	Aug-13	---	Yes	---	---	Unknown
Polly Cr.	Jul-87	Aug-13	---	No	---	---	Unknown
Stillwater Cr.	Aug-13	Aug-13	Yes	---	---	---	2017
Big Trout Cr.	Jul-10	Jun-12	No	Yes	---	---	Unknown
Otter Cove Cr.	Aug-71	Jun-12	---	No	---	---	Unknown
Black Sturgeon R.	Aug-11	Aug-13	No	No	---	---	Unknown
Big Squaw Cr.	Jun-72	Jun-09	---	No	---	---	Unknown
Wolf R.	Jul-11	Aug-13	Yes	Yes	---	---	2015
Coldwater Cr.	Jul-12	Aug-12	Yes	---	---	---	Unknown
Pearl R.	Jul-10	Jun-12	Yes	Yes	---	---	Unknown
D'Arcy Cr.	Jul-10	Jun-12	Yes	No	---	---	Unknown
Blende Cr.	Jul-13	Aug-13	No	---	---	---	Unknown
MacKenzie R.	Aug-13	Aug-13	Yes	---	280	102	Unknown
Neebing-McIntyre FW	Jul-13	Aug-13	Yes	---	---	---	Unknown
Kaministiquia R.	Oct-13	Aug-13	---	---	---	---	2016
Corbett Cr.	Jul-13	Aug-13	Yes	---			2016
Whitefish R.	Oct-13	Aug-13	---	---			2016

Table 11 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
Cloud R.	Jul-12	Aug-12	No	---	---	---	Unknown
Pine R.	Jul-73	Aug-11	---	No	---	---	Unknown
Pigeon R.	Jul-12	Aug-12	Yes	---	---	---	Unknown
United States							
Waiska R.	Jul-07	Sep-11	No	No	---	---	Unknown
Sec 11SW Cr.	Never	Jul-13	---	Yes	---	---	Unknown
Pendills Cr.	Jul-12	Jun-13	No	---	---	---	Unknown
Grants Cr.	Jun-08	Jul-13	No	Yes	1,910	0	Unknown
Halfaday Cr.	Jul-12	Jun-13	Yes	Yes	---	---	Unknown
Naomikong Cr.	Jul-63	Jul-13	---	Yes	---	---	Unknown
Ankodosh Cr.	Jun-08	Aug-13	No	Yes	7,306	1,370	Unknown
Roxbury Cr.	Jun-08	Aug-13	No	Yes	5,745	1,077	Unknown
Galloway Cr.	Jul-07	Jul-13	No	Yes	1,931	322	Unknown
Tahquamenon R.	Oct-10	Aug-13	Yes	Yes	---	---	***2014***[1]
Betsy R.	Oct-10	Jul-13	No	Yes	---	---	Unknown
Three Mile Cr.	Jun-62	Jun-11	---	No	---	---	Unknown
Little Two Hearted R.	Jul-12	Jun-13	No	---	---	---	Unknown
Two Hearted R.	Aug-10	Sep-12	Yes	Yes			***2014***[1]
Dead Sucker R.	Aug-13	Sep-13	No	---	---	---	Unknown
Sucker R. (Alger Co.)	Sep-10	Sep-13	Yes	Yes	---	---	***2014***[1]
Chipmunk Cr.	Sep-62	Jul-13	---	No	---	---	Unknown
Carpenter Cr.	Aug-05	Jul-13	Yes	Yes	---	---	Unknown
Sable Cr.	Sep-89	Jul-13	---	Yes	---	---	Unknown
Hurricane R.	Never	Jun-12	---	Yes	---	---	Unknown
Sullivans Cr.	Sep-10	Aug-12	No	Yes	---	---	Unknown
Seven Mile Cr.	Jul-67	Aug-12	---	No	---	---	Unknown
Beaver Lake Cr.							
Lowney Cr.	Sep-10	May-12	Yes	Yes	---	---	Unknown
Mosquito R.	Jun-73	May-12	---	No	---	---	Unknown
Miners R.							
Barrier downstream	Jul-13	Sep-13	Yes	Yes	---	---	2017
Barrier upstream	Jul-13	Sep-13	No	No	---	---	Unknown
Munising Falls Cr.	Sep-64	Jun-12	---	Yes	---	---	Unknown
Anna R.	Jul-13	Sep-13	No	No	---	---	Unknown
Tourist Park Cr.	Never	Jun-12	---	---	---	---	Unknown
Furnace Cr.							
Lower	Sep-10	Jun-13	Yes	Yes	6,988	434	Unknown
Upper	Sep-10	Jun-13	No	No	---	---	Unknown
Five Mile Cr.	Jul-13	Sep-13	Yes	No	---	---	Unknown
Au Train R.							
Upper	Jun-11	Aug-13	Yes	Yes	178,318	43,739	***2014***
Lower	Jun-11	Aug-13	No	No	---	---	Unknown
Rock R.	Jul-02	May-09	---	No	---	---	Unknown
Deer Lake Cr.	Aug-70	Jun-12	---	No	---	---	Unknown

Table 11 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
Laughing Whitefish R.	Jun-11	Jun-13	No	Yes	24,162	5,421	***2014***
Sand R.							
Below Dam	Jul-12	Aug-12	No	---	---	---	2015
Above Dam	Jul-12	Aug-13	Yes	---	32,581	108	2015
Chocolay R.	Jul-12	Aug-12	Yes	Yes	---	---	2016
Carp R.	Jul-12	Aug-13	Yes	Yes	103,195	5,312	***2014***
Dead R.	Jul-12	Jun-13	Yes	---	5,929	1,976	***2014***
Harlow Cr.	Jun-11	Aug-13	No	Yes	34,560	1,980	2015
Little Garlic R.	Oct-10	Aug-13	Yes	Yes	---	---	***2014***[1]
Garlic R.	Jun-11	Aug-11	Yes	Yes	---	---	2015
Iron R.	Aug-13	Aug-13	No	---	---	---	2017
Salmon Trout R. (Marquette Co.)	Jul-12	Oct-12	Yes	Yes	---	---	2016
Pine R.	Jun-11	Oct-13	Yes	Yes	---	---	Unknown
Huron R.	Aug-13	Jul-13	---	---	---	---	2016
Ravine R.	Sep-13	Jul-13	---	---	---	---	***2014***
Slate R.	Sep-13	Aug-12	---	---	---	---	Unknown
Silver R.	Sep-13	Jul-13	---	---	---	---	***2014***
Falls R.	Aug-13	Jul-13	---	---	---	---	***2014***
Six Mile Cr.	May-63	Jul-13	---	Yes	362	72	Unknown
Little Carp R.	Oct-12	Jul-13	No	---	---	---	Unknown
Kelsey Cr.	Never	Jul-13	---	Yes	---	---	Unknown
Sturgeon R.	Aug-13	Oct-13	Yes	---	25,537	8,512	Unknown
Pilgrim R.	Aug-62	Jun-13	---	Yes	2,752	2,752	Unknown
Trap Rock R.	Jul-11	Jun-13	No	Yes	40,391	1,910	2015
McCallum Cr.	Aug-63	Jul-10	---	No	---	---	Unknown
Traverse R.	Jun-12	Sep-13	Yes	Yes	62,665	2,183	2015
Little Gratiot R.	Aug-72	May-12	---	No	---	---	Unknown
Eliza Cr.	Jul-11	May-12	No	Yes	---	---	Unknown
Gratiot R.	Jul-11	May-12	Yes	Yes	---	---	Unknown
Smiths Cr.	May-64	Jul-11	---	No	---	---	Unknown
Boston-Lily Cr.	Aug-62	Aug-12	No	No	---	---	Unknown
Schlotz Cr.	Never	Jun-13	---	Yes	2,013	67	Unknown
Salmon Trout R. (Houghton Co.)	Jul-13	Sep-13	No	Yes	---	---	Unknown
Mud Lake Outlet	Oct-73	Jul-10	---	No	---	---	Unknown
Graveraet R.	Aug-63	Jun-13	---	Yes	2,854	486	2015
Elm R.	Jul-07	Sep-13	No	Yes	7,910	293	Unknown
Misery R.							
Barrier downstream	Jul-11	Aug-12	No	Yes	---	---	2015
Barrier upstream	Sep-00	Jun-12	---	No	---	---	Unknown
East Sleeping R.	Jul-13	Aug-13	No	---	---	---	2017
West Sleeping R.	Aug-09	Aug-13	No	Yes	16,242	3,455	***2014***
Firesteel R.	Oct-11	Aug-13	Yes	Yes	89,437	1,265	2015
Ontonagon R.	Oct-12	Aug-13	Yes	Yes	84,198	2,833	2015

Table 11 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
Potato R.	May-11	Aug-13	No	Yes	---	---	***2014***[1]
Floodwood R.	Never	Aug-10	---	No	---	---	Unknown
Cranberry R. (Ontonagon Co.)	May-11	Aug-13	Yes	Yes	---	---	***2014***[1]
Mineral R.	Oct-10	Jul-13	No	Yes	82,271	42,450	Unknown
Big Iron R.	Never	Aug-13	No	Yes	53	0	Unknown
Little Iron R.	Sep-75	Aug-13	---	Yes	---	---	Unknown
Union R.	May-64	Jul-13	---	No	---	---	Unknown
Black R.	Jul-10	Jul-11	No	---	---	---	Unknown
Montreal R.	Jul-75	Aug-13	---	No	---	---	Unknown
Washington Cr.	Jun-80	Jul-12	---	No	---	---	Unknown
Bad R.	Sep-11	Sep-12	Yes	Yes	---	---	***2014***[1]
Fish Cr. (Eileen Twp)	Jul-10	Aug-13	No	Yes	9,409	855	Unknown
Sioux R.	Never	Aug-13	---	Yes	43,380	3,643	Unknown
Pikes Cr.	Never	Jul-12	---	Yes	---	---	Unknown
Red Cliff Cr.	Sep-11	Aug-13	No	Yes	393	79	Unknown
Raspberry R.	Jun-63	Jul-12	---	No	---	---	Unknown
Sand R.	Sep-11	Aug-13	Yes	Yes	4,238	2,119	Unknown
Cranberry R. (Bayfield Co.)	Jul-13	Sep-13	No	---	---	---	Unknown
Iron R.							
Barrier downstream	Jul-13	Sep-13	No	---	---	---	Unknown
Barrier upstream	Oct-64	Sep-12	---	No	---	---	Unknown
Reefer Cr.	Oct-64	Sep-13	---	No	---	---	Unknown
Fish Cr. (Orienta Twp)	Oct-64	Aug-13	---	No	---	---	Unknown
Brule R.							
Barrier downstream	Jun-12	Sep-12	Yes	Yes	---	---	2015
Barrier upstream	Jun-86	Sep-12	---	No	---	---	Unknown
Poplar R.	Sep-11	Aug-13	No	Yes	1,613	538	Unknown
Middle R.							
Barrier downstream	Jul-13	Sep-13	No	---	---	---	Unknown
Amnicon R.	Jun-12	Sep-12	Yes	Yes	---	---	2015
Nemadji R.	Oct-13	Aug-13	---	---	---	---	Unknown
St. Louis R.	Sep-87	Sep-11	---	No	---	---	Unknown
Sucker R. (St. Louis Co.)	Never	Jun-10	---	No	---	---	Unknown
Gooseberry R.	Aug-76	Aug-12	---	Yes	---	---	Unknown
Splitrock R.	Aug-76	Jun-10	---	No	---	---	Unknown
Poplar R.	Jul-77	Aug-12	---	Yes	---	---	Unknown
Arrowhead R.	Jun-09	Sep-13	No	Yes	444	0	Unknown

[1] Stream being treated based on expert judgement
[2] Stream deferred for treatment from 2013

Table 12. Status of larval sea lampreys in historically infested lentic areas of Lake Superior during 2013.

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	Jun-12	Jun-12	Never
Stokely Cr.	Havilland Bay	Jun-13	Jul-09	Aug-11
Harmony R.	Batchawana Bay	Jun-13	Jun-13	Aug-12[1]
Chippewa R.	Batchawana Bay	Sep-11	Sep-11	Aug-11
Batchawana R.	Batchawana Bay	Jun-13	Jun-13	Aug-12[1]
Carp R.	Batchawana Bay	Oct-12	Oct-12	Aug-07
Agawa R.	Agawa Bay	Aug-12	Aug-12	Aug-10
Michipicoten R. (Lower)	Marina Area (M001)	Aug-12	Aug-12	Sep-13[1]
Gravel R.	Mountain Bay	Aug-13	Aug-13	Aug-13
Little Cypress R.	Cypress Bay	Aug-78	Aug-78	Never
Cypress R.	Cypress Bay	Jun-12	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-12	Aug-12	Aug-10
Nipigon R. (Lower)	Nipigon Bay	Jun-10	Jul-02	Oct-11
Nipigon R.	Stillwater (T003)	Aug-13	Aug-13	Aug-13
Nipigon R.	Polly Lake	Jun-12	Jul-90	Jul-87
Big Trout Cr.	Nipigon Bay	Jun-12	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-12	Aug-12	Aug-13
Current R.	Thunder Bay	Aug-13	Aug-13	Aug-10[1]
Neebing-McIntyre Floodway	Thunder Bay	Aug-05	Jul-90	Never
Kaministiquia R. (Lower)	Thunder Bay (M001)	Aug-13	Aug-13	Oct-13
Pigeon R.	Pigeon Bay	Aug-13	Aug-13	Aug-10
United States				
Pendills Cr.	Tahquamenon Bay	Jul-12	Jul-12	Never[2]
Grants Cr.	Tahquamenon Bay	Jul-13	Jul-13	Never[2]
Ankodosh Cr.	Tahquamenon Bay	Jun-13	Jun-13	Jul-11
Halfaday Cr.	Tahquamenon Bay	Jul-12	Jul-12	Never[2]
Roxbury Cr	Tahquamenon Bay	Jun-13	Jun-13	Never[2]
Galloway Cr.	Tahquamenon Bay	Jun-13	Jul-88	Never
Sucker R.	Grand Marais Harbor	Sep-09	Aug-90	Never
Carpenter Cr.	West Bay	Sep-13	Sep-13	Sep-12
Beaver Lake Cr.	Beaver Lake	Sep-10	Sep-10	Never[2]
Anna R.	Munising Bay	Aug-12	Aug-12	Aug-11
Miners R.	Miners Lake	Sep-13	Sep-13	Jun-11
Furnace Cr.	Furnace Bay	Aug-13	Aug-13	Aug-10
	Furnace Lake – Outlet	Jun-12	Jun-12	Never[2]
	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]

Table 12 continued.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Carp R.	Offshore mouth	Aug-11	Aug-11	Never[2]
Dead R.	Presque Isle Harbor	Jun-13	Jun-13	Jul-12
Harlow Cr.	Harlow Lake – Offshore Bismark Cr.	Jun-13	Jun-13	Never[2]
Little Garlic R.	Little Garlic R.	Sep-11	Sep-11	Jul-12
Garlic R.	Garlic R. offshore mouth	Jul-12	Sep-05	Never[2]
	Saux Head Lake	Aug-11	Jul-10	Never[2]
Ravine R.	Huron Bay	Jul-13	Jul-13	Jun-12
Slate R.	Huron Bay	Jul-13	Jul-13	Never[2]
Silver R.	Huron Bay	Aug-12	Aug-12	Aug-11
Falls R.	Huron Bay	Jul-13	Jul-13	Jun-12
Trap Rock R.	Torch Lake	Aug-11	Aug-11	Aug-13
Eliza Cr.	Eagle Harbor	Jul-03	Sep-78	Never
Mineral R.	Offshore mouth	Sep-11	Sep-11	Never[2]
Black R.	Black River Harbor	Jun-12	Jun-12	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	Aug-12	Aug-12	Never

[1] Scheduled for treatment during 2014
[2]Low-density larval population monitored with 3.2% granular Bayluscide surveys

Lake Michigan

- Larval assessment surveys were conducted on a total of 113 tributaries and offshore of 14 tributaries. The status of larval sea lamprey populations in historically infested Lake Michigan tributaries and lentic areas is presented in Tables 13 and 14.

- Surveys to estimate the abundance of larval sea lampreys were conducted in 34 tributaries.

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 21 tributaries. No new populations were discovered.

- Post-treatment assessments were conducted in 25 tributaries and 3 lentic areas to determine the effectiveness of lampricide treatments during 2012 and 2013.

- Surveys to evaluate barrier effectiveness were conducted in 11 tributaries. Sea lamprey larvae were found upstream from blocking structures on the Kewaunee and Boardman rivers and Trail Creek. Infestations on the Boardman River and Trail Creek were from escapement prior to recent repairs; no new recruitment was observed in 2013. Casco Creek (Kewaunee River) and Trail Creek have been scheduled for treatment during 2014.

- Surveys to collect larval sea lampreys for pheromone extraction were conducted in five tributaries.

Table 13. Status of larval sea lampreys in Lake Michigan tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2013.

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.							
Upper	May-12	Jul-13	No	No	---	---	Unknown
Lower	Aug-13	May-13	---	---	---	---	Unknown
Paquin Cr.	Oct-87	Apr-12	---	Yes	---	---	Unknown
Davenport Cr.	Sep-13	Jun-13	---	---	---	---	Unknown
Hog Island Cr.	Sep-13	Jun-13	---	---	---	---	2017[2]
Sucker R.	Jun-61	Sep-12	---	Yes	---	---	Unknown
Black R.	Jun-13	Sep-13	No	No	---	---	2017[2]
Mattix Cr.	Sep-13	Sep-12	---	---	---	---	Unknown
Mile Cr.	Oct-13	Jun-13	---	---	---	---	Unknown
Millecoquins R.	Oct-13	Sep-13	---	---	---	---	2016[2]
Rock R.	Sep-13	Jul-13	---	---	---	---	Unknown
Crow R.	Sep-13	Jun-13	---	---	---	---	Unknown
Cataract R.	Sep-13	Jul-13	---	---	---	---	Unknown
Pt. Patterson Cr.	Jul-13	Jun-13	---	---	---	---	Unknown
Hudson Cr.	Jul-13	Jun-13	---	---	---	---	Unknown
Swan Cr.	Jul-13	Jun-13	---	---	---	---	Unknown
Seiners Cr.	May-84	May-12	---	Yes	---	---	Unknown
Milakokia R.	Jul-13	Aug-13	No	No	---	---	2017[2]
Bulldog Cr.	Sep-13	Sep-13	---	---	---	---	Unknown
Gulliver Lake Outlet	Sep-13	Sep-13	---	---	---	---	Unknown
Marblehead Cr.	Sep-13	May-13	---	---	---	---	Unknown
Manistique R.							
Barrier upstream	Sep-12	Sep-13	Yes	Yes	---	---	2014[1]
Barrier downstream	Jun-13	Sep-13	Yes	Yes	---	---	2014[1]
Southtown Cr.	Jul-13	Sep-13	No	No	---	---	Unknown
Thompson Cr.	Never	May-13	---	Yes	173	173	Unknown
Johnson Cr.	Jun-13	Aug-13	No	No	---	---	Unknown
Deadhorse Cr.	Sep-13	Aug-13	---	---	---	---	Unknown
Gierke Cr.	Never	May-10	---	Yes	---	---	Unknown
Bursaw Cr.	Sep-13	Aug-13	---	---	---	---	Unknown
Parent Cr.	Jul-13	Sep-13	No	No	---	---	Unknown
Poodle Pete Cr.	Sep-13	Aug-13	---	---	---	---	Unknown
Valentine Cr.	May-12	Jul-12	No	No	---	---	Unknown
Little Fishdam R.	May-01	Apr-12	---	No	---	---	Unknown
Big Fishdam R.	Sep-11	Jul-13	Yes	Yes	---	---	Unknown
Sturgeon R.	Aug-13	Jun-13	---	---	---	---	2016[2]
Ogontz R. (Entire)	Oct-10	Sep-13	Yes	Yes	---	---	2014[2]
W. Br. Ogontz R.	Sept-11	Sept-13	Yes	Yes	---	---	2014[2]
Squaw Cr.	May-12	Jun-12	No	No	---	---	Unknown
Hock Cr.	May-81	Sep-13	---	Yes	0	0	Unknown
Whitefish R.	Jun-13	Oct-13	Yes	Yes	72,553	2,315	2016[2]
Bills Cr.	Jun-13	Jul-13	Yes	---	36,270	2,315	2014

Table 13 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Status of Larval Lamprey Population (surveys since last treatment) Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Rapid R.	May-12	Jul-13	Yes	Yes	17,504	2,276	2015[2]
Tacoosh R.	May-07	Jul-13	Yes	Yes	3,294	3,294	2014[2]
Days R.							
Barrier downstream	Sep-13	Jul-13	---	---	---	---	2014
Barrier upstream	Oct-11	Jul-12	Yes	Yes	---	---	Unknown
Portage Cr.	Oct-09	Sep-13	Yes	Yes	0	0	Unknown
Ford R.	May-13	Oct-13	Yes	Yes	---	---	2014[1]
Sunnybrook Cr.	May-71	Jun-13	---	Yes	---	---	Unknown
Bark R.	Oct-11	Apr-12	No	No	---	---	Unknown
Cedar R.	May-13	Jul-13	Yes	---	3,596	0	2014[1]
Sugar Cr.	May-08	Aug-12	No	No	---	---	Unknown
Arthur Bay Cr.	Jun-10	Jun-13	Yes	No	---	---	Unknown
Rochereau Cr.	Apr-63	Aug-10	---	No	---	---	Unknown
Johnson Cr.	May-10	Aug-12	No	No	---	---	Unknown
Bailey Cr.	Apr-09	Aug-13	Yes	Yes	364	182	Unknown
Beattie Cr.	May-09	Jul-13	Yes	Yes	120	13	Unknown
Springer Cr.	Apr-13	Jul-13	No	---	---	---	Unknown
Menominee R.	Jun-07	Aug-12	Yes	Yes	---	---	Unknown
Little R.	Aug-77	Jun-11	---	No	---	---	Unknown
Peshtigo R.	Oct-11	Aug-13	Yes	Yes	82,682	16,536	2014
Oconto R.	May-12	Jun-12	No	No	---	---	Unknown
Pensaukee R.	Nov-77	Jun-12	---	No	---	---	Unknown
Suamico R.	Never	Jun-12	---	No	---	---	Unknown
Ephraim Cr.	Apr-63	Jun-11	---	No	---	---	Unknown
Hibbards Cr.	May-07	May-12	No	No	---	---	Unknown
Whitefish Bay Cr.	May-87	Aug-13	---	Yes	237	237	Unknown
Shivering Sands Cr.	Apr-12	Jun-12	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	Aug-13	No	Yes	31	31	Unknown
Ahnapee R.	Apr-64	Aug-13	No	No	---	---	Unknown
Three Mile Cr.	Sep-08	Aug-13	Yes	Yes	6,904	1,808	2014
Kewaunee R.							
Barrier downstream	May-75	May-12	---	Yes	---	---	Unknown
Barrier upstream	May-75	Aug-13	---	Yes	487	487	Unknown
Casco Cr.	May-07	Aug-13	---	Yes	3,098	2,279	2014
Scarboro Cr.	May-75	Aug-13	---	Yes	---	---	Unknown
East Twin R.	Oct-08	Aug-13	Yes	Yes	391	391	Unknown
Fischer Cr.	May-87	May-12	---	No	---	---	Unknown
French Farm Cr.	Never	Jun-11	---	No	---	---	Unknown
Carp Lake Outlet	Sep-13	Oct-13	No	No	---	---	2017
Big Stone Cr.	Sep-13	Oct-13	No	No	---	---	Unknown
Big Sucker R.	Sep-13	Sep-13	---	---	---	---	Unknown
Wycamp Lake Outlet	Sep-13	Sep-13	---	---	---	---	Unknown

Table 13 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Status of Larval Lamprey Population (surveys since last treatment) Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Bear R.	Never	Jun-12	---	No	---	---	Unknown
Horton Cr.	Sep-13	Jun-13	---	---	---	---	2017
Boyne R.	Sep-13	May-13	---	---	---	---	2017
Porter Cr.	Sep-13	Jun-13	---	---	---	---	2017
Jordan R.	Jul-11	Oct-13	Yes	Yes	---	---	2014[1]
Monroe Cr.	Aug-13	Jun-13	---	---	---	---	Unknown
Loeb Cr.	Aug-13	Jun-13	---	---	---	---	2017
McGeach Cr.	Oct-99	Jun-12	---	No	---	---	Unknown
Elk Lake Outlet	Jul-11	Oct-13	No	No	---	---	Unknown
Yuba Cr.	May-06	Jun-12	---	No	---	---	Unknown
Acme Cr.	Aug-63	Jun-12	---	No	---	---	Unknown
Mitchell Cr.	Jun-13	Sep-13	No	No	---	---	2016
Boardman R. (lower)	Jun-09	Jun-13	No	Yes	2,753	1,943	2015
Boardman R. (mid.)	Oct-11	Sep-13	No	Yes	9,426	628	2015
Hospital Cr.	Jun-09	Sep-13	No	Yes	229	229	2015
Leo Cr.	Never	Jun-13	---	No	---	---	Unknown
Good Harbor Cr.	Jul-10	Jul-13	No	No	---	---	Unknown
Crystal R.	Nov-11	Jun-13	No	No	---	---	Unknown
Platte R. (upper)	Jun-12	Sep-13	Yes	Yes	105,335	18,319	2014
Platte R. (middle)	Aug-12	Sep-13	No	Yes	---	---	2014[3]
Platte R. (lower)	Jun-12	Sep-13	Yes	Yes	33,631	13,916	2014
Betsie R.	Jun-13	Jul-13	No	---	---	---	2014[1]
Bowen Cr.	Jun-09	Jul-13	No	No	---	---	Unknown
Big Manistee R.	Aug-13	Oct-12	---	---	---	---	2016
Bear Cr.	Jul-13	Jul-13	---	---	---	---	2016
L. Manistee R.	Jul-11	Oct-13	No	Yes	---	---	2014[2]
Gurney Cr.	Aug-09	Oct-13	No	Yes	909	0	2015
Cooper Cr.	Jul-08	Jun-11	No	No	---	---	Unknown
Lincoln R.	Aug-10	Oct-13	No	Yes	---	---	2014[2]
Pere Marquette R.	Jul-12	Aug-13	Yes	Yes	85,861	42,930	2014
Bass Lake Outlet	Aug-78	Sep-13	---	No	---	---	Unknown
Pentwater R. (N. Br.)	Jul-13	Oct-13	No	No	---	---	2017
South Branch	Never	Oct-09	---	No	---	---	Unknown
Lambricks Cr.	Sep-84	Oct-09	---	No	---	---	Unknown
Stony Cr.	Jun-10	Sep-12	No	No	---	---	Unknown
Flower Cr.	Jun-11	Sep-13	No	Yes	---	---	2015
White R.	Aug-13	Oct-13	No	No	---	---	2014[1]
Duck Cr.	Jul-84	Sep-12	---	No	---	---	Unknown
Muskegon R.	Aug-11	Sep-13	Yes	Yes	---	---	2014[2]
Brooks Cr.	Aug-10	Sep-13	No	Yes	---	---	2014[2]
Cedar Cr.	Aug-10	Sep-13	No	Yes	---	---	2014[2]
Bridgeton Cr.	Aug-11	Sep-13	No	No	---	---	2014[2]
Minnie Cr.	Aug-11	Sep-13	No	No	---	---	2014[2]
Bigelow Cr.	Aug-08	Sep-13	No	Yes	---	---	2014[2]

Table 13 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Status of Larval Lamprey Population (surveys since last treatment) Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Big Bear Cr.	Aug-70	Sep-12	---	No	---	---	Unknown
Mosquito Cr.	Sep-68	Sep-13	---	No	---	---	Unknown
Black Cr.	Aug-08	Jul-13	No	No	---	---	Unknown
Grand R.	Never	Jul-12	---	No	---	---	Unknown
Norris Cr.	Aug-08	Jun-13	---	No	---	---	Unknown
Lowell Cr	Sep-65	Jun-13	---	No	---	---	Unknown
Buck Cr.	Sep-65	Jul-12	---	No	---	---	Unknown
Rush Cr.	Sep-65	Jun-13	---	No	---	---	Unknown
Sand Cr.	Jun-07	Jun-13	---	No	---	---	Unknown
Crockery Cr.	Jul-12	Oct-13	No	No	---	---	2015
Bass R.	Aug-04	Jun-13	---	No	---	---	Unknown
Rogue R.	Sep-09	Oct-13	No	No	---	---	Unknown
Pigeon R.	Oct-64	Jun-13	---	No	---	---	Unknown
Pine Cr.	Oct-64	Jun-13	---	No	---	---	Unknown
Gibson Cr.	Jul-84	Jul-13	---	No	---	---	Unknown
Kalamazoo R.	Oct-65	Jul-12	---	No	---	---	Unknown
Bear Cr.	Sep-10	Sep-13	No	Yes	4,673	610	2014
Sand Cr.	Sep-10	Sep-13	No	Yes	5,220	345	2015
Mann Cr.	Oct-12	Jun-13	No	No	---	---	2016
Rabbit R.	Aug-08	Jul-13	No	Yes	5,747	3,861	2015
Swan Cr.	Jul-13	Sep-13	No	No	---	---	2017
Allegan 3 Cr.	Sep-65	Jul-13	---	No	---	---	Unknown
Allegan 4 Cr.	Oct-78	Sep-12	---	No	---	---	Unknown
Allegan 5 Cr.	Never	Jun-13	---	No	---	---	Unknown
Black R.							
North Branch	Jun-77	Sep-11	---	No	---	---	Unknown
Middle Branch	Jun-11	Jul-13	No	Yes	9,923	6,615	2014
South Branch	Never	Jul-13	---	No	---	---	Unknown
Brandywine Cr.	Aug-85	Sep-12	---	No	---	---	Unknown
Rogers Cr.	May-98	Sep-13	---	Yes	937	352	2015
St. Joseph R.	Never	Jul-10	---	No	---	---	Unknown
Lemon Cr.	Oct-65	Sep-11	---	No	---	---	Unknown
Pipestone Cr.	Sep-10	Sep-13	No	Yes	14,673	4,634	2014
Meadow Dr.	Oct-65	Sep-11	---	No	---	---	Unknown
Hickory Cr.	Oct-65	Sep-13	---	Yes	15,816	2,433	2015
Paw Paw R.	Jun-12	Sep-13	No	Yes	---	---	2015
Blue Cr.	Jun-12	Sep-13	No	No	---	---	2015
Mill Cr.	Jun-12	Sep-13	No	No	---	---	2015
Brandywine Cr.	Jun-12	Sep-13	No	No	---	---	2015
Brush Cr.	Jun-12	Sep-13	No	No	---	---	2015
Hayden Cr.	Jun-12	Sep-13	No	No	---	---	2015
Campbell Cr.	Jun-12	Sep-12	No	No	---	---	2015

Table 13 continued.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Status of Larval Lamprey Population (surveys since last treatment) Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Galien R. (N. Br.)	Oct-10	Sep-13	Yes	Yes	5,429	5,429	2015
E. Br. & Dowling Cr.	Oct-10	Sep-13	No	No	---	---	2015
S. Br. & Galina Cr.	Oct-12	Sep-13	No	No	---	---	2016
Spring Cr.	Oct-12	Sep-13	No	No	---	---	2016
S. Br. Spring Cr.	Oct-12	Sep-13	No	No	---	---	2016
State Cr.	May-86	Sep-13	---	Yes	3,610	3,610	2014
Trail Cr.	Oct-10	Sep-13	No	Yes	13,314	10,996	2014
Donns Cr.	May-66	Sep-12	---	No	---	---	Unknown
Burns Ditch	Jul-99	May-13	---	No	---	---	Unknown

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

Table 14. Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2013 (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)
Carp Lake Outlet (A)	Sep 28	0.1	29.6	0.0	0.5
Big Stone Cr. (B)	Sep 26	0.1	5.9	0.0	1.4
Big Sucker Cr. (C)	Sep 27	0.1	45.9	0.0	3.5
Wycamp Lake Outlet (D)	Sep 26	0.2	59.2	0.0	2.3
Horton Cr. (E)	Sep 3	0.3	145.1	2.5[3]	1.3
Boyne R. (F)	Sep 2	2.2	850.5	0.0	3.2
Boyne R. lentic	Jun 18	---	---	16.5[3]	---
Porter Cr. (G)	Sep 3	0.2	176.9	1.8[3]	6.1
Mitchell Cr. (H)	Jun 7	0.3	98.8	0.0	6.8
Monroe Cr. (I)	Aug 31	0.1	64.7	0.0	1.8
Loeb Cr. (J)	Aug 31	0.1	22.2	0.0	3.1
Betsie R. (K)	Jun 19	8.5	2,351.2	0.0	18.7
Manistee R. (L)	Jul 17	42.5	9,023.9	106.3[3]	93.2
Pentwater R. (M)	Jul 9	1.8	675.6	0.0	40.1
White R. (N)	Aug 16	7.6	4,201.8	0.1[3]	156.2
Kalamazoo R. (O)					
Swan Cr.	Jul 18	1.5	263.7	0.0	6.3
Springer Cr. (P)	Apr 26	0.6	79.3	0.0	5.2
Cedar R. (Q)	May 14	8.5	2,504.1	9.5	133.6
Ford R. (R)	May 11	14.2	3,257.0	14.3	225.4
Days R. (S)	Sep 11	0.1	70.2	0.0	6.9
Whitefish R. (T)	Jun 7	5.7	1,662.9	9.8	109.5
Sturgeon R. (U)	Aug 2	4.2	707.5	0.0	124.0
Poodle Pete Cr. (V)	Sep 12	0.1	5.9	0.0	0.6
Parent Cr. (W)	Jul 13	0.1	21.1	0.0	2.3

Table 14 continued.

Tributary	Date	Discharge (m^3/s)	TFM (kg)[1,2]	Bayluscide (kg)[1,3]	Distance Treated (km)
Bursaw Cr. (X)	Sep 15	0.1	26.8	0.0	4.3
Deadhorse Cr. (Y)	Sep 13	0.1	8.7	0.0	2.7
Johnson Cr. (Z)	Jun 29	0.1	3.7	0.0	1.1
Southtown Cr. (AA)	Jul 9	0.1	1.5	0.0	0.7
Manistique R. lentic (BB)	Jul 2	---	---	72.9[3]	---
Marblehead Cr. (CC)	Sep 17	0.1	9.1	0.0	3.7
Gulliver Lake Outlet (DD)	Sep 15	0.1	13.6	0.0	2.3
Bulldog Cr. (EE)	Jun 27	0.2	43.5	0.0	2.6
Milakokia R. (FF)	Jun 27	0.8	499.1	0.0	25.3
Swan Cr. (GG)	Jul 11	0.1	1.7	0.0	1.1
Hudson Cr. (HH)	Jun 28	0.1	22.0	0.0	3.5
Point Patterson Cr. (II)	Jul 11	0.2	46.7	0.0	0.5
Cataract R. (JJ)	Sep 28	0.1	20.0	0.0	1.4
Crow R. (KK)	Aug 31	0.7	157.0	0.2[3]	5.0
Rock R. (LL)	Sep 28	0.1	45.9	0.0	4.2
Millecoquins R. (MM)	Sep 26	4.8	1,086.6	0.0	58.6
Mile Cr. (NN)	Oct 1	0.1	8.2	0.0	1.8
Mattix Cr. (OO)	Sep 2	0.1	8.9	0.0	1.9
Black R. (PP)	Jun 7	0.4	305.9	0.0	27.4
Hog Island Cr. (QQ)	Sep 29	0.1	41.9	0.0	6.8
Davenport Cr. (RR)	Sep 2	0.5	83.7	0.0	1.8
Brevort R. (SS)	Aug 29	1.4	206.6	0.0	14.8
Total for Lake		**109.4**	**28,964.1**	**233.9**	**1,123.5**

[1]Lampricide quantities are reported in kg of active ingredient.
[2]Includes a total of 582.3 TFM bars (121.3)kg active ingredient) applied in 16 streams.
[3]Includes 3.2% granular Bayluscide applied in spot treatments or to lentic areas.

Lake Huron

- Larval assessments surveys were conducted on a total of 133 tributaries (85 Canada, 48 U.S.) and offshore of 10 tributaries (5 Canada, 5 U.S.). The status of larval sea lamprey populations in historically infested Lake Huron tributaries and lentic areas are presented in Tables 15 and 16.

- Surveys to estimate abundance of larval sea lampreys were conducted in 15 tributaries (4 Canada, 11 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 66 tributaries (61 Canada; 5 U.S) and offshore of 2 Canadian tributaries. One new population was discovered in the Whitefish River.

- Post-treatment assessments were conducted in 27 tributaries (6 Canada, 21 U.S.) and offshore of 3 tributaries (3 Canada) to determine the effectiveness of lampricide treatments conducted during 2012 and 2013.

- Surveys to evaluate barrier effectiveness were conducted in 12 tributaries (3 Canada, 9 U.S.). Larval assessment surveys upstream from the Caro Dam in the Cass River (Saginaw River tributary), were conducted in 2013 after a single sea lamprey larva was found in Sucker Creek in 2012. An additional two larvae and one juvenile were found in 2013. The dam was likely compromised during a 2010 flood event and resulted in limited spawning. The tributary did not rank for treatment in 2014.

- Production potential studies were completed in two Canadian tributaries to Lake Huron; the Saugeen and the Upper Nottawasaga rivers. These investigations evaluated the production potential for sea lamprey upstream from critical barriers by sampling habitat and native lamprey populations as a surrogate for sea lampreys. The population of Ichthyomyzon larvae is estimated to be 554,591 in the main Saugeen River from Denny's Dam to the Maple Hill Dam. The estimate of Ichthyomyzon larvae for the Upper Nottawasaga Watershed upstream from the Nicolston Dam is 74,478.

- Monitoring of larval sea lampreys in the St. Marys River continued during 2013. A total of 779 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 0.9 million (95% confidence limits 0.59 – 1.1 million); 85% of the raw catch were age-1 larvae, which corresponds with 2012 observations of increased egg viability following the cessation of the SMRT.

Table 15. Status of larval sea lampreys in Lake Huron tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2013.

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			
Canada							
St. Marys R.	Sep-13	Sep-13	Yes	Yes	900,000	---	***2014***
Root R.	Aug-10	Jul-12	Yes	Yes	---	---	***2014***[1]
Garden R.	Jul-11	Jul-11	---	---	---	---	***2014***
Echo R.							
Upper	Oct-99	Oct-13	---	No	---	---	Unknown
Lower	Jul-11	Jul-13	No	Yes	---	---	Unknown
Bar & Iron Cr.	Nov-12	Jul-13	No	No	---	---	Unknown
Bar R.	Oct-11	Jul-12	No	No	---	---	Unknown
Sucker Cr. (H-39)	Apr-12	Jun-13	No	No	---	---	Unknown
Two Tree R.	May-10	Jun-12	No	Yes	---	---	Unknown
Richardson Cr.	Aug-11	Jun-12	No	No	---	---	Unknown
Watson Cr.	May-10	May-13	No	Yes	---	---	2015
Gordon Cr.	Sep-11	Jun-12	No	No	---	---	Unknown
Browns Cr.	Sep-11	Jun-12	No	No	---	---	Unknown
Koshkawong R.	Apr-12	Jun-12	No	Yes	---	---	Unknown
No Name (H-65)	Jun-13	Jul-13	No	No	---	---	Unknown
No Name (H-68)	Sep-75	Apr-12	---	No	---	---	Unknown
MacBeth Cr.	Jun-67	Jul-11	---	No	---	---	Unknown
Thessalon R.							
Upper	Aug-11	Jun-13	No	No	---	---	Unknown
Lower	Jun-10	Sep-12	Yes	Yes	---	---	***2014***[1]
Livingstone Cr.	Jun-13	Sep-12	---	---	---	---	Unknown
Mississagi R.	Aug-13	Sep-12	---	---	---	---	2016
Blind R.	May-84	May-12	---	No	---	---	Unknown
Lauzon R.	Jun-11	Jul-13	No	Yes	1,373	351	2015
Spragge Cr.	Oct-95	May-12	---	No	---	---	Unknown
No Name (H-114)	Jun-11	Sep-11	Yes	Yes	---	---	Unknown
Marcellus Cr.	Jun-13	Sep-12	---	---	---	---	Unknown
Serpent R.							
Main	Jun-12	Sep-12	No	---	---	---	Unknown
Grassy Cr.	Jun-11	Sep-13	No	Yes	---	---	2015
Spanish R.							
Main	Sep-11	Sep-12	No	Yes	---	---	Unknown
Lacloche Cr.	Oct-10	Oct-13	No	Yes	3,063	1,531	***2014***[2]
Birch Cr.	Oct-10	Jul-13	No	Yes	21,622	13,161	***2014***
Kagawong R.	Aug-67	May-12	---	No	---	---	Unknown
Unnamed (H-267)	May-11	Jul-13	No	No	---	---	Unknown
Silver Cr.	May-11	Jul-13	No	Yes	1,319	0	Unknown
Sand Cr.	Oct-11	Jul-12	Yes	Yes	---	---	Unknown
Mindemoya R.	Jun-11	Jul-13	No	Yes	17,797	0	2015
Timber Bay Cr.	May-11	Jul-13	No	Yes	---	---	2015

Table 15 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			
Hughson Cr.	Aug-13	Jul-13	---	---			Unknown
Manitou R.	Aug-13	Sep-11	---	---	---	---	2015
Blue Jay Cr.	Jun-11	Jul-13	No	Yes	---	---	Unknown
Kaboni Cr.	Oct-78	May-12	---	No	---	---	Unknown
Chikanishing R.	Jun-03	May-12	---	No	---	---	Unknown
French R. System							
O.V. Channel	Jun-12	Jul-09	---	---	---	---	Unknown
Wanapitei R.	Jun-11	Jun-08	---	---	---	---	2016
Key R. (Nesbit Cr.)	Sep-72	May-12	---	No	---	---	Unknown
Still R.	Jun-96	Jul-13	---	No	---	---	Unknown
Magnetawan R.	Jun-11	Jul-09	---	---	---	---	2015
Naiscoot R.	May-13	Jun-13	No	---	---	---	2017
Shebeshekong R.	Never	Jun-13	---	No	---	---	Unknown
Boyne R.	May-13	Jun-13	No	Yes	---	---	2017
Musquash R.	Aug-13	Jul-11	---	---	---	---	Unknown
McDonald Cr.	Never	Jul-09	---	No	---	---	Unknown
Simcoe/Severn	Never	May-12	---	Yes	---	---	Unknown
Coldwater R.	Never	May-11	---	No	---	---	Unknown
Sturgeon R.	Apr-12	May-12	No	No	---	---	2016
Hog Cr.	Sep-78	May-11	---	No	---	---	Unknown
Lafontaine Cr.	Jun-68	May-11	---	No	---	---	Unknown
Nottawasaga R.							
Main	May-13	Jul-11	---	---	---	---	Unknown
Boyne R.	May-13	Jul-11	---	---	---	---	Unknown
Bear Cr.	Jun-13	Apr-11	---	---	---	---	Unknown
Pine R.	Jun-13	Jun-13	---	---	---	---	2017
Marl Cr.	Apr-13	Jun-13	No	No	---	---	Unknown
Pretty R.	May-72	Apr-11	---	No	---	---	Unknown
Silver Cr.	Sep-82	May-12	---	No	---	---	Unknown
Bighead R.	Jun-12	May-13	Yes	Yes	---	---	2015
Bothwells Cr.	Jun-79	May-12	---	No	---	---	Unknown
Sydenham R.	Jun-72	May-12	---	No	---	---	Unknown
Sauble R.	Jun-04	Jun-13	---	Yes	---	---	Unknown
Saugeen R.	Jun-71	May-10	---	No	---	---	Unknown
Bayfield R.	Jun-70	May-13	---	No	---	---	Unknown
United States							
Mission Cr.	Never	Jun-12	---	No	---	---	Unknown
Frenchette Cr.	Never	Jun-12	---	No	---	---	Unknown
Ermatinger Cr.	Never	Jun-12	---	No	---	---	Unknown
Charlotte R.	Oct-11	Jun-12	No	No	---	---	Unknown

Table 15 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			
Little Munuscong R.	Oct-10	Aug-13	Yes	Yes	75,267	0	2015
Big Munuscong R.	Jun-99	Jun-12	---	No	---	---	Unknown
Taylor Cr.	Oct-11	Jun-12	---	Yes	---	---	2015
Carlton Cr.	Jun-13	Sep-13	Yes	Yes	---	---	Unknown
Canoe Lake Outlet	May-70	Apr-13	---	No	---	---	Unknown
Caribou Cr.	Jun-11	Apr-13	No	No	---	---	Unknown
Bear Lake Outlet	Jun-11	Apr-13	No	Yes	---	---	Unknown
Carr Cr.	Jun-13	Aug-13	No	Yes	---	---	Unknown
Joe Straw Cr.	Jun-13	Aug-13	No	Yes	---	---	Unknown
Huron Point Cr.	Jun-13	Jul-13	No	---	---	---	Unknown
Saddle Cr.	Never	Oct-12	---	No	---	---	Unknown
Albany Cr.							
Barrier downstream	Apr-11	Apr-13	Yes	Yes	4,575	59	2015
Barrier upstream	Jul-07	Jul-13	No	No	---	---	Unknown
Trout Cr.	Oct-10	Apr-13	Yes	Yes	511	113	Unknown
Beavertail Cr.	May-11	Apr-13	No	No	---	---	Unknown
Prentiss Cr.	May-11	Apr-13	Yes	No	---	---	Unknown
McKay Cr.	May-11	Apr-13	Yes	Yes	---	---	Unknown
Flowers Cr.	Jun-13	Apr-13	---	---	---	---	Unknown
Ceville Cr.	Jun-13	Aug-13	No	No	---	---	Unknown
Hessel Cr.	May-11	Apr-13	No	Yes	---	---	Unknown
Steeles Cr.	May-11	Apr-13	No	Yes	---	---	Unknown
Nunns Cr.							
Barrier downstream	Aug-13	Aug-13	---	---	---	---	Unknown
Nunns Cr.							
Barrier upstream	May-96	Sep-13	---	Yes	---	---	Unknown
Pine R.	Jun-10	Sep-13	Yes	Yes	---	---	***2014***[1]
McCloud Cr.	Oct-72	May-11	---	No	---	---	Unknown
Carp R.	May-11	Sep-13	Yes	Yes	---	---	***2014***[1]
Martineau Cr.	Jun-12	Jul-13	No	No	---	---	Unknown
Hoban Cr.	Jun-12	Apr-13	No	---	---	---	Unknown
266-20 Cr.	Aug-76	Jul-12	---	No	---	---	Unknown
Beaugrand Cr.	Never	Jul-12	---	No	---	---	Unknown
Little Black R.	May-67	May-11	---	No	---	---	Unknown
Cheboygan R.	Oct-83	Jul-13	---	Yes	---	---	Unknown
Mullett Cr.	Never	Jun-10	---	No	---	---	Unknown
Laperell Cr.	May-00	Jun-13	---	No	---	---	Unknown
Meyers Cr.	Sep-99	Jun-13	---	No	---	---	Unknown
Maple R.	Sep-12	May-13	No	No	---	---	2015
Pigeon R.	Aug-12	May-13	No	No	---	---	2015
Little Pigeon R.	Aug-12	May-13	No	No	---	---	2015
Sturgeon R.	Sep-12	May-13	No	No	---	---	2015
Little Sturgeon R.	Never	Sep-10	---	No	---	---	Unknown
Elliot Cr.	Jun-13	Sep-13	No	Yes	---	---	Unknown

Table 15 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			
Grass Cr.	May-78	Apr-11	---	No	---	---	Unknown
Greene Cr.							
Barrier downstream	Jul-12	Jun-13	No	No	---	---	Unknown
Barrier upstream	Jun-07	Jun-13	Yes	No	---	---	Unknown
Mulligan Cr.	Jul-12	Jul-13	Yes	Yes	---	---	Unknown
Grace Cr.	Jun-13	Sep-13	Yes	Yes	---	---	Unknown
Black Mallard Cr.	Apr-12	Jun-13	Yes	Yes	2,048	683	2015
Seventeen Cr.	Jul-12	Jun-13	No	No	---	---	Unknown
Ocqueoc R.							
Barrier downstream	Jun-13	Sep-13	No	No	---	---	2017
Barrier upstream	Aug-09	Sep-13	Yes	Yes	12,820	9,437	***2014***
Johnny Cr.	Sep-70	May-11	---	---	---	---	Unknown
Schmidt Cr.							
Lower	Jun-13	Sep-13	No	Yes	---	---	2017
Upper	May-08	Jun-13	---	---	---	---	Unknown
Nagels Cr.	Never	Sep-12	---	No	---	---	Unknown
Trout R.							
Barrier downstream	Jun-13	Sep-13	No	Yes	---	---	2016
Barrier upstream	Oct-07	Jun-13	---	---	---	---	Unknown
Swan R.	Jun-10	Sep-12	No	No	---	---	Unknown
Grand Lake Outlet	Never	Oct-11	---	---	---	---	Unknown
Middle Lake Outlet	Jun-67	Oct-11	---	---	---	---	Unknown
Long Lake Outlet	Jun-13	Sep-13	Yes	Yes	440	275	Unknown
Squaw Cr.	Jun-13	Sep-13	No	No	---	---	Unknown
Devils R.	May-11	Sep-13	No	Yes	---	---	***2014***[1]
Black R.	May-11	Aug-13	Yes	Yes	138,801	7,798	2015
Butternut Cr.	May-11	Aug-13	No	No	---	---	2015
Au Sable R.	Jun-10	Jun-13	Yes	Yes	---	---	***2014***[1]
Pine R.	May-87	Sep-12	---	No	---	---	Unknown
Tawas Lake Outlet	Jul-09	Jul-13	No	No	---	---	Unknown
Cold Cr.	Jul-13	Sep-13	No	No	---	---	2017
Sims Cr.	Jul-09	Jul-11	No	No	---	---	Unknown
Grays Cr.	Sep-05	Jul-13	---	No	---	---	Unknown
Silver Cr.	Jul-13	Sep-13	Yes	No	---	---	2017
East Au Gres R.	Jul-13	Sep-13	No	No	---	---	2017
Au Gres R.	May-10	Jul-13	No	Yes	---	---	***2014***[1]
Rifle R.	Aug-11	Sep-13	Yes	Yes	---	---	***2014***[1]
Saginaw R.							
Cass R.	May-12	Sep-12	No	No	---	---	2015
Juniata Cr.	May-12	Aug-12	No	No	---	---	2015
Sucker Cr.	Never	Sep-13	---	Yes	644	644	Unknown
Scott Drain	Jun-08	Aug-11	No	No	---	---	2015
Goodings Cr.	May-12	Sep-12	No	No	---	---	2015
Tittabawassee R.	Never	Sep-08	---	No	---	---	Unknown

Table 15 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			
Chippewa R.	May-12	Sep-13	Yes	Yes	404,430	117,091	***2014***
Coldwater R.	May-12	Sep-13	No	No	---	---	***2014***
Pine R.	Apr-12	Sep-13	Yes	Yes	48,663	15,207	***2014***
Little Salt Cr.	May-02	Sep-13	No	Yes	---	---	***2014***
Big Salt Cr.	Jun-09	Sep-13	No	Yes	---	---	***2014***
North Br.	Never	Sep-13	---	Yes	1,292	1,148	***2014***
Carroll Cr.	May-07	Sep-13	No	Yes	11,120	8,340	***2014***
Big Salt R.	May-10	Sep-12	No	No	---	---	Unknown
Bluff Cr.	May-10	Sep-12	No	No	---	---	Unknown
Shiawassee R.	May-13	Oct-13	Yes	No	---	---	Unknown
Rock Falls Cr.	Never	Aug-12	---	No	---	---	Unknown
Sucker Cr.	Never	Aug-12	---	No	---	---	Unknown
Cherry Cr.	Never	Aug-12	---	No	---	---	Unknown
Mill Cr.	May-85	Sep-13	---	Yes	---	---	Unknown

[1] Stream being treated based on expert judgement
[2] Stream being treated based on geographic efficiency

Table 16. Status of larval sea lampreys in historically infested lentic areas of Lake Huron during 2013.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Echo R.	Echo Lake	Jul-12	Jul-12	Sep-13
	Solar Lake	Jul-06	May-90	Jul-87
	Stuart Lake	May-90	May-90	Jul-80
Sucker Cr.	Desjardins Bay	Jun-13	Jun-13	Jul-84
Two Tree R.	North Channel	Aug-81	Aug-81	Never
Gordon Cr.	Tenby Bay	Aug-91	Aug-91	Jul-84
Brown's Cr.	Tenby Bay	Aug-13	Aug-91	Aug-87
Koshkawong R.	North Channel	Aug-91	Aug-91	Never
Unnamed (H-68)	North Channel	Apr-12	May-95	Never
Mississagi R.	North Channel	May-97	Aug-90	Jul-81
Lauzon R.	North Channel	Sep-12	Jul-10	Jun-12
Unnamed (H-114)	North Channel	Sep-11	Sep-11	Jul-10
Kagawong R.	Mudge Bay	May-11	Jul-90	Aug-87
Mindemoya R.	Providence Bay	May-12	Jul-88	Jul-81
Manitou R.	Michael's Bay	Jul-13	Jul-13	Oct-12
Blue Jay Cr.	Michael's Bay	Jul-13	Jul-10	Aug-87
Still R.	Byng Inlet	Jun-13	Jul-13	Jun-12
United States				
Caribou Cr.	Caribou Cr. (Offshore)	Jul-13	Jul-13	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	Jun-12	Jul-80	Never
Nunns Cr.	St. Martin Bay	Jun-09	Aug-87	Never
Pine R.	St. Martin Bay	Jun-12	Jun-12	Never[1]
McCloud Cr.	St. Martin Bay	Jul-10	Jul-10	Never
Carp R.	St. Martin Bay	Jun-12	Jun-12	Jun-13
Martineau Cr.	Horseshoe Bay	Sep-10	Sep-10	Never[1]
Cheboygan R.	Straits of Mackinac	Jul-13	Aug-93	Never
	Burt Lake (Sturgeon R.)	Aug-11	Aug-98	Never
Elliot Cr.	Duncan Bay	Jun-13	Jun-13	Never
Black Mallard R.	Black Mallard Lake	Jul-12	Jun-10	Never
Hammond Bay	Hammond Bay	Jun-13	Jun-13	Never
Mulligan Cr.	Mulligan Cr. (offshore)	Jun-13	Jun-13	Never[1]
Ocqueoc R.	Hammond Bay	Sep-12	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 Bayluscide 3.2% Granular Sea Lamprey Larvicide surveys.

Lake Erie

- Larval assessments were conducted on a total of 66 tributaries (19 Canada, 47 U.S.) and offshore of 3 U.S. tributaries. The status of larval sea lampreys in historically infested Lake Erie tributaries and lentic areas is presented in Tables 17 and 18.

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

- Surveys to detect new larval populations were conducted in 40 tributaries (11 Canada, 29 U.S.). No new populations were discovered.

- Surveys to evaluate barrier effectiveness were conducted in six tributaries (two Canada, four U.S.). No upstream infestations were discovered.

- A total of 17.75 ha of the St. Clair River were surveyed with GB, including the upper river and the three main delta channels. Annual sampling of index plots is used to monitor population trends in the river and detect new areas of infestation. The total catch of 434 sea lampreys was scattered throughout the river with a few high density areas, particularly north-west of Stag Island. A total of 3.6 ha were surveyed in Lake St. Clair at the mouth of the St. Clair River and 10 sea lampreys were captured. Additional work to define the distribution and abundance of sea lamprey larvae in the St. Clair River is planned in 2014.

- A total of 1.1 ha of the Detroit River were surveyed with GB. No sea lamprey larvae were detected.

Table 17. Status of larval sea lampreys in Lake Erie tributaries with a history of sea lamprey production, and estimates of abundance from tributaries surveyed during 2013.

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							
East Cr.	Jun-87	Jun-13	No	Yes	---	---	Unknown
Catfish Cr.	Jun-13	Jul-12	No	Yes	---	---	Unknown
Silver Cr.	Oct-09	Jun-13	No	No	---	---	Unknown
Big Otter Cr.	Sep-13	Sep-13	No	No	---	---	**2014**[1]
South Otter Cr.	Aug-10	Jul-12	No	No	---	---	Unknown
Clear Cr.	May-91	Jul-12	No	No	---	---	Unknown
Big Cr.	Sep-13	Sep-13	---	Yes	---	---	**2014**[1]
Forestville Cr.	Aug-13	Jun-13	---	---	---	---	Unknown
Normandale Cr.	Jun-87	Jul-12	No	No	---	---	Unknown
Fishers Cr.	Jun-87	Jun-13	No	No	---	---	Unknown
Young's Cr.	Aug-13	Jul-12	---	---	---	---	Unknown
United States							
Buffalo R.	Never	Jul-10	---	---	---	---	Unknown
Buffalo Cr.	Jun-13	Aug-13	Yes	---	---	---	Unknown
Cayuga Cr.	Never	Aug-13	---	Yes	3,219	3,219	Unknown
Cazenovia Cr.	Sept-13	Aug-13	---	---	---	---	Unknown
Delaware Cr.	Jun-13	Aug-13	No	---	---	---	Unknown
Cattaraugus Cr.	Apr-13	Aug-13	Yes	Yes	18,019	2,361	Unknown
Halfway Br.	Oct-86	Apr-13	---	---	---	---	Unknown
Canadaway Cr.	Oct-86	Jun-11	---	No	---	---	Unknown
Chautauqua Cr.	Never	Jul-13	---	No	---	---	Unknown
Crooked Cr.	May-13	Jul-13	No	No	---	---	Unknown
Raccoon Cr.	May-13	Jul-13	Yes	No	---	---	Unknown
Conneaut Cr.	May-13	Jul-13	Yes	Yes	16,678	15,476	**2014**
Wheeler Cr.	Never	Jul-11	---	No	---	---	Unknown
Grand R.	Apr-13	Aug-13	No	No	---	---	Unknown
Chagrin R.	Never	May-13	---	Yes	16,678	5,124	Unknown
St. Clair River/Lake St. Clair Tributaries							
Black R.	Never	May-13	---	No	---	---	Unknown
Mill Cr.	Never	May-13	---	No	---	---	Unknown
Pine R.	Apr-88	May-13	---	Yes	2,367	2,367	Unknown
Belle R.	Never	May-13	---	No	---	---	Unknown
Clinton R.	Never	May-13	---	No	---	---	Unknown
St. Clair R.	Never	Aug-13	---	Yes	---	---	Unknown
Thames R.	Never	May-13	---	Yes	431	287	Unknown

[1] Stream being treated based on deferral from previous year

Table 18. Status of larval sea lampreys in historically infested lentic areas of Lake Erie during 2013.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Cattaraugus Cr.	Sunset Bay	Aug-13	Aug-12	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 3.2% granular Bayluscide surveys.

Lake Ontario

- Larval assessments were conducted on a total of 38 tributaries (18 Canada, 20 U.S.). The status of larval sea lampreys in historically infested Lake Ontario tributaries and lentic areas is presented in Tables 19 and 20.

- Surveys to estimate abundance of larval sea lampreys were conducted in 12 tributaries (5 Canada, 7 U.S.).

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

- Post-treatment assessments were conducted in nine tributaries (two Canada, seven U.S.) to determine the effectiveness of lampricide treatments conducted during 2012 and 2013.

- Surveys to evaluate barrier effectiveness were conducted in seven tributaries (six Canada, one U.S.). No upstream infestations were discovered.

Table 19. Status of larval sea lampreys in Lake Ontario tributaries with a history of sea lamprey production and estimates of abundance from tributaries surveyed during 2013.

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			
Canada							
Niagara R.	Never	Jul-10	---	Yes	---	---	Unknown
Ancaster Cr.	May-03	Aug-13	No	Yes	---	---	Unknown
Grindstone Cr.	Never	Sep-11	No	No	---	---	Unknown
Bronte Cr.	Jun-13	Aug-13	Yes	Yes	---	---	2016
Sixteen Mile Cr.	Jun-82	Sep-11	No	No	---	---	Unknown
Credit R.	Jul-11	Jul-12	Yes	No	---	---	2015
Humber R.	Never	Aug-13	---	No	---	---	Unknown
Rouge R.	Jun-11	Aug-13	No	Yes	663	0	Unknown
Petticoat Cr.	Sep-04	Jul-11	No	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
Duffins Cr.	May-12	Aug-12	No	Yes	---	---	2015
Carruthers Cr.	Sep-76	Jul-13	No	No	---	---	Unknown
Lynde Cr.	May-12	Aug-12	No	Yes	---	---	2015
Oshawa Cr.	May-12	Aug-12	No	Yes	---	---	2015
Farewell Cr.	Jun-12	Aug-12	No	No	---	---	2015
Bowmanville Cr.	May-11	Aug-13	Yes	No	---	---	**2014**[1]
Wilmot Cr.	May-12	Aug-12	No	Yes	---	---	2015
Graham Cr.	May-96	Jul-13	No	No	---	---	Unknown
Wesleyville Cr.	Oct-02	Aug-12	No	No	---	---	Unknown
Port Britain Cr.	Apr-12	Aug-12	No	No	---	---	2015
Gage Cr.	May-71	Jul-13	No	No	---	---	Unknown
Cobourg Br.	Oct-96	Aug-13	No	No	0	0	Unknown
Covert Cr.	Jun-13	Sep-13	Yes	Yes	---	---	2016
Grafton Cr.	Oct-07	Sep-13	No	Yes	1,064	768	**2014**[2]
Shelter Valley Cr.	Sep-03	Jul-13	No	No	---	---	Unknown
Colborne Cr.	May-09	Sept-13	No	Yes	1,089	735	**2014**
Salem Cr.	Apr-12	Aug-12	No	Yes	---	---	2015
Proctor Cr.	Apr-12	Aug-12	No	Yes	---	---	2015
Smithfield Cr.	Sep-86	Jun-12	No	No	---	---	Unknown
Trent R. (Canal System)	Sep-11	Jun-12	No	No	---	---	Unknown
Mayhew Cr.	Apr-12	Jun-12	No	---	---	---	2015
Moira R.	Jun-11	Jun-12	Yes	Yes	---	---	Unknown
Salmon R.	Jun-00	Jun-12	No	Yes	---	---	Unknown
Napanee R.	Never	Jul-13	---	No	0	0	Unknown
United States							
Black R.	Aug-12	Jul-13	Yes	No	---	---	2016
Stony Cr.	Sep-82	May-11	No	No	---	---	Unknown
Sandy Cr.	Never	Apr-12	---	No	---	---	Unknown
South Sandy Cr.	Apr-13	Jul-13	Yes	Yes	---	---	2016
Skinner Cr.	Apr-05	Jul-13	No	No	---	---	Unknown
Lindsey Cr.	Apr-13	Aug-13	Yes	No	4,119	3,733	**2014**
Blind Cr.	May-76	Jul-10	No	No	---	---	Unknown
Little Sandy Cr.	May-13	Aug-13	Yes	Yes	---	---	2016
Deer Cr.	Apr-04	Apr-12	No	No	---	---	Unknown
Salmon R.	May-11	Aug-12	Yes	Yes	---	---	**2014**[1]
Orwell Br.	Apr-13	Aug-13	Yes	No	---	---	**2014**[1]
Trout Br.	Apr-13	Aug-13	Yes	Yes	---	---	**2014**[1]
Grindstone Cr.	Apr-13	Aug-13	Yes	Yes	---	---	2016
Snake Cr.	May-11	Aug-12	No	No	---	---	2015
Sage Cr.	May-78	Jul-13	No	No	---	---	Unknown
Little Salmon R.	Apr-12	Aug-13	Yes	Yes	85,071	13,683	**2014**

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
Butterfly Cr.	May-72	Apr-12	No	No	---	---	Unknown
Catfish Cr.	Apr-12	Jul-13	Yes	Yes	---	---	2015
Oswego R.							
Black Cr.	May-81	Jun-11	No	No	---	---	Unknown
Big Bay Cr.	Sep-93	Apr-12	No	No	---	---	Unknown
Scriba Cr.	Jun-10	Apr-12	No	No	---	---	Unknown
Fish Cr.	Jun-13	Jul-13	No	No	---	---	2016
Carpenter Br.	May-94	Apr-12	No	No	---	---	Unknown
Putnam Br./ Coldsprings Cr.	May-96	Jul-13	No	No	---	---	Unknown
Hall Br.	Never	Oct-10	---	No	---	---	Unknown
Crane Br.	Never	Apr-12	---	No	---	---	Unknown
Skaneateles Cr.	Never	Oct-10	---	No	---	---	Unknown
Rice Cr.	May-72	Jul-13	No	No	---	---	Unknown
Eight Mile Cr.	Apr-07	Apr-12	No	No	---	---	Unknown
Nine Mile Cr.	May-11	Aug-13	Yes	Yes	57,774	37,250	**2014**
Sterling Cr.	May-12	Aug-12	No	No	---	---	2015
Blind Sodus Cr.	May-78	Jul-13	No	No	---	---	Unknown
Red Cr.	Apr-10	Aug-12	No	No	---	---	2015
Wolcott Cr.	May-79	Apr-11	No	No	---	---	Unknown
Sodus Cr.	May-10	Aug-12	No	Yes	---	---	Unknown
Forest Lawn Cr.	Never	Aug-13	---	Yes	103	70	Unknown
Irondequoit Cr.	Never	Aug-12	---	No	---	---	Unknown
Larkin Cr.	Never	Aug-12	---	No	---	---	Unknown
Northrup Cr.	Never	Aug-12	---	No	---	---	Unknown
Salmon Cr.	Apr-05	Aug-13	No	Yes	657	792	Unknown
Sandy Cr.	Apr-09	Aug-13	No	Yes	17,824	14,616	Unknown
Oak Orchard Cr. Marsh Cr.	May-08	Aug-13	No	Yes	3,878	1,473	**2014**[2]
Johnson Cr.	Apr-10	Aug-13	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 being treated based on geographic efficiency

Table 20. Status of larval sea lampreys in historically infested lentic areas of Lake Ontario during 2013.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Duffins Cr.	Duffins Cr. - lentic	Aug-12	Aug-12	Never[1]
Oshawa Cr.	Oshawa Cr. - lentic	Jul-13	Oct–81	Never[1]
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.

Juvenile Assessment

The juvenile life stage is assessed through the interpretation of marking rates by feeding juvenile sea lampreys on lake trout. Terminology for life stages in this report have been standardized from previous years. *Out-migrating juveniles* replaced *metamorphosing-phase* and *transformers*, and *feeding juvenile*s replaced *parasitic-phase*. Used in conjunction with adult sea lamprey abundance to annually evaluate the performance of the SLCP, marking rates on lake trout are contrasted against the targets set for each lake. Marking rates on lake trout are estimated from fisheries assessments conducted by state, provincial, tribal and federal fishery management agencies associated with each lake, and are updated when the data become available. These data provide a metric of the mortality inflicted on lake trout on a lake-wide basis.

Beginning in 2007, the Commission contracted with the Service's Green Bay Fish and Wildlife Conservation Office (GBFWCO) to calculate marking statistics and lake trout abundance and to evaluate and describe the consistency of indices used to understand the damage caused by sea lampreys. In the fall of 2010, the Commission and GBFWCO began a process to create an updated database that consolidates the most recent fisheries data to create the metrics used to assess lamprey impacts across the lakes. Data from survey and commercial sampling has been submitted from over 25 organizations and work is underway to continue to standardize the multiple data-sets into cohesive lake-wide databases. Included in these submissions is information pertaining to marking on other species that has recently become an area of concern and will be evaluated in the future. The most recent results of this effort related to lake trout are presented in Figures 3-5 and Figures 8-9 and were calculated from un-weighted data for the whole lake (average number of marks calculated from all lake trout captured of a specific length range during a specific time period). The reason for the refresh of data sources was that calculation methods and the extent of data that were used to produce the previously used plots of marking rates were not consistent between the most recent graphs presented here and those presented in previous reports. Work continues to evaluate a number of ways to present the data, including weighting data based on characteristics of the individual lake units and possible separation of distinct regions within a lake, among other ideas. With this further analysis, it is hoped that a better understanding of lamprey impacts on the fish communities in the lakes and how they affect each other will be developed.

Standardized netting of out-migrating juveniles has been conducted in the St Marys River since 1998 as an index of relative abundance produced in this system. Additional netting of out-migrating juveniles was conducted in seven tributaries during 2013 to prevent their out-migration to the Great Lakes and to provide lampreys for research.

Lake Superior

- Lake trout marking data for Lake Superior are provided by the Department of Natural Resources from Michigan, Minnesota, and Wisconsin, Great Lakes Indian Fish and Wildlife Commission (GLIFWC), Chippewa-Ottawa Resource Authority (CORA), Keweenaw Bay Indian Community, Grand Portage Band of Lake Superior Chippewa Indians, and the OMNR, and analyzed by the Service's GBFWCO.

- Based on standardized spring assessment data, the marking rate during 2013 was 5.7 A1-A3 marks per 100 lake trout >533mm (Figure 3). The marking rate has been greater than the target of 5 per 100 fish since 1995, but has declined for 5 consecutive years.

- The MIDNR provided data on the frequency of juvenile sea lampreys attached to fishes caught by sport charter fishes during 2013.

    - A total of 34 juvenile sea lampreys attached to lake trout were collected from 4 of 8 management districts. The attachment rate during 2013 was 0.9 per 100 lake trout (n=3,587), which was less than the attachment rate during 2012 (1.6) and similar to attachment rates in 2011 and 2010 (0.96 and 0.9 respectively).

- Trapping for out-migrating juveniles was conducted in the Traverse, Bad, and Sioux rivers and Harlow Creek during October and November. Fyke nets were set in each river and 221 sea lampreys were captured (Traverse – 38, Bad – 169, Sioux – 0, Harlow – 14). Trapping on the Traverse, Bad, and Sioux rivers was conducted by GLIFWC.

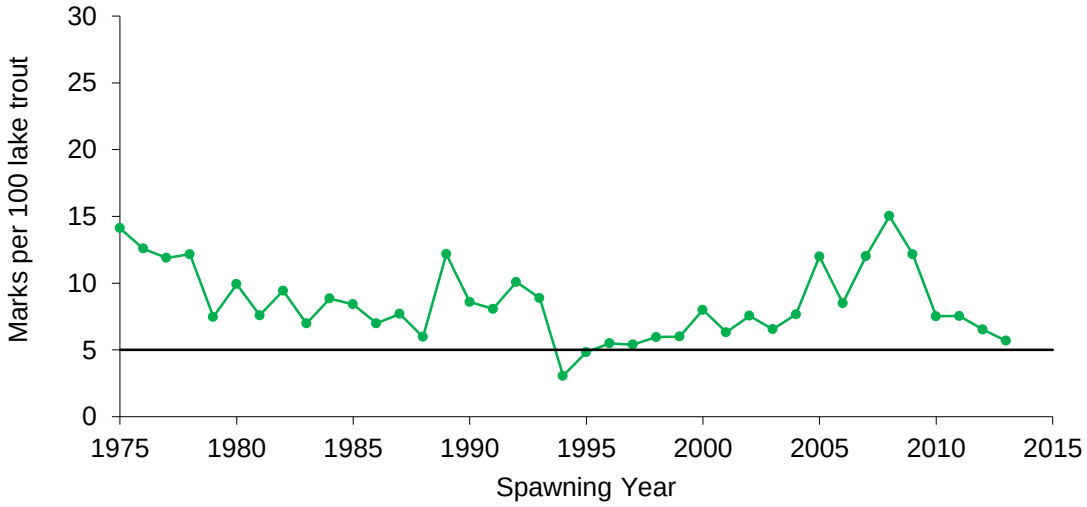

Figure 3. Average number of A1-A3 marks per 100 lake trout >533 mm caught during April-June assessments in Lake Superior plotted in the year that the juvenile cohort returned as adults (marking recorded in the spring is inflicted by the cohort of sea lampreys that spawned that year). The horizontal line represents the target of 5 A1-A3 marks per 100 fish.

Lake Michigan

- Lake trout marking data for Lake Michigan are provided by the Department of Natural Resources from Michigan, Wisconsin, Illinois, and Indiana, CORA, Service and U.S. Geological Survey (USGS), and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2013 was 8.0 A1-A3 marks per 100 lake trout >533mm. The marking rate has been greater than the target of 5 per 100 fish for at least the previous 10 years, but has declined during 2006-2013 (Figure 4).

- The MIDNR provided data on the frequency of juvenile sea lampreys attached to fishes caught by sport charter fishes during 2013.

    - A total of 673 juvenile sea lampreys were collected from 13 management districts: 395 were attached to lake trout and 278 were attached to Chinook salmon. Attachment rates during 2013 were 1.17 per 100 lake trout (n=33,649) and 0.36 per 100 Chinook salmon (n=76,842), which was higher than the attachment rates on lake trout and Chinook salmon during 2012 (0.92 and 0.08, respectively).

- Trapping for out-migrating juveniles was conducted in the Rapid, Tacoosh, and Big South Branch Pere Marquette rivers during October and November. Fyke nets were set in each river and 29 sea lampreys were captured (Rapid – 20, Tacoosh – 2, Big South Branch – 7).

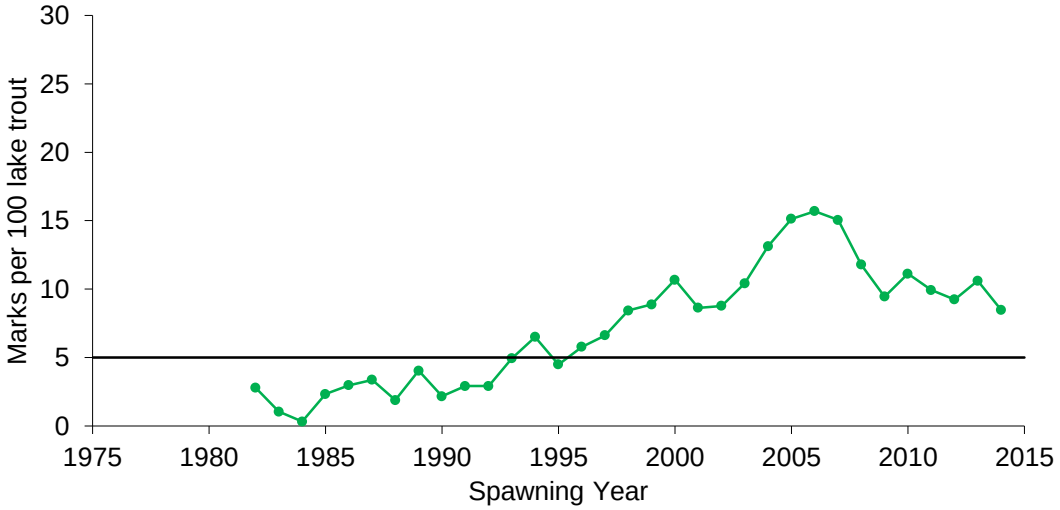

Figure 4. Average number of A1-A3 marks per 100 lake trout >533 mm from standardized fall assessments in Lake Michigan, plotted in the year that the juvenile cohort returned as adults (marking recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). The horizontal line represents the target of 5 A1-A3 marks per 100 fish.

Lake Huron

- Lake trout marking data for Lake Huron are provided by the MIDNR, CORA, USGS and the OMNR, and analyzed by the Service's GBFWCO.

- Based on standardized spring assessment data, the marking rate during 2013 was 12.0 A1-A3 marks per 100 lake trout >533 mm. The marking rate has been greater than the target of 5 per 100 fish since 1983 (Figure 5).

- Canadian commercial fisheries in northern Lake Huron continued to provide feeding juvenile sea lampreys in 2013, along with associated catch information including date, location and host species. The total number of sea lampreys captured each year, along with effort data provided by OMNR, can be used as an index of juvenile abundance in northern Lake Huron (Figure 6). The preliminary total sea lamprey catch for 2013 (523) is the lowest in over 20 years. Effort is not yet available for 2013.

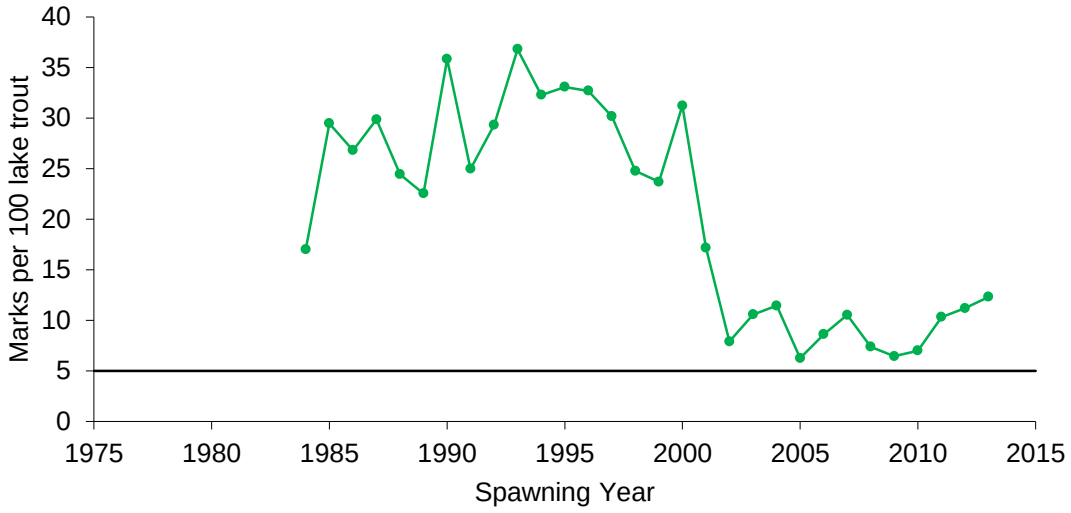

Figure 5. Average number of A1-A3 marks per 100 lake trout >533 mm caught during April-June assessments in Lake Huron, plotted in the year that the juvenile cohort returned as adults (marking recorded in the spring is inflicted by the cohort of sea lampreys that spawned that year). The horizontal line represents the target of 5 A1-A3 marks per 100 fish.

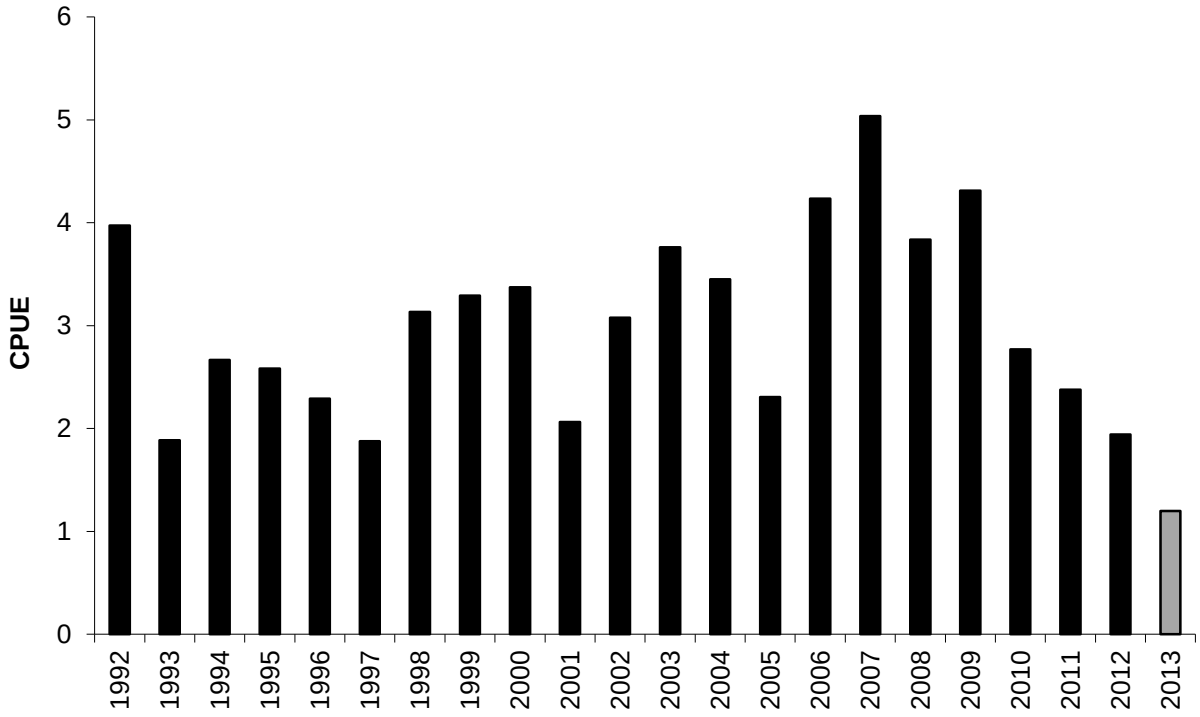

Figure 6. Northern Lake Huron commercial fisheries index showing CPUE (number of feeding juvenile sea lampreys per 10,000 yards of gillnet) for 1992-2013. The mean annual effort for 2008-2012 (4.4 million yards) was used to standardize the 2013 catches (grey bar).

- Since 1998, standardized trapping for out-migrating juveniles has been conducted in the St Marys River as an index of sea lamprey production in this system. Eleven floating fyke nets are deployed each October and November in the Munuscong, Sailor's Encampment, and Middle Neebish channels. In 2013, fyke nets were operated for a total of 474 net days, resulting in the capture of 14 out-migrating juveniles, and a CPUE of 0.03 (Figure 7).

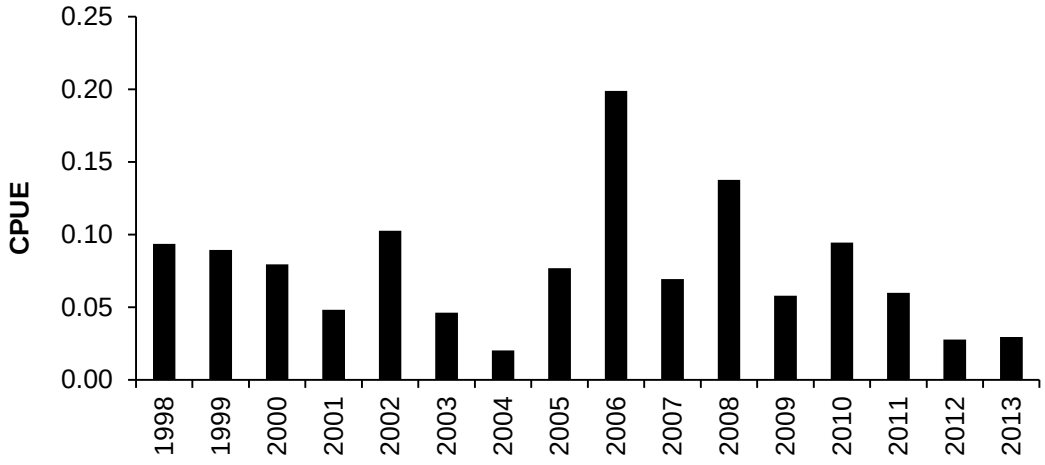

Figure 7. CPUE (number of out-migrating juvenile sea lampreys per net day) of fall fyke netting in the St. Marys River during 1998-2013.

Lake Erie

- Lake trout marking data for Lake Erie are provided by the New York State Department of Environmental Conservation (NYSDEC), the Pennsylvania Fish and Boat Commission (PFBC), the USGS and the OMNR, and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2013 was 14 A1-A3 marks per 100 lake trout >533 mm (Figure 8). The marking rate has been greater than the target for the last 10 years and increased slightly during 2013.

- No data are collected in Lake Erie to determine the frequency of feeding juvenile sea lampreys attached to fish caught by sport fishers.

- A mark-recapture study was initiated in 2012 to: 1) determine whether out-migrating juveniles released in the St. Clair River can migrate successfully through the Huron-Erie Corridor (HEC) and survive to be recaptured in the eastern basin in Lake Erie; and 2) compare recovery rates for juveniles released in the HEC and eastern Lake Erie tributaries. Out-migrating juveniles with coded wire tags were released the fall of 2012 in the St. Clair River (417), Big Creek (46), Big Otter (46), Cattaraugus Creek (44), Conneaut Creek (44), Crooked Creek (44), Grand River (67), Raccoon Creek (43), Silver Creek (44), South Otter Creek (44), and Young's Creek (43).

    - Tagged sea lampreys will be recaptured as adults in traps in Lake Erie in 2014.

    - Forty-three juvenile sea lampreys captured in Lake Erie commercial and charter fisheries in 2012 and 2013 were scanned for coded wire tags in 2013. No tags were found.

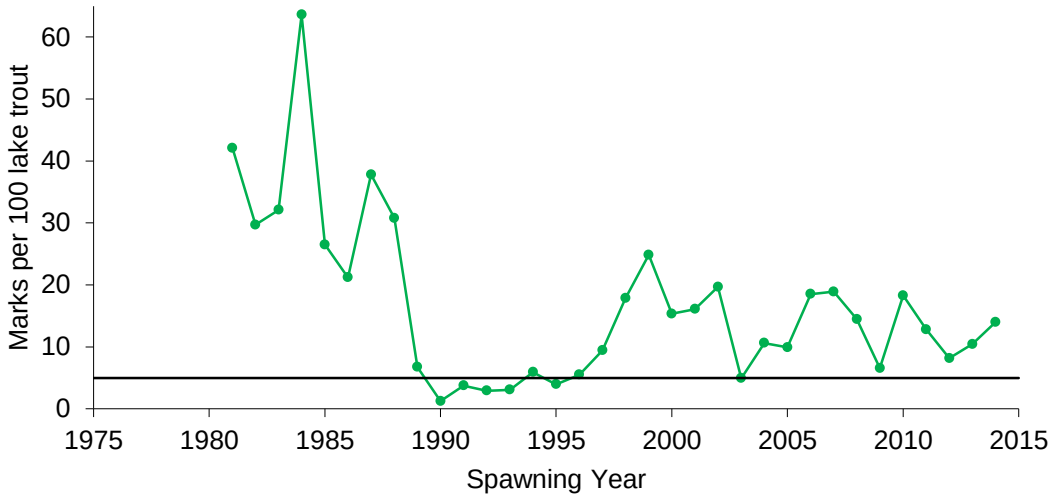

Figure 8. Average number of A1-A3 marks per 100 lake trout >533 mm from standardized fall assessments in Lake Erie, plotted in the year that the juvenile cohort returned as adults (marking recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). The horizontal line represents the target of 5 A1-A3 marks per 100 fish.

Lake Ontario

- Lake trout marking data for Lake Ontario are provided by the USGS, the OMNR, and the NYSDEC, and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2013 was 2.2 A1 marks per 100 lake trout >431 mm. The marking rate is slightly greater than the target, but marking rates have been relatively stable in Lake Ontario over the past six years (Figure 9).

- The NYSDEC provided data on the frequency of juvenile sea lampreys attached to fish caught by anglers during April 15 - September 30, 2013.

    - An estimated 3,441 juvenile sea lampreys were observed by anglers. The percent composition of salmonine host species to which lampreys were attached was coho salmon (1.6%), Chinook salmon (68.8%), rainbow trout (5.6%), brown trout (13.6%), and lake trout (10.4%). Attachment rates during April 15 – September 30, 2013 were 1.43 per 100 trout and salmon in the west region, 1.50 in the west central region, 2.53 in the east central region, and 1.26 in the east region. In comparison to 2012, attachment rates during April 15 – September 30, 2013 were lower in the west, west central and east regions (1.55, 2.32, and 1.42 respectively). In the east central region, the 2012 attachment rate was higher than it was during April 15 – September 30, 2013 (2.05), but lower than it was in 2011 (2.69).

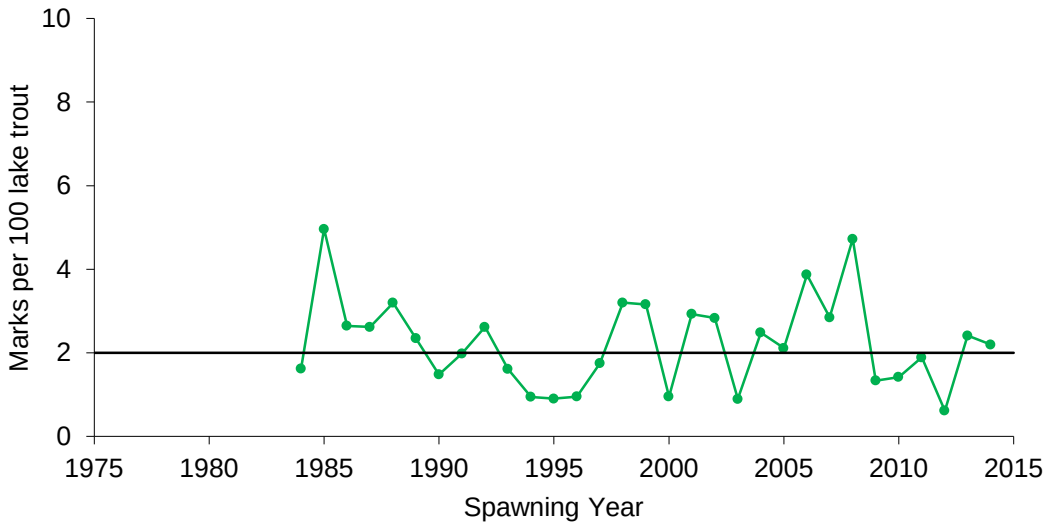

Figure 9. Average number of A1 marks per 100 lake trout >431 mm from standardized fall assessments in Lake Ontario, plotted in the year that the juvenile cohort returned as adults (marking recorded in the fall is inflicted by the cohort of sea lampreys that spawns the next spring). The horizontal line represents the target of 2 A1 marks per 100 fish.

Adult Assessment

The long-term effectiveness of the SLCP has been measured by the annual estimation of the lake-wide populations of adult sea lampreys. Terminology for life stages in this report have been standardized from previous years and the term *adult* has replaced *spawning-phase*. Traps and nets are operated to capture migrating adult sea lampreys during the spring and early summer. Abundance is estimated using a combination of mark-recapture and trapping efficiency estimates of adults in streams with traps, and regression model-predicted estimates in streams without traps.

Lake Superior

- A total of 3,641 sea lampreys were trapped on 19 tributaries (Table 21, Figure 15).

- The estimated population of adult sea lampreys was 53,871 (95% CI; 44,920-68,896) and was within the target range of 39,209 ± 21,083 (Figure 10).

- Adult sea lamprey migrations were monitored in the Amnicon, Poplar, Middle, Bad, Firesteel, Misery, and Silver rivers through cooperative agreements with GLIFWC, 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 (WDNR), and in the Miners River with the National Park Service, Pictured Rocks National Lakeshore.

- An eel-ladder style trap (ELST) was tested at the Brule River trapping site. This was the second year of a two year study to compare trap success and bias of the ELST compared to traditional funnel traps. Results of this research are currently being analyzed, but early observations indicate that sea lampreys will use the ladders and have a 100% retention rate in the associated trap. A Commission research completion report, *Field comparison of eel-ladder-style and traditional lamprey traps* (Reinhardt et al.), will be submitted in early 2014.

Table 21. Tributary name, number caught, adult sea lamprey 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 2013 (letter in parentheses corresponds to location of stream in Figure 15).

Tributary	Number Caught	Adult 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.	250	803	31	--	--	---	---	---	---
- McIntyre R.	0	0	0	0	0	---	---	---	---
Pancake R. (B)									
- Gimlet Cr.	62	---	---	62	50	---	---	---	---
Carp R. (C)	116	212	55	116	50	---	---	---	---
Stokely Cr. (D)	0	0	0	0	0	---	---	---	---
Big Carp R. (E)	15	19	78	15	60	---	---	---	---
Total or Mean (Canada)	**443**	**---**	**---**	**193**	**51**	**---**	**---**	**---**	**---**
United States									
Tahquamenon R. (F)	1,087	7,001	16	31	84	465	475	223	256
Betsy R. (G)	402	2,059	20	42	57	462	455	223	234
Miners R. (H)	183	433	42	62	65	426	433	200	199
Furnace Bay Cr. (I)	45	140	32	4	100	398	---	215	---
Rock R. (J)	283	466	61	166	45	437	441	196	205
Laughing Whitefish R. (K)	5	---	---	1	100	440	---	286	---
Chocolay R.(L)	47	---	---	4	100	478	---	256	---
Big Garlic R. (M)	44	---	---	1	100	560	---	412	---
Silver R. (N)	26	78	33	4	75	463	414	266	280
Misery R. (O)	30	59	51	3	33	420	370	153	325
Firesteel R. (P)	12	---	---	1	100	420	---	253	---
Red Cliff Cr. (Q)	0	---	---	---	---	---	---	---	---
Bad R. (R)	286	4,131	7	7	43	443	407	200	165
Brule R. (S)	42	---	33	---	---	---	---	---	---
Poplar R. (T)	0	---	---	---	---	---	---	---	---
Middle R. (U)	704	6,984	10	18	56	423	441	255	233
Amnicon R. (V)	2	---	---	---	---	---	---	---	---
Total or Mean (U.S.)	**3,198**	**---**	**---**	**344**	**56**	**442**	**440**	**211**	**212**
Total or Mean (for lake)	**3,641**	**---**	**---**	**537**	**54**	**441**	**430**	**177**	**176**

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

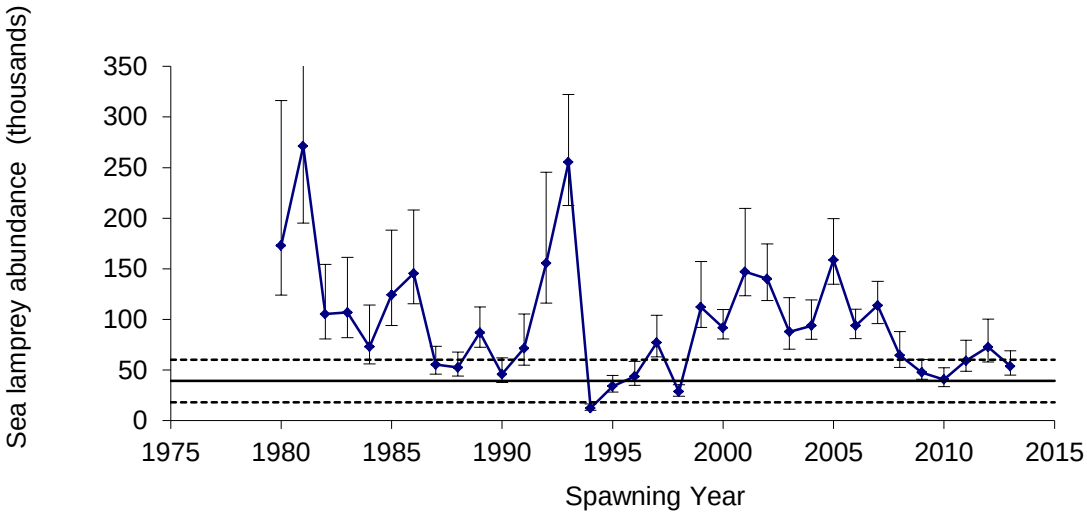

Figure 10. Annual lake-wide population estimates of adult sea lampreys in Lake Superior, 1980 – 2013 with 95% confidence intervals (vertical error bars). Target abundance is indicated by the solid horizontal line with 95% confidence intervals (dashed horizontal lines).

Lake Michigan

- A total of 10,587 sea lampreys were trapped at 18 sites in 17 tributaries (Table 22, Figure 15).

- The estimated population of adult sea lampreys was 57,596 (95% CI; 52,971-63,469) and was within the target range of 59,331 ± 13,557 (Figure 11).

- Adult 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.

Table 22. Tributary name, number caught, adult sea lamprey estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Michigan during 2013 (letter in parentheses corresponds to location of stream in Figure 15).

Tributary	Number Caught	Adult Estimate	Trap Efficiency	Number Sampled[1]	Percent Males[2]	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Carp Lake Outlet (A)	1,187	1,437	83	409	55	485	490	241	256
Jordan R. (B)	---	---	---	---	---	---	---	---	---
Deer Cr.	42	95	44	9	44	483	493	261	286
Elk Lake Outlet (C)	8	---	---	---	---	---	---	---	---
Boardman R. (D)	217	472	46	57	47	501	496	256	277
Betsie R. (E)	729	2,797	26	99	64	505	487	269	264
Big Manistee R. (F)	689	3,771	18	65	68	500	498	279	290
Little Manistee R. (G)	28	40	71	13	38	507	486	288	263
Muskegon R. (H)	879	2,709	32	134	56	507	512	281	288
White R. (I)	342	781	44	97	57	498	497	266	271
St. Joseph R. (J)	480	5,963	8	31	61	488	488	241	255
Trail Cr. (K)	150	288	52	53	38	492	489	241	255
East Twin R. (L)	52	266	20	10	40	502	487	338	269
Oconto R. (M)	12	---	---	1	0	---	500	---	208
Peshtigo R. (N)	1,966	3,161	62	260	42	512	510	273	291
Menominee R. (O)	292	1,946	15	13	69	507	543	266	339
Ogontz R. (P)	0	---	---	---	---	---	---	---	---
Manistique R. (Q)	3,491	5,948	59	157	50	504	502	271	284
Hog Island Cr. (R)	23	91	25	7	71	497	532	283	298
Total or Mean	**10,587**	**---**	**---**	**1,415**	**53**	**505**	**499**	**262**	**275**

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

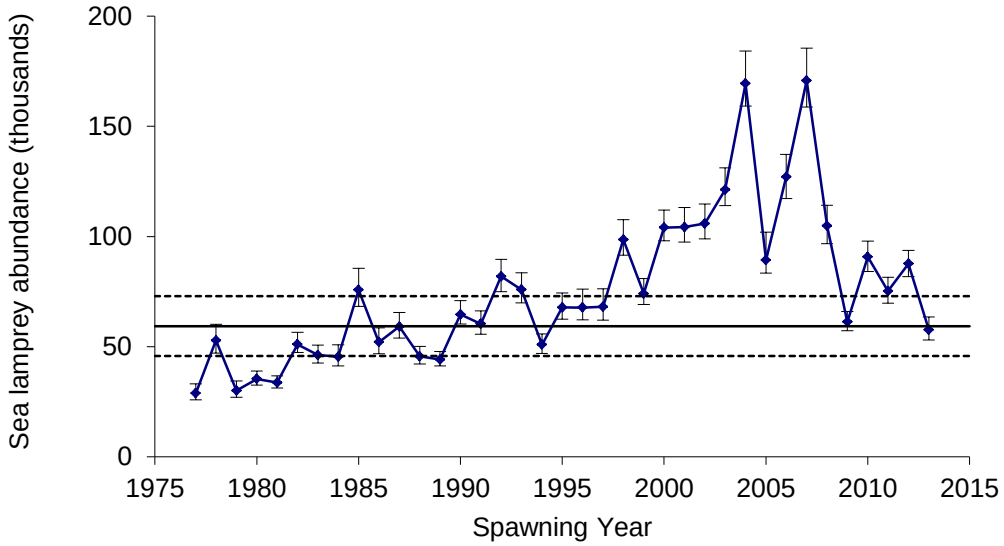

Figure 11. Annual lake-wide population estimates of adult sea lampreys in Lake Michigan, 1980-2013 with 95% confidence intervals (vertical error bars). Target abundance is indicated by the solid horizontal line with 95% confidence intervals (dashed horizontal lines).

Lake Huron

- A total of 36,241 sea lampreys were trapped at 16 sites in 15 tributaries (Table 23, Figure 15).

- The estimated population of adult sea lampreys was 126,421 (95% CI; 115,644-156,881) and was greater than target range of 76,396 ± 20,260 (Figure 12).

- A total of 6,198 adult sea lampreys were captured in traps operated in the St. Marys River at the Clergue Generating Station (Clergue) in Canada, and the USACE, Cloverland Electric plants and compensating gates in the U.S. The estimated population in the river was 11,695 sea lampreys and trapping efficiency was 53%.

- A field experiment to increase trap efficiency by manipulating flow at the compensating gates and at the Clergue was conducted on the St. Marys River. Results showed that increases in water flow around traps at the Clergue increased sea lamprey movement and their availability to traps, but did not affect trap capture. Increases in water flow did result in increased trap capture at the compensating gates near the upstream end of the St. Marys River rapids. Additionally, surveys performed by professional divers indicated that marked sea lampreys migrate to the trap site and mix with unmarked sea lampreys. Divers also found that sea lampreys could be manually removed downstream from the Clergue. Finally, shifting the flow in the St. Marys River rapids from one side to the other did not increase our ability to observe and sample sea lamprey nests. A Commission research completion report, *Enhanced St. Marys River Sea Lamprey Control* (Barber et al.), was submitted during 2013.

- An eel-ladder style trap (ELST) was tested at the Ocqueoc and Cheboygan rivers trapping sites. This was the second year of a two year study to compare trap success and bias of the ELST compared to traditional funnel traps. Results of this research are currently being analyzed, but early observations indicate that sea lampreys will use the ladders and have a 100% retention rate in the associated trap. A Commission research completion report, *Field comparison of eel-ladder-style and traditional lamprey traps* (Reinhardt et al.), will be submitted in 2014.

Table 23. Tributary name, number caught, adult sea lamprey 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 2013 (letter in parentheses corresponds to location of stream in Figure 15).

Tributary	Number Caught	Adult Estimate	Trap Efficiency	Number Sampled[1]	Percent Males[2]	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Canada									
St. Marys R. (A)	6198	11695	53	5116	63	---	---	---	---
Echo R. (B)	4510	7671	60	440	60	---	---	---	---
Thessalon R. (C)	62	769	8	62	84	---	---	---	---
Bridgeland Creek (Little Thessalon)	3814	5981	64	352	58	---	---	---	---
Mississagi R. (D)	23	---	---	23	70	---	---	---	---
Total or Mean (Canada)	**14,607**	**---**	**---**	**5,993**	**67**	**---**	**---**	**---**	**---**
United States									
Saginaw R. (E)	---	---	---	---	---	---	---	---	---
Tittabawassee R.	35	---	---	---	---	---	---	---	---
East Au Gres R. (F)	1,280	6,062	21	74	72	380	362	341	329
Au Sable R. (G)	873	6,311	14	40	78	392	353	350	333
Devils R. (H)	42	192	22	11	55	507	498	280	275
Trout R. (I)	86	206	42	20	70	477	509	244	265
Ocqueoc R. (J)	2,432	3,868	63	405	52	489	489	242	255
Greene Cr. (K)	2	---	---	---	---	---	---	---	---
Cheboygan R. (L)	16,455	23,404	70	917	55	492	489	241	250
Carp R. (M)	15	---	---	---	---	---	---	---	---
Trout Cr. (N)	39	168	23	3	33	248	520	505	275
Albany Cr. (O)	375	1,144	33	56	57	475	479	257	254
St. Marys R. (A)	See Canada	See Canada	See Canada	13	54	516	533	295	333
Total or Mean (U.S.)	**21,634**	**---**	**---**	**1,539**	**56**	**480**	**484**	**253**	**257**
Total or Mean (for Lake)	**36,241**	**---**	**---**	**7,532**	**63**	**473**	**476**	**237**	**232**

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

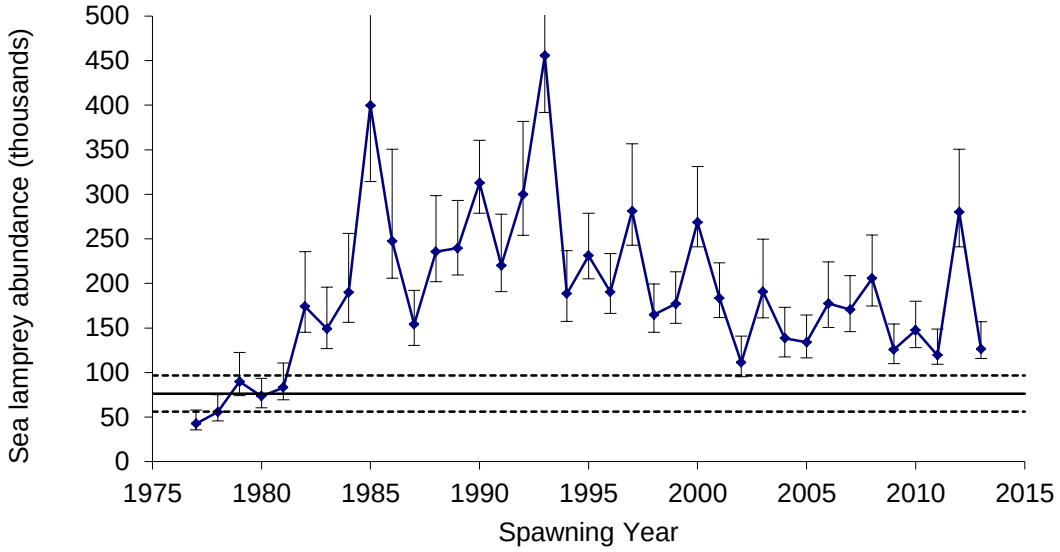

Figure 12. Annual lake-wide population estimates of adult sea lampreys in Lake Huron, 1980 – 2013 with 95% confidence intervals (vertical error bars). Target abundance is indicated by the solid horizontal line with 95% confidence intervals (dashed horizontal lines).

Lake Erie

- A total of 6,015 sea lampreys were trapped in nine sites on five tributaries during 2013 (Table 24, Figure 15).

- The estimated population of adult sea lampreys was 16,641 (95% CI; 14,716-19,654) and was greater than target range of 3,536 ± 1,079 (Figure 13).

- Construction of the permanent sea lamprey trap at Scoby Hill Dam on Cattaraugus Creek was completed and the trap was operated during the 2013 trapping season, capturing 2,420 sea lampreys. Trap efficiency improved to 59% during 2013 compared to 14% and 5% during 2012 and 2011, respectively, when portable traps were used.

- Experimental trapping in Clear Creek, tributary to Cattaraugus Creek, was completed with the assistance of the Seneca Nation of Indians. Two fyke nets were successfully deployed, capturing 53 sea lampreys.

- A population estimate was derived for Big Otter Creek for the first time, using a permanent trap located in a tributary, Little Otter Creek, and releasing marked sea lampreys throughout the entire river.

Table 24. Tributary name, number caught, adult sea lamprey 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 2013 (letter in parentheses corresponds to location of stream in Figure 15).

Tributary	Number Caught	Adult 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 Otter Cr. (A)	32	---	---	---	---	---	---	---	---
Little Otter Cr.	139	1838	8	---	---	---	---	---	---
Big Cr. (B)	2785	4958	56	---	---	---	---	---	---
Young's Cr. (C)	419	639	66	---	---	---	---	---	---
Total or Mean (Canada)	**3,375**	---	---	---	---	---	---	---	---
United States									
Cattaraugus Cr. (D)	2,420	4,136	59	274	51	527	522	292	302
Spooner Cr.	30	---	---	5	60	521	494	306	274
Clear Cr.	53								
Grand R. (E)	136	875	16	3	33	540	440	296	277
Huron R. (F)	1	---	---	---	---	---	---	---	---
Total or Mean (U.S.)	**2,640**	---	---	**282**	**51**	**527**	**520**	**292**	**301**
Total or Mean (for lake)	**6,015**	---	---	**282**	**51**	**527**	**520**	**292**	**301**

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

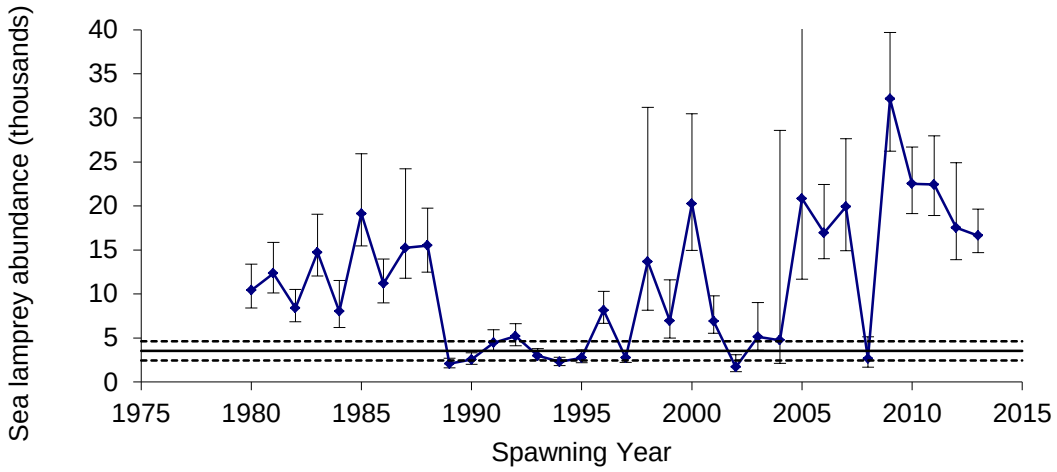

Figure 13. Annual lake-wide population estimates of adult sea lampreys in Lake Erie, 1980 – 2013 with 95% confidence intervals (vertical error bars). Target abundance is indicated by the solid horizontal line with 95% confidence intervals (dashed horizontal lines).

Lake Ontario

- A total of 6,434 sea lampreys were trapped at 12 sites on 11 tributaries (Table 25, Figure 15).

- The estimated population of adult sea lampreys was 29,098 (95% CI; 26,352-32,357), which was within the target range of 31,427 ± 3,927 (Figure 14).

Table 25. Tributary name, number caught, adult sea lamprey estimate, trap efficiency, number sampled, percent males, and biological characteristics of adult sea lampreys captured in assessment traps or nets in tributaries of Lake Ontario during 2013 (letter in parentheses corresponds to location of stream in Figure 15).

Tributary	Number Caught	Adult 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									
Humber R. (A)	3,674	4481	82	374	46	491	488	280	284
Duffins Cr. (B)	763	953	80	76	45	524	505	310	294
Bowmanville Cr. (C)	211	984	21	69	36	511	503	289	292
Graham Cr. (D)	306	561	55	99	48	513	498	287	281
Cobourg Cr. (E)	272	554	49	19	37	510	484	---	---
Salmon R. (F)	58	167	35	---	---	---	---	---	---
Total or Mean (Canada)	**5,284**	---	---	**637**	**45**	**501**	**493**	**286**	**286**
United States									
Black R. (G)	341	2,100	16	16	62	451	485	221	294
Salmon R.(H)									
Orwell Br.	435	908	48	91	49	517	514	308	302
Grindstone Cr. (I)	4	---	---	---	---	---	---	---	---
Little Salmon R. (J)	24	---	---	---	---	---	---	---	---
Sterling Cr. (K)	280	938	30	54	65	505	507	280	284
Sterling Valley Cr.	66	---	---	1	0	---	439	---	238
Total or Mean (U.S.)	**1,150**	---	---	**162**	**56**	**505**	**508**	**288**	**296**
Total or Mean (for lake)	**6,434**	---	---	**799**	**47**	**502**	**496**	**287**	**288**

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

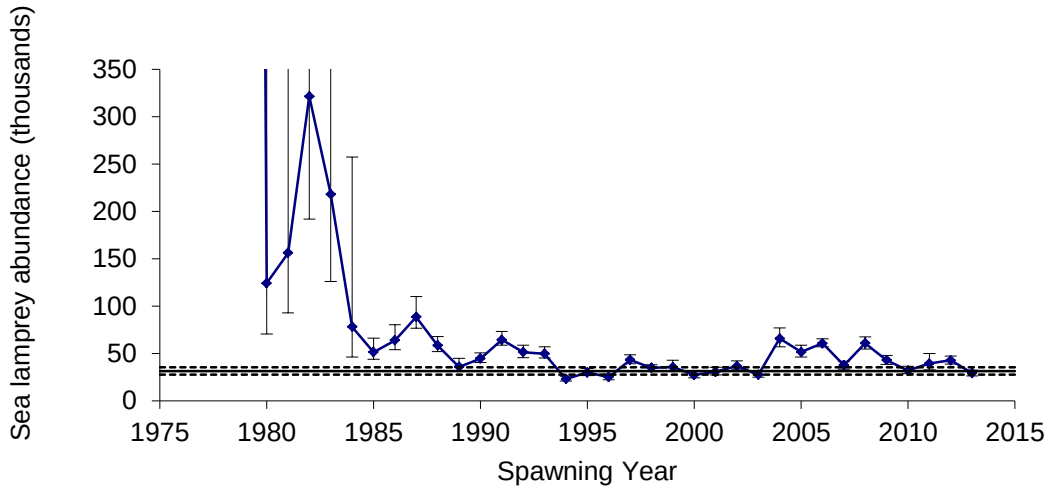

Figure 14. Annual lake-wide population estimates of adult sea lampreys in Lake Ontario, 1980 – 2013 with 95% confidence intervals (vertical error bars). Target abundance is indicated by the solid horizontal line with 95% confidence intervals (dashed horizontal lines).

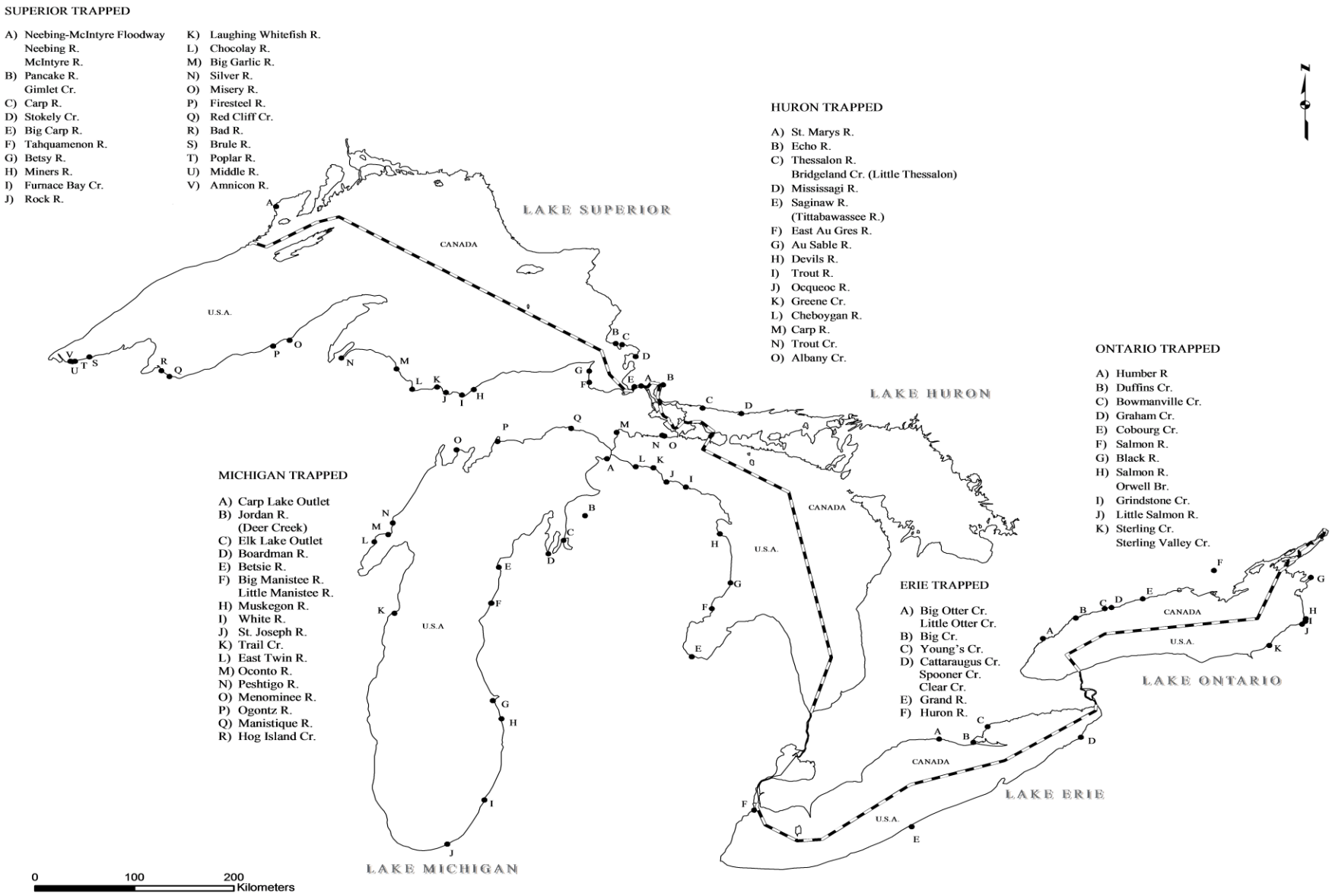

Figure 15. Locations of tributaries where assessment traps were operated during 2013.

RISK MANAGEMENT

Risk management addresses environmental and non-target issues related to the implementation of the SLCP in the U.S. 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 US 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 habitat.

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 2013, 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:

- Columbus Ohio Field Office
- East Lansing Field Office
- Green Bay Field Office
- New York Field Office
- Pennsylvania 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

- Snuffbox Mussel - A Biological Assessment (BA) that evaluated the toxicity of TFM to the federally-listed snuffbox mussel (*Epioblasma triquetra*) was accepted by the Columbus Ohio Field Office (COFO). COFO's concurrence with the BA's "not likely to adversely affect" determination means that streams that have extant populations of snuffbox mussels can be treated with TFM provided that treatments occur prior to snuffbox glochidia encystment (May 1) on the gills of the host fish (logperch; *Percina caprodes*) and lampricide is applied at a target concentration ratio ≤ 1.3 X the predicted sea lamprey minimum lethal concentration (SLMLC) to minimize logperch mortality. These conditions were met during the 2013 treatment of the Grand River (Ohio). A total of 10 dead logperch were collected within the 25 miles of the Grand River surveyed for non-target mortality.

State-Listed Species

Annual Reviews

Reviews are annually conducted with state agencies to fulfill regulatory 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 2013, the following state regulatory offices reviewed endangered species within their jurisdiction and issued permits to conduct lampricide applications:

- MIDNR
- Pennsylvania Department of Environmental Protection

Species or Stream-specific Investigations

- Stonecat madtom - A survey for stonecats (*Notorus flavus*) that were captured, marked, and released in a riffle section on the Chippewa River (Lake Huron) prior to and following the 2012 TFM treatment, was conducted during July. A total of 30 stonecats were collected, one of which had a mark from the 2012 August survey. The purpose of the study was to determine the proportion of the population that survived a TFM (3-triflouro-methyl-4-nitrophenol) treatment. A completion report will be submitted to the GLFC.

Field Protocols

Both federal and state listed species are considered in protocols that are annually developed for SLCP field staff. The protocols detail conservation measures to be followed where sea lamprey control activities are scheduled near listed species. During 2013, 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 2013.*

- *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 2013*.

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 2013 for the 55 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 2013.

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 greater than 50 non-schooling or 1,000 schooling fish of any non-target species or taxa during a lampricide application (Table 26).

Table 26. Summary of 6(a)(2) reports submitted for incidents of non-target mortality during 2013.

Lake	Stream	Mortality	Freq	Comments
Erie	Grand R.[1]	Stonecat (*Noturus flavus*) N. Hog Sucker (*Hypentelium nigricans*)	178 50	Sensitive to TFM & downstream of AP with poor mix
	Conneaut Cr.[1]	Stonecat (*Noturus flavus*) Mudpuppy (*Necturus maculosus*)	529 110	Sensitive to TFM & downstream of AP
		Bullfrog tadpole (*Rana catesbeiana*) American toad tadpole (*Bufo americanus*)	5,103 2,000	Found in backwater, longer contact time
	Cazenovia Cr.[1]	Stonecat *(Noturus flavus)* Creek Chub *(Semotilus atromaculatus)*	1,500 400	Unexpected pH drop due to heavy rain
Superior	Ravine R. [1]	Mottled sculpin (*Cottus bairdii*)	53	Unexpected pH drop

[1] TFM. [2] Niclosamide. TFM/niclosamide[3]

This table does not include 6(A)(2) Reports that were filed as a result of sea lamprey control operations conducted in Lake Champlain or its tributaries.

DFO Species At Risk (SAR) Assessment

In conjunction with the St. Clair River granular Bayluscide assessment work, Department Species at Risk staff based at the Canadian Centre for Inland Waters in Burlington, Ontario completed a second year of trawl sampling to evaluate the impacts of Niclosamide exposure to Species at Risk, including northern madtom (*Noturus stignosis)*, channel darter, (*Percina copelandi)*, and several native mussel species. A subset of assessment plots (22) were trawled using a Missouri trawl net both before and after Sea Lamprey Control Centre (SLCC) Bayluscide applications. Twenty-two additional control plots that were not treated with Bayluscide were trawled as well. Consistent with observations in 2012, no non-target effects were observed in any of the assessment trawls.

The results of this work were presented at a December 2013 meeting in Sarnia, Ontario attended by Department SAR and SLCC staff and researchers from USGS - Upper Midwest Environmental Sciences Center (UMESC). Research emanating from discussions by this group on the impacts of Bayluscide on various life phases of native mussel species is ongoing at UMESC.

TASK FORCE REPORTS

During its 2012 Annual Meeting the Commission restructured its Sea Lamprey Integration Committee (SLIC) and task forces. The SLIC was reformed into the Sea Lamprey Control Board (SLCB). The Lampricide Control and Barrier task forces remained intact. The Assessment and Reproduction Reduction task forces were disbanded and replaced with the two new task forces: the Larval Assessment Task Force and the Trapping Task Force. 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 SLCB, which established 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 SLCB.

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.

2013 Membership

Brian Stephens (Chair), Barry Scotland, (Department); Dorance Brege, Cheryl Kaye, Lisa Walter, Shawn Nowicki, Tim Sullivan (Service); Jean Adams, Mike Boogaard, Terry Hubert, Karen Slaght (USGS); Michael Wilkie (Wilfred Laurier University); Dale Burkett, Ted Treska (GLFC 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.

2013 Outcomes:

1. Where applicable, strategies were employed to reduce the number of sea lamprey that survive treatment and increase the effectiveness of individual stream treatments. Backwater and isolated areas in the target stream that don't receive lethal doses of lampricide were treated in conjunction with the main application be prevent survival and/or escapement in these refugia areas. Lampricide concentrations were targeted to be greater than 10% above theoretical values due to some uncertainty with the predictive chart levels. With the exception of outside agency constraints (i.e. state, provincial, hydro generation) streams were scheduled for treatment in the optimal time of year to ensure sufficient discharge. As the field season continues into the fall period, streams are to be treated for a longer duration because of seasonal variation in TFM sensitivity.

2. Available personnel from all three stations (Marquette, Ludington, and Sault Ste. Marie) combined to treat Cattaraugus Creek in late March to ensure that remaining US tributaries scheduled for treatment in Lake Erie could be conducted during the spring which is the optimal time for these streams. This time period was considerably earlier than the normal field season start. In addition,
3. The new shallow draft jet drive granular Bayluscide spray boat was used for the first time in 2013. A hybrid approach to treating some plots in the St. Marys was used to treat a higher percentage of the area. The new boat was able to apply lampricide to shallow areas and then data was transferred to the operating system on the larger spray boat to complete the plot. This resulted in improved coverage in individual plots.
4. Treated streams that were listed under the 'Geographical Efficiencies' category of the stream ranking process in order to realize savings in travel and to increase the efficiency in utilizing field personnel . Some of these treatments included both a lotic TFM and lentic gB application in conjunction with each other resulting in increased effectiveness.
5. The use of Emulsifiable Concentrate (EC) was increased both in large systems and in tributaries not generally treated using niclosamide. As compared to Bayluscide Wettable Powder (WP), this product is easier to apply and results in improved regulation of the chemical concentrations to ensure required levels to kill lamprey are achieved.
6. An internal lampricide control program review was initiated in 2013. The review identified areas within lampricide control where current operations, methods, policies etc. may be improved to realize a more effective and efficient lampricide application program.

2014 Objectives:

1. Review past results and larval assessment data to direct implementation of applicable treatment strategies to achieve improved efficacy for streams ranked for treatment in 2014.
2. Deploy additional personnel from within the program during the spring to treat more streams to take advantage of seasonal susceptibility and optimal stream discharge and water chemistries.
3. To increase treatment effectiveness on St. Marys gB applications, utilize all three spray boats within the program to ensure treatments are completed before aquatic vegetation becomes problematic.
4. Continue to develop methodology to apply Emulsifiable Concentrate (EC) in larger volume applications in order to phase out the use of Wettable Powder. The use of EC facilitates the application and regulation of niclosamide concentrations.

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

2013 Outcomes:

1. Lampricide analysis and water chemistry data from treatments in 2013 were reviewed to identify potential areas that did not receive theoretical lethal TFM concentrations during stream treatments. Information is provided to larval assessment to help guide treatment evaluation survey effort and if required, may result in re-treatment.
2. Treatment evaluation surveys were reviewed to identify deficiencies in the treatment effectiveness.

2014 Objectives:

1. Review treatment generated data and treatment evaluation survey information to refine treatment enhancement strategies for future treatments.
2. Conduct on-stream observations during lampricide treatments to determine the presence of residual larvae and identify possible sources.

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.

2013 Outcomes:

1. Provided assistance to the Larval Assessment Task Force in development of the 2014-2015 large-scale treatment strategy.
2. Where applicable, **i**mplemented control strategies (such as identifying treatment enhancement strategies and identifying and inventorying geographical features where treatment effectiveness can be improved) as identified in the Sea Lamprey Control Plan for all the Great Lakes

2014 Objectives:

1. Assist the Larval Assessment Task Force in the development of a comprehensive treatment and assessment plan the HEC.
2. Implement, where practical, lampricide control strategies as described in the Sea Lamprey Control Plans.
3. To increase the effectiveness of stream treatments which are combined with lentic gB applications through the stream ranking process, attempt to treat the lentic area in conjunction with or immediately following the TFM application.
4. Optimize stream treatment schedules to facilitate implementation of the large-scale treatment strategy.

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.

2013 Membership

Jessica Barber (Chair), Cheryl Kaye, Rob Elliott (Service); Brian Stephens, Tonia Van Kempen, Bhuwani Paudel, and Tom Pratt (Department); Jim Galloway and Carl Platz (USACOE); Randy Claramunt and Gary Whelan (MIDNR); Melissa Rose (OMNR); Nicholas Johnson (USGS); Rob McLaughlin (University of Guelph); Dale Burkett and 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.

2013 Outcomes:

1. Construction of the Orwell Brook (Lake Ontario) sea lamprey barrier was completed reducing access to spawning habitat. Funds used to conduct annual lampricide treatments of Orwell Brook were re-allocated within the treatment program.
2. Stoplog replacement and maintenance at the Union Street Dam, Boardman River (Lake Michigan) was completed to address escapement, thereby restoring the blocking function and limiting access to upstream spawning habitat.
3. Modifications to the Sand River (Lake Superior) barrier to prevent upstream migration were completed, restoring the blocking function of the barrier to ensure adult sea lampreys do not have access to spawning habitats.
4. Routine maintenance at purpose-built sea lamprey barriers was completed to ensure adult sea lampreys do not have access to spawning habitats.
5. Inspection of barriers built by others in the Great Lakes was conducted to assess whether these structures would prevent upstream migration and to identify repairs necessary to minimize the number of parasitic lampreys originating from untreated sources.

2014 Objectives:

1. Initiate construction of the Manistique River (Lake Michigan) sea lamprey barrier to prevent sea lampreys from migrating upstream to spawning habitat.
2. Complete design for rebuilding the Harpersfield Dam on the Grand River (Lake Erie) as a sea lamprey barrier. Plan for construction in FY15 to ensure that sea lampreys remain blocked at the Harpersfield Dam.

3. Initiate rebuild of Denny's Dam on the Saugeen River (Lake Huron), subject to successful consultation between OMNR and Saugeen Ojibway Nation to ensure that sea lampreys remain blocked at Denny's Dam.
4. Members remain engaged in the Structured Decision Analysis effort to reach a decision point regarding the Black Sturgeon River (Lake Superior) Camp 43 dam.
5. Members remain engaged in the analysis of options at the 6th Street Dam on the Grand River (Lake Michigan) to assess risk of adult sea lampreys migrating upstream of the proposed structure that will enable a whitewater rapids area in downtown Grand Rapids.
6. Continue working on priority GLFER barrier projects with the USACE: Bad River (Lake Superior), White and Little Manistee rivers (Lake Michigan) to limit sea lamprey access to spawning habitat.
7. Investigate repair, rebuild, or removal alternatives for the sea lamprey barrier on Duffin's Creek (Lake Ontario) to restore blocking function.
8. Operate and maintain barriers to limit sea lamprey access 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.

2013 Outcomes:

1. Participated in repellant trials at the Carp Lake Outlet (Lake Michigan) where the compound was found to increase the likelihood of upstream movement highlighting its utility in a push-pull scenario to direct lampreys toward a successful trap or effective treatment location.
2. Cheboygan Working Group developed a strategic plan proposing a practical set of options to pursue in the upper Cheboygan to estimate population size and control options. Group investigated wounding and adult capture reports from the upper Cheboygan River system and confirmed presence of adult sea lampreys through monitoring of fyke nets and nest surveys.

2014 Objectives:

1. Remain involved in barrier research regarding use of chemo-sensory techniques to block or guide sea lamprey movement to increase capture of adult sea lampreys at barrier/trap complexes.
2. Support repellant trials in a bifurcated stream to further test alarm cue response and its utility in a push-pull scenario to direct lampreys toward a successful barrier/trap complex or effective treatment location.
3. Submit a proposal to field test the NEMO system as a guiding or blocking technology to limit sea lamprey access to spawning habitat.
4. The Cheboygan Working Group will repeat 2013 experiment, but with an increased number of releases (3-5,000) to conduct a more robust analysis to determine population abundance upstream of the Cheboygan Lock and Dam complex.

Larval Assessment Task Force

The task force was established in 2012 and combined some objectives from the Assessment Task Force and the Larval Assessment Work Group.

Purpose

Rank streams and lentic areas for sea lamprey control options and evaluate success of lampricide treatments through assessment of residual larvae.

2013 Membership

Lisa Walter (Chair) and Alex Gonzalez, (USFWS); Fraser Neave, Mike Steeves and Brian Stephens, (DFO); Jean Adams and Chris Holbrook, (USGS); Travis Brenden, (Quantitative Fisheries Center, Michigan State Univeristy); Ted Treska and Dale Burkett (GLFC Secretariat). Rotating members: Aaron Jubar, Lynn Kanieski, Dave Keffer, Matt Symbal (USFWS); Kevin Tallon and Sean Morrison (DFO)

Progress towards goals described in the GLFC Vision:

Goal 1: Suppress sea lamprey populations to target levels.

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

2013 Outcomes:

1. Detection surveys were conducted on 212 tributaries and two lentic areas during 2013. Schlotz Creek (a Lake Superior tributary) and the Whitefish River (a Lake Huron tributary) were identified as new producers but neither ranked for treatment during 2014. Sea lamprey larvae were found in Casenovia, Cayuga and Forestville creeks, tributaries to Lake Erie's Buffalo River. Casenovia and Forestville creeks were subsequently treated during 2013.
2. Distribution surveys were conducted during 2013 for tributaries scheduled for treatment during late summer and fall 2013 and for tributaries that were scheduled for treatment in early 2014. Conducting distribution surveys during the year of treatment can improve the placement accuracy of treatment application points.
3. During 2013, 17.75 ha of the St. Clair River was surveyed with granular Bayluscide (gB), including the upper river and the three main delta channels. Annual sampling of index plots is used to monitor population trends in the river and detect new areas of infestation. A total catch of 434 sea lampreys was scattered throughout the river with a few high-density areas, particularly northwest of Stag Island. A total of 3.6 ha were surveyed in Lake St. Clair at the mouth of the St. Clair River and ten sea lampreys were captured. The Detroit River was sampled but no larvae were recovered.

LATF and joint LATF/LCTF meeting discussions focused on potential treatment and assessment options to be included in the HEC Assessment and Control Plan. Recommendations for additional data analysis were made, and subsequent GIS work re-estimated river-wide habitat, expanding the area beyond what was mapped with RoxAnn. Habitat was classified based on substrate, bathymetry and velocity data, and total available habitat in the entire river (including channels adjacent to the Walpole Island First Nation) is now estimated to be 5,515 ha (one previous estimate was 1,352 ha). Applying this more comprehensive habitat value to the density estimates results in a St. Clair River larval population estimate of 1.14 million larvae.

2014 Objectives:

1. Continue to plan and conduct assessments that investigate potential new infestations in streams and lentic areas and prepare streams for lampricide treatments in 2014 and 2015.
2. Draft a HEC Assessment and Control Plan for review at the fall 2014 SLCB meeting. Incorporate findings from the Lake Erie juvenile coded-wire tag study (returns are expected in spring 2014). Conduct larval assessments on the HEC that target index sites and previously unassessed areas of concern in the St. Clair River. Continue consultations with Walpole Islands First Nations (WIFN) and if agreement is reached, conduct RoxAnn and gB or deepwater electrofishing assessments in channels adjacent to WIFN lands.

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

2013 Outcomes:

1. Post-treatment assessments were conducted on 95 tributaries and 11 lentic areas that were treated during 2012 and 2013. Seven tributaries totaling 865 staff days of lampricide control effort ranked for treatment during 2014 based on residual sea lampreys found in treatment evaluation surveys conducted during 2013. Treatments of these streams are estimated to kill about 841,000 larvae basin-wide.

2014 Objectives:

1. Continue to conduct post-treatment assessments on all treated river systems and rank streams where large residual sea lampreys are recovered.
2. The USGS - UMESC will investigate the release rate and emergence time of larval lampreys when gB is applied in cold water (<10 C). Results from this study have direct applicability to both treatment effectiveness and larval assessment protocols, since collection time on gB assessment plots is currently one hour regardless of water temperature.

Goal 2: Increase the effectiveness and efficiency of sea lamprey control to further reduce sea lamprey populations in each Great Lake.

Strategy 3: Improve existing and develop new rapid assessment methods to determine the distribution and relative abundance of larval sea lamprey populations.

2013 Outcomes:

1. LATF members updated protocols detailing methods to conduct ranking surveys. Discussions on how to code survey types, specifically in negative streams and above barriers, were held at the 13-02 LATF meeting to maintain consistency among offices.

2014 Objectives:

1. The LATF is working with the BTF to create a protocol for consistently estimating production above barriers. A draft of the protocol is expected to be complete for the 14-02 SLCB meeting. In addition, the FWS will be working to combine the larval assessment and BIPSS databases to simplify reporting.
2. Investigate the potential for using non-traditional methods, such as eDNA, to investigate presence/absence and to quantify larval sea lampreys. Sampling negative streams using eDNA could provide a thorough inventory of sea lamprey producing tributaries. If the method is available to determine presence, sample processing logistics would need to be explored.

Strategy 4: Implement integrated sea lamprey control strategies for each lake and evaluate their effectiveness.

2013 Outcomes:

1. Members of the LATF finalized the development of the 2014-2015 large-scale treatment strategy, which called for treatment of large producers in lakes Michigan and Huron. The suite of streams selected for treatment during 2014 is Lake Huron's Garden River and Lake Michigan's Manistique, Ford, Cedar, Jordan, Betsie and White rivers.

2014 Objectives:

1. Complete treatment evaluations on tributaries treated as part of the 2012-2013 large-scale treatment strategy and document presence of residuals and recruitment. Draft an interim report for review in fall 2014.
2. Work on a HEC Assessment and Control Plan continues, and a draft will be available for review at fall 2014 meetings. Coded-wire tagged juveniles released during fall 2012 should be observed in adult assessment traps during 2014.
3. Plan for distribution surveys on streams selected for treatment as part of the 2015 large scale treatment strategy.

Trapping Task Force

Purpose
Coordinate optimization of trapping techniques for assessing adult sea lamprey populations and removing adult and transforming sea lampreys from spawning and feeding populations.

2013 Membership
Gale Bravener (Chair) and Mike Steeves (Department), Jessica Barber (Service), Jean Adams, Scott Miehls, Jane Rivera, Alex Haro (USGS); Weiming Li and Michael Wagner (Michigan State University); Rob McLaughlin (University of Guelph), Michael Siefkes, Dale Burkett (Commission Secretariat).

Progress towards goals described in the GLFC Vision:

Goal 1: Suppress sea lamprey populations to target levels.

Strategy 4: Quantify the relationship between the abundance of adult sea lampreys, lake trout abundance, and marking rates on lake trout.

2013 Outcomes:

1. Trap operation and maintenance for the purpose of estimating adult sea lamprey abundance was conducted in 71 streams throughout the Great Lakes. The abundance of adult sea lampreys was estimated for each of the Great Lakes, using a combination of mark recapture estimates for trapped streams, and model estimates for un-trapped streams.
2. An index to track adult sea lamprey populations over time continued to be explored. This would avoid the need to rely on model-based population estimates in streams that have never been trapped.
3. Up-to-date lake trout wounding rate data continued to be assembled for each of the Great Lakes.

2014 Objectives:

1. Operate and maintain traps for the purpose of estimating lake-wide adult sea lamprey abundance at 71 streams throughout the Great Lakes.
2. Continue to improve the current method of estimating lake-wide abundance estimates, while evaluating an alternative (index) method.
3. Assemble the most recent lake trout wounding data, and work towards generating more regional or management unit lake trout wounding and abundance estimates.
4. Investigate wounding on species other than lake trout, and the relationship between wounding in areas of high densities of what are considered to be likely targets of young juveniles (bloaters, ciscoes) compared to wounding rates on other species in the same area.

5. Pending the results from pilot project work, begin Lake Huron mark-recapture study using large juveniles tagged with CWT and acoustic telemetry, to evaluate juvenile survival, stream selection by adults, and timing of stream entry by adults (led by Holbrook).
6. Complete the ongoing mark-recapture study to determine the relative contribution of transformers originating St. Clair River to Lake Erie.

Strategy 6: Deploy trapping methods to increase capture of adult and recently metamorphosed sea lampreys.

2013 Outcomes:

1. Six U.S. streams were targeted for trapping recently metamorphosed sea lamprey using nets to remove them before they migrate downstream to feed on fishes in the Great Lakes. A total of 250 sea lampreys were captured.
2. Research to determine the diel and spatial distribution of out-migrating juveniles continued on Lake Champlain tributaries. Sea lampreys were captured throughout the stream channel, rather than being restricted to a portion of the channel.
3. Testing the ability of NEPTUN and Smith-Root electrical systems to guide out-migrating juveniles swimming downstream was completed in February 2013. Both systems guided significantly more lamprey to a trap in the raceway channel compared to control trials. However, testing in a larger flume at the Conte Anadromous Fish Lab in Turners Falls, MA, which mimicked real water depths and velocities, had lower success.
4. Testing the ability of a fishwheel to catch adult sea lampreys in large rivers with no barrier began on the Manistee River April 28 and operated until June 21. Mechanical failure prevented direct comparison to the barrier integrated trap at Tippy Dam during the full season. However, recovery of lamprey marked during June was similar between the wheel and the upstream barrier trap.
5. Testing of eel-ladder style traps (ELST) continued in Cheboygan and Ocqueoc rivers. Side by side comparisons demonstrated that ELSTs caught more sea lampreys (and more female than male sea lampreys) than traditional funnels in the Cheboygan River but not in the Ocqueoc River, suggesting that their utility may be site-specific. All ELSTs showed 100% retention and deployment in the Brule River fishway suggested some promise for sorting lampreys from other fishes.

2014 Objectives:

1. Continue trapping of out-migrating juveniles for control in newly discovered, deferred, or problem streams to mitigate escapement to the lakes, beginning in October 2014.
2. Continue research to determine the diel and spatial distribution of out-migrating juveniles in Lake Champlain tributaries.
3. Continue to test the ability of a fishwheel to capture sea lampreys and obtain a population estimate using mark-recapture methods, in a large river with no barrier.
4. Continue testing and fine-tuning Eel Ladder Style Traps to determine their applicability to the control program.

5. Test the ability of a portable version of the NEPTUN system (NEMO) to guide adult sea lampreys into a trap in management scale situations, starting with Bridgeland Creek in 2014.

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

Strategy 1: Increase the capture of sea lampreys by developing cost-effective trapping methods including those based on release of pheromones.

2013 Outcomes:

1. The large scale field study to test baiting existing sea lamprey control traps with synthesized 3kPZS is complete, the data have undergone extensive analysis, including recent analyses to determine under what conditions 3kPZS-baited trapping is most effective. Nick Johnson and the pheromone research group have met to interpret the results and discuss the recommendation on if and how to proceed.
2. The study to test the ability of spermiating male washings (SMW) and synthesized 3kPZS to increase trap catch was completed. At barriers, SMW-baited traps captured significantly more sea lampreys than paired 3kPZS-baited traps (13% more). At spawning grounds, no difference in trap catch was observed. The lack of an observed difference on spawning grounds may be attributed to increased pheromone competition and other sensory interactions.
3. The finding that 3kPZS can stimulate immature female activity in daytime was published (Walaszczyk et al 2013 J. Biol. Rhythms)
4. The development of a procedure to measure pheromones from 100ml of stream water was published (Wang et al 2013 J. Separation Science 36).
5. The Li lab was involved in the search for antagonist. After searching 8 million compounds – the best inhibitor of 3kPZS is PZS. 3kPZS at 10^{-12}M is highly attractive, PZS at 10^{-12}M is highly repulsive, combined there is no effect. Has application in deterring females form streams.
6. The Li lab continued to search for novel pheromone compounds. Four possible structures of "LW1" (the only behaviorally active migratory pheromone compound found) were investigated; two had an effect ("973" and "971"). Compound 973 can attract late-stage migratory females as well as the full signal (larval washings). Although 971 did not have positive results, 973 + 971 combined seems to act like a sex pheromone.

2014 Objectives:

1. Identify and test novel migratory pheromone compounds.
2. Identify and test novel mating pheromone compounds.
3. Identify and test pheromone antagonists.

Strategy 2: Evaluate a repellent-based method to deter sea lampreys from spawning areas.

2013 Outcomes:

1. Alarm substance (dead lamprey odor) field trials were conducted successfully on the Carp Lake Outlet (Lake Michigan). High alarm cue application increased the likelihood of upstream movement, speed of movement, and trap catch compared to low alarm cue or control nights. During control nights, lampreys tended to rest more often than if they are receiving a cue. It appears that the alarm cue induces movement, with the possible mechanism being motivation to get past the source of the odor.
2. The Li lab discovered a substance (substance 'X') that is very repulsive to both males and females. The substance is equally stimulatory as PZS. This is not likely a necromone. This compound is released by wounded lampreys; possibly an alarm compound.

2014 Objectives:

1. Test the efficacy of the alarm cue as a barrier to migration when applied to one side of a river confluence. Previous research indicates a high likelihood that 100% blockage can be achieved in one tributary at a stream bifurcation (Year 2 of the EPA-funded demonstration project).If the proposal submitted to EPA (with Nick Johnson) is approved, test a push-pull strategy with alarm cue and 3kPZS in a stream with barrier integrated traps.
2. Contingent on EPA funding, (1) evaluate sea lamprey responses to contrasting/conflicting chemical information at critical decision points during the migration (mixtures of alarm cue and larval odor); and (2) work with Nick Johnson to test a push-pull trapping strategy with alarm cue and 3kPZS in a stream with barrier integrated traps. Continue to investigate "substance X" and its function as an alarm cue released by wounded sea lampreys.
3. In cooperation with Dr. Muralee Nair the Wagner lab will continue work to identify the chemical composition of the alarm cue.

Strategy 4: Implement integrated strategies for sea lamprey control for each lake and evaluate their effectiveness.

2013 Outcomes:

1. Worked with LATF to identify and target streams for trapping out-migrating juveniles for control.
2. Evaluated the effects of integrated control strategies that have been implemented (e.g. large-scale treatment strategies) by developing adult sea lamprey abundance estimates and wounding rates on lake trout.

2014 Objectives:

1. Work with LATF to identify and target streams for trapping out-migrating juveniles for control.
2. Continue to evaluate the effect of integrated control strategies that have been implemented by developing adult sea lamprey abundance estimates and wounding rates on lake trout.

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 adult lampreys for visitors to experience the sea lampreys first-hand. During 2013, this display was in attendance at several large capacity events (Table 27).

Table 27. Dates and locations of public outreach performed by agents of the sea lamprey control program in 2013.

Date	Location	Venue	Lead Agency
January 12-13	Michigan City, IN	Northwest Indiana Steelheaders	Service
January 17-21	Cleveland, OH	Mid-America Boat & Fishing Show	Service
January 18-27	Milwaukee, WI	Milwaukee Boat Show	Service
February 7-10	Toronto, ON	Toronto Sportsmen's Show	Department
February 13-17	Duluth, MN	Duluth Boat Sports Travel and RV Show	Service
March 1-2	Hammond, IN	Cabela's Sport Weekend	GLFC
March 21-24	Grand Rapids, MI	Ultimate Sport Show	Service
March 20	Marquette, MI	Northern Michigan University Career Fair	Service
July 12-13	Escanaba, MI	Escanaba Maritime Festival	Service
August 12-18	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:
Bruce Morrison: Treatment Supervisor
Shawn Robertson: Treatment Supervisor
Barry Scotland: Assistant Supervisor
Alan Rowlinson: Assistant Supervisor

Lampricide Application Coordinators:
Peter Grey
Jamie Storozuk

Lampricide Analysis Technicians:
Jerome Keen
Mike MacKenna
Richard Middaugh
Shawn Robertson

Lampricide Application Technicians:
Charlie Boudreau
Adam Loubert
Paul Kyostia
Sean Nickle
Chris Sierzputowski
Jamie Smith
John Tibbles
Sarah Woods

Barriers:
Bhuwani Paudel: Barrier Engineering Coordinator
Joe Hodgson: Barrier Engineering Technician

Section Head, Assessment: Mike Steeves

Assessment Biologists:
Gale Bravener: Adult Supervisor
Vacant: Larval Supervisor (Upper Lakes)
Fraser Neave: Larval Supervisor (Lower Lakes)

Assessment Technicians
Ryan Booth
Jennifer Hallett
Sarah Larden
Sean Morrison
Andrea Phippen
Jeff Rantamaki
Kevin Tallon
Thomas Voigt

Administrative Support:
Lisa Vine: Finance and Administrative Officer
Christine Reid: Receptionist
Melanie McCaig: Accounts Clerk

Maintenance:
Brian Greene: Supervisor
Chad Hill: Assistant

Environmental Assessment Biologist:
Tonia Van Kempen: Supervisor

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 Neeley
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)
Bobbie Halchishak (CS)
Tim Falconer (CS)
John Ewalt (CS)
Gena Long (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

UNITED STATES FISH AND WILDLIFE SERVICE (CONTINUED)

Robert Adair, Program Manager

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

Larval Assessment Fish Biologists:
Lisa Walter, Larval Assessment Supervisor
Lynn Kanieski
Matthew Symbal

Larval Assessment Biological Science Technicians:
Kyle Krysiak
Nikolas Rewald
Jarvis Applekamp (CS)
Michael Blohm (CS)
Chris Gagnon (CS)
Rachael Guth (CS)
Robert Wollney (CS)

Chemist:
Stephen Lantz

Risk Management:
Cheryl Kaye: Risk Management Supervisor
Mary Henson: Fish Biologist
Mary Wilson: Biological Science Technician

Maintenance Worker:
David Magno

Adult Unit Supervisor : Michael Twohey

Fish Biologists:
Jessica Barber: Barriers and Trapping Supervisor
Pete Hrodey
Gregory Klingler

Biological Science Technicians:
Daniel Kochanski
Dennis Smith
Jason VanEffen
Deborah Winkler
Chad Andresen (CS)
Bruce Eldridge (CS)
Kevin Letson (CS)
Sara Ruiter (CS)