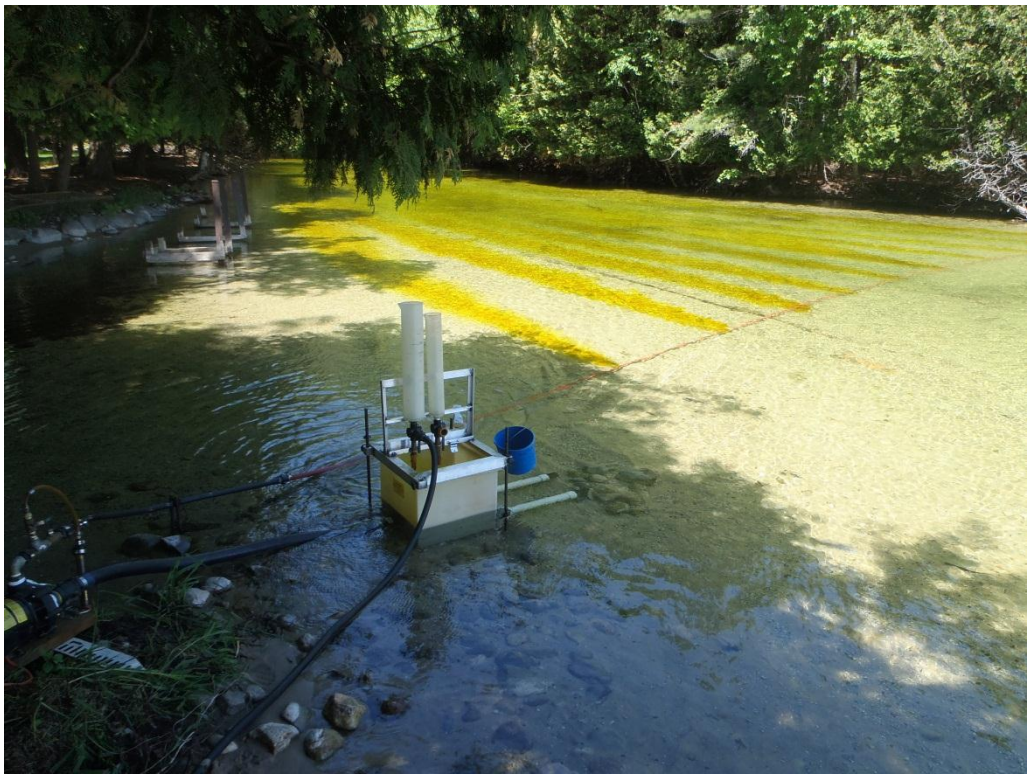
SEA LAMPREY CONTROL IN THE GREAT LAKES 2014

ANNUAL REPORT TO
THE GREAT LAKES FISHERY COMMISSION



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GLFC Annual Meeting
Grand Rapids, Michigan
June 10-11, 2015

Photo by Kevin Butterfield, USFWS

Alex Gonzalez (U.S. Fish and Wildlife Service) conducts analysis of TFM concentrations during the Manistique River treatment. On the cover: Application of TFM to the Middle Platte River, June 9, 2014 (photo by Kevin Butterfield, USFWS).

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EXECUTIVE SUMMARY

This report summarizes Sea Lamprey control activities conducted by the United States Fish and Wildlife Service and Fisheries and Oceans Canada in the Great Lakes during 2014. 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 was adopted by the Great Lakes Fishery Commission in 2011. Lampricide treatments were conducted on 71 tributaries and 13 lentic areas. Larval assessment crews surveyed 549 Great Lakes tributaries and 66 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 69 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 (79,583, 95% CI: 59,591 – 134,836) increased from the 2012 and 2013 abundance estimates. The target level for Lake Superior is 39,260 ± 21,262. In Lake Michigan, abundance (59,687 95% CI: 54,709 – 65,860) was within the target level of 59,192 ± 13,414 for the second consecutive year. In Lake Huron, abundance (104,361, 95% CI: 94,820 – 125,439) showed a substantial reduction compared to the 2012 and 2013 estimates. The target level for Lake Huron is 75,891 ± 20,203. In Lake Erie, abundance (14,577, 95% CI: 13,184 – 16,342) decreased from the 2013 estimate but remains greater than the target level of 3,778 ± 1,206. In Lake Ontario, abundance (19,482, 95% CI: 16,880 – 24,032) was less than the target level of 34,200 ± 10,335 and is the lowest abundance estimate in the time series.

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 2014 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 five-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 five-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 five-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 five-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 estimated average abundance for the five-year period, 1994–1998, when marking rates were closest to 5 marks per 100 fish (5.2 A1-3 marks per 100 Lake Trout >533mm). The calculated target abundance in Lake Superior is 39,260 ± 21,262 Sea Lampreys.

During 2014, adult Sea Lamprey abundance in Lake Superior was estimated to be 79,583 (95% CI; 59,591 – 134,836), an increase from 2012 and 2013 abundance estimates. The Sea Lamprey marking rate on Lake Trout is currently at 2.5 A1-A3 marks per 100 Lake Trout >533mm, which is less than the target of 5 marks per 100 fish.

Lake Michigan

The Lake Michigan Committee established the following goal for Sea Lamprey control in Lake Michigan:

- *Suppress Sea Lamprey abundance 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 estimated average abundance for the five-year period, 1988–1992, when marking rates were closest to 5 marks per 100 fish (4.7 A1-3 marks per 100 Lake Trout >533mm). The calculated target abundance in Lake Michigan is 59,192 ± 13,414 Sea Lampreys.

During 2014, adult Sea Lamprey abundance in Lake Michigan was estimated to be 59,687 (95% CI; 54,709 – 65,860), which was within the target range for the second consecutive year. The Sea Lamprey marking rate on Lake Trout is currently at 10.0 A1-A3 marks per 100 Lake Trout >533mm. The marking rate has been greater than the target of 5 marks per 100 fish since 1996.

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 adult Sea Lamprey abundance target and range for Lake Huron were calculated as 25% of the estimated average abundance during the five-year period prior to the publication of the fish-community objectives (1989–1993). The calculated target using these data is 75,891 ± 20,203

Sea Lampreys in Lake Huron. 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.

During 2014, adult Sea Lamprey abundance in Lake Huron was estimated to be 104,361 (95% CI; 94,820 – 125,439). The 2014 abundance estimate represents a substantial reduction when compared with the 2012 and 2013 estimates. The Sea Lamprey marking rate on Lake Trout is currently 11.6 A1-A3 marks per 100 Lake Trout >533 mm. The marking rate has been greater than the target of 5 marks per 100 fish since 1983.

Lake Erie

The *Fish-Community Goals and Objectives for Lake Erie* does not include a specific Sea Lamprey objective, however it does acknowledge that effective Sea Lamprey control is needed to support the fish-community objectives for Lake Erie, especially those related to Lake Trout restoration:

- *Eastern basin – provide sustainable harvests of Walleye, Smallmouth Bass, Yellow Perch, Whitefish, Rainbow Smelt, Lake Trout, Rainbow Trout, and other salmonines; restore a self-sustaining population of Lake Trout to historical levels of abundance.*

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

The target and range of adult Sea Lamprey abundance for Lake Erie were calculated from the estimated average abundance for the five-year period, 1991–1995, when marking rates were closest to 5 marks per 100 fish (4.4 A1-3 marks per 100 Lake Trout >533mm). The calculated target abundance in Lake Erie is 3,778 ± 1,206 Sea Lampreys.

During 2014, adult Sea Lamprey abundance in Lake Erie was estimated to be 14,577 (95% CI: 13,184 – 16,342). For the sixth consecutive year, this level of abundance is greater than the target range. The Sea Lamprey marking rate on Lake Trout is currently 16.6 A1-A3 marks per 100 Lake Trout >533mm.

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 Lake Trout 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 five-year period, 1993–1997, when marking rates were closest to 2 marks per 100 Lake Trout >431 mm (1.6 A1 marks per fish >431 mm). The calculated target adult abundance in Lake Ontario is 34,200 ± 10,335 Sea Lampreys.

During 2014, adult Sea Lamprey abundance in Lake Ontario was estimated to be 19,482 (95% CI; 16,880 – 24,032), which was less than the fish-community objective target range and the lowest estimate in the time series. The Sea Lamprey marking rate on Lake Trout is currently 1.6 A1 marks per 100 Lake Trout >431mm.

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 control units administer lampricide formulations (TFM or TFM augmented with Bayluscide 70% wettable powder or 20% emulsifiable concentrate) and analyze active ingredients during stream treatments, and apply Bayluscide 3.2% granular (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 and charged 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 2014 is presented in the LCTF section of this report.

During 2014, lampricide treatments were conducted on 71 tributaries and 13 lentic areas of the Great Lakes (Table 1). Historical control efforts compared to 2014 control efforts are presented in Figure 1.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes in 2014.

Lake	Number of Streams	Number of Lentic	Discharge (m^3/s)	Distance Treated (km)	TFM (kg) [1,2]	Bayluscide (kg) [1,3]
Superior	25	7	171.4	670.2	17,146.0	758.2
Michigan	22	5	219.3	1,793.8	47,778.5	397.6
Huron	12	1	124.3	991.4	28,282.4	2,078.6
Erie	2	0	1.8	20.0	487.5	0.0
Ontario	10	0	48.1	235.2	6,654.5	24.9
Total	**71**	**13**	**564.9**	**3,710.6**	**100,348.9**	**3,259.3**

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

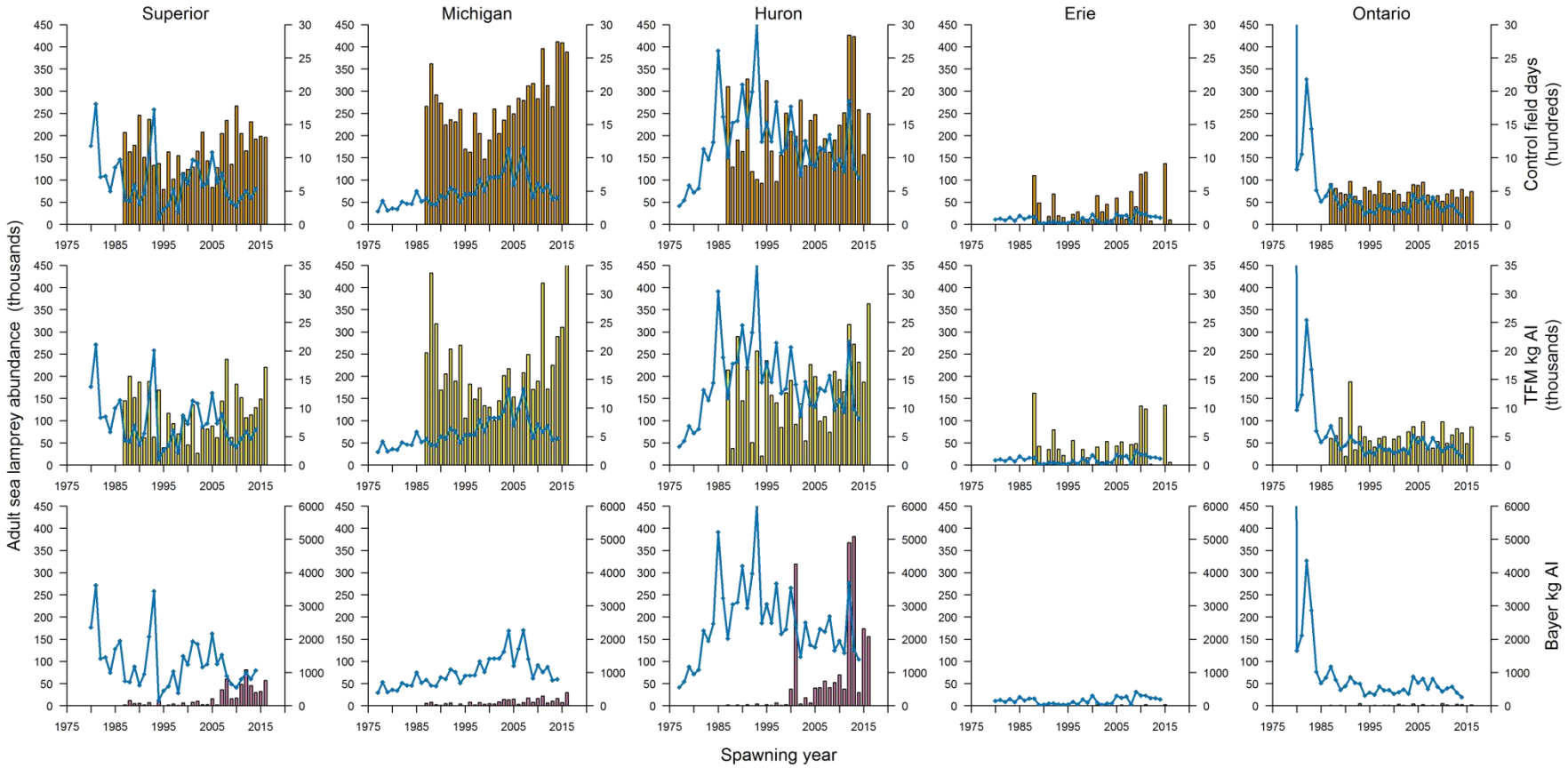

Figure 1. Row 1: Number of control field days (orange bars). Row 2: TFM used (kg active ingredient, yellow bars). Row 3: Bayluscide used (kg active ingredient, purple bars). All rows: Abundance of adult Sea Lampreys is shown with blue lines. All metrics plotted against the Sea Lamprey spawning year. Control metrics are offset by 2 years, e.g., control applied during 2006 is plotted on the 2008 spawning year - the year the treatment effect would first be observed in the adult Sea Lamprey population.

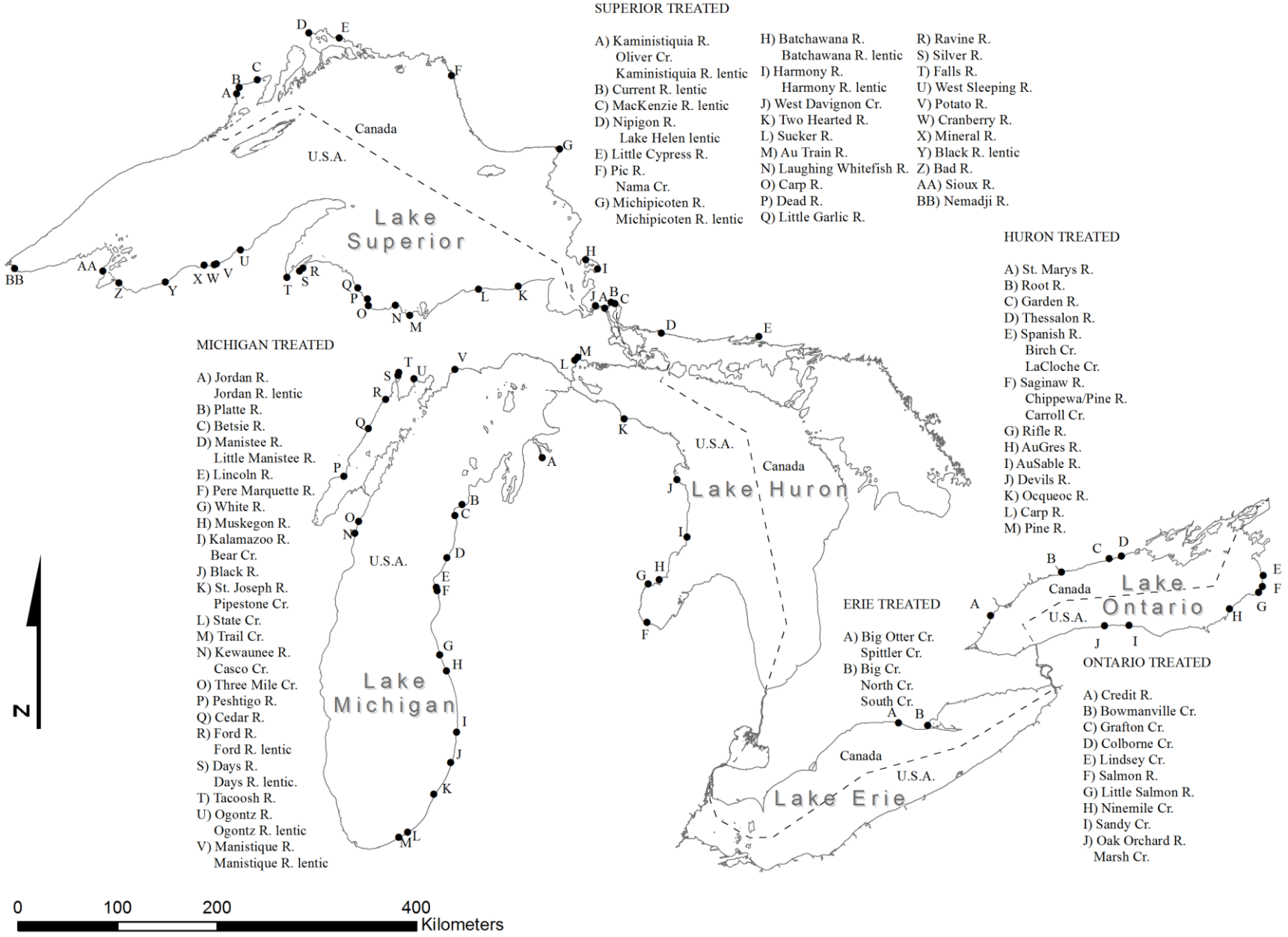

Figure 2. Location of tributaries treated with lampricide in 2014.

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 2005–2014. Fifty-two tributaries (19 Canada, 33 U.S.) are treated every 4–6 years. Details on lampricide applications to Lake Superior tributaries and lentic areas during 2014 are found in Table 2 and Figure 2.

- Lampricide treatments were completed in 25 tributaries (8 Canada, 17 U.S.) and in 7 lentic areas (6 Canada, 1 U.S.).

- The Sioux River was treated with lampricide for the first time and contained high densities of Sea Lampreys throughout most of the treated length of stream.

- The Black River (Gogebic County) lentic area was added to the treatment schedule after a dense larval Sea Lamprey population was discovered inside the breakwalls.

- A portion of the Bad River treatment was postponed due to extremely high stream discharge. The Marengo, Brunsweiler, and upper Potato rivers were treated as scheduled in mid-September whereas the mainstream and White River were completed in late October.

- A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters was applied to a second consecutive treatment of the Nemadji River. After the 2013 treatment, the river was estimated to contain 43,000 residual Sea Lampreys and the 2014 year class.

- Fossom Creek (Ravine River tributary), did not receive an effective treatment due to extremely low water levels and the presence of several beaver dams. Since the Ravine River is treated annually, Fossom Creek is scheduled to be retreated in 2015.

- Extremely high stream discharge rendered the Tahquamenon River untreatable. The stream has been rescheduled for treatment in 2015.

- Nama Creek (Pic River tributary), deferred for treatment in 2013, was treated in its entirety for the first time since 1979.

- The Little Cypress River was treated for the first time.

- The Michipicoten River was treated in August 2014 after being deferred in 2013.

- Oliver Creek, (Kaministiquia River tributary), was added to the treatment schedule based on the results of larval assessment surveys conducted in 2014.

- Offshore lentic areas associated with the Harmony and Batchawana rivers were treated twice in an effort to reduce the number of larvae surviving the first application. Based on an efficacy of 75%, the estimated residual populations were large enough to rank for retreatment based on the cost-per-kill of larvae >100mm.

Table 2. Details on the application of lampricides to tributaries and lentic areas of Lake Superior during 2014 (letter in parentheses corresponds to location of stream in Figure 2).

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
Canada								
Kaministiquia R. (A)								
Oliver Creek	14-Aug	0.1	4.7	32.9	---	---	---	---
Kaministiquia R. lentic	12-Aug	---	---	---	---	---	---	69.7
Current R. lentic (B)	14-Aug	---	---	---	---	---	---	40.7
MacKenzie R. lentic (C)	13-Aug	---	---	---	---	---	---	93.7
Nipigon R. (D)	19-Aug	60.5	11.6	5,954.2	1.6	78.0	6.1	0.1
Lake Helen lentic	20-Aug	---	---	---	---	---	---	80.6
Little Cypress R. (E)	13-Aug	0.1	0.4	6.8	0.2	---	---	---
Pic R. (F)								
Nama Cr.	14-Aug	2	14.8	489.5	---	---	---	---
Michipicoten R. (G)	8-Aug	43.7	24.6	2,594.7	1.9	---	23.2	---
Michipicoten R. lentic	9-Aug	---	---	---	---	---	---	50.9
Batchawana R. (H)	25-Jun	6.9	12.4	428.9	0.4	---	5.5	0.2
Batchawana R. lentic	26-Jun	---	---	---	---	---	---	114.8
Batchawana R. lentic	31-Jul	---	---	---	---	---	---	111.9
Harmony R. (I)	26-Jun	0.2	2.9	12.1	---	---	---	---
Harmony R. lentic	23-Jun	---	---	---	---	---	---	37.1
Harmony R. lentic	1-Aug	---	---	---	---	---	---	37.1
West Davignon Cr. (J)	26-Jun	0.2	4.2	21.2	---	---	---	---
Total (Canada)		**113.7**	**75.6**	**9,540.3**	**4.1**	**78.0**	**34.8**	**636.8**

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

Table 2. *continued*

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
United States								
Two Hearted R. (K)	18-Jul	4.3	106.1	645.4	2.9	---	---	---
Sucker R. (L)	14-Jul	2.2	22.4	281.3	---	---	---	---
Au Train R. (M)	9-Jul	4.1	16.7	843.3	---	---	---	---
Laughing Whitefish R. (N)	12-Jul	1.6	8.1	98.2	---	---	---	---
Carp R. (O)	10-Jul	3.1	8.5	475.9	---	---	---	---
Dead R. (P)	27-Aug	3.3	2.1	291.6	---	---	---	---
Little Garlic R. (Q)	27-Aug	0.1	9.3	25.3	1.3	---	---	---
Ravine R. (R)	21-Aug	0.1	9.8	21.0	0.2	---	---	---
Silver R. (S)	26-Aug	0.7	6.9	92.7	0.2	---	---	---
Falls R. (T)	24-Aug	1.5	0.3	279.2	---	---	---	---
West Sleeping R. (U)	22-Jun	0.1	7.2	28.0	---	---	---	---
Potato R. (V)	21-Jun	0.1	31.6	92.1	1.0	---	---	---
Cranberry R. (W)	21-Jun	0.1	22.4	53.0	1.3	---	---	---
Mineral R. (X)	19-Jun	0.4	11.3	119.3	1.0	---	---	---
Black R. lentic (Y)	8-Oct	---	---	---	---	---	---	8.6
Bad R. (Z)	15-Sep	28.6	136.3	2,769.7	---	---	---	---
Sioux R. (AA)	13-Sep	1	7.2	102.3	0.2	---	---	---
Nemadji R. (BB)	9-Oct	6.4	188.4	1,355.6	19.6	---	---	---
Total (United States)		**57.7**	**594.6**	**7,573.9**	**27.7**	---	---	**8.6**
Total for Lake		**171.4**	**670.2**	**17,114.2**	**31.8**	**78.0**	**34.8**	**645.4**

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

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-five tributaries have historical records of larval Sea Lamprey production, and of these, 90 tributaries have been treated with lampricides at least once during 2005–2014. Thirty tributaries are treated every 3–5 years. Details on lampricide applications to Lake Michigan tributaries and lentic areas during 2014 are found in Table 3 and Figure 2.

- Lampricide treatments were completed in 22 tributaries and 5 lentic areas.

- This was the first year of an expanded large-scale treatment strategy that targeted consecutive year treatments to remove residual Sea Lampreys in large producing streams in lakes Michigan and Huron. The Jordan, Betsie, White, Cedar, Ford, and Manistique rivers and lentic areas offshore of the Manistique, Ford, and Jordan rivers were included as part of this effort. The Little Manistee and Muskegon rivers, which were already scheduled for treatment during 2014, are also part of the strategy. Since the strategy dismisses the need to treat streams in consecutive years that have already been treated in two of the last three years, the treatments during 2014 of the Betsie, Cedar, Ford, and Manistique rivers concluded their role in the strategy.

- State Creek was treated for the first time since 1986.

- Treatment of the Muskegon River was scheduled for mid-September in coordination with the Michigan Department of Natural Resources (MIDNR) and Little River Band of Ottawa Indians to allow time for juvenile Lake Sturgeon to grow to a size when they are more able to resist the effects of a lampricide treatment. Despite this fall treatment effort, some juvenile Lake Sturgeon mortality occurred.

- Portions of the treatments of the Ford and Cedar rivers were postponed due to extremely high discharge. Several tributaries as well as the upper Ford River were treated as scheduled in May and the mainstream of both systems were completed in late October.

- The East Branch Fox River (Manistique River tributary), was treated about 25 miles further upstream than the historical upper application point and resulted in remote and challenging access issues.

- Bills Creek (Whitefish River tributary) was not treated in 2014. This stream has been rescheduled for treatment in 2015 in conjunction with the entire Whitefish River treatment.

Table 3. Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2014 (letter in parentheses corresponds to location of stream in Figure 2).

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
Jordan R. (A)	18-Jul	5.7	34.3	1,732.7	13.2	---	9.4	---
Jordan R. lentic	21-Jun	---	---	---	---	---	---	18.8
Platte R. (B)	6-Jun	16.2	21.2	4,357.4	8.3	---	---	---
Betsie R. (C)	2-Jul	10.8	18.7	1,657.2	---	---	15.6	---
Manistee R. (D)								
Little Manistee R.	20-Jul	6.2	79.5	1,538.8	25.5	---	7.6	0.1
Lincoln R. (E)	22-Jun	2.8	34.1	682.3	4.1	---	---	---
Pere Marquette R. (F)	31-Jul	19.8	260.3	5,128.8	4.3	---	28.3	---
White R. (G)	28-Aug	11.3	157.0	4,321.0	13.3	---	---	---
Muskegon R. (H)	12-Sep	45.3	136.7	9,245.5	49.2	---	127.3	0.1
Kalamazoo R. (I)								
Bear Cr.	17-Jul	0.2	6.6	70.7	6.6	---	---	---
Black R. (J)	10-May	3.0	25.4	688.5	---	---	---	---
St. Joseph R. (K)								
Pipestone Cr.	9-May	1.1	6.6	451.6	6.2	---	---	---
State Cr. (L)	26-Apr	0.1	1.8	17.6	---	---	---	---
Trail Cr. (M)	26-Apr	1.9	29.3	415.3	1.6	---	---	---
Kewaunee R. (N)								
Casco Cr.	8-May	0.5	3.1	369.4	0.8	---	---	---
Three Mile Cr. (O)	9-May	0.3	4.8	178.7	1.0	---	---	---
Peshtigo R. (P)	10-Oct	26.3	19.3	3,804.0	---	---	6.7	---
Cedar R. (Q)	27-May	20.1	133.6	3,741.1	1.3	---	---	---
Ford R. (R)	23-May	22.7	216.9	4,348.9	5.0	---	18.0	---
Ford R. lentic	25-Oct	---	---	---	---	---	---	54.5
Days R. (S)	13-Aug	0.3	6.9	98.3	---	---	---	---
Days R. lentic.	16-Aug	---	---	---	---	---	---	15.3
Tacoosh R. (T)	30-Sep	0.2	22.9	147.6	---	---	---	---
Ogontz R. (U)	4-Oct	1.0	16.1	113.9	4.4	---	---	---
Ogontz R. lentic	30-Sep	---	---	---	---	---	---	18.4
Manistique R. (V)	7-Jul	23.5	558.7	4,511.3	13.1	---	19.3	---
Manistique R. lentic	10-Oct	---	---	---	---	---	---	58.2
Total for Lake		**219.3**	**1,793.8**	**47,620.6**	**157.9**	**---**	**232.2**	**165.4**

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

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 2004–2014. Forty-nine tributaries (22 Canada, 27 U.S.) are treated every 3–5 years. Details on lampricide applications to Lake Huron tributaries and lentic areas during 2014 are found in Table 4 and Figure 2.

- Lampricide applications were completed in 12 tributaries (4 Canada, 8 U.S.), 1 lentic area (0 Canada, 1 U.S.) and 340 ha of the St. Marys River (see Table 4).

- Based on 2014 post-treatment larval assessment, two GB plots on the St. Marys River were expanded and retreated to reduce the number of residual Sea Lampreys.

- This was the first year of an expanded large-scale treatment strategy that targeted consecutive year treatments to remove residual Sea Lampreys in large producing streams in lakes Michigan and Huron. The Garden River was treated as part of this effort. The Au Gres, Au Sable and Pine rivers, which were already scheduled for treatment during 2014, are also part of the strategy.

- Upstream distribution of Sea Lampreys in the North Branch of the Chippewa River (Saginaw River tributary) significantly increased the distance of stream that required treatment compared to past treatments.

Table 4. Details on the application of lampricides to tributaries and lentic areas of Lake Huron during 2014 (letter in parentheses corresponds to location of stream in Figure 2).

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
Canada								
St Marys R. (A)	16-Jun	---	---	---	---	---	---	856.2
Root R. (B)	8-Sep	5.7	51.7	326.4	2.8	---	---	---
Garden R.(C)	16-Jul	4.2	73.7	478.6	1.0	---	---	0.5
Thessalon R. (D)	8-Jul	6.2	32.7	430.1	0.4	---	---	0.4
Spanish R. (E)								
Birch Cr.	4-Jun	1	18.4	149.2	0.0	---	---	---
LaCloche Cr.	2-Jun	0.9	15.2	122.2	0.6	---	---	---
Total (Canada)		**18.0**	**191.7**	**1,506.5**	**4.8**	**---**	**---**	**857.1**
United States								
Saginaw R. (F)								
Chippewa/Pine R.	25-May	28.3	189.2	10,295.6	2.5	25.7	15.9	---
Carroll Cr.	10-May	2.5	18	264.1	---	---	---	---
Rifle R. (G)	14-Aug	8.5	168.9	2,790.6	21.8	---	18.3	---
AuGres R. (H)	28-Apr	13	70.5	2,915.3	2.1	---	---	---
AuSable R. (I)	9-Jul	41.1	24.9	6,905.4	17.9	---	78.1	2.45
Devils R. (J)	29-Oct	1	12.5	476.6	---	---	---	---
Ocqueoc R. (K)	26-Oct	2.8	27.2	575.3	---	---	---	---
Carp R. (L)	19-Jun	3.7	98.2	1,077.6	2.5	---	---	31.80
Pine R. (M)	5-Jun	5.4	190.3	1,409.8	14.0	---	---	---
St. Marys R. (A)	8-Jul	---	---	---	---	---	---	1,049.2
Total (United States)		**106.3**	**799.7**	**26,710.3**	**60.8**	**25.7**	**112.3**	**1,083.5**
Total for Lake		**124.3**	**991.4**	**28,216.8**	**65.6**	**25.7**	**112.3**	**1,940.6**

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

Lake Erie

Lake Erie has 842 tributaries (525 Canada, 317 U.S.). Twenty-seven tributaries (11 Canada, 16 U.S.) have historical records of larval Sea Lamprey production. Of these, 14 tributaries (7 Canada, 7 U.S.) have been treated with lampricides at least once during 2005–2014. Eight tributaries (three Canada, five U.S.) are treated every 3–5 years. Details on lampricide applications to Lake Erie tributaries and lentic areas during 2014 are found in Table 5 and Figure 2. 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 2005–2014.

- Lampricide treatments were completed in two Canadian tributaries.

- North and South creeks, (Big Creek tributaries) were retreated upstream of Lehman Dam in 2014. Low flow conditions in 2013 resulted in an ineffective treatment.

- The upper portion of Spittler Creek, (Big Otter Creek tributary) was treated in 2014. This section of stream was deferred to 2014 as insufficient discharge prevented treatment in 2013.

Table 5. Details on the application of lampricides to tributaries and lentic areas of Lake Erie during 2014 (letter in parentheses corresponds to location of stream in Figure 2).

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
Canada								
Big Otter Cr. (A)								
Spittler Creek	May 28	0.8	13.5	256.1	---	---	---	---
Big Cr. (B)								
North Creek	May 30	0.6	4.1	128.8	---	---	---	---
South Creek	May 30	0.4	2.4	102.6	---	---	---	---
Total (Canada)		**1.8**	**20.0**	**487.5**	---	---	---	---
Total for Lake		**1.8**	**20.0**	**487.5**	---	---	---	---

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

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, 36 tributaries (16 Canada, 20 U.S.) have been treated with lampricides at least once during 2005–2014. Twenty-seven tributaries (13 Canada, 14 U.S.) are treated on a regular 3–5 year cycle. Details on lampricide applications to Lake Ontario tributaries and lentic areas during 2014 are found in Table 6 and Figure 2.

- Lampricide applications were conducted in 10 streams (4 Canada, 6 U.S.).

- Credit River was added to the treatment list after larval surveys in 2014 confirmed it was necessary.

- Trout Brook (Salmon River tributary, NY) was treated further upstream from the historical upper distribution of larvae.

- Orwell Brook (Salmon River tributary, NY) was treated upstream of the barrier for the second time since 2012 to target a residual population established prior to construction. This stream will not be treated again in 2015, as larval surveys did not indicate the presence of residual larvae or recruitment above the barrier.

Table 6. Details on the application of lampricides to tributaries and lentic areas of Lake Ontario during 2014 (letter in parentheses corresponds to location of stream in Figure 2).

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)[1]	Solid TFM (kg)[1]	Wettable Powder Bayluscide (kg)[1]	Emulsifiable Concentrate Bayluscide (kg)[1]	Granular Bayluscide (kg)[1]
Canada								
Credit R. (A)	19-Jun	9.7	41	1,764.1	---	---	23.6	0.9
Bowmanville Cr. (B)	23-May	2.6	19.7	733.3	---	---	---	---
Grafton Cr. (C)	25-May	0.4	0.3	81.1	---	---	---	---
Colborne Cr. (D)	25-May	0.8	0.9	180.1	---	---	---	---
Total (Canada)		**13.5**	**61.9**	**2,758.6**	---	---	**23.6**	**0.9**
United States								
Lindsey Cr. (E)	26-May	0.5	10.4	75.4	0.2	---	---	---
Salmon R. (F)	1-May	27.4	59.8	1,976.6	2.3	---	---	0.1
Little Salmon R. (G)	30-May	1.4	38.8	242.8	2.5	---	---	0.1
Ninemile Cr. (H)	23-May	0.9	26.1	226.3	4.2	---	---	---
Sandy Cr. (I)	28-Apr	3.1	27.8	1,049.3	---	---	---	0.1
Oak Orchard R. (J) Marsh Cr.	27-Apr	1.24	10.4	316.3	---	---	---	0.1
Total (United States)		**34.5**	**173.3**	**3,886.7**	**9.2**	---	---	**0.4**
Total for Lake		**48.1**	**235.2**	**6,645.3**	**9.2**	---	**23.6**	**1.3**

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

ALTERNATIVE CONTROL

The Service and Department continue to coordinate with the Commission and other partners to research and develop alternatives to lampricide treatments to provide a broader spectrum of tactics to control Sea Lampreys. During 2014, barriers were the only operational alternative control method. Juvenile trapping and nest destruction were explored as potential alternative methods. Other methods that are currently being investigated include the use of attractants (e.g. pheromones), repellents (e.g. alarm cues), and new trapping designs.

Sterile Male Release Technique

The Commission discontinued the Sterile Male Release Technique (SMRT) in the St. Marys River 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 2014, the mean egg viability from 20 nests was 52%. This was lower than the mean egg viabilities in 2012 and 2013 (74% and 79%), presumably due to the unseasonably cool water flowing from Lake Superior, but still higher than any egg viabilities from 1997–2011 when SMRT was ongoing (mean 29%; range 4–48%).

- The proportion of age-1 larvae (<47mm) captured in the St. Marys River by deep water electrofishing (DWEF) increased during 2011-2014, with the two highest proportions since 1993 observed in 2013 and 2014. These are the first two cohorts following the discontinuation of SMRT. This trend is similar to the trend in mean annual egg viabilities in that both indices reached their highest recorded levels after the SMRT was discontinued.

Juvenile Trapping

- Trapping for out-migrating juvenile Sea Lampreys was conducted by the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) in the Bad River (Lake Superior) during September and October. Fyke nets were set at Elmhoist Bridge and eight out-migrating juveniles were captured.

- Trapping for out-migrating juveniles was conducted in the Big South Branch Pere Marquette River (Lake Michigan) during March and April. Fyke nets and a rotary screw trap were fished near Wilson Road and no out-migrating juveniles were captured.

Nest Destruction

- A four-mile section of the Potato River (Lake Superior) was surveyed through a cooperative agreement with GLIFWC to search for adult Sea Lamprey spawning activity and nests. No adults or nests were observed during 66 hours of effort during June and July 2014.

Barriers

The Sea Lamprey barrier program priorities are:

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 control where other options are impossible, excessively expensive, or ineffective;
   b. provide a cost-effective alternative to lampricide control;
   c. improve cost-effective control in conjunction with 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 (USACE) on the construction, operation, and maintenance of Sea Lamprey barriers. The task force's report on the charges during 2014 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 2014, there were 73 Sea Lamprey barriers in the Great Lakes basin that were either purpose-built to block Sea Lampreys (46), or constructed for other purposes (27), but modified to serve a Sea Lamprey control function (Figure 3).

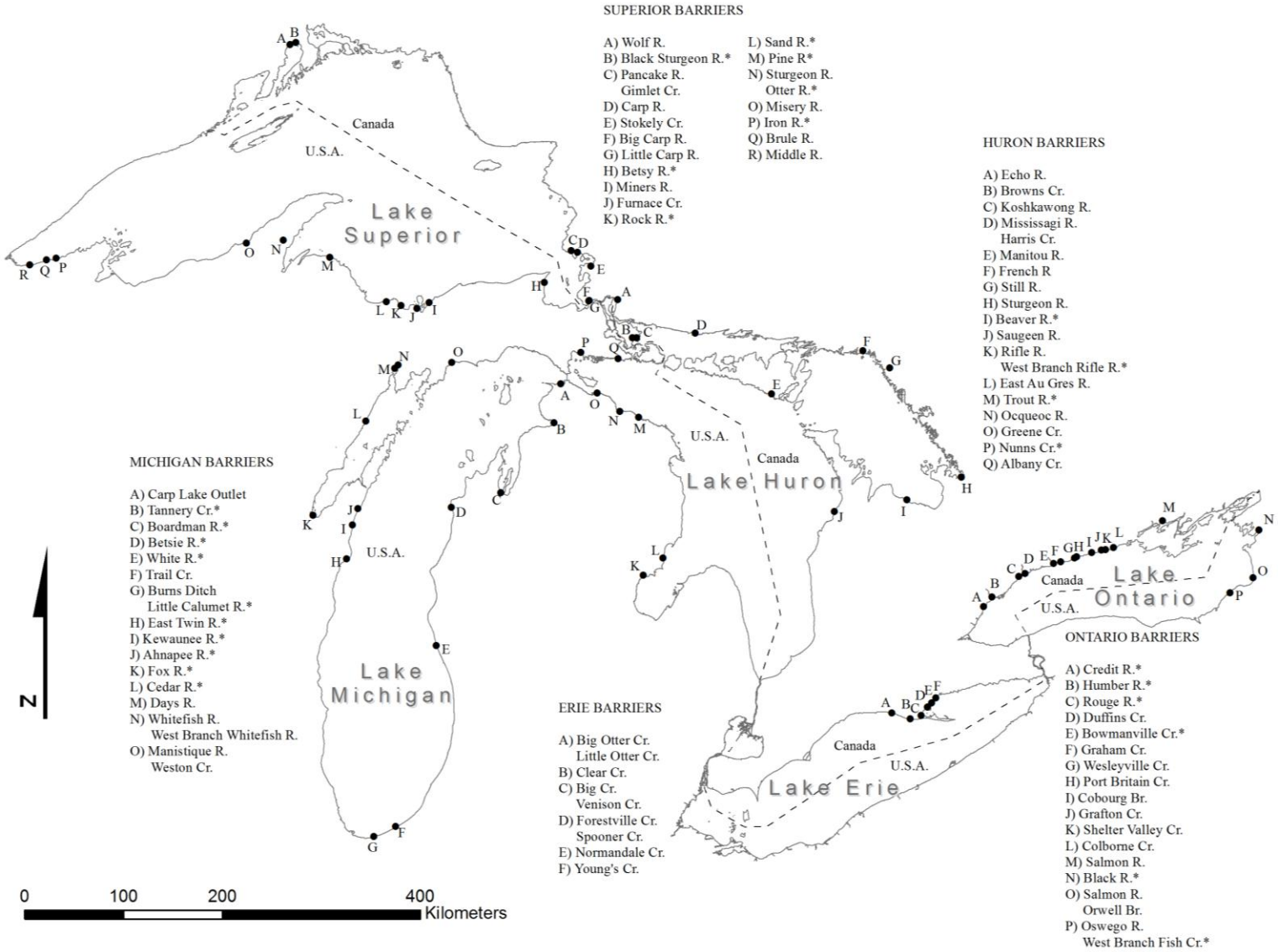

Figure 3. Locations of tributaries with Sea Lamprey barriers. Structures that have been modified or constructed by others that prevent the upstream migration of Sea Lampreys are indicated by an asterisk.

Lake Superior

The Commission has invested in 18 barriers on Lake Superior (Figure 3). Of these, 11 were purpose-built as Sea Lamprey barriers and 7 were constructed for other purposes, but have been modified to block Sea Lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited 33 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.

    - Gimlet Creek (Pancake River tributary) – Repairs were completed to the access road which was damaged by flooding in fall 2014.

Ensure Blockage to Sea Lamprey Migration

- Sturgeon River – Service personnel modified the weirs in the fish ladder at the Otter Lake Dam on the Otter River to create a lamprey barrier within the ladder.

- Black Sturgeon River – In 2012, the Ontario Ministry of Natural Resources and Forestry (OMNRF) initiated a Class Environmental Assessment (EA) of their proposal to remove the Camp 43 Dam and construct a new Sea Lamprey barrier 50 km upstream at the former Camp 1 site. As part of this continuing process, the OMNRF, in cooperation with the Commission, hosted four Structured Decision Making (SDM) meetings to evaluate options for the existing dam, ranging from the status quo to relocation. Dr. Michael Jones (Michigan State University), the meeting facilitator, authored a summary report; however, the participants were unable to reach a consensus. Based on input from the public, First Nations, and stakeholders, as well as the results of the SDM, the OMNRF has decided to continue the EA process, which will include preparation of a Draft Environmental Study Report. The Report will take several months to complete and include details of the proposed project, evaluation of potential environmental effects of the project and alternatives, mitigation, and monitoring plans, and cost estimates for completion of the project.

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

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

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Huron R.	South Fork Chinks Cr.	USFWS[1]	#211, 213, 217 road crossing culverts	Concur	Ineffective barrier
Salmon Trout R.	Unnamed trib.	USFWS[1]	# 17, 18 road crossing culverts	Concur	Ineffective barrier
Sturgeon R.	Otter R.	MIDNR[2]	Otter Lake Dam	Do not concur	Blocking barrier
Union R.	N/A	USFWS[1]	Union Springs Dam	Concur	Upstream of blocking falls
Bad R.	Kepsel's Cr.	USFWS[1]	Wildcat Road culvert	Concur	Ineffective barrier

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Ashland).
[2]Michigan Department of Natural Resources.

New Construction

- Bad River – The USACE is the lead agency administering a project to construct a Sea Lamprey barrier in the Bad River. The USACE approved the Preliminary Restoration Plan (PRP) to review potential barrier sites on the Bad River under the Great Lakes Fishery Ecosystem Restoration program (GLFER). 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. Survey work was completed during summer 2014.

- Whitefish River – Hydraulic analysis at the proposed barrier site has been completed and the required crest height determined. Based on the surficial soil profile, steel sheet pile would be suitable for barrier construction at this site. Design elements may include a seasonally operated or fixed crest and a trap-and-sort fishway. Planning will continue in 2015.

Assessment of Candidate Streams

- No assessments were conducted.

Lake Michigan

The Commission has invested in 15 barriers on Lake Michigan (Figure 3). Of these, 5 were purpose-built as Sea Lamprey control barriers and 10 were constructed for other purposes, but have been modified to block Sea Lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited 149 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 – The decommissioning of the former electrical barrier was completed. A site visit is planned for spring 2015 to ensure erosion control and re-vegetation measures are intact; a ribbon-cutting event is planned during summer 2015.

- Trail Creek – Service personnel placed 40 tons of large rip-rap on the east bank downstream of the barrier to repair and prevent erosion. Modifications were completed to operate a pool and weir fish ladder for the fall Chinook Salmon migration while maintaining sufficient drop in the spring to block Sea Lamprey migrations.

Ensure Blockage to Sea Lamprey Migration

- Kewaunee River – A special appropriation from the State of Wisconsin provided supplemental funding for improving the Sea Lamprey barrier on the Kewanuee River. The Service is working in cooperation with the state to gather blueprints for the Buzz Besadny Fish Facility and Dam, along with existing hydrological data in that section of the river.

- Boardman River – The Service worked with Traverse City Parks and Recreation Department to replace all stop logs in each section of the spillway during 2012. Surveys conducted upstream of the Union Street Dam during 2013 and 2014 found no spawning activity or larval recruitment. The Service will continue to monitor for escapement upstream of the Union Street Dam.

- White River – During September 2012, the Service collaborated with the City of Hesperia, Department of Public Works to install new stop logs at the Hesperia Dam. No young-of-year Sea Lampreys were found upstream of the Hesperia Dam during 2013 fall electrofishing surveys; however, one young-of-year Sea Lamprey was collected during the 2014 lampricide treatment.

- Grand River – The City of Grand Rapids along with several citizens groups are proposing to remove the 6th Street Dam on the Grand River to provide for more varied use of the downtown rapids area. The current plan calls for removal of the existing structure and the creation of an artificial rapids complex that can be used by kayakers and anglers. A new inflatable crest structure is proposed approximately one mile upstream of the current location. A stakeholders meeting was held during November 2014 in Grand Rapids to discuss and update the Grand River Rapids Restoration Project Report, including the proposed Sea Lamprey barrier. The Service, Department, and Commission are engaged in the review of the proposed structure and will maintain a presence at various levels of project coordination.

- The Service provided field support to Michigan State University researcher, Dr. Michael Wagner, to conduct EPA-funded Sea Lamprey alarm substance field trials on the Carp Lake Outlet. Alarm cue tests were conducted to determine whether trap efficacy could be

increased by incorporating a naturally derived repellent (Sea Lamprey "alarm cue") alongside a synthesized partial sex pheromone (3kPZS) during the spawning migration. Initial results suggest that application of the repellent will be effective in moving migrants into the direct vicinity of trap entrances when traps are sited at barriers.

- Consultations to ensure blockage at barriers were conducted with partner agencies for 17 sites in 12 streams during 2014 (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
Milwaukee R.	Ulao Cr.	NOAA[1]	Channel restoration	Concur	Ineffective barrier
Root R.		WIDNR[2]	Horlick Dam	Do not concur	First barrier
Chicago R.	North Br.	USACE[3]	Foster Avenue Dam	Concur	Lack of habitat
Jordan R.		USFWS[4]	Old State Rd. culvert	Concur	Ineffective barrier
Bowen Cr.	Unnamed Trib.	USFWS[4]	Chamberlain Rd. culvert	Concur	Ineffective barrier
Manistee R.	Trib. to Soper Cr.	USFWS[4]	Soper Fish Farm Dam (Brooke Dam)	Concur	Upstream of blocking barrier
Little Manistee R.	Syers Cr.	MIDNR[5]	Syers Lake Dam	Concur	Dam improvements
Pere Marquette R.	Sanborn Cr.	USFWS[4]	40th St. culvert	Concur	Ineffective barrier
White R.	Bear Cr.	USFWS[4]	128th Ave. culvert	Concur	Ineffective barrier
Grand R.	Fish Cr.	USFWS[4]	Hubbardston Dam	Conditional	6th Street Dam must remain in place or be replaced
Grand R.		USFWS[4]	Sanitation Dam	Concur	Upstream of blocking barrier
Grand R.	Rum Cr.	USFWS[4]	Old Mill Dam	Concur	Upstream of blocking barrier
Grand R.	Rum Cr.	USFWS[4]	Rock Dam	Concur	Upstream of blocking barrier
Kalamazoo R.	Battle Cr.	USFWS[4]	Duck Lake Dam	Concur	Upstream of blocking barrier
St. Joseph R.	Dowagiac R.	USFWS[4]	Niles Dam (Pucker St.)	Concur	Upstream of blocking barrier
St. Joseph R.	East Br. Paw Paw R.	USFWS[4]	63rd Ave. culvert	Concur	Ineffective barrier
St. Joseph R.	East Br. Paw Paw R.	USFWS[4]	26th St. culvert	Concur	Ineffective barrier

[1]National Oceanic and Atmospheric Administration.
[2]Wisconsin Department of Natural Resources.
[3]U.S. Army Corps of Engineers.
[4]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Green Bay).
[5]Michigan Department of Natural Resources

New Construction

- Manistique River –The USACE is the lead agency administering a project to construct a Sea Lamprey barrier to replace a deteriorated structure in the Manistique River. Project partners include the Commission, Service, MIDNR, City of Manistique, and Manistique Papers, Inc. The existing Manistique Paper Dam was identified as the most feasible site for a new barrier.

The project was on hold while the Michigan Department of Environmental Quality completes review of the permit and wetland mitigation requirements.

- White River – The USACE is the lead agency on a project to construct a Sea Lamprey barrier on the White River. Project partners include the Commission, Service, and MIDNR. This project was on hold due to fish passage concerns by the MIDNR.

- Little Manistee River – The USACE is the lead agency on this project to replace the current dam at the MIDNR egg taking facility on the Little Manistee River. The current barrier height is insufficient to prevent Sea Lampreys from migrating upstream. The USACE is pursuing this project under the GLFER program and is currently preparing the Preliminary Restoration Plan for the project, which is scheduled to be completed during 2015. Service staff met during August 2014 with the USACE and MIDNR to discuss location and design of a new barrier.

Assessment of Candidate Streams

- No assessments were conducted.

Lake Huron

The Commission has invested in 17 barriers on Lake Huron (Figure 3). Of these, 13 were purpose-built as Sea Lamprey barriers and 4 were constructed for other purposes, but have been modified to block Sea Lamprey migrations.

Barrier Inventory and Project Selection System

- Field crews visited 104 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 – Sediment that had accumulated upstream of the barrier was flushed out during the fall of 2014. In addition, on-site observations indicate that stop logs are lifting during periods of high flow, increasing the risk of Sea Lamprey escapement. A locking mechanism will be installed during 2015.

- The electrical field of the combination low-head/electrical barrier in the Ocqueoc River was operated manually (continuously on) from April 11– April 22 when Smith-Root installed a new computer and smart concentrator panel. The barrier was active from April 22–May 10

and from May 13–May 18. The barrier was electrified for 36 total days when water levels inundated the low-head barrier.

Ensure Blockage to Sea Lamprey Migration

- Cheboygan River – Plans 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 continued discussion with the USACE and the MIDNR regarding 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 GLFER 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, obtain morphology and statolith microchemistry data, and estimate abundance of adult lampreys in the upper river. Results indicate that a small population of adult Sea Lampreys ($n < 200$) completed their life cycle in the upper Cheboygan River during 2013 and 2014. Because the adult Sea Lamprey population in the upper Cheboygan River is small and has low immigration rates, the upper river could offer a unique system by which to test alternative control techniques and Sea Lamprey eradication strategies. Adult Sea Lamprey assessment in the Cheboygan River will continue during 2015.

- Saugeen River – Although rehabilitation of Denny's Dam was anticipated to commence in 2009, no progress has been made for a variety of reasons. It is currently on hold pending consultation between the Saugeen Ojibway Nation and the OMNRF.

- Consultations to ensure blockage at barriers in five tributaries were completed with partner agencies for seven sites (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
Charlotte R.		USFWS[1]	12 Mile Rd. culvert	Concur	Ineffective barrier
Cheboygan R.	Foch Lake Outlet	MIDNR[2]	Foch Lake Dam	Concur	Barrier repair
Cheboygan R.	Cold Cr. tributary to Rainy Cr.	USFWS[1]	Roost Rd. culvert	Concur	Ineffective barrier
Cheboygan R.	Maple R.	USFWS[1]	Lake Kathleen Dam	Conditional	Barrier modification/ removal
Ocqueoc R.		MIDNR[2]	Emma Lake Level Control Structure Dam	Concur	Barrier repair
Thunder Bay R.	Wildcat Cr.	USFWS[1]	Hubbard Lake Trail culvert	Concur	Ineffective barrier
Black R.	South Br.	Huron Pines	Lavergne Rd. culvert	Pending	Ineffective barrier

[1]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Alpena).
[2]Michigan Department of Natural Resources.

New Construction

- No new construction projects were initiated or underway.

Assessment of Candidate Streams

- Bighead River – Department staff attended a second meeting with OMNRF staff in October 2014 and addressed concerns regarding the initial proposed site and fish passage that were raised during the first meeting. An alternative site has been identified which is located approximately 3 km upstream from the original site on privately owned land. The collection of hydrological and hydraulic data continues from the previous and new sites.

- Pine River (Nottawasaga River) – At the same meeting referred to above, Department staff addressed similar concerns regarding a previously proposed Pine River barrier. Following a meeting with Canadian Forces Base (CFB) Borden in September 2014, a preferred location has been identified within the Base. Discussion concerning the site location, construction, and fish passage options were favorably received by CFB Borden personnel. Hydrologic and hydraulic data collection at the new site is ongoing.

Lake Erie

The Commission has invested in seven barriers on Lake Erie (Figure 3), all of which were purpose-built as Sea Lamprey barriers.

Barrier Inventory and Project Selection System

- Field crews visited 116 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 two Canadian barriers:

    - Little Otter Creek – A water flow deflector was installed to prevent the inundation of the integrated Sea Lamprey trap to reduce risk to personnel conducting trap operations during high spring flows.

    - Young's Creek – New concrete steps with railings were installed to provide safer access to the site for barrier and trap operation and maintenance.

Ensure Blockage to Sea Lamprey Migration

- A consultation to ensure blockage at a barrier in one tributary was completed with a partner agency (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
Raisin R.		USFWS[1]	Sterling State Park Wetland Dike	Concur	Wetland improvement

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

New Construction

- Grand River –The USACE is the lead agency administering a project to construct a Sea Lamprey barrier to replace a deteriorated structure in Harpersfield, Ohio. Project partners include the Commission, Service, Ohio Department of Natural Resources, and Ashtabula County. The USACE developed several alternatives, including: status quo, onsite rebuild, or rebuild further downstream. The USACE selected an onsite rebuild as the preferred alternative and completed the Detailed Project Report, which was sent to the USACE District Headquarters for approval. Construction is targeted for 2016.

Assessment of Candidate Streams

- Big Otter Creek – Repairing an existing dam at a railroad bridge (Black Bridge in Tillsonburg, Ontario, Canada) has been identified as a potential option for preventing Sea Lampreys from accessing roughly 50 km of the upper watershed. Discussions with the owners of the dam, as well as OMNRF, the Long Point Conservation Authority, and the Town of Tillsonburg, will be initiated in 2015. Hydraulic data collection downstream of the Black Bridge Dam is ongoing.

Fish Community Assessments

- Fish community assessments were conducted on three tributaries to Lake Erie: Forestville, Normandale, and Young's creeks to evaluate the potential impacts of Sea Lamprey barriers on fish communities in streams where they have been constructed. Analysis of the results is pending.

Lake Ontario

The Commission has invested in 16 barriers on Lake Ontario (Figure 3). 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 73 structures on tributaries to Lake Ontario 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 (9 Canada, 2 U.S.).

- Repairs or improvements were conducted on two Canadian barriers:

    - Graham Creek – The water intake box and Johnson Screen were relocated closer to the Sea Lamprey trap to improve water inflow and to reduce clogging of the screen with sediment and floating debris.

    - Cobourg Creek – Streambed modifications completed in 2013 to increase flow through the fishway and minimize clogging of the intake screen have only been partially successful. The situation will be monitored during the 2015 Sea Lamprey migration, and if performance continues to be compromised, a self-cleaning Johnson Screen will be installed in the fishway.

Ensure Blockage to Sea Lamprey Migration

- Duffins Creek – An investigation is underway to improve safety around the barrier while restoring its Sea Lamprey control function.

- Credit River – Two aluminum stop logs were fabricated and delivered to the OMNRF, who installed them in the fishway to ensure the blockage of Sea Lampreys. In addition, OMNRF staff identified potential routes of escapement through holes in the main crest of the dam, which were subsequently sealed in the fall of 2014.

- Bowmanville Creek – The retrofit of the lamprey trap associated with the new fishway was completed and operational for the 2014 season. To monitor the Sea Lamprey control function of the new fishway, a data logger was installed to collect flow information.

- Ganaraska River – A stop log was provided to the Ganaraska Region Conservation Authority to prevent Sea Lamprey escapement through the fishway. The original upper stop log was washed away during a spring flood in 2013.

- No consultations to ensure blockage at barriers were completed with partner agencies during 2014.

New Construction

- No new construction projects were initiated or underway.

Assessment of Candidate Streams

- No assessments were conducted.

ASSESSMENT

The SLCP has three assessment components and include the following:

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 exposure to lampricides, the time series of adult abundance is the primary metric used to evaluate 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 2014 are presented in the LATF and TTF sections of this report.

Larval Assessment

Tributaries considered for lampricide treatment during 2015 were assessed during 2014 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 and DWEF. 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 2015 based on the lowest cost per kill of larval Sea Lampreys ≥100 mm, as estimated using this index of abundance and average treatment costs. Additional surveys are used to define the distribution of Sea Lampreys within a stream, detect new populations, evaluate lampricide treatments, and to establish the sites for lampricide application.

Lake Superior

- Larval assessments were conducted on 189 tributaries (51 Canada, 138 U.S.) and 29 lentic areas (16 Canada, 13 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 (9 Canada, 26 U.S.) and in lentic areas offshore of 9 tributaries (5 Canada, 4 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 86 tributaries (19 Canada, 67 U.S.). No new producers were found. A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters led to additional surveys being conducted in nine of these streams that had no history of Sea Lamprey infestation. Based on survey observations, negative streams with moderate to high potential for future infestation will be a higher priority for future assessments.

- Post-treatment assessments were conducted in 13 tributaries (8 Canada, 5 U.S.) and 4 lentic areas (3 Canada, 1 U.S.) to determine the effectiveness of lampricide treatments conducted during 2013 and 2014. The Cypress, Huron, and Sturgeon rivers ranked for treatment again in 2015 based on the presence of residual Sea Lampreys. The Mackenzie River (lentic) was re-treated in 2014 based on the presence of residual Sea Lampreys.

- Surveys to evaluate barrier effectiveness were conducted in seven tributaries (two Canada, five U.S.). Escapement was evident only at the Otter Lake Dam in the Sturgeon River (Baraga County), where one young-of-year Sea Lamprey was found upstream.

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

- Surveys were conducted in non-wadable lentic and lotic areas using 92.08 kg (active ingredient; 40.6 Canada, 51.48 U.S.) of GB. Survey details are provided in Table 13.

Table 11. Status of larval Sea Lamprey in Lake Superior tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2014.

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 Davignon Cr.	May-72	Jun-13	---	No	---	---	Unknown
West Davignon Cr.	Jun-14	Jul-14	Yes	No	---	---	Unknown
Little Carp R.	May-08	Jun-14	---	Yes	---	---	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-14	---	No	---	---	Unknown
Horseshoe Cr.	Never	Jun-11	---	No	---	---	Unknown
Havilland Cr.	Jul-13	Jun-14	No	No	---	---	Unknown
Stokely Cr.	Jun-08	May-14	---	No	---	---	Unknown
Tier Cr.	Never	Jul-14	---	No	---	---	Unknown
Harmony R.	Jun-14	Jul-14	No	---	---	---	Unknown
Sawmill Cr.	Jul-11	Jun-14	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	Jun-14	Yes	No	---	---	Unknown
Batchawana R.	Jun-14	Jul-14	Yes	No	---	---	2018
Digby Cr.	Jun-13	Jul-13	Yes	---	---	---	Unknown
Carp R.	Jun-09	Jun-13	---	Yes	---	---	2016
Pancake R.	Jun-12	Jul-12	No	---	---	---	2016
Westman Cr.	Never	Aug-12	---	Yes	---	---	Unknown
Agawa R.	Sep-12	Jul-14	Yes	Yes	---	---	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	Jul-14	Yes	Yes	849	0	Unknown
Michipicoten R.	Aug-14	Aug-12	---	Yes	---	---	2018
Dog R.	Aug-63	Aug-12	---	Yes	---	---	Unknown
White R.	Jul-12	Jul-13	Yes	Yes	---	---	Unknown
Pic R.	Jul-13	Jul-14	No	No	---	---	2019
Nama Cr.	Aug-14	Jul-11	---	Yes			2019
Little Pic R.	Aug-11	Aug-13	No	No	---	---	Unknown
Prairie R.	Jul-94	Jul-14	---	No	---	---	Unknown
Steel R.	Jul-12	Jul-14	Yes	Yes	---	---	2016
Pays Plat R.	Jul-11	Aug-14	Yes	Yes	116,752	43,791	***2015***
Little Pays Plat Cr.	Jul-07	Aug-14	---	Yes	23,820	6,011	***2015***
Gravel R.	Jul-12	Aug-13	Yes	Yes	---	---	2016
Little Gravel R.	Jul-13	Aug-13	Yes	---	---	---	Unknown
Little Cypress	Aug-14	Aug-13	---	---	---	---	Unknown
Cypress R.	Jul-13	Aug-14	Yes	Yes	91,486	34,676	***2015***
Jackpine R.	Never	Aug-13	---	Yes	---	---	Unknown
Jackfish R.	Jul-12	Aug-14	Yes	Yes	---	---	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
Nipigon R.							
Upper Nipigon R.	Aug-14	Aug-12	---	---	---	---	2019
Lower Nipigon R.	Aug-06	Aug-14	---	Yes	---	---	Unknown
Cash Cr.	Jul-09	Aug-14	---	Yes	88,609	4,747	***2015***
Polly Cr.	Jul-87	Aug-13	---	No	---	---	Unknown
Stillwater Cr.	Aug-13	Aug-13	Yes	---	---	---	2017
Big Trout Cr.	Jul-10	Aug-14	Yes	Yes	27,885	2,535	***2015***
Otter Cove Cr.	Aug-71	Jun-12	---	No	---	---	Unknown
Black Sturgeon R.	Aug-11	Aug-13	No	No	---	---	Unknown
Big Squaw Cr.	Jun-72	Aug-14	---	No	---	---	Unknown
Wolf R.	Jul-11	Aug-13	Yes	Yes	---	---	***2015***[1]
Coldwater Cr.	Jul-12	Aug-12	Yes	---	---	---	Unknown
Pearl R.	Jul-10	Aug-14	Yes	Yes	3,291	525	***2015***
D'Arcy Cr.	Jul-10	Aug-14	Yes	No	---	---	Unknown
Blende Cr.	Jul-13	Aug-13	No	---	---	---	Unknown
MacKenzie R.	Aug-13	Aug-13	Yes	---	---	---	Unknown
Neebing-McIntyre FW	Jul-13	Aug-13	Yes	---	---	---	Unknown
Kaministiquia R.	Oct-13	Aug-14	Yes	Yes	---	---	2016
Corbett Cr.	Jul-13	Aug-13	Yes	---			2016
Whitefish R.	Oct-13	Aug-13	---	---			2016
Oliver Cr.	Aug-14	Aug-14	---	---			2016
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	Jul-14	No	No	---	---	Unknown
Sec 11SW Cr.	Never	Jul-13	---	Yes	---	---	Unknown
Pendills Cr.	Jul-12	Jul-14	No	No	---	---	Unknown
Grants Cr.	Jun-08	Jul-13	No	Yes	1,104	0	***2015***
Halfaday Cr.	Jul-12	Jul-14	Yes	Yes	---	---	Unknown
Naomikong Cr.	Jul-63	Jul-14	---	Yes	---	---	Unknown
Ankodosh Cr.	Jun-08	Sep-14	No	Yes	4,912	951	***2015***
Roxbury Cr.	Jun-08	Sep-14	No	Yes	17,579	663	***2015***
Galloway Cr.	Jul-07	Sep-14	No	Yes	4,192	815	***2015***
Tahquamenon R.	Oct-10	Sep-14	Yes	Yes	---	---	***2015***[2]
Betsy R.	Oct-10	Sep-14	No	Yes	10,448	2,985	***2015***
Three Mile Cr.	Jun-62	Jun-14	---	Yes	---	---	Unknown
Little Two Hearted R.	Jul-12	Jun-14	No	Yes	---	---	Unknown
Two Hearted R.	Jul-14	Jun-14	---	---	---	---	Unknown
Dead Sucker R.	Aug-13	Sep-13	No	---	---	---	Unknown
Sucker R. (Alger Co.)	Jul-14	Aug-14	Yes	No	---	---	Unknown
Chipmunk Cr.	Sep-62	Jul-13	---	No	---	---	Unknown
Carpenter Cr.	Aug-05	Aug-14	Yes	Yes	865	695	***2015***
Sable Cr.	Sep-89	Jul-13	---	Yes	---	---	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
Hurricane R.	Never	Jun-12	---	No	---	---	Unknown
Sullivans Cr.	Sep-10	Aug-14	No	Yes	475	119	***2015***
Seven Mile Cr.	Jul-67	Aug-12	---	No	---	---	Unknown
Beaver Lake Cr.							
Lowney Cr.	Sep-10	Aug-14	Yes	Yes	13,418	335	***2015***
Mosquito R.	Jun-73	Jul-14	---	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-14	---	No	---	---	Unknown
Anna R.	Jul-13	Sep-13	No	No	---	---	Unknown
Tourist Park Cr.	Never	Jun-12	---	---	---	---	Unknown
Furnace Cr.							
Lower	Sep-10	Aug-14	Yes	Yes	939	39	Unknown
Upper	Sep-10	Aug-14	No	No	---	---	Unknown
Five Mile Cr.	Jul-13	Sep-13	Yes	No	---	---	Unknown
Au Train R.							
Upper	Jul-14	Aug-13	Yes	Yes	---	---	Unknown
Lower	Jun-11	Aug-13	No	No	---	---	Unknown
Rock R.	Jul-02	Jun-14	---	No	---	---	Unknown
Deer Lake Cr.	Aug-70	Jun-12	---	No	---	---	Unknown
Laughing Whitefish R.	Jul-14	Jun-13	No	Yes	---	---	Unknown
Sand R.							
Below Dam	Jul-12	Sep-14	No	---	874	92	***2015***
Above Dam	Jul-12	Sep-14	Yes	---	10,198	1,085	***2015***
Chocolay R.	Jul-12	Jul-14	Yes	Yes	498,843	38,869	***2015***
Carp R.	Jul-14	Aug-13	Yes	Yes			Unknown
Dead R.	Aug-14	Jun-13	Yes	---			Unknown
Harlow Cr.	Jun-11	Aug-13	No	Yes	21,357	3,147	***2015***
Little Garlic R.	Aug-14	Jul-14	Yes	Yes	---	---	Unknown
Garlic R.	Jun-11	Aug-11	Yes	Yes	---	---	***2015***[1]
Iron R.	Aug-13	Aug-13	No	---	---	---	2017
Salmon Trout R. (Marquette Co.)	Jul-12	Jun-14	Yes	Yes	---	---	2016
Pine R.	Jun-11	Sep-14	Yes	Yes	16,864	2,594	***2015***
Huron R.	Aug-13	Jul-14	---	---	8,874	6,212	***2015***
Ravine R.	Aug-14	Jul-14	---	---	---	---	***2015***
Slate R.	Sep-13	Aug-14	---	No	---	---	Unknown
Silver R.	Aug-14	Jul-14	---	---	---	---	***2015***
Falls R.	Aug-14	Jul-13	---	---	---	---	***2015***
Six Mile Cr.	May-63	Jul-14	---	Yes			Unknown
Little Carp R.	Oct-12	Jul-14	Yes	Yes	21,429	661	***2015***
Kelsey Cr.	Never	Jul-13	---	Yes			Unknown
Sturgeon R.	Aug-13	Aug-14	Yes	Yes	286,951	73,577	***2015***
Pilgrim R.	Aug-62	Jun-14	---	Yes			Unknown
Trap Rock R.	Jul-11	Sep-14	No	Yes	180,415	36,973	***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
McCallum Cr.	Aug-63	Jul-10	---	No	---	---	Unknown
Traverse R.	Jun-12	Sep-14	Yes	Yes	---	---	***2015***[1]
Little Gratiot R.	Aug-72	May-12	---	No	---	---	Unknown
Eliza Cr.	Jul-11	Jun-14	No	Yes	---	---	Unknown
Gratiot R.	Jul-11	Jun-14	Yes	Yes	3,759	1,481	***2015***
Smiths Cr.	May-64	Jun-14	---	No	---	---	Unknown
Boston-Lily Cr.	Aug-12	Jun-14	No	No	---	---	Unknown
Schlotz Cr.	Never	Jun-13	---	Yes	---	---	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	Sep-14	---	Yes	33,979	2,436	***2015***
Elm R.	Jul-07	Sep-13	No	Yes	---	---	Unknown
Misery R.							
Barrier downstream	Jul-11	Aug-12	No	Yes	---	---	***2015***[1]
Barrier upstream	Sep-00	Jun-12	---	No	---	---	Unknown
East Sleeping R.	Jul-13	Jun-14	Yes	---	---	---	2017
West Sleeping R.	Jun-14	Aug-13	No	Yes	---	---	Unknown
Firesteel R.	Oct-11	Sep-14	Yes	Yes	---	---	***2015***[1]
Ontonagon R.	Oct-12	Sep-14	Yes	Yes	261,578	18,934	***2015***
Potato R.	Jun-14	Aug-14	No	---	---	---	Unknown
Floodwood R.	Never	Jul-14	---	No	---	---	Unknown
Cranberry R. (Ontonagon Co.)	Jun-14	Aug-14	No	---	---	---	Unknown
Mineral R.	Jun-14	Jul-13	No	Yes	---	---	Unknown
Big Iron R.	Never	Aug-13	No	Yes	---	---	Unknown
Little Iron R.	Sep-75	Aug-13	---	Yes	---	---	Unknown
Union R.	May-64	Jul-13	---	No	---	---	Unknown
Black R.	Jul-10	Aug-14	No	Yes	---	---	Unknown
Montreal R.	Jul-75	Aug-13	---	No	---	---	Unknown
Washington Cr.	Jun-80	Jul-12	---	No	---	---	Unknown
Bad R.	Oct-14	Jul-14	---	---	---	---	2018
Fish Cr. (Eileen Twp)	Jul-10	Jul-14	No	Yes	34,388	7,476	***2015***
Sioux R.	Sep-14	Aug-14	---	---	---	---	Unknown
Pikes Cr.	Never	Jul-12	---	Yes	---	---	Unknown
Red Cliff Cr.	Sep-11	Aug-14	No	Yes	3,041	507	Unknown
Raspberry R.	Jun-63	Jul-12	---	No	---	---	Unknown
Sand R.	Sep-11	Aug-14	Yes	Yes	2,530	0	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

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
Brule R.							
Barrier downstream	Jun-12	Jul-14	Yes	Yes	72,954	19,865	***2015***
Barrier upstream	Jun-86	Sep-12	---	No	---	---	Unknown
Poplar R.	Sep-11	Jul-14	No	Yes	4,751	1,859	***2015***
Middle R.					---	---	
Barrier downstream	Jul-13	Sep-13	No	---	---	---	Unknown
Amnicon R.	Jun-12	Jul-14	Yes	Yes	---	---	***2015***[1]
Nemadji R.	Oct-14	Aug-14	---	---	---	---	Unknown
St. Louis R.	Sep-87	Aug-14	---	No	---	---	Unknown
Sucker R. (St. Louis Co.)	Never	Jun-14	---	No	---	---	Unknown
Gooseberry R.	Aug-76	Aug-12	---	Yes	---	---	Unknown
Splitrock R.	Aug-76	Jun-14	---	No	---	---	Unknown
Poplar R.	Jul-77	Aug-12	---	Yes	---	---	Unknown
Arrowhead R.	Jun-09	Sep-13	No	Yes	---	---	Unknown

[1] Stream being treated based on expert judgement
[2] Stream deferred for treatment from 2014

Table 12. Status of larval Sea Lampreys in historically infested lentic areas of Lake Superior during 2014.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Goulais R.	Goulais Bay	Jul-08	Jul-08	Aug-85
Havilland Cr.	Havilland Bay	Jul-14	Jul-14	Never[1]
Stokely Cr.	Havilland Bay	Jun-13	Jul-09	Aug-11
Harmony R.	Batchawana Bay	Jul-14	Jun-13	Aug-14
Chippewa R.	Batchawana Bay	Jul-14	Jul-14	Aug-11[1]
Batchawana R.	Batchawana Bay	Sep-14	Jul-14	Jul-14
Carp R.	Batchawana Bay	Oct-12	Oct-12	Aug-07
Agawa R.	Agawa Bay	Jul-14	Jul-14	Aug-10
Michipicoten R. (Lower)	Marina Area	Aug-12	Aug-12	Aug-14
Gravel R.	Mountain Bay	Aug-13	Aug-13	Aug-13
Little Cypress R.	Cypress Bay	Aug-78	Aug-78	Never
Cypress R.	Cypress Bay	Aug-14	Aug-14	Oct-11[1]
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-14
Nipigon R. (Lower)	Nipigon Bay	Aug-14	Aug-14	Oct-11[1]
Nipigon R.	Stillwater	Aug-13	Aug-13	Aug-13
Nipigon R.	Polly Lake	Jun-12	Jul-90	Jul-87
Big Trout Cr.	Nipigon Bay	Aug-14	Aug-14	Oct-11
Black Sturgeon R.	Black Bay	Aug-11	Jul-04	Never
Wolf R.	Black Bay	Aug-14	Aug-14	Never[1]
MacKenzie R.	MacKenzie Bay	Aug-14	Aug-14	Aug-14
Current R.	Thunder Bay	Aug-13	Aug-13	Aug-14
Neebing-McIntyre Floodway	Thunder Bay	Aug-14	Jul-90	Never
Kaministiquia R. (Lower)	Thunder Bay	Aug-14	Aug-14	Oct-13[1]
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	Aug-14	Aug-14	Sep-12
Beaver Lake Cr.	Beaver Lake	Sep-10	Sep-10	Never[2]
Anna R.	Munising Bay	Aug-14	Aug-14	Aug-11
Miners R.	Miners Lake	Sep-13	Sep-13	Jun-11
Furnace Cr.	Furnace Bay	Aug-14	Aug-14	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]

Table 12. *continued.*

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Five Mile Cr.	Offshore mouth	Aug-11	Aug-11	Never[2]
Carp R.	Offshore mouth	Aug-14	Aug-14	Never[2]
Dead R.	Presque Isle Harbor	Jun-13	Jun-13	Jul-12
Harlow Cr.	Harlow Lake – Offshore Bismark Cr.	Jul-14	Jul-14	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	Jul-14	Jul-14	Never[2]
Ravine R.	Huron Bay	Aug-14	Aug-14	Jun-12
Slate R.	Huron Bay	Jul-13	Jul-13	Never[2]
Silver R.	Huron Bay	Aug-14	Aug-14	Aug-11
Falls R.	Huron Bay	Aug-14	Aug-14	Jun-12
Trap Rock R.	Torch Lake	Jun-14	Jun-14	Aug-13
Eliza Cr.	Eagle Harbor	Jul-03	Sep-78	Never
Mineral R.	Offshore mouth	Aug-14	Aug-14	Never[2]
Black R.	Black River Harbor	Aug-14	Aug-14	Sep-14
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

Table 13. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Superior for larval assessment purposes during 2014.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Haviland Cr. (lentic)	1.68	0.30
Harmony R. (lentic)	1.68	0.30
Chippewa R. (lentic)	1.68	0.30
Batchawana R. (lentic)	3.36	0.6
Batchawana R. (lotic)	0.84	0.15
Pancake R. (lentic)	1.68	0.30
Agawa R. (lentic)	1.68	0.30
Old Woman R. (lentic)	1.68	0.30
Pic R. (lentic)	1.68	0.30
Pic R. (lotic)	1.96	0.35
Steel R. (lentic)	0.84	0.15
Cypress R. (lentic)	1.68	0.30
Jackfish R. (lentic)	1.12	0.20
Jackfish R. (lotic)	0.56	0.10
Nipigon R. (lotic)	3.36	0.60
Big Trout Cr. (lentic)	1.68	0.30
Black Sturgeon R. (lotic)	0.84	0.15
Wolf R. (lentic)	1.68	0.30
Pearl R. (lotic)	1.96	0.35
MacKenzie R. (lentic)	1.68	0.30
Neebing-McIntrye Floodway (lentic)	1.68	0.30
Kaministiquia R. (lotic)	5.60	1.00
Total (Canada)	**40.6**	**7.25**
United States		
Waiska R. (lotic)	1.07	0.19
Carpenter Cr. (lentic)	3.52	0.63
Anna R. (lentic)	1.74	0.31
Furnace Cr. (lentic)	1.74	0.31
Five Mile Cr. (lentic)	0.58	0.10
Carp R. (lentic)	1.74	0.31
Dead R. (lentic)	2.90	0.52
Harlow River (Harlow Lake lentic)	1.74	0.31
Garlic R. (Saux Head Lake lentic)	2.61	0.47
Huron R. (lotic)	0.87	0.16
Ravine R. (lentic)	4.64	0.83
Silver R. (lentic)	5.23	0.93
Falls R. (lentic)	4.35	0.78
Trap Rock R. (lentic)	2.32	0.41
Deer Lake Outlet (lotic)	0.15	0.04
East Sleeping R. (lotic)	0.29	0.05
Ontonagon R. (lotic)	1.45	0.26
Floodwood R. (lotic)	0.15	0.03
Black R. (lentic)	2.32	0.41
Black R. (lotic)	2.03	0.36
Sioux R. (lotic)	0.87	0.15
Nemadji R. (lotic)	2.21	0.39
St. Louis R. (lotic)	6.96	1.24
Total (United States)	**51.48**	**9.19**
Total for Lake	**92.08**	**16.44**

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

Lake Michigan

- Larval assessment surveys were conducted on 172 tributaries and 17 lentic areas. The status of larval Sea Lamprey populations in historically infested Lake Michigan tributaries and lentic areas is presented in Tables 14 and 15.

- Surveys to estimate the abundance of larval Sea Lampreys were conducted in 19 tributaries.

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 91 tributaries. A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters led to additional surveys being conducted in 76 streams that had no history of infestation and had not been recently surveyed (some >25 years). One new Sea Lamprey population was discovered in Silver Creek (Kewaunee County; n=4, 99-138mm). The population was localized in the mouth of the stream and no infestation was detected upstream in the system. The stream was not ranked for treatment but will continue to be monitored. Based on survey observations, negative streams with moderate to high potential for future infestation will be a higher priority for future assessments.

- Post-treatment assessments were conducted in 41 tributaries and 3 lentic areas to determine the effectiveness of lampricide treatments during 2013 and 2014. The Whitefish River and Mattix and Marblehead creeks ranked for treatment again in 2015 based on the presence of residual Sea Lampreys.

- An evaluation of larval and juvenile Sea Lamprey production potential was completed on Grand River tributaries upstream of 6th Street Dam. The purpose of the work was to evaluate the production potential of Sea Lampreys upstream from critical barriers by quantitatively assessing larval habitat and native lamprey abundances as a surrogate for Sea Lampreys. Results from the study are pending.

- Surveys to collect larval Sea Lampreys for pheromone extraction were conducted in one tributary.

- Service staff assisted in field studies conducted by the USGS Upper Midwest Environmental Sciences Center (UMESC) to determine the concentrationof niclosamide (2', 5-dichloro-4'-nitrosalicylanilide) in sediment (sand and silt) and in the water column following the application of GB off the mouths of Hog Island Creek (Mackinaw County, Michigan) and Peshtigo River (Marinette County, Wisconsin).

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 45.12 kg (active ingredient) of GB. Survey details are provided in Table 16.

Table 14. Status of larval Sea Lampreys in Lake Michigan tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2014.

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
Brevort R.							
Upper	May-12	Jul-13	No	No	---	---	Unknown
Lower	Aug-13	Jul-14	No	---	---	---	Unknown
Paquin Cr.	Oct-87	Apr-12	---	Yes	---	---	Unknown
Davenport Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Hog Island Cr.	Sep-13	Jun-14	No	---	---	---	2017[2]
Sucker R.	Jun-61	Sep-12	---	Yes	---	---	Unknown
Black R.	Jun-13	Sep-13	No	---	---	---	2016[2]
Mattix Cr.	Sep-13	Jul-14	Yes	---	310	89	***2015***
Mile Cr.	Oct-13	Aug-14	Yes	No	---	---	Unknown
Millecoquins R.	Sep-13	Jul-14	Yes	---	---	---	2016[2]
Rock R.	Sep-13	Jun-14	Yes	---	---	---	Unknown
Crow R.	Aug-13	Jun-14	No	---	---	---	Unknown
Cataract R.	Sep-13	Jul-14	Yes	---	---	---	Unknown
Pt. Patterson Cr.	Jul-13	Jul-14	No	---	---	---	Unknown
Hudson Cr.	Jul-13	Aug-14	Yes	Yes	---	---	Unknown
Swan Cr.	Jul-13	Aug-14	No	No	---	---	Unknown
Seiners Cr.	May-84	May-12	---	Yes	---	---	Unknown
Milakokia R.	Jul-13	Aug-13	No	---	---	---	2016[2]
Bulldog Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Gulliver Lake Outlet	Sep-13	Jun-14	No	---	---	---	Unknown
Marblehead Cr.	Sep-13	Jun-14	Yes	---	508	297	***2015***
Manistique R.	Sep-14	Sep-14	Yes	---	---	---	Unknown
Southtown Cr.	Jul-13	Sep-13	No	---	---	---	Unknown
Thompson Cr.	Never	Jun-14	---	Yes	---	---	Unknown
Johnson Cr.	Jun-13	Aug-13	No	---	---	---	Unknown
Deadhorse Cr.	Sep-13	Jun-14	Yes	---	44	44	Unknown
Gierke Cr.	Never	May-13	---	Yes	---	---	Unknown
Bursaw Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Parent Cr.	Jul-13	Jun-14	No	---	---	---	Unknown
Poodle Pete Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Valentine Cr.	May-12	Jul-12	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	Oct-14	Yes	---	---	---	***2015[1]***
Ogontz R.	Sep-14	Jul-14	---	---	---	---	2018[2]
Squaw Cr.	May-12	Jun-12	No	---	---	---	Unknown
Hock Cr.	May-81	Aug-14	---	Yes	195	0	Unknown
Whitefish R.	Jun-13	Sep-14	Yes	Yes	265,988	30,686	***2015***
Rapid R.	May-12	Sep-14	Yes	Yes	---	---	***2015[2]***
Tacoosh R.	Oct-14	Jul-14	---	---	---	---	Unknown

Table 14. *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
Days R.							
Barrier downstream	Aug-14	Jul-14	---	---	---	---	***2015***
Barrier upstream	Oct-11	Jul-14	Yes	No	---	---	Unknown
Portage Cr.	Oct-09	May-14	Yes	Yes	---	---	Unknown
Ford R.	Oct-14	Aug-14	---	---	---	---	2017[2]
Sunnybrook Cr.	May-71	Jun-13	---	Yes	---	---	Unknown
Bark R.	Oct-11	Aug-14	Yes	Yes	9,254	3,365	***2015***
Cedar R.	Oct-14	Jul-14	---	---	---	---	2017[2]
Sugar Cr.	May-08	Aug-12	No	No	---	---	Unknown
Arthur Bay Cr.	Jun-10	Jul-13	Yes	No	---	---	Unknown
Rochereau Cr.	Apr-63	Aug-14	---	No	---	---	Unknown
Johnson Cr.	May-10	Aug-12	No	No	---	---	Unknown
Bailey Cr.	Apr-09	Aug-14	Yes	Yes	118	118	***2015***[3]
Beattie Cr.	May-09	Aug-14	Yes	Yes	437	146	***2015***
Springer Cr.	Apr-13	Jul-13	No	---	---	---	Unknown
Menominee R.	Jun-07	Aug-14	Yes	Yes	---	---	Unknown
Little R.	Aug-77	Jul-14	---	No	---	---	Unknown
Peshtigo R.	Oct-14	Aug-14	---	---	---	---	***2015***[4]
Oconto R.	May-12	Aug-14	Yes	Yes	186,545	114,545	***2015***
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-14	---	Yes	---	---	Unknown
Whitefish Bay Cr.	May-87	Aug-13	---	Yes	---	---	Unknown
Shivering Sands Cr.	Apr-12	May-14	Yes	No	---	---	Unknown
Lilly Bay Cr.	Apr-63	May-14	---	No	---	---	Unknown
Bear Cr.	May-75	Jun-11	---	No	---	---	Unknown
Door Co. 23 Cr.	May-07	Aug-13	No	Yes	---	---	Unknown
Silver Creek	Never	May-14	---	Yes	---	---	Unknown
Ahnapee R.	Apr-64	Aug-13	No	No	---	---	Unknown
Three Mile Cr.	May-14	Aug-14	Yes	No	387	193	Unknown
Kewaunee R.							
Barrier downstream	May-75	May-12	---	Yes	---	---	Unknown
Barrier upstream	May-75	Aug-13	---	Yes	---	---	Unknown
Casco Cr.	May-14	Aug-14	Yes	No	---	---	Unknown
Scarboro Cr.	May-75	Aug-13	---	Yes	---	---	Unknown
East Twin R.	Oct-08	Aug-14	Yes	Yes	531	0	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	Jun-14	No	No	---	---	Unknown
Bear R.	Never	Jun-14	---	No	---	---	Unknown

Table 14. *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
Horton Cr.	Sep-13	Jun-14	---	---	---	---	2017
Boyne R.	Sep-13	Jun-14	Yes	Yes	---	---	***2015***[1]
Porter Cr.	Sep-13	Jun-14	---	---	---	---	2017
Jordan R.	Jul-14	Jul-14	---	---	---	---	***2015***[1]
Monroe Cr.	Aug-13	Jun-14	No	No	---	---	Unknown
Loeb Cr.	Aug-13	Jun-14	---	---	---	---	2017
McGeach Cr.	Oct-99	Jun-12	---	No	---	---	Unknown
Elk Lake Outlet	Jul-11	Jun-14	No	No	---	---	Unknown
Tobeco Creek	Never	Jun-14	---	No	---	---	Unknown
Yuba Cr.	May-06	Jun-14	---	No	---	---	Unknown
Acme Cr.	Aug-63	Jun-12	---	No	---	---	Unknown
Mitchell Cr.	Jun-13	Sep-13	No	No	---	---	2016
Boardman R. (lower)	Jun-09	Sep-14	No	Yes	948	948	***2015***
Boardman R. (mid.)	Oct-11	Sep-14	No	Yes	5,536	2,768	***2015***
Hospital Creek	Jun-09	Sep-14	No	Yes	1,455	146	***2015***
Leo Cr.	Never	Jun-13	---	No	---	---	Unknown
Ennis Creek	Never	Jun-14	---	No	---	---	Unknown
Northport Creek	Never	Jun-14	---	No	---	---	Unknown
Leland River	Never	Jun-14	---	No	---	---	Unknown
Good Harbor Cr.	Jul-10	Jul-13	No	No	---	---	Unknown
Crystal R.	Nov-11	Jun-14	No	No	---	---	Unknown
Platte R. (upper)	Jun-14	Sep-14	Yes	Yes	---	---	2016
Platte R. (middle)	Jun-14	Sep-14	No	Yes	---	---	2016
Platte R. (lower)	Jun-14	Sep-14	No	Yes	---	---	2016
Betsie R.	Jul-14	Jun-14	---	---	---	---	2016
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-14	Jul-14	---	---	---	---	***2015***[1]
Gurney Cr.	Aug-09	Sep-14	Yes	Yes	5,145	0	2016
Cooper Cr.	Jul-08	Jun-11	No	No	---	---	Unknown
Lincoln R.	Jun-14	Oct-14	No	No	---	---	2018
Pere Marquette R.	Sep-14	Jul-14	---	---	---	---	2017
Bass Lake Outlet	Aug-78	Sep-13	---	No	---	---	Unknown
Pentwater R. (N. Br.)	Jul-13	Aug-14	Yes	Yes	---	---	2017
South Branch	Never	Oct-09	---	No	---	---	Unknown
Lambricks Cr.	Sep-84	Aug-14	No	No	---	---	2017
Stony Cr.	Jun-10	Aug-14	Yes	No	---	---	Unknown
Flower Cr.	Jun-11	Aug-14	No	Yes	---	---	2016
White R.	Sep-14	Aug-14	--	--	---	---	2017
Duck Cr.	Jul-84	Sep-12	---	No	---	---	Unknown
Muskegon R.	Sep-14	Aug-14	---	---	---	---	***2015***[1]
Brooks Cr.	Sep-14	Aug-14	---	---	---	---	***2015***[1]
Cedar Cr.	Sep-14	Aug-14	---	---	---	---	***2015***[1]
Bridgeton Cr.	Sep-14	Aug-14	---	---	---	---	***2015***[1]

Table 14. *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
Minnie Cr.	Sep-14	Aug-14	---	---	---	---	***2015***[1]
Bigelow Cr.	Sep-14	Aug-14	---	---	---	---	***2015***[1]
Big Bear Cr.	Aug-70	Aug-14	---	No	---	---	Unknown
Mosquito Cr.	Sep-68	Aug-14	---	No	---	---	Unknown
Black Cr.	Aug-08	Jul-13	No	No	---	---	Unknown
Grand R.	Never	Jul-12	No	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	Aug-14	No	Yes	---	---	2016
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.	Jul-14	Jul-14	--	--	---	---	Unknown
Sand Cr.	Sep-10	Jul-14	No	Yes	---	---	2016
Mann Cr.	Oct-12	Jun-13	No	No	---	---	2016
Rabbit R.	Aug-08	Jul-14	No	Yes	5,747	3,861	***2015***
Swan Cr.	Jul-13	Jul-14	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	Jul-14	---	Yes	190	190	***2015***
Allegan 6 Cr.	Never	Jul-14	--	No	---	---	Unknown
Black R.							
North Branch	Jun-77	Sep-11	---	No	---	---	Unknown
Middle Branch	May-14	Jul-14	Yes	Yes	9,573	3,191	***2015***
South Branch	Never	Jul-13	---	No	---	---	Unknown
Brandywine Cr.	Aug-85	Sep-14	---	No	---	---	Unknown
Rogers Cr.	May-98	Sep-14	---	Yes	---	---	2016
St. Joseph R.	Never	Jul-10	---	No	---	---	Unknown
Lemon Cr.	Oct-65	Sep-11	---	No	---	---	Unknown
Pipestone Cr.	May-14	Oct-14	No	--	---	---	Unknown
Meadow Dr.	Oct-65	Sep-11	---	No	---	---	Unknown
Hickory Cr.	Oct-65	Sep-13	---	Yes	47,875	5,440	***2015***[1]
Paw Paw R.	Jun-12	Sep-14	No	Yes	---	---	***2015***[1]
Blue Cr.	Jun-12	Sep-14	No	No	---	---	***2015***[1]
Mill Cr.	Jun-12	Sep-14	No	Yes	---	---	***2015***[1]
Brandywine Cr.	Jun-12	Sep-14	No	No	---	---	***2015***[1]
Brush Cr.	Jun-12	Sep-14	No	No	---	---	***2015***[1]
Hayden Cr.	Jun-12	Sep-13	No	No	---	---	***2015***[1]
Campbell Cr.	Jun-12	Sep-12	No	No	---	---	***2015***[1]

Table 14. *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-14	Yes	Yes	978	978	2016
E. Br. & Dowling Cr.	Oct-10	Jul-14	No	No	---	---	2016
S. Br. & Galina Cr.	Oct-12	Sep-14	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.	Apr-14	Jul-14	No	No	---	---	2014
Trail Cr.	Apr-14	Aug-14	No	No	---	---	2014
Donns Cr.	May-66	Sep-12	---	No	---	---	Unknown
Burns Ditch	Jul-99	Oct-14	---	Yes	25,577	23,320	***2015***

[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 15. Status of larval Sea Lampreys in historically infested lentic areas of Lake Michigan during 2014.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Brevort R.	Brevort Lake (Silver Cr. – Offshore)	Aug-13	Jul-08	Never[1]
	Brevort Lake (L. Brevort R. – Offshore)	Aug-13	Aug-74	Never
Paquin Cr.	Paquin Cr. (Offshore)	Jul-08	Jul-08	Never[1]
Hog Island Cr.	Hog Island Cr. (Offshore)	Jun-14	Sep-12	Jun-07[1]
Black R.	Black R. (Offshore)	Sep-14	Aug-11	Never[1]
Mile Cr.	Mile Cr. (Offshore)	Jun-08	Jun-08	Never[1]
Millecoquins R.	Millecoquins Lake (Cold Cr. – Offshore)	Jun-14	Jun-14	Never[1]
Milakokia R.	Seul Choix Bay	Jun-14	Aug-80	Never
Manistique R.	Manistique R. (Offshore)	Jun-14	Jun-14	Oct-14
Deadhorse Cr.	Deadhorse Cr. (Offshore)	Jul-11	Oct-64	Never
Bursaw Cr.	Bursaw Cr. (Offshore)	Jul-11	Jul-11	Never[1]
Valentine Cr.	Big Bay De Noc	Sep-11	Aug-94	Never
Ogontz R.	Big Bay De Noc	Jul-14	Jul-14	Sep-14
Whitefish R.	Little Bay De Noc	Jun-13	Aug-93	Never[1]
Rapid R.	Little Bay De Noc	Jul-14	Jun-13	Jun-12
Days R.	Little Bay De Noc	Aug-13	Aug-13	Aug-14
Escanaba R.	Little Bay De Noc	Aug-10	Jul-06	Never[1]
Portage Cr.	Portage Bay	Jul-84	Aug-82	Never
Ford R.	Green Bay	Jun-13	Jun-13	Oct-14
Sunny Br.	Green Bay	Sep-82	Aug-81	Never
Bark R.	Green Bay	Jul-11	Sep-98	Never
Cedar R.	Green Bay	Jul-13	Jul-13	Jun-10
Beattie Cr.	Green Bay	Jul-08	Jul-85	Never
Menominee R.	Green Bay	Aug-14	Aug-14	Never[1]
Peshtigo R.	Green Bay	Aug-14	Aug-14	Never
Bear R.	Little Traverse Bay	Jun-14	Jun-08	May-07
Horton Cr.	Horton Bay (Lake Charlevoix)	Jun-14	Jun-14	Sep-13
Boyne R.	Boyne Harbor (Lake Charlevoix)	Jun-14	Jun-14	Jun-13
Porter Cr.	Lake Charlevoix	Jun-14	Jun-14	Sep-13
Jordan R.	Lake Charlevoix	Jun-14	Jun-14	Jul-14
Monroe Cr.	Lake Charlevoix	Jun-13	Jun-13	Aug-13
Mitchell Cr.	Grand Traverse Bay (East Arm)	May-04	May-04	Never[1]
Boardman R.	Grand Traverse Bay (West Arm)	Sep-14	Sep-14	Jun-12
Leland R.	Leland R. (Offshore)	Jun-1	Jun-13	Never[1]
Platte R.	Loon Lake	Sep-08	Sep-08	Never[1]
	Platte Lake	Sep-08	Jul-03	Never[1]
Betsie R.	Betsie Lake	May-08	Aug-83	Never[1]
Big Manistee R.	Manistee Lake (Big Manistee – Offshore)	Jul-08	Jul-08	Never[1]
	Manistee Lake (Little Manistee – Offshore)	Jul-08	Jul-08	Jul-08

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

Table 16. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Michigan for larval assessment purposes during 2014.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Hog Island R. (lentic)	2.90	0.52
Black R. (lentic)	0.58	0.10
Millecoquins R. (lentic)	2.23	0.41
Millecoquins Lake (lentic)	2.23	0.41
Milakokia R. (lentic)	1.16	0.21
Manistique R. (lentic)	6.96	1.24
Ogontz R. (lentic)	2.32	0.41
Whitefish R. (Trout Lake lentic)	1.74	0.31
Rapid R. (lentic)	2.32	0.41
Menominee R. (lotic)	4.64	0.83
Menominee R. (lentic)	2.32	0.41
Peshtigo R. (lentic)	1.16	0.21
Bear R. (lentic)	1.68	0.30
Horton Cr. (lentic)	1.12	0.20
Boyne R. (lentic)	1.68	0.30
Porter Cr. (lentic)	0.56	0.10
Jordan R. (lentic)	1.12	0.20
Elk Lake Outlet (lentic)	1.12	0.20
Boardman R. (lentic)	1.68	0.30
Boardman R. (Boardman Lake lentic)	1.12	0.20
Leland R. (lentic)	1.68	0.30
Muskegon R. (lotic)	1.68	0.30
Rabbit R. (lotic)	1.12	0.20
Total for Lake	**45.12**	**8.07**

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

Lake Huron

- Larval assessment surveys were conducted on 99 tributaries (49 Canada, 50 U.S.) and 19 lentic areas (10 Canada, 9 U.S.). The status of larval Sea Lamprey populations in historically infested Lake Huron tributaries and lentic areas are presented in Tables 17 and 18.

- Surveys to estimate abundance of larval Sea Lampreys were conducted in 19 tributaries (8 Canada, 11 U.S.) and 5 lentic areas (4 Canada, 1 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 30 tributaries (14 Canada, 16 U.S.). No new populations were detected.

- Post-treatment assessments were conducted in 12 tributaries (6 Canada, 6 U.S.) to determine the effectiveness of lampricide treatments during 2013 and 2014. Hughson and Carlton creeks and Echo River (lentic) ranked for treatment again in 2015 based on the presence of residual Sea Lampreys.

- Surveys to evaluate barrier effectiveness in six tributaries (four Canada, two U.S.) indicated no evidence of escapement.

- Monitoring of larval Sea Lampreys in the St. Marys River continued during 2014. Approximately 880 geo-referenced sites were sampled using DWEF. Surveys were conducted according to a stratified, systematic sampling design. The larval Sea Lamprey population in the St. Marys River was estimated to be 1.1 million (95% confidence limits 0.7-1.4 million).

- An evaluation of larval and juvenile Sea Lamprey production potential was completed on the Saginaw River. The purpose of the work was to evaluate the production potential of Sea Lamprey upstream from critical barriers by quantitatively assessing larval habitat and native lamprey abundances as a surrogate for Sea Lampreys. Results from the study are pending.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 44.25 kg (active ingredient, 22.82 Canada, 21.49 U.S.) of GB. Survey details are provided in Table 19.

Table 17. Status of larval Sea Lampreys in Lake Huron tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2014.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Canada							
St. Marys R.	Aug-14	Aug-14	Yes	Yes	600,000	---	***2015***
Root R.	Sep-14	Jun-14	---	---	---	---	2018
Garden R.	Sep-14	Jul-14	---	---	---	---	***2015***
Echo R.							
Upper	Oct-99	Jun-14	---	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-14	No	No	---	---	Unknown
Sucker Cr.	Apr-12	Jun-13	No	No	---	---	Unknown
Two Tree R.	May-10	Jul-14	No	Yes	982	982	***2015***
Richardson Cr.	Aug-11	Jun-14	No	No	---	---	Unknown
Watson Cr.	May-10	Jul-14	No	Yes	535	535	***2015***
Gordon Cr.	Sep-11	Jun-14	No	No	---	---	Unknown
Browns Cr.	Sep-11	Jun-14	No	Yes	---	---	2016
Koshkawong R.	Apr-12	Jun-14	No	Yes	2,884	96	***2015***[2]
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	Jun-14	---	Yes	---	---	Unknown
Thessalon R.							
Upper	Aug-11	Jun-13	No	No	---	---	Unknown
Lower	Jul-14	Jul-14	No	---	---	---	2017
Livingstone Cr.	Jun-13	Sep-12	---	---	---	---	Unknown
Mississagi R.	Aug-13	Jun-14	No	No	---	---	2017
Blind R.	May-84	May-12	---	No	---	---	Unknown
Lauzon R.	Jun-11	Sep-14	No	Yes	7,108	3,275	***2015***
Spragge Cr.	Oct-95	May-12	---	No	---	---	Unknown
No Name (H-114)	Jun-11	Sep-14	Yes	Yes	408	0	***2015***[2]
Marcellus Cr.	Jun-13	Sep-12	---	---	---	---	Unknown
Serpent R.							
Main	Jun-12	Sep-12	No	---	---	---	Unknown
Grassy Cr.	Jun-11	Sep-13	No	Yes	---	---	2016
Spanish R.							
Main	Sep-11	Sep-12	No	Yes	---	---	***2015***
Lacloche Cr.	Jun-14	Jun-14	No	---	---	---	***2015***
Birch Cr.	Jun-14	Jun-14	No	---	---	---	***2015***
Kagawong R.	Aug-67	May-12	---	No	---	---	Unknown
Unnamed (H-267)	May-11	Jul-13	No	No	---	---	Unknown
Silver Cr.	May-11	Sep-14	No	Yes	6,462	0	2016
Sand Cr.	Oct-11	Jul-12	Yes	Yes	---	---	***2015***[1]
Mindemoya R.	Jun-11	Jul-13	No	Yes	---	---	***2015***[1]
Timber Bay Cr.	May-11	Jun-14	No	Yes	---	---	***2015***[1]

Table 17. *continued.*

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Hughson Cr.	Aug-13	Sep-14	Yes	Yes	11,068	1,614	***2015***
Manitou R.	Aug-13	Jun-14	No	No	---	---	2017
Blue Jay Cr.	Jun-11	Jun-14	No	Yes	---	---	***2015***[1]
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	May-14	---	No	---	---	Unknown
Key R. (Nesbit Cr.)	Sep-72	May-12	---	No	---	---	Unknown
Still R.	Jun-96	Jul-13	---	No	---	---	Unknown
Magnetawan R.	Jun-11	Sep-14	No	No	---	---	***2015***[1]
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	May-14	No	No	---	---	Unknown
McDonald Cr.	Never	May-14	---	No	---	---	Unknown
Simcoe/Severn	Never	May-14	---	Yes	---	---	Unknown
Coldwater R.	Never	May-14	---	No	---	---	Unknown
Sturgeon R.	Apr-12	May-14	No	No	---	---	Unknown
Hog Cr.	Sep-78	May-14	---	No	---	---	Unknown
Lafontaine Cr.	Jun-68	May-14	---	No	---	---	Unknown
Nottawasaga R.							
Main	May-13	May-14	Yes	Yes	---	---	Unknown
Boyne R.	May-13	Jul-11	---	---	---	---	Unknown
Bear Cr.	Jun-13	May-14	No	No	---	---	Unknown
Pine R.	Jun-13	May-14	No	No	---	---	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-14	Yes	Yes	---	---	***2015***[1]
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-14	---	No	---	---	Unknown
Bayfield R.	Jun-70	May-13	---	No	---	---	Unknown
Sauble R.	Jun-04	May-09	No	No	---	---	Unknown
Saugeen R.	Jun-71	May-10	No	No	---	---	Unknown
Bayfield R.	Jun-70	Jun-10	No	No	---	---	Unknown
United States							
Mission Cr.	Never	Jun-12	---	No	---	---	Unknown
Frenchette Cr.	Never	Jun-12	---	No	---	---	Unknown
Ermatinger Cr.	Never	Jun-12	---	No	---	---	Unknown
Charlotte R.	Oct-11	Jul-14	---	No	---	---	Unknown

Table 17. *continued.*

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Little Munuscong R.	Oct-10	Aug-14	---	Yes	19,697	0	2016
Big Munuscong R.	Jun-99	Jun-12	---	No	---	---	Unknown
Taylor Cr.	Oct-11	Aug-14	Yes	Yes	36,848	2,457	***2015***
Carlton Cr.	Jun-13	Sep-14	Yes	Yes	1,412	471	***2015***
Canoe Lake Outlet	May-70	Apr-13	---	No	---	---	Unknown
Caribou Cr.	Jun-11	Sep-14	No	Yes	---	---	Unknown
Bear Lake Outlet	Jun-11	May-14	No	Yes	---	---	Unknown
Carr Cr.	Jun-13	Aug-13	---	Yes	---	---	Unknown
Joe Straw Cr.	Jun-13	Aug-13	---	---	---	---	Unknown
Huron Point Cr.	Jun-13	Jul-13	No	---	---	---	Unknown
Saddle Cr.	Never	Oct-12	---	No	---	---	Unknown
Albany Cr.							
Barrier downstream	Apr-11	Aug-14	---	Yes	3,584	448	***2015***
Barrier upstream	Jul-07	Jul-13	No	No	---	---	Unknown
Boiling Springs Cr.	Never	Apr-10	---	No	---	---	Unknown
Trout Cr.	Oct-10	Aug-14	---	Yes	2,435	812	***2015***
Beavertail Cr.	May-11	Jun-14	No	Yes	---	---	Unknown
Prentiss Cr.	May-11	Sep-14	Yes	No	---	---	Unknown
McKay Cr.	May-11	May-14	Yes	Yes	---	---	Unknown
Susan Cr.	Never	Apr-10	---	No	---	---	Unknown
Flowers Cr.	Jun-13	Apr-13	---	---	---	---	Unknown
Ceville Cr.	Jun-13	Aug-13	No	---	---	---	Unknown
Hessel Cr.	May-11	Aug-14	No	Yes	3,580	462	***2015***
Law Cr.	Never	Oct-10	---	No	---	---	Unknown
Steeles Cr.	May-11	Sep-14	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-14	Sep-14	Yes	Yes	---	---	***2015***
McCloud Cr.	Oct-72	May-14	---	Yes	352	282	***2015***
Carp R.	Jun-14	Sep-14	Yes	Yes	---	---	*Unknown*
Martineau Cr.	Jun-12	Jul-13	No	---	---	---	Unknown
Hoban Cr.	Jun-12	Apr-13	No	---	---	---	Unknown
Rogers Cr.	Never	May-14	---	No	---	---	Unknown
Sec. 7 Cr.	Never	May-10	---	No	---	---	Unknown
266-20 Cr.	Aug-76	Jul-12	---	No	---	---	Unknown
Beaugrand Cr.	Never	Jul-12	---	No	---	---	Unknown
Little Black R.	May-67	May-14	---	No	---	---	Unknown
Cheboygan R.	Oct-83	Sept-14	---	Yes	---	---	Unknown
Mullett Cr.	Never	Jun-10	---	No	---	---	Unknown
Laperell Cr.	May-00	Jun-13	---	No	---	---	Unknown

Table 17. *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
Meyers Cr.	Sep-99	Jun-13	---	No	---	---	Unknown
Maple R.	Sep-12	May-13	No	No	---	---	2016
Pigeon R.	Aug-12	May-14	Yes	Yes	---	---	2016
Little Pigeon R.	Aug-12	May-14	No	No	---	---	Unknown
Sturgeon R.	Sep-12	May-14	No	Yes	---	---	2016
Little Sturgeon R.	Never	Sep-10	---	No	---	---	Unknown
Elliot Cr.	Jul-13	Sep-13	No	Yes	---	---	2017
Greene Cr.							
Barrier downstream	Jul-12	May-14	No	No	---	---	Unknown
Barrier upstream	Jun-07	May-14	No	No	---	---	Unknown
Grass Cr.	May-78	Apr-11	---	No	---	---	Unknown
Mulligan Cr.	Jul-12	Sep-14	Yes	Yes	2,030	0	2016
Grace Cr.	Jun-13	Sep-13	No	Yes	---	---	2017
Black Mallard Cr.							
Lower	Apr-12	Aug-14	Yes	Yes	---	---	***2015***[1]
Upper	Apr-12	Jun-13	Yes	Yes	---	---	***2015***[1]
Seventeen Cr.	Jul-12	Jun-13	No	No	---	---	Uknown
Ocqueoc R.							
Barrier downstream	Aug-12	Sep-13	Yes	Yes	---	---	2016
Barrier upstream	Oct-14	Aug-14	---	---	---	---	Unknown
Johnny Cr.	Sep-70	Sep-11	---	No	---	---	Unknown
Schmidt Cr.							
Lower	May-13	Sep-13	No	Yes	---	---	2016
Upper	May-08	Jun-13	---	No	---	---	Unknown
Nagels Cr.	Never	Sep-12	---	No	---	---	Unknown
Trout R.							
Barrier Downstream	Jun-13	Sep-13	No	Yes	---	---	2017
Barrier upstream	Oct-07	Jun-13	---	No	---	---	Unknown
Swan R.	Jun-10	Sep-12	---	No	---	---	Unknown
Grand Lake Outlet	Never	Aug-14	---	No	---	---	Unknown
Middle Lake Outlet	Jun-67	Aug-14	---	No	---	---	Unknown
Long Lake Outlet	Jun-13	Sep-13	Yes	Yes	---	---	2017
Squaw Cr.	Jun-13	Sep-13	---	No	---	---	Unknown
Devils R.	Oct-14	Aug-13	----	----	---	---	2018
Black R.	May-11	Aug-14	---	Yes	100,843	13,269	***2015***
Butternut Cr.	May-11	Aug-14	---	Yes	---	---	***2015***
Au Sable R.	Jul-14	Jul-14	Yes	No	---	---	***2015***
Pine R.	May-87	Sep-12	---	No	---	---	Unknown
Tawas Lake Outlet	Jul-09	Jun-14	---	Yes	6,349	5,771	***2015***
Cold Cr.	Jul-13	Jun-14	Yes	No	---	---	2017
Sims Cr.	Jul-09	Jun-14	---	No	---	---	Unknown
Grays Cr.	Sep-05	Jun-14	---	No	---	---	Unknown
Silver Cr.	Jul-13	Sep-13	Yes	No	---	---	***2015***

Table 17. *continued.*

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
East Au Gres R.	Jul-13	Sep-13	No	No	---	---	2017
Au Gres R.	Apr-14	Jun-14	No	No	---	---	2017
Rifle R.	Aug-14	Jun-14	---	---	---	---	2017
Saginaw R.							
Cass R.	May-12	Jul-14	No	Yes	43,921	17,214	***2015***
Juniata Cr.	May-12	Jul-14	No	Yes	---	---	***2015***
Scott Drain	Jun-08	Jul-14	No	No	---	---	Unknown
Goodings Cr.	May-12	Jul-14	Yes	Yes	---	---	***2015***
Perry Creek	Never	Sep-14	---	Yes	---	---	***2015***
West Wells Cr.	May-12	Sep-14	No	Yes	---	---	***2015***
Flint River	Never	Sep-14	---	No	---	---	Unknown
Armstrong Cr.	Never	Sep-14	---	Yes	355	355	***2015***
Tittabawassee R.	Never	Sep-08	---	No	---	---	Unknown
Chippewa R.	May-14	Aug-14	No	Yes	---	---	2017
Coldwater R.	May-14	Apr-14	No	No	---	---	Unknown
Pine R.	May-14	Aug-14	Yes	Yes	79,678	46,129	***2015***
Little Salt Cr.	May-14	Sep-13	---	---	---	---	Unknown
Big Salt Cr.	May-14	Sep-13	---	---	---	---	Unknown
North Br.	May-14	Aug-14	No	No	---	---	Unknown
Carroll Cr.	May-14	Aug-14	No	No	---	---	Unknown
Big Salt R.	May-10	Sep-14	No	Yes	13,581	9,054	***2015***
Bluff Cr.	May-10	Sep-14	No	Yes	---	---	***2015***
Shiawassee R.	May-13	Jul-14	No	Yes	---	---	***2015***
Rock Falls Cr.	Never	Jul-14	---	No	---	---	Unknown
Sucker Cr.	Never	Aug-12	---	No	---	---	Unknown
Cherry Cr.	Never	Aug-12	---	No	---	---	Unknown
Mill Cr.	May-85	Sep-13	---	Yes	---	---	2016

[1]Stream being treated based on next large scale treatment
[2]Stream being treated based on expert judgement

Table 18. Status of larval Sea Lampreys in historically infested lentic areas of Lake Huron during 2014.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Echo River	Echo Lake	Jul-14	Jul-14	Sep-13[1]
	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	Jun-14	Jun-14	Jul-81[1]
Lauzon R.	North Channel	Jun-14	Jun-14	Jun-12[1]
Unnamed (H-114)	North Channel	Sep-14	Sep-14	Jul-10[1]
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)	Aug-09	Jul-13	Jun-10
Albany Cr.	Albany Bay (Offshore)	Jul-14	Jul-14	Never[1]
Trout Cr.	Trout Cr. (Offshore)	Jul-14	Jul-11	Never[1]
Beavertail Cr.	Beavertail Bay	Aug-14	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	Aug-14	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-14
Martineau Cr.	Horseshoe Bay	Sep-14	Sep-14	Never[1]
Cheboygan R.	Straits of Mackinac	Jul-12	Aug-93	Never
	Burt Lake (Sturgeon R.)	Aug-11	Aug-98	Never
Elliot Cr.	Duncan Bay	Jul-12	Jul-12	Never
Mulligan Cr.	Mulligan Cr. (Offshore)	Aug-14	Jun-13	Never[1]
Black Mallard R.	Black Mallard Lake	Jul-12	Jun-10	Never
Hammond Bay Cr.	Hammond Bay	Sep-14	Sep-14	Never
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)	Sep-14	Sep-14	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.

Table 19. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Huron for larval assessment purposes during 2014.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Echo R. (Echo Lake lentic)	1.12	0.20
Bar R. (lotic)	0.14	0.02
Twotree R. (lentic)	1.12	0.20
Mississagi R. (lentic)	1.96	0.35
Mississagi R. (lotic)	1.68	0.30
Lauzon R. (lentic)	1.68	0.30
Unnamed (lentic)	1.68	0.30
Silver Cr. (lentic)	0.56	0.10
French R. System (lotic)	1.12	0.20
Shawanaga R. (lotic)	0.56	0.10
Shawanaga Landing Cr. (lotic)	0.56	0.10
Seguin R. (lotic)	1.12	0.20
Go Home R. (lotic)	0.56	0.10
Musquash R. (lotic)	1.12	0.20
Simcoe/Severn System (lentic)	1.68	0.30
Sturgeon R. (lentic)	0.56	0.10
Nottawasaga R. (lotic)	2.24	0.40
Beaver R. (lentic)	0.56	0.10
Saugeen R. (lotic)	1.12	0.20
Little Current (lentic)	1.68	0.30
Total (Canada)	**22.82**	**4.07**
United States		
Charlotte R. (lotic)	0.87	0.09
Little Munuscong R. (lotic)	0.41	0.07
Albany Cr. (lentic)	2.32	0.41
Trout Cr. (lentic)	2.32	0.41
Beavertail Cr. (lentic)	1.74	0.31
Nunns Cr. (lentic)	1.16	0.21
Martineau Cr. (lentic)	1.74	0.31
Cheboygan R. (lotic)	0.84	0.15
Mulligan Cr. (lentic)	1.12	0.20
Mulligan Cr. (lotic)	0.56	0.10
Ocqueoc R. (Ocqueoc Lake lentic)	1.12	0.20
Hammond Bay Station Outlet (lentic)	0.56	0.10
Au Sable R. (lentic)	3.36	0.60
Au Sable R. (lotic)	3.37	0.60
Total (United States)	**21.49**	**3.76**
Total for Lake	**44.31**	**7.83**

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

Lake Erie

The control agents continue to delineate the distribution and abundance of the larval Sea Lamprey population in the St. Clair River, hypothesized to be a primary source of feeding 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.

Of critical importance to the ongoing larval Sea Lamprey assessments in the St. Clair River, a collaborative agreement between the Commission and Walpole Island First Nation (WIFN) enabled intensive DWEF to be completed in WIFN territorial waters during 2014 to provide quantitative information on larval Sea Lamprey habitat and densities. This year was the first of a two year assessment; favorable conditions and the availability of WIFN assistants resulted in a comprehensive evaluation of production potential for most of the waters adjacent to WIFN.

- Larval assessments were conducted on a total of 40 tributaries (15 Canada, 25 U.S.) and lentic area of 1 U.S. tributary. The status of larval Sea Lampreys in historically infested Lake Erie tributaries and lentic areas is presented in Tables 20 and 21.

- Surveys to estimate the abundance of larval Sea Lampreys were conducted in 10 tributaries (1 Canada, 9 U.S.).

- Surveys to detect new larval populations were conducted in 12 tributaries (4 Canada, 8 U.S.). A new population of large Sea Lamprey larvae was found in Big Sister Creek, New York. The stream ranked for treatment in 2015.

- Surveys to evaluate barrier effectiveness in six tributaries (four Canada, two U.S.) indicated no evidence of escapement.

- Post-treatment assessments were conducted in seven tributaries (five Canada, two U.S.) to determine the effectiveness of lampricide treatments during 2013 and 2014. Raccoon Creek ranked for treatment again in 2015 based on the presence of residual Sea Lampreys.

- An evaluation of larval and juvenile Sea Lamprey production potential was completed on the Grand River in Ontario. The purpose of the work was to evaluate the production potential of Sea Lamprey upstream from critical barriers by quantitatively assessing larval habitat and native lamprey abundance as a surrogate for Sea Lampreys. Results from the study are pending.

- A total of 5.5 ha of the St. Clair River were surveyed with GB, including the upper river and in U.S. waters of 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 55 Sea Lamprey was scattered throughout the river with a few high density areas.

- A total of 733 DWEF sites were assessed in St. Clair River, adjacent to WIFN, and 7 Sea Lamprey larvae were collected among sites. This information was combined with the remainder of the larval assessment data resulting in a river-wide population estimate of 919,509 larval Sea Lampreys.

- Surveys were conducted in non-wadable lentic and lotic areas using 27.78 kg (active ingredient; 7.28 Canada, 21.28 U.S.) of GB. Survey details are provided in Table 22.

Table 20. Status of larval Sea Lampreys in Lake Erie tributaries with a history of Sea Lamprey production, and estimates of abundance from tributaries surveyed during 2014.

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-14	No	Yes	---	---	Unknown
Silver Cr.	Oct-09	May-14	No	No	---	---	Unknown
Big Otter Cr.	Sep-13	Sep-13	No	No	---	---	2016
South Otter Cr.	Aug-10	May-14	No	No	---	---	Unknown
Clear Cr.	May-91	May-14	No	No	---	---	Unknown
Big Cr.	Sep-13	Jul-14	---	No	---	---	2016
Forestville Cr.	Aug-13	May-14	---	---	---	---	Unknown
Normandale Cr.	Jun-87	May-14	No	No	---	---	Unknown
Fishers Cr.	Jun-87	Jun-13	No	No	---	---	Unknown
Young's Cr.	Aug-13	May-14	---	---	---	---	Unknown
United States							
Buffalo R.	Never	Jun-14	---	---	---	---	Unknown
Buffalo Cr.	Jun-13	Jun-14	No	No	---	---	Unknown
Cayuga Cr.	Never	Jun-14	---	No	3,874	3,874	***2015***
Cazenovia Cr.	Sept-13	Jun-14	No	No	---	---	Unknown
Big Sister Cr.			---	Yes	2,483	2,483	***2015***
Delaware Cr.	Jun-13	Jun-14	No	No	---	---	Unknown
Cattaraugus Cr.	Apr-13	Oct-14	Yes	Yes	18,744	3,080	2016
Halfway Br.	Oct-86	Apr-13	---	---	---	---	Unknown
Canadaway Cr.	Oct-86	Jun-14	---	Yes	477	382	***2015***
Chautauqua Cr.	Never	Jul-13	---	No	---	---	Unknown
Crooked Cr.	May-13	Oct-14	No	Yes	1,757	98	Unknown
Raccoon Cr.	May-13	Jun-14	Yes	Yes	285	285	***2015***
Conneaut Cr.	May-13	Oct-14	Yes	Yes	4,579	4,121	***2015***
Wheeler Cr.	Never	Jul-11	---	---	---	---	Unknown
Grand R.	Apr-13	Jun-14	No	No	---	---	2016
Chagrin R.	Never	Jun-14	---	No	---	---	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	Aug-14	---	No	0	0	Unknown
Belle R.	Never	May-14	---	No	---	---	Unknown
Clinton R.	Never	May-14	---	No	---	---	Unknown
Paint Cr.	Never	Sept-14	---	Yes	3,584	3,584	***2015***
St. Clair R.	Never	May-14	---	Yes	---	---	Unknown
Thames R.	Never	May-13	---	Yes	1,599	738	***2015***

[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 21. Status of larval Sea Lampreys in historically infested lentic areas of Lake Erie during 2014.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
United States				
Cattaraugus Cr.	Sunset Bay	Aug-14	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.

Table 22. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Erie for larval assessment purposes during 2014.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
St. Clair R. (lotic)	7.28	1.3
Total (Canada)	**7.28**	**1.3**
United States		
Cattaraugus Cr. (lotic)	0.56	0.10
St. Clair R. (lotic)	20.72	3.7
Total (United States)	**21.28**	**3.8**
Total for Lake	**28.56**	**5.1**

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

Lake Ontario

- Larval assessments were conducted on a total of 49 tributaries (27 Canada, 22 U.S.). The status of larval Sea Lampreys in historically infested Lake Ontario tributaries and lentic areas is presented in Tables 23 and 24.

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

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in seven Canadian tributaries. No new populations were detected.

- Surveys to evaluate barrier effectiveness in 10 tributaries (8 Canada, 2 U.S.) indicated no evidence of escapement.

- Post-treatment assessments were conducted in 10 tributaries (4 Canada, 6 U.S.) to determine the effectiveness of lampricide treatments conducted during 2013 and 2014. Residual larvae were observed in low numbers, but no tributaries required re-treatment.

- An evaluation of production potential was conducted on the Humber River in Ontario, Canada. The purpose of this work was to evaluate the production potential for Sea Lamprey upstream from critical barriers by quantitatively assessing habitat and native lamprey populations as a surrogate for Sea Lampreys. Results from the evaluation are pending.
- A total of 1.7 ha of the Niagara River was surveyed with GB. Four larval Sea Lampreys were collected.

- Surveys were conducted in non-wadable lentic and lotic areas using 26.88 kg (active ingredient; 19.04 Canada, 7.84 U.S.) of GB. Survey details are provided in Table 25.

Table 23. Status of larval Sea Lampreys in Lake Ontario tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2014.

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Canada							
Niagara R.	Never	Jun-14	---	Yes	---	---	Unknown
Ancaster Cr.	May-03	Aug-13	No	Yes	---	---	Unknown
Grindstone Cr.	Never	Jun-14	No	Yes	---	---	Unknown
Bronte Cr.	Jun-13	Aug-13	Yes	Yes	---	---	2016
Sixteen Mile Cr.	Jun-82	Jul-14	No	No	---	---	Unknown
Credit R.	Jun-14	Jun-14	No	No	---	---	2017
Humber R.	Never	Jun-14	---	No	---	---	Unknown
Rouge R.	Jun-11	Jul-14	No	Yes	2,245	1,313	***2015***
Petticoat Cr.	Sep-04	Jul-14	No	No	---	---	Unknown
Duffins Cr.	May-12	Jul-14	No	Yes	---	---	***2015***[1]
Carruthers Cr.	Sep-76	Jul-13	No	No	---	---	Unknown
Lynde Cr.	May-12	Jul-14	No	Yes	---	---	***2015***[1]
Oshawa Cr.	May-12	Jul-14	No	Yes	---	---	***2015***[1]
Farewell Cr.	Jun-12	Jul-14	No	Yes	---	---	***2015***[1]
Bowmanville Cr.	May-14	Jul-14	No	No	---	---	2017
Wilmot Cr.	May-12	Jul-14	No	Yes	---	---	***2015***[1]
Graham Cr.	May-96	Jul-13	No	No	---	---	Unknown
Wesleyville Cr.	Oct-02	Jul-14	No	No	---	---	Unknown
Port Britain Cr.	Apr-12	Jul-14	No	Yes	---	---	2016
Gage Cr.	May-71	Jul-13	No	No	---	---	Unknown
Cobourg Br.	Oct-96	Aug-13	No	No	---	---	Unknown
Covert Cr.	Jun-13	Sep-13	Yes	Yes	---	---	2016
Grafton Cr.	May-14	Jul-14	No	No	---	---	Unknown
Shelter Valley Cr.	Sep-03	Jul-13	No	No	---	---	Unknown
Colborne Cr.	May-14	Jul-14	No	No	---	---	Unknown
Salem Cr.	Apr-12	Jul-14	No	Yes	---	---	***2015***[1]
Proctor Cr.	Apr-12	Jul-14	No	Yes	---	---	***2015***
Smithfield Cr.	Sep-86	Jun-12	No	No	---	---	Unknown
Trent R. (Canal System)	Sep-11	May-14	No	Yes	---	---	Unknown
Mayhew Cr.	Apr-12	May-14	No	Yes	---	---	***2015***[1]
Moira R.	Jun-11	Jun-14	No	Yes	---	---	Unknown
Salmon R.	Jun-00	Jun-14	No	Yes	---	---	Unknown
Napanee R.	Never	Jul-13	---	No	---	---	Unknown
United States							
Black R.	Aug-12	Aug-14	No	Yes	---	---	***2015***[1]
Stony Cr.	Sep-82	Aug-14	No	No	---	---	Unknown
Sandy Cr.	Never	Aug-14	---	No	---	---	Unknown
South Sandy Cr.	Apr-13	Jul-13	No	Yes	---	---	2016
Skinner Cr.	Apr-05	Jul-13	No	No	---	---	Unknown
Lindsey Cr.	Jun-14	Aug-14	Yes	No	---	---	2017

Table 23. *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
Blind Cr.	May-76	Aug-14	No	No	---	---	Unknown
Little Sandy Cr.	May-13	Aug-13	No	Yes	---	---	2016
Deer Cr.	Apr-04	Aug-14	No	No	---	---	Unknown
Salmon R.	May-14	Aug-14	Yes	Yes	---	---	2017
Orwell Brook	May-14	Aug-14	Yes	No	---	---	2017
Trout Brook	May-14	Aug-14	Yes	Yes	---	---	2017
Grindstone Cr.	Apr-13	Aug-13	Yes	Yes	---	---	2016
Snake Cr.	Aug-14	Aug-12	No	Yes	---	---	***2015***[1]
Sage Cr.	May-78	Jul-13	No	No	---	---	Unknown
Little Salmon R.	Apr-12	Aug-14	No	Yes	---	---	Unknown
Butterfly Cr.	May-72	Apr-12	No	No	---	---	Unknown
Catfish Cr.	Apr-12	Aug-14	No	Yes	---	---	***2015***[1]
Oswego R.							
Black Cr.	May-81	Aug-14	No	No	---	---	Unknown
Big Bay Cr.	Sep-93	Apr-12	No	No	---	---	Unknown
Scriba Cr.	Jun-10	Apr-14	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	Aug-14	No	Yes	28,728	3,010	***2015***
Nine Mile Cr.	May-11	Aug-14	No	Yes	---	---	Unknown
Sterling Cr.	May-12	Aug-14	No	Yes	---	---	***2015***[1]
Blind Sodus Cr.	May-78	Jul-13	No	No	---	---	Unknown
Red Cr.	Apr-10	Aug-14	No	Yes	7,112	3,556	***2015***
Wolcott Cr.	May-79	Aug-14	No	No	---	---	Unknown
Sodus Cr.	May-10	Aug-14	No	Yes	427	285	***2015***
Forest Lawn Cr.	Never	Aug-13	---	Yes	---	---	2016
Irondequoit Cr.	Never	Aug-14	---	No	---	---	Unknown
Larkin Cr.	Never	Aug-12	---	No	---	---	Unknown
Northrup Cr.	Never	Aug-12	---	No	---	---	Unknown
Salmon Cr.	Apr-05	Aug-13	No	Yes	---	---	Unknown
Sandy Cr.	Apr-14	Aug-14	No	Yes	---	---	Unknown
Oak Orchard Cr. Marsh Cr.	Apr-14	Aug-14	No	Yes	---	---	Unknown
Johnson Cr.	Apr-10	Aug-13	No	No	---	---	Unknown
Third Cr.	May-72	Aug-14	No	No	---	---	Unknown
First Cr.	May-95	Aug-14	No	No	---	---	Unknown

[1]Stream is being treated based on expert judgement.

Table 24. Status of larval Sea Lampreys in historically infested lentic areas of Lake Ontario during 2014.

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	Aug-14	Aug-14	Never[1]

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

Table 25. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Ontario for larval assessment purposes during 2014.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Niagara R. (lotic)	9.52	1.7
Twelve Mile Cr. (lotic)	1.12	0.2
Twenty Mile Cr. (lotic)	1.12	0.2
Rouge R. (lotic)	1.68	0.3
Trent R. (lotic)	1.68	0.3
Moira R. (lotic)	2.24	0.4
Salmon R. (lotic)	1.68	0.3
Total (Canada)	**19.04**	**3.4**
United States		
Black R. (lotic)	2.24	0.4
Black R. (lentic)	1.68	0.3
Salmon R. (lotic)	2.24	0.4
Little Salmon R. (lotic)	1.68	0.3
Total (United States)	**7.84**	**1.4**
Total for Lake	**26.88**	**4.8**

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

Juvenile Assessment

The juvenile life stage is assessed through the interpretation of marking rates by feeding juvenile Sea Lampreys on Lake Trout. 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 Sea 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 4-6 and Figures 9-10 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 Sea Lamprey impacts on the fish communities in the lakes and how they affect each other will be developed.

Lake Superior

- Lake Trout marking data for Lake Superior are provided by MIDNR, Minnesota Department of Natural Resources, and Wisconsin Department of Natural Resources (WDNR), GLIFWC, the Red Cliff Band of Lake Superior Chippewa, the Chippewa-Ottawa Resource Authority (CORA), the Keweenaw Bay Indian Community, the Grand Portage Band of Lake Superior Chippewa Indians, OMNRF, and the Service's Ashland Office and analyzed by the Service's GBFWCO.

- The MIDNR provided data on the frequency of juvenile Sea Lampreys attached to fishes caught by sport charter fishes during 2014.

    - A total of 12 juvenile Sea Lampreys were collected from 8 management districts: 12 were attached to Lake Trout and none were attached to Chinook Salmon. Attachment rates during 2014 were 0.2 per 100 Lake Trout (n=4,866) and 0.00 per 100 Chinook Salmon (n=35), which were lower than the attachment rates on Lake Trout and Chinook Salmon during 2013 (0.9 and 1.57, respectively).

- Based on standardized spring assessment data, the marking rate during 2014 was 2.5 A1-A3 marks per 100 Lake Trout >533mm (Figure 4). The marking rate has been declining and is below the target of 5 per 100 Lake Trout for the first time since 1995.

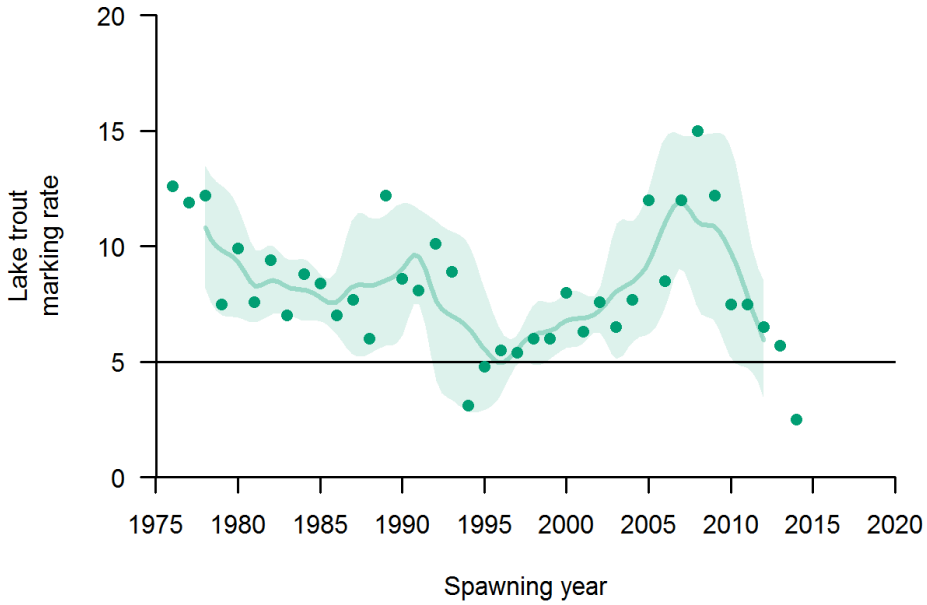

Figure 4. Average number of A1-A3 marks per 100 Lake Trout >533 mm caught during April-June assessments in Lake Superior plotted in the year that the juvenile cohort returned as adults (marking recorded in the spring is inflicted by the cohort of Sea Lampreys that spawned that year). The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout. The five-year moving average (green line) with 95% confidence intervals (shaded area) is provided for visual reference.

Lake Michigan

- Lake Trout marking data for Lake Michigan are provided by MIDNR, WDNR, Illinois Department of Natural Resources, Indiana Department of Natural Resources, CORA, Grand Traverse Bay Band of Ottawa Indians, Little Traverse Bay Bands of Odawa Indians, Little River Band of Ottawa Indians, Service, and U.S. Geological Survey (USGS), and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2014 was 10.0 A1-A3 marks per 100 Lake Trout >533mm (Figure 5). The marking rate has been greater than the target for many of the previous 20 years, though it has been steady since 2006.

- The MDNR and WDNR provided data on the frequency of juvenile Sea Lampreys attached to fish caught by sport charter fishers during 2014.

    - A total of 668 juvenile Sea Lampreys were collected from 14 management districts: 163 were attached to Lake Trout and 505 were attached to Chinook Salmon. Attachment rates during 2014 were 0.43 per 100 Lake Trout (n=38,286)

and 0.60 per 100 Chinook Salmon (n=83,922), which was lower for the attachment rate on Lake Trout during 2013 (1.17 per 100 lake trout) but higher for the attachment rate for Chinook Salmon during 2013 (0.36 per 100 Chinook Salmon).

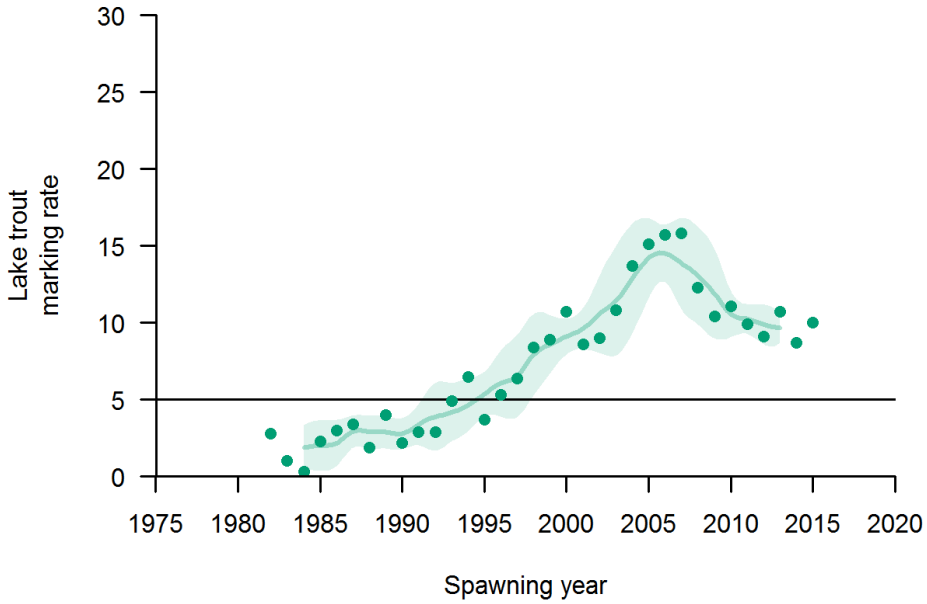

Figure 5. Average number of A1-A3 marks per 100 Lake Trout >533 mm from standardized fall assessments in Lake Michigan, plotted in the year that the juvenile cohort returned as adults (marking recorded in the fall is inflicted by the cohort of Sea Lampreys that spawn the next spring). The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout. The five-year moving average (green line) with 95% confidence intervals (shaded area), is provided for visual reference.

Lake Huron

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

- Based on standardized spring assessment data, the marking rate during 2014 was 11.6 A1-A3 marks per 100 Lake Trout >533 mm. The marking rate has been greater than the target of 5 per 100 Lake Trout since 1983 (Figure 6).

- Canadian commercial fisheries in northern Lake Huron continued to provide feeding juvenile Sea Lampreys in 2014, 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 the OMNRF, can be used as an index of juvenile abundance in northern Lake Huron. Although the data for 2014 is not yet available, the CPUE value for 2013 was the lowest in nearly 30 years (Figure 7).

- 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 2014, fyke nets were operated for a total of 495 net days, resulting in the capture of 19 out-migrating juveniles, and a CPUE of 0.04 (Figure 8).

- The MDNR provided data on the frequency of juvenile Sea Lampreys attached to fishes caught by sport charter fishers during 2014.

    - A total of 99 juvenile Sea Lampreys were collected from 6 management districts: 80 were attached to Lake Trout and 19 were attached to Chinook Salmon. Attachment rates during 2014 were 1.43 per 100 Lake Trout (n=5,609) and 2.82 per 100 Chinook Salmon (n=673), which were higher than the attachment rates on Lake Trout and Chinook Salmon during 2013 (1.04 and 0.71, respectively).

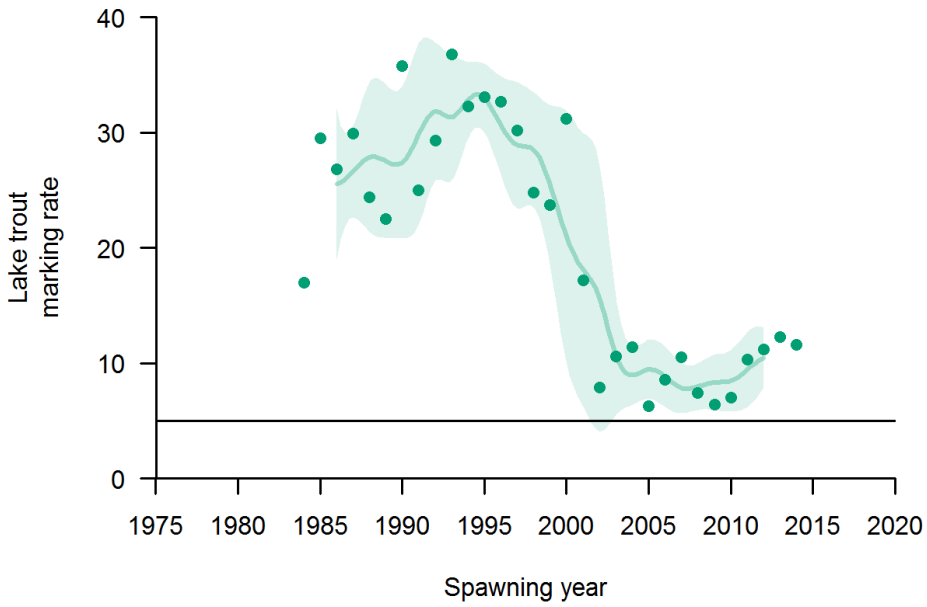

Figure 6. Average number of A1-A3 marks per 100 Lake Trout >533 mm caught during April-May assessments in Lake Huron, by Sea Lamprey spawning year (marking recorded in the spring is inflicted by the cohort of Sea Lampreys that spawned that year). Horizontal line represents the fish-community objective target of 5 A1-A3 marks per 100 fish. The five-year moving average (green line) with 95% confidence intervals (shaded area), is provided for visual reference.

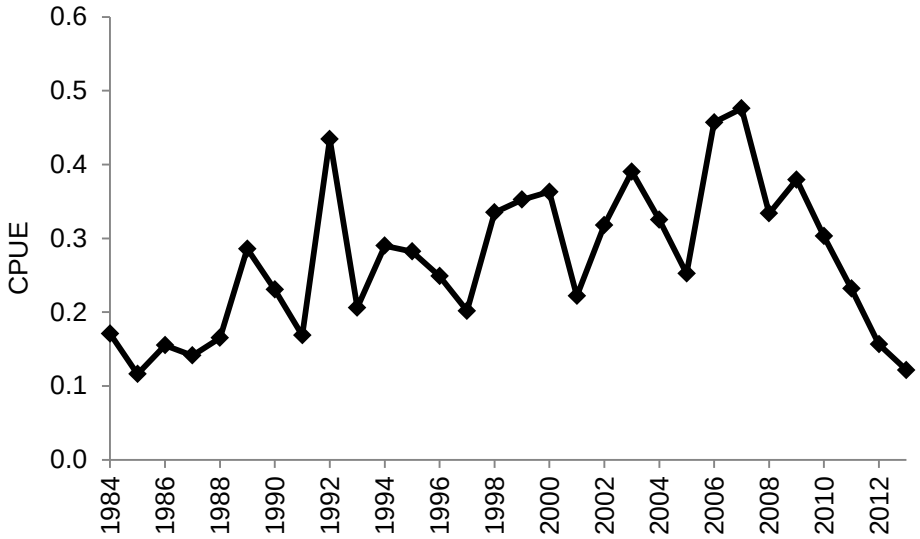

Figure 7. Northern Lake Huron commercial fisheries index showing CPUE (number of feeding juvenile Sea Lampreys per km of gillnet per night) for 1984-2013.

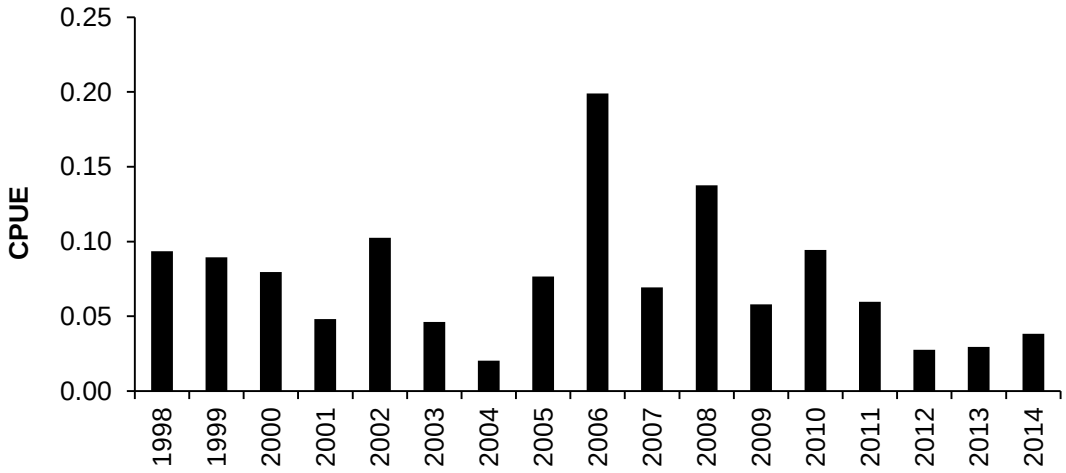

Figure 8. Catch per unit effort (number of out-migrating juvenile Sea Lampreys per net day) from fall fyke netting in the St. Marys River during 1998-2014.

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, the USGS, and OMNRF, and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2014 was 16.6 A1-A3 marks per 100 Lake Trout >533 mm, up from 13.6 in 2013. The marking rate has been greater than the target for the last 10 years and has been increasing the last 3 years after a 2 year decline from a high of 20 in 2009 (Figure 9).

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

- A mark-recapture study was initiated during 2012 to: 1) determine whether out-migrating juveniles released in the St. Clair River could 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 during the fall of 2012 in the St. Clair River (n=417), and 10 other Lake Erie tributaries (n=465). All Sea Lampreys caught in adult assessment traps in Lake Erie tributaries were scanned for coded wire tags during 2014. Tags were collected from 10 adult Sea Lampreys (3 released in the St. Clair River, 7 released in Lake Erie tributaries). A Commission research completion report, *Estimating Lake Erie Juvenile Abundance and Assessing Survival of Migrating Juveniles in the Huron-Erie Corridor* (Barber et al., in press) will be submitted in 2015.

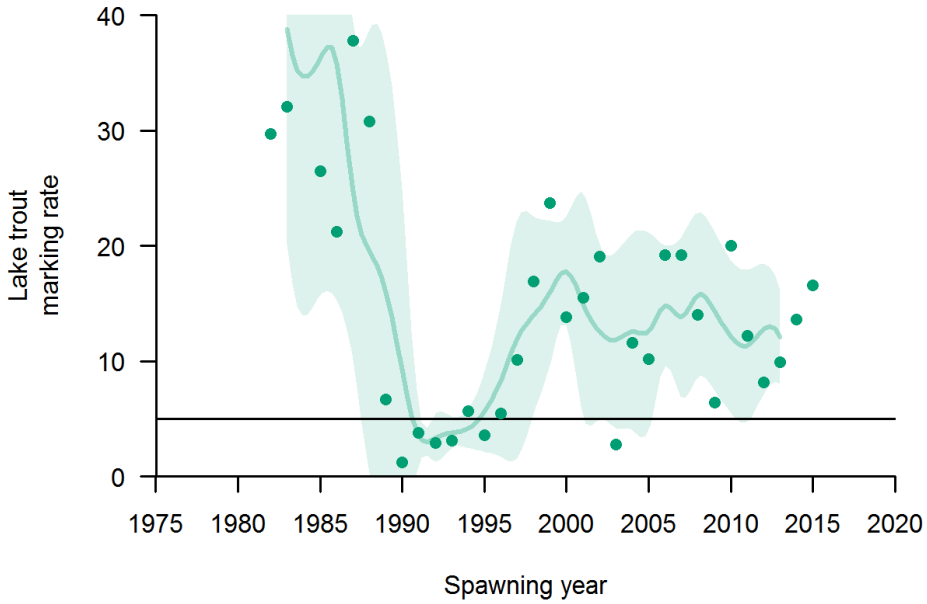

Figure 9. Average number of A1-A3 marks per 100 Lake Trout >533 mm from standardized fall assessments in Lake Erie, plotted in the year that the juvenile cohort returned as adults (marking recorded in the fall is inflicted by the cohort of Sea Lampreys that spawn the next spring). The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout. The five-year moving average (green line) with 95% confidence intervals (shaded area), is provided for visual reference.

Lake Ontario

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

- Based on standardized fall assessment data, the marking rate during 2014 was 1.6 A1 marks per 100 Lake Trout >431 mm. The current marking rate is below the target and has been below or slightly above the target since 2008 (Figure 10).

- The NYSDEC provided data on the frequency of juvenile Sea Lampreys attached to fish caught by sport charter fishers during April 15 – September 30, 2014.

    - An estimated 2,998 juvenile Sea Lampreys were observed by anglers. The percent composition of salmonine host species to which lampreys were attached was Coho Salmon (2.56%), Chinook Salmon (58.12%), Rainbow Trout (18.8%), Brown Trout (17.95%), and Lake Trout (2.56%). Attachment rates were 1.34 per 100 trout and salmon in the west region, 0.87 in the west central region, 1.61 in the east central region, and 2.15 in the east region. In comparison to 2013, attachment rates were lower in the west, west central and east central regions (1.43, 1.50, and 2.53 respectively). In the east region, the 2014 attachment rate was higher than it was during both 2012 and 2013 (1.42 and 1.26 respectively).

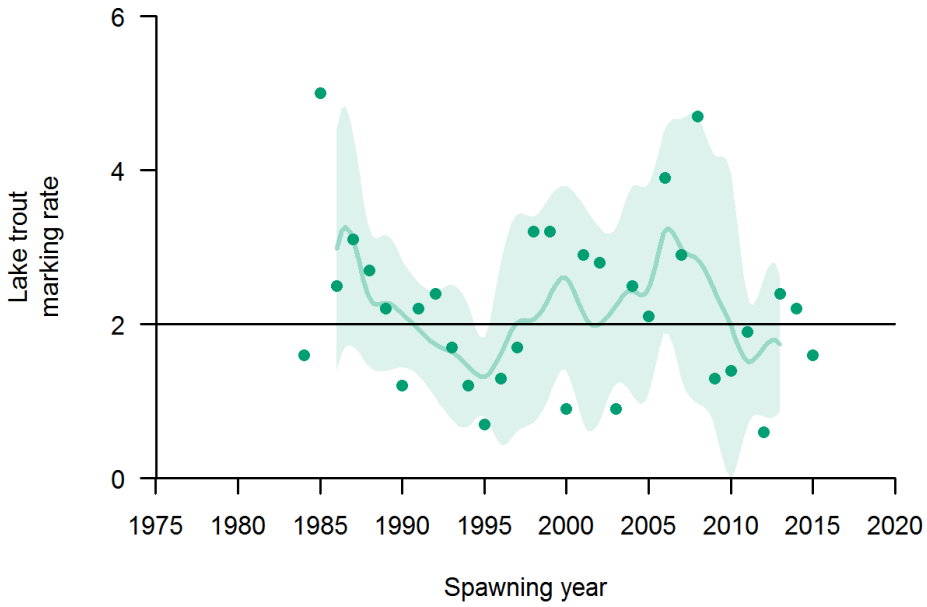

Figure 10. Number of A1 marks per 100 Lake Trout >431 mm from standardized fall assessments in Lake Ontario, by Sea Lamprey spawning year (marking recorded in the fall is inflicted by the cohort of Sea Lampreys that spawn the next spring). Horizontal line represents the fish-community objective target of 2 A1 marks per 100 fish. The five-year moving average (green line) with 95% confidence intervals (shaded area), is provided for visual reference.

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. 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 trap efficiency estimates of adults in streams with traps, and regression model-predicted estimates in streams without traps.

Lake Superior

- A total of 3,346 Sea Lampreys were captured at 23 sites in 22 tributaries (Table 26, Figure 21).

- The estimated population of adult Sea Lampreys was 79,583 (95% CI; 59,591 – 134,836), an increase from 2012 and 2013 abundance estimates. Target range is 39,260 ± 21,262 (Figures 11-12).

- During the late August lampricide treatment in the Silver River (Baraga County), several adult Sea Lampreys were observed in the river.

- 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 WDNR, and in the Miners River with the National Park Service, Pictured Rocks National Lakeshore.

- An eel-ladder style trap (ELST) and smooth wetted ramp were tested at the Brule River trapping site. This was the first year of a two-year study to determine if passage success differs between ELST ramps and smooth ramps and Sea Lampreys and finfish. Early observations indicated that ELST ramps were 100% selective for Sea Lampreys while smooth ramps were mostly selective for finfish; however, some Sea Lampreys were able to ascend the smooth ramps.

Table 26. Information collected from adult Sea Lamprey captured in assessment traps or nets in tributaries of Lake Superior during 2014 (letter in parentheses corresponds to streams in Figure 21).

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.	216	657	33	---	---	---	---	---	---
McIntyre R.	0	---	---	0	---	---	---	---	---
Pancake R. (B)									
Gimlet Cr.	18	48	38	18	72	---	---	---	---
Carp R. (C)	29	90	32	29	66	---	---	---	---
Stokely Cr. (D)	1	---	---	1	100	---	---	---	---
Big Carp R. (E)	3	---	---	3	67	---	---	---	---
Total or Mean (Canada)	**267**	**---**	**---**	**51**	**69**	**---**	**---**	**---**	**---**
United States									
Tahquamenon R. (F)	244	2,555	10	6	67	462	415	218	174
Betsy R. (G)	122	633	19	10	80	445	443	199	190
Miners R. (H)	164	438	37	35	77	418	407	179	172
Furnace Bay Cr. (I)	31	---	---	---	---	---	---	---	---
Rock R. (J)	342	867	39	61	52	438	435	187	192
Laughing Whitefish R. (K)	11	---	---	---	---	---	---	---	---
Chocolay R.(L)	144	1,107	13	11	55	434	421	167	177
Big Garlic R. (M)	103	988	10	2	50	480	460	217	202
Silver R. (N)	109	227	48	13	62	436	428	196	198
Misery R. (O)	107	175	61	6	83	416	435	176	198
Firesteel R. (P)	24	---	---	---	---	---	---	---	---
Bad R. (Q)	642	10,886	6	18	44	421	420	187	186
Red Cliff Cr. (R)	0	---	---	---	---	---	---	---	---
Brule R. (S)	973	8,098	12	37	68	430	434	202	197
Poplar R. (T)	0	---	---	---	---	---	---	---	---
Middle R. (U)	52	320	16	6	67	442	440	217	182
Amnicon R. (V)	11	---	---	---	---	---	---	---	---
Total or Mean (U.S.)	**3,079**	**---**	**---**	**205**	**62**	**431**	**429**	**190**	**189**
Total or Mean (for lake)	**3,346**	**---**	**---**	**256**	**64**	**431**	**429**	**190**	**189**

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

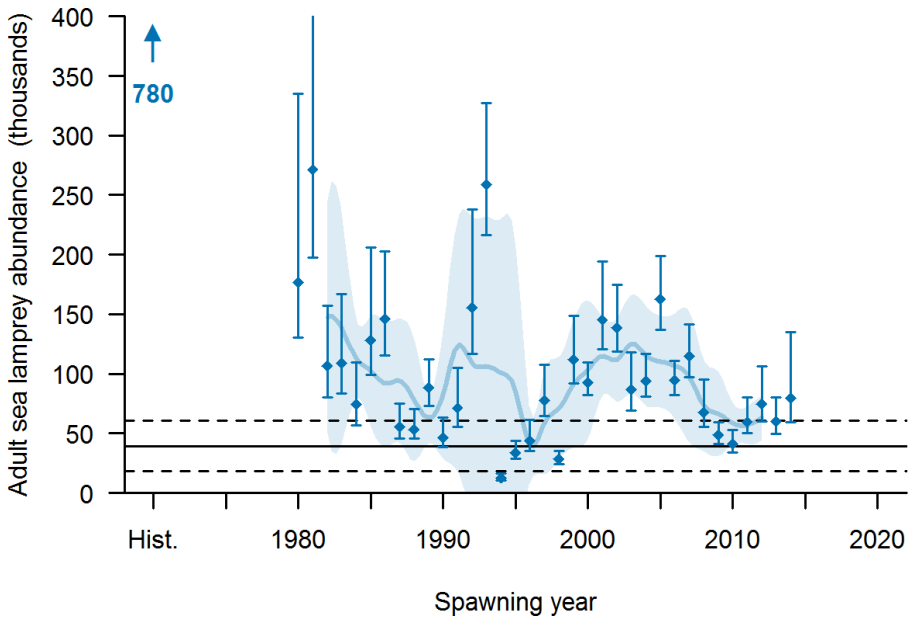

Figure 11. Abundance estimates with 95% CIs (vertical bars) of adult Sea Lampreys in Lake Superior, including historic pre-control abundance and the five-year moving average (line) with 95% CIs (shaded area). Target abundance and 95% CI range were estimated from abundances during a period with acceptable marking rates (horizontal solid and dashed lines).

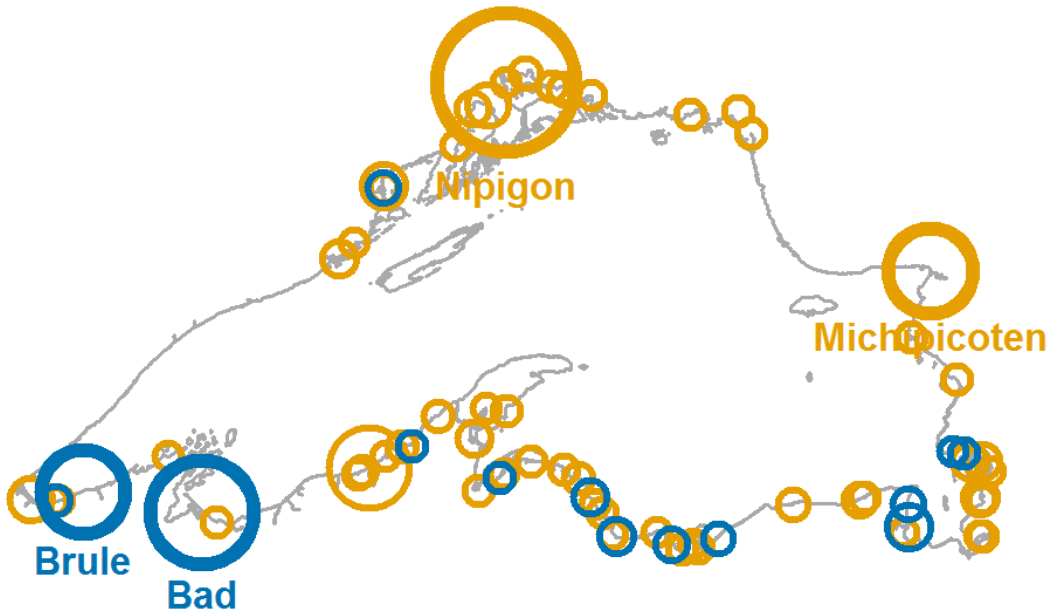

Figure 12. Distribution of adult Sea Lampreys in streams during the spring spawning migration, 2014. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). Tributaries composing over half of the lake-wide adult population estimate are identified (Nipigon 16,000; Bad 11,000; Michipicoten 8,200; Brule 8,100).

Lake Michigan

- A total of 9,624 Sea Lampreys were trapped at 17 sites in 16 tributaries (Table 27, Figure 21).
- The estimated population of adult Sea Lampreys was 59,687 (95% CI; 54,709-65,860) and was within the target range of 59,192 ± 13,414 (Figures 13-14).
- 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.
- Service personnel enlarged the downstream opening of the Sea Lamprey trap at Tippy Dam on the Big Manistee River to increase the attraction flow.
- The USACE continued planning for trap improvement projects at the Little Manistee and Muskegon rivers using GLFER funding.

Table 27. Information collected from adult Sea Lampreys Sea Lamprey captured in assessment traps or nets in tributaries of Lake Michigan during 2014 (letter in parentheses corresponds to stream location in Figure 21).

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
Carp Lake Outlet (A)	1,596	2,125	75	465	55	480	479	229	233
Jordan R. (B)	---	---	---	---	---	---	---	---	---
Deer Cr.	32	111	29	4	25	428	389	186	325
Elk Lake Outlet (C)	110	1,839	6	9	44	516	391	339	195
Boardman R. (D)	412	734	56	113	55	476	482	242	252
Betsie R. (E)	644	1,836	35	121	64	485	481	255	268
Big Manistee R. (F)	469	3,902	12	31	45	478	477	264	278
Little Manistee R.	8	---	---	1	0	---	450	---	266
Muskegon R. (G)	222	1,551	14	7	14	450	479	234	262
St. Joseph R. (H)	840	1,949	43	173	47	481	487	256	265
Trail Cr. (I)	73	---	---	5	100	492	---	264	---
East Twin R. (J)	221	584	38	36	56	495	491	264	261
Oconto R. (K)	4	---	---	---	---	---	---	---	---
Peshtigo R. (L)	1,426	2,952	48	173	43	479	481	235	245
Menominee R. (M)	84	678	12	2	100	488	---	212	---
Ogontz R. (N)	1	---	---	---	---	---	---	---	---
Manistique R. (O)	3,433	11,655	29	82	60	499	497	268	283
Hog Island Cr. (P)	49	115	43	19	58	509	501	297	268
Total or Mean	**9,624**	**---**	**---**	**1,241**	**53**	**483**	**481**	**244**	**250**

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

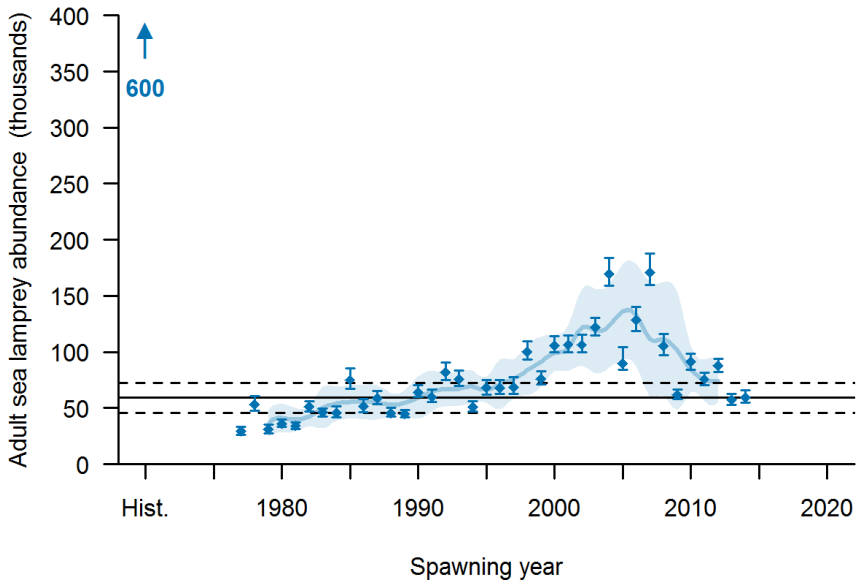

Figure 13. Abundance estimates with 95% CIs (vertical bars) of adult Sea Lampreys in Lake Michigan, including historic pre-control abundance and the five-year moving average (line) with 95% CIs (shaded area). Target abundance and 95% CI range were estimated from abundances during a period with acceptable marking rates (horizontal solid and dashed lines).

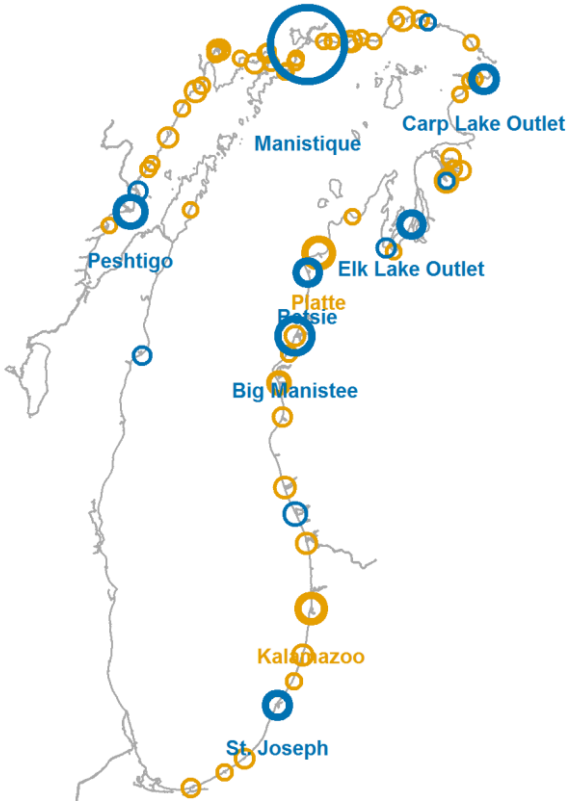

Figure 14. Distribution of adult Sea Lampreys in streams during the spring spawning migration, 2014. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). Tributaries composing over half of the lake-wide adult population estimate are identified (Manistique 12,000; Big Manistee 3,900; Peshtigo 3,000; Platte 2,700; Kalamazoo 2,500; Carp Lake Outlet 2,100; St. Joseph 1,900; Elk Lake Outlet 1,800; Betsie 1,800).

Lake Huron

- A total of 28,849 Sea Lampreys were trapped at 16 sites in 15 tributaries (Table 28, Figure 21).

- During 2014, adult Sea Lamprey abundance in Lake Huron was estimated to be 104,361 (95% CI; 94,820 – 125,439). The 2014 abundance estimate represents a substantial reduction from 2012 and 2013 estimates. Target range is 75,891 ± 20,203 (Figures 15-16).

- A total of 2,404 adult Sea Lampreys were captured in traps operated in the St. Marys River at the Clergue Generating Station in Canada, and the USACE, Cloverland Electric plants and compensating gates in the U.S. The estimated population in the river was 13,973 Sea Lampreys and trapping efficiency was 17%.

- The USACE continued planning for trap improvement projects at the St. Marys, Au Sable, and East Au Gres rivers using GLFER program funding.

- An ELST was tested at the Ocqueoc and Cheboygan River trapping sites. This was the first year of a two year study to determine if ramp flow, angle, and the presence of pheromone influence entry and completion rate of ELSTs. Results of this research are currently being analyzed, but early observations indicate that all of these factors influence completion rates to some degree. This work will be repeated during 2015. A Commission research progress report, *Refinement of a new trapping tool for migrating adult Sea Lamprey* (Reinhardt et al., in press), will be submitted in early 2015.

- A portable trap with vertical electrode pulsed-DC lead was tested in Bridgeland Creek, a tributary of the Thessalon River. The portable trap with an electric lead captured 2,819 adult Sea Lampreys or about 48% of the estimated Sea Lampreys in Bridgeland Creek during 2014. A barrier-integrated trap was fished upstream of the electric lead trap and captured an additional 2,442 Sea Lampreys. Given the catch of Sea Lampreys in both traps, the combined Sea Lamprey exploitation rate in Bridgeland Creek equaled 93%, which was a record high for the site and the Great Lakes basin. Impacts to non-target species were deemed negligible. During 2015, experiments will be repeated in Bridgeland Creek and another trap with pulsed DC lead will be experimentally deployed in the Chocolay River, Michigan, a tributary of Lake Superior.

Table 28. Information collected from adult Sea Lamprey captured in assessment traps or nets in tributaries of Lake Huron during 2014 (letter in parentheses corresponds to stream in Figure 21).

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									
St. Marys R. (A)	2,404	13,973	17	1,403	69	---	---	---	---
Echo R. (B)	1,674	3,398	49	170	58	---	---	---	---
Thessalon R. (C)	142	678	21	116	72	---	---	---	---
Bridgeland Cr.	4,752	5,112	93	4,049	60	---	---	---	---
Mississagi R. (D)	59	---	---	59	80	---	---	---	---
Total or Mean (Canada)	**9,031**	---	---	**5,797**	**63**	---	---	---	---
United States									
Saginaw R. (E)	---	---	---	---	---	---	---	---	---
Tittabawassee R.	171	---	---	---	---	---	---	---	---
East Au Gres R. (F)	394	1,155	34	2	100	499	---	280	---
Au Sable R. (G)	608	---	---	1	100	510	---	325	---
Devils R. (H)	112	531	21	24	46	466	478	256	266
Trout R. (I)	0	---	---	---	---	---	---	---	---
Ocqueoc R. (J)	3,056	4,005	76	388	49	469	471	216	219
Greene Cr. (K)	0	---	---	---	---	---	---	---	---
Cheboygan R. (L)	15,005	18,110	83	1,176	51	477	479	215	229
Carp R. (M)	85	414	21	2	100	491	---	265	---
Trout Cr. (N)	130	361	36	28	68	469	451	223	257
Albany Cr. (O)	257	1,494	17	29	52	464	455	221	220
St. Marys R. (A)	See Canada	See Canada	See Canada	8	75	478	514	271	285
Total or Mean (U.S.)	**19,818**	---	---	**1,658**	**51**	**475**	**477**	**217**	**228**
Total or Mean (for Lake)	**28,849**	---	---	**7,455**	**60**	**475**	**477**	**217**	**228**

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

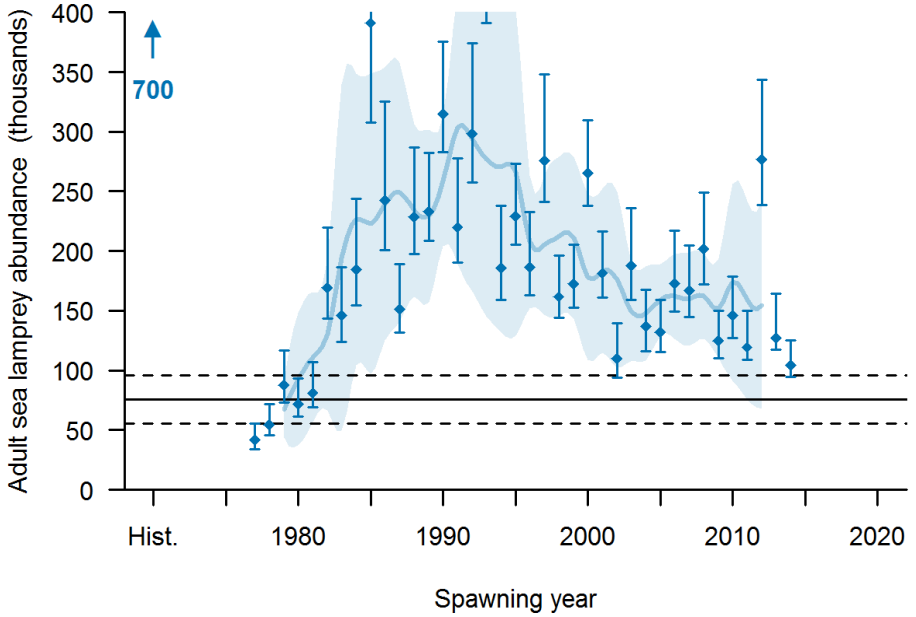

Figure 15. Abundance estimates with 95% CIs (vertical bars) of adult Sea Lampreys in Lake Huron, including historic pre-control abundance and the five-year moving average (line) with 95% CIs (shaded area). Target abundance and 95% CI ranges (horizontal solid and dashed lines) were estimated from abundances during a period with acceptable marking rates.

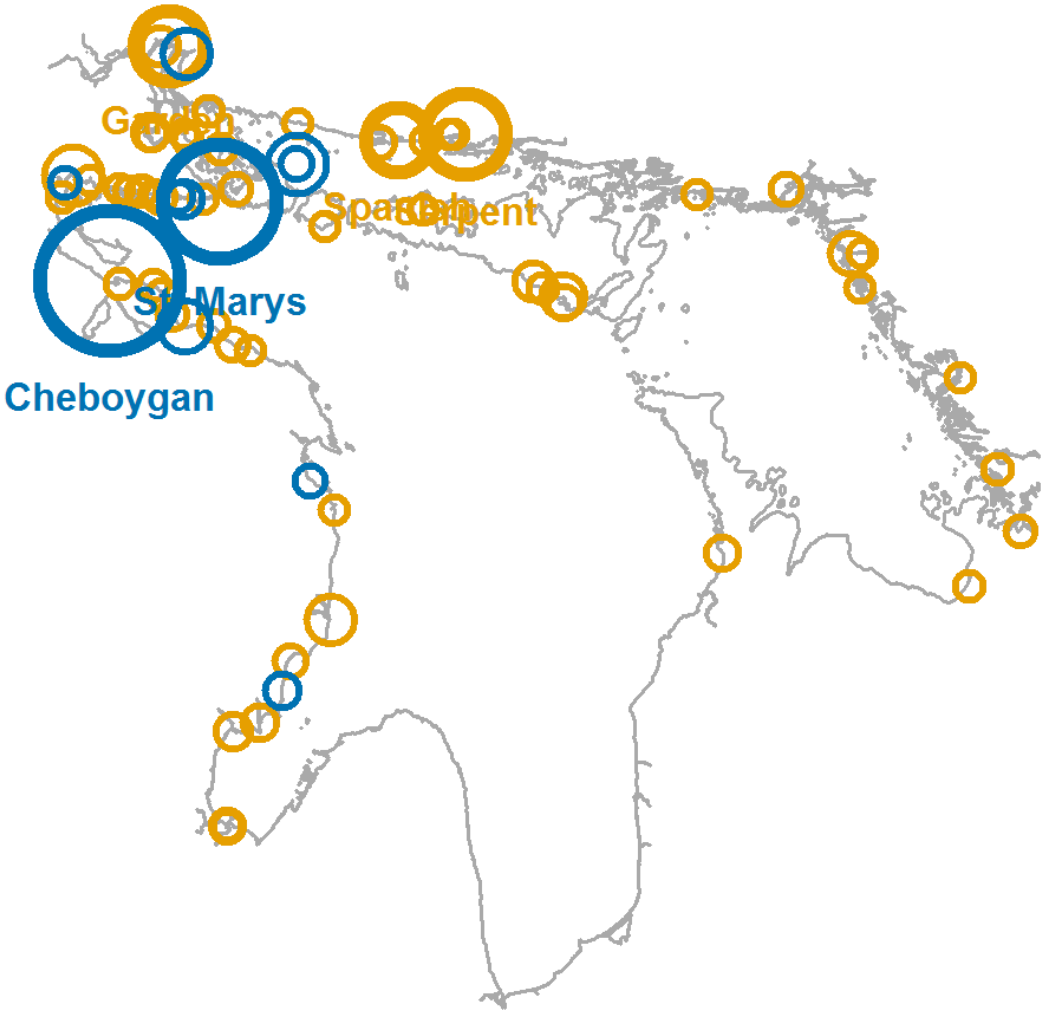

Figure 16. Distribution of adult Sea Lampreys in streams during the spring spawning migration, 2014. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). Tributaries composing over half of the lake-wide adult population estimate are identified (Cheboygan 18,000; St. Marys 14,000; Serpent 8,600; Garden 7,000; Spanish 6,000).

Lake Erie

- A total of 5,816 Sea Lampreys were trapped in 6 sites on 5 tributaries during 2014 (Table 29, Figure 21).

- The estimated population of adult Sea Lampreys was 14,577 (95% CI; 13,184-16,342) which was greater than the target range of 3,778 ± 1,206 (Figures 17-18).

Table 29. Information collected from Sea Lamprey adults captured in assessment traps or nets in tributaries of Lake Erie during 2014 (letter in parentheses corresponds to 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)	---	---	---	---	---	---	---	---	---
Little Otter Cr.	127	195	26	---	---	---	---	---	---
Big Cr. (B)	2,124	3,022	70	---	---	---	---	---	---
Young's Cr. (C)	484	758	64	---	---	---	---	---	---
Total or Mean (Canada)	**2,735**	---	---	---	---	---	---	---	---
United States									
Cattaraugus Cr. (D)	2,537	5,089	50	316	66	509	508	273	283
Spooner Cr.	93	---	---	22	46	477	497	240	272
Grand R. (E)	451	990	46	87	53	496	490	251	262
Total or Mean (U.S.)	**3,081**	---	---	**425**	**62**	**506**	**503**	**268**	**277**
Total or Mean (for lake)	**5,816**	---	---	**425**	**62**	**506**	**503**	**268**	**277**

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

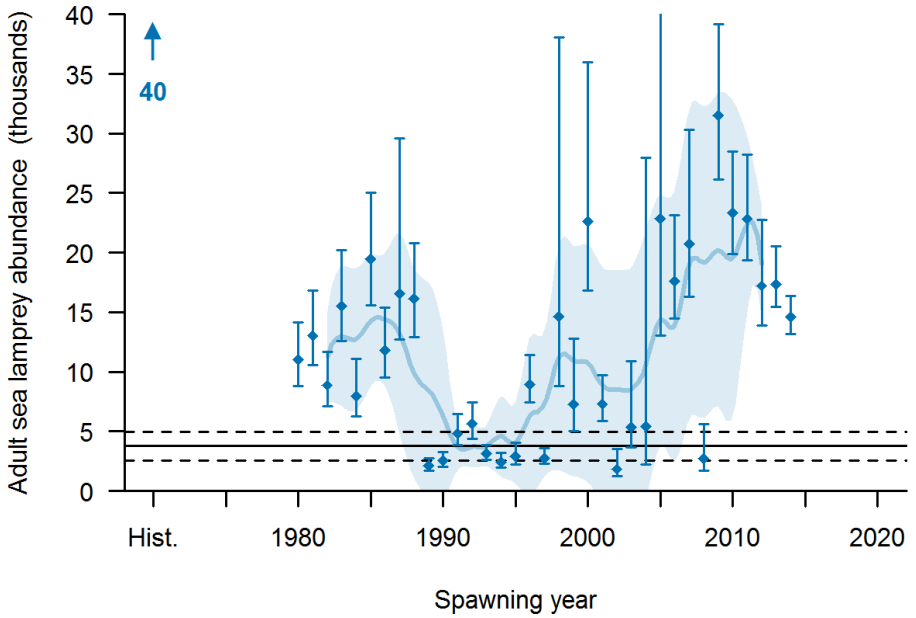

Figure 17. Abundance estimates with 95% CIs (vertical bars) of adult Sea Lampreys in Lake Erie, including historic pre-control abundance and the five-year moving average (line) with 95% CIs (shaded area). Target abundance and 95% CI range (horizontal solid and dashed lines) were estimated from abundances during a period with acceptable marking rates.

Figure 18. Distribution of adult Sea Lampreys in streams during the spring spawning migration, 2014. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). Tributaries composing over half of the lake-wide adult population estimate are identified (Cattaraugus 5,100; Big 3,000).

Lake Ontario

- A total of 4,072 Sea Lampreys were trapped at 12 sites on 11 tributaries (Table 30, Figure 21).

- The estimated population of adult Sea Lampreys was 19,482 (95% CI; 16,880-24,032), which was lower than the target range of 34,200 ± 10,335 (Figures 19-20).

Table 30. Information collected from Sea Lamprey adults captured in assessment traps or nets in tributaries of Lake Ontario during 2014 (letter in parentheses corresponds to stream in Figure 21).

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)	2,536	4,100	62	254	45	482	480	252	256
Duffins Cr. (B)	399	1,032	39	40	55	492	478	257	246
Bowmanville Cr. (C)	211	677	31	67	58	503	498	276	278
Graham Cr. (D)	169	246	69	55	49	511	490	274	258
Cobourg Cr. (E)	175	265	66	66	48	489	486	246	261
Salmon R. (F)	2	---	---	1	100	---	---	---	---
Total or Mean (Canada)	**3,492**	---	---	**483**	**49**	**491**	**484**	**258**	**259**
United States									
Black R. (G)	95	---	---	---	---	---	---	---	---
Salmon R.(H)									
Orwell Br.	84	137	61	22	45	472	469	255	257
Grindstone Cr. (I)	47	---	---	---	---	---	---	---	---
Little Salmon R. (J)	93	391	24	10	80	517	492	298	279
Sterling Cr. (K)	216	847	25	18	72	500	540	292	311
Sterling Valley Cr.	45	161	28	3	67	457	438	270	221
Total or Mean (U.S.)	**580**	---	---	**53**	**62**	**493**	**488**	**281**	**271**
Total or Mean (for lake)	**4,072**	---	---	**536**	**50**	**491**	**484**	**261**	**260**

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

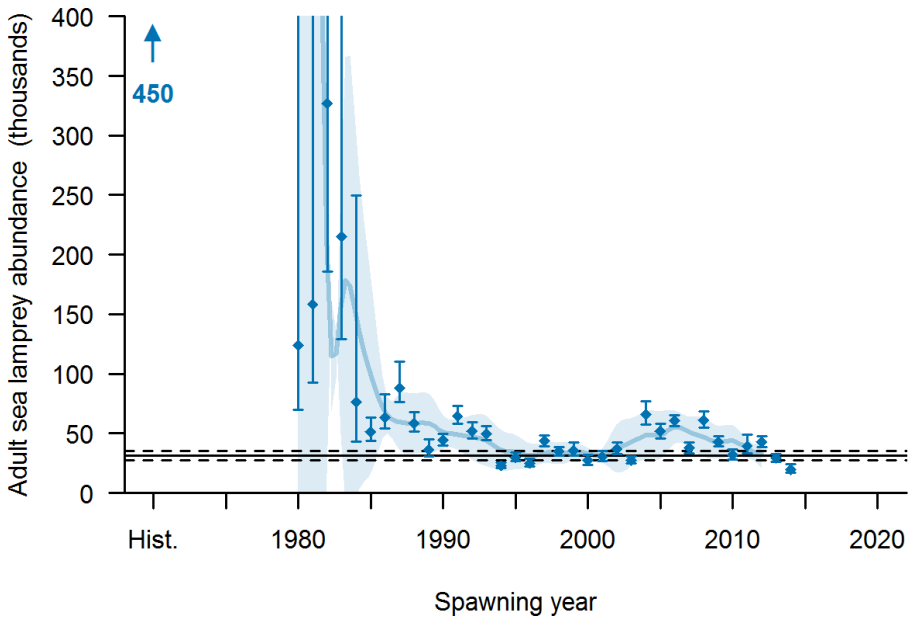

Figure 19. Abundance estimates with 95% CIs (vertical bars) of adult Sea Lampreys in Lake Ontario, including historic pre-control abundance and the five-year moving average (line) with 95% CIs (shaded area). Target abundance and 95% CI ranges (horizontal solid and dashed lines) were estimated from abundances during a period with acceptable marking rates.

Figure 20. Distribution of adult Sea Lampreys in streams during the spring spawning migration, 2014. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). Tributaries composing over half of the lake-wide adult population estimate are identified (Humber 4,100; Black 2,800; Duffins 1,000; Credit 1,000; Salmon (River) 930).

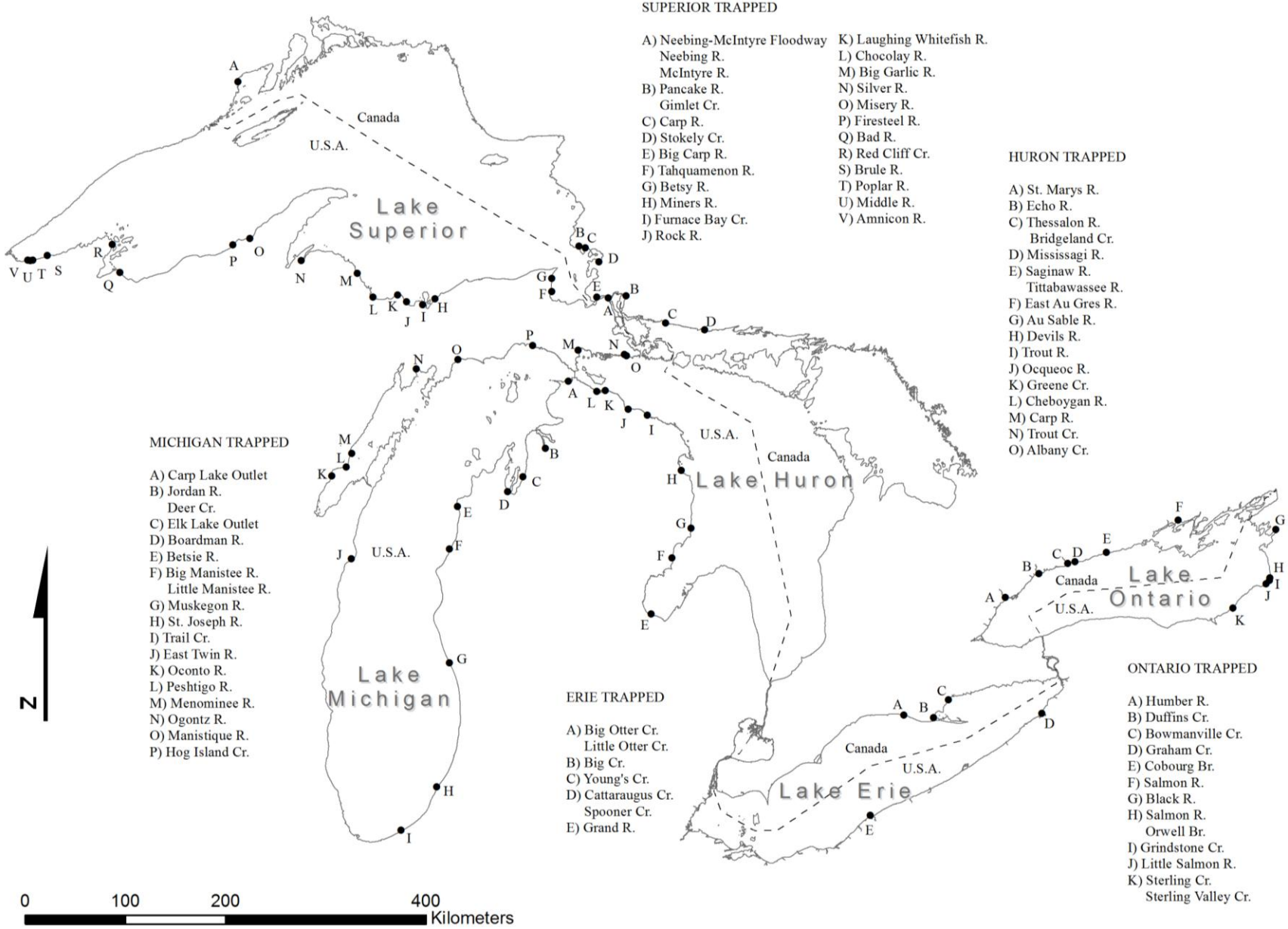

Figure 21. Locations of tributaries where assessment traps were operated during 2014.

RISK MANAGEMENT

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

Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires all US federal agencies to consult with the Service's Ecological Services Program (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 2014, the following ES field 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 from:

- East Lansing Field Office
- Green Bay Field Office
- New York Field Office
- Pennsylvania Field Office
- Twin Cities Field Office
- Bloomington 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 was taken on the SLCP programmatic review during 2014.

Species or Stream-specific Investigations

No risk management program activities were focused on federally-listed species during the 2014 field season.

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 2014, the following state regulatory offices reviewed potential impact of SLCP operations on state-listed endangered species within their jurisdiction and issued permits to conduct lampricide applications:

- Michigan Department of Natural Resources
- Pennsylvania Department of Environmental Protection

Species or Stream-specific Investigations

- Hornyhead Chub - Studies were conducted in a portable bioassay trailer on Conneaut Creek (Lake Erie) to determine the toxicity of TFM to the Hornyhead Chub (HHC: *Nocomis biguttatus*). Results demonstrated that the HHC is not sensitive to TFM at the concentrations used to control Sea Lampreys. The HHC is listed as endangered in the State of Pennsylvania and has only been found in the upper section of Conneaut Creek (Porter Road to Fish Creek Road) and a small tributary (Fish Creek). These sections of the Conneaut Creek were not included in the 2013 treatment due to the presence of HHCs, but will be included in the 2015 spring treatment.

Field Protocols

Both federal and state listed species are included in protocols that are annually developed by the risk management team for field staff. The protocols detail conservation measures to be followed where Sea Lamprey control activities are scheduled near listed species. During 2014, the following protocols were implemented to protect and avoid disturbance to federal- and state-listed species:

Non-target Sampling - A field trial of the technical operating procedure for biological surveys and collections was conducted in the Ford River (Lake Michigan) to gauge effort and feasibility of implementation. Revisions to the procedure and additional field trials are planned for 2015.

- *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 2014.*

- *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 2014.*

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 2014 for the 99 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. During 2014, NEPA was required for new cooperative agreements for the following actions:

- Bad River adult sea lamprey assessment
- Clear Creek adult sea lamprey assessment
- Bad River lampricide treatment

Portable sea lamprey assessment traps (placement and service) and lampricide treatments do not individually or cumulatively have a significant effect on the environment and fall under the class of actions that are categorical excluded from the execution of an environmental assessment. Therefore, NEPA was addressed by completing the NEPA Compliance Checklist for each project. In addition, each project was reviewed by Regional and Tribal Historic Preservation Officers who determined that the projects would not have a negative impact on historic property or sites of cultural importance.

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 31).

Table 31. Summary of 6(a)(2) reports submitted for incidents of non-target mortality during 2014.

Lake	Stream	Mortality	Freq	Comments
Seneca	Catherine Cr. Canal [3]	Tessellated darter (*Etheostoma olmstedi*)	97	Fish unable to escape treatment plot
Champlain	Salmon R.[1]	Stonecat (*Noturus flavus*)	84	Sensitive to TFM
	Au Sable R. Delta [2]	Tessellated Darter	500	Fish unable to escape treatment plot
	Little Au Sable R. [1]	Stonecat	106	Sensitive to TFM
Ontario	Sandy Cr. [3]	Stonecat	350	Sensitive to TFM & unexpected pH drop due to heavy rain
	Salmon R.[1]	Mudpuppy (*Necturus maculosus*)	550	Sensitive to TFM & unexpected pH drop during the night

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

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.

2014 Membership

Brian Stephens (Chair), Bruce Morrison, Shawn Robertson (Department); Cheryl Kaye, Stephen Lantz, Shawn Nowicki, Tim Sullivan, Lisa Walter (Service); Jean Adams (USGS/Commission); Mike Boogaard, Terry Hubert, Karen Slaght (USGS); Michael Wilkie (Wilfred Laurier University); Dale Burkett, Ted Treska (Commission Secretariat).

Progress towards goals described in the GLFC Vision:

Goal 1: Suppress Sea Lamprey populations to target levels.

Strategy 1: Implement lampricide treatment strategies to suppress Sea Lamprey populations to target levels in each Great Lake.

2014 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 did not receive lethal doses of lampricide were treated secondarily in conjunction with the main application. 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, hydroelectric generation) streams were scheduled for treatment in the optimal time of year to ensure sufficient

discharge. As the field season continued into the fall period, streams were to be treated for a longer duration because of seasonal variation in TFM sensitivity.

2: Personnel within the program were deployed to the control units in order to treat more streams in the spring (when conditions are generally optimal) and to augment treatment effort on complex, labor intensive systems later in the season.

3: The shallow draft jet drive GB spray boat was deemed unnecessary for treatment plots in the St. Marys River in 2014 due to higher discharges through the compensating gates. However, the boat was utilized in the estuary of the Michipicoten River to increase coverage in shallow waters.

4: Treated streams 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 . Additional streams were added to the treatment schedule based on 2014 larval assessment data and the proximity of treatment crews.

5: The use of Emulsifiable Concentrate (EC) was increased during the 2014 field season. Due to refinements in application methods, the Control Agents are prepared to use EC exclusively. A new policy inventory level for EC has been established and the use of Bayluscide Wettable Powder (WP) will be phased out once the supply of the product is exhausted. As compared to WP, the liquid formulation is easier to apply and results in improved regulation of the chemical concentrations to ensure required levels to kill lamprey are achieved.

2015 Objectives:

1: Review past treatment results and larval assessment data to direct implementation of applicable treatment strategies to achieve improved efficacy for streams ranked for treatment in 2015.

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 as well as to offset staffing shortfalls on larger systems.

3: Where applicable, increase treatment effectiveness on treatment applications of GB by scheduling a combination all three spray boats within the program.

4: Support and provide input into research that investigates Sea Lamprey sensitivity and non-target effects of fishes to TFM which may lead to new control strategies**.**

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

2014 Outcomes:

1: Lampricide analysis and water chemistry data from treatments in 2014 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.

2015 Objectives:

1: Review past treatment history and larval assessment information for streams ranked for treatment in 2015 to identify impediments to effectiveness and develop strategies to increase efficacy.

2: Participate in technical assistance projects and assist in research to optimize the effectiveness of lampricide applications.

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

Strategy 4: Implement integrated strategies for Sea Lamprey control for each lake and evaluate their effectiveness.

2014 Outcomes:

1: Implemented the first year of the 2014–2015 large scale treatment strategy. Favorable conditions during the 2014 field season resulted in additional treatments (both stream TFM and lentic GB applications) being conducted based on larval assessment information collected during the current field season.

2: Provided assistance to the LATF in the development of an assessment and control plan for the HEC which is to be presented at the 14-02 Sea Lamprey Control Board meeting.

2015 Objectives:

1: Assist LATF in the development of possible control strategies in the HEC as directed by Sea Lamprey Control Board.

2: Assist in the development of recommendations and implement tactics from the lampricide control review to increase effectiveness of treatments.

Barrier Task Force

Purpose

The task force was established during April 1991 to coordinate efforts of the Department, the Service, and the USACE on the construction, operation, and maintenance of Sea Lamprey barriers.

2014 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 (USACE); Gary Whelan (MIDNR); David Gonder (OMNRF); 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.

2014 Outcomes:

1: Planning continued on 16 barrier construction projects to prevent Sea Lampreys from accessing spawning habitat.

2: Stop log replacement and maintenance in the auxiliary spillway 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 under normal flow conditions.

3: Modifications to the stop log configuration at the Otter Lake Dam on the Sturgeon River (Lake Superior) defacto 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 under normal flow conditions.

4: Routine maintenance at all purpose-built Sea Lamprey barriers was completed to ensure adult Sea Lampreys do not have access to spawning habitat.

5: Inspection of approximately 400 existing barriers in the Great Lakes was conducted to assess whether structures would prevent upstream migration and to identify repairs necessary to minimize the number of parasitic lampreys originating from untreated sources.

6: Review of 30 fish passage projects was initiated or completed to determine the effect of fish passage and dam or culvert removals to Sea Lamprey control operations.

7: Completed electrofishing surveys and habitat assessments conducted upstream of barriers of concern in the Grand and Saginaw rivers to quantify potential infestation

risk; barrier inspections were also completed to verify historical information and at locations not currently represented in the barrier database.

2015 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 FY16 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 OMNRF and Saugeen Ojibway Nation to ensure that Sea Lampreys remain blocked at Denny's Dam.

4: Members remain engaged in the process 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 create a whitewater rapids area in downtown Grand Rapids.

6: Continue working on priority GLFER barrier projects with the USACE: Bad (Lake Superior) and Little Manistee rivers (Lake Michigan) to limit Sea Lamprey access to spawning habitat.

7: Investigate repair, rebuild, or removal alternatives of the Sea Lamprey barrier on Duffin's Creek (Lake Ontario) to restore blocking function.

8: Investigate use of existing surrogate species data to predict infestation risk upstream of blocking barriers.

9: Deliver barrier program of operation and maintenance to limit Sea Lamprey access to spawning habitat.

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

Strategy 4: Implement integrated Sea Lamprey control strategies for each lake and evaluate their effectiveness.

2014 Outcomes:

1: Participated in alarm cue 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. Preliminary data analysis indicates application of the alarm cue to half of the channel (side opposite the trap) decreased the time it took lampreys to find the trap by 50%. Trap capture success in 2014 was >80%.

2: Participated in alarm cue trials at Deer and Stutts creeks (Lake Michigan) to test the efficacy of the alarm cue to block one tributary at a confluence of similar-sized streams (Stutts Creek, Manistique River system) and a tributary to a large river (Deer Creek, East Jordan River system) in the presence of larval odor. Preliminary data analysis indicates larval removal is necessary before blockage.

3: The Cheboygan Working Group (CWG) investigated wounding and adult capture reports from the upper Cheboygan River system and confirmed presence of a small adult Sea Lamprey population through monitoring of fyke nets. The CWG is considering options for control in the Upper Cheboygan, which include push-pull trapping and SMRT.

2015 Objectives:

1: Remain involved in barrier research regarding use of chemo-sensory techniques to block or guide Sea Lampreys to increase capture of adult Sea Lampreys at barrier/trap complexes.

2: Participate in research trials 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: Participate in a workshop where results of behavioral manipulation experiments will be transferred to control agents and the broader research community associated with the GLFC. The intent of the workshop is to create an annual forum to discuss results from recent work attempting to improve Sea Lamprey trapping and lampricide control via behavioral manipulation techniques.

3: Submit proposal to field test a combination of alternative strategies (pheromone, alarm cue, portable electric guidance systems, etc.) to block Sea Lampreys from accessing spawning habitat.

4: The CWG will repeat 2013-2014 experiment during 2015 to conduct adult Sea Lamprey assessment in the upper Cheboygan River to confirm that adult populations upstream of the Cheboygan Lock and Dam complex are small. The CWG will also prepare a strategy document that describes potential control actions in the upper Cheboygan River watershed.

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.

2014 Membership

Lisa Walter (Chair), Alex Gonzalez and Aaron Jubar, (Service); Fraser Neave, Mike Steeves, Brian Stephens and Kevin Tallon (Department); Jean Adams and Chris Holbrook, (USGS); Travis Brenden, (Quantitative Fisheries Center, Michigan State University); Ted Treska and Dale Burkett (Commission Secretariat).

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.

2014 Outcomes:

1: Detection surveys were conducted on 226 tributaries basin-wide during 2014. Eighty-five Wisconsin tributaries of lakes Superior and Michigan were assessed as part of a special appropriation from the State of Wisconsin. Low density Sea Lamprey populations were discovered in Silver Creek, a small Lake Michigan tributary in Door County, WI and Big Sister Creek, a Lake Erie tributary near Angola, NY. Big Sister Creek has ranked for treatment during 2015 and Silver Creek will continue to be monitored. Additionally, detection surveys conducted in seven northeastern Illinois tributaries found the streams to be of poor quality and without Sea Lamprey infestation.

2: Distribution surveys were conducted during 2014 in tributaries scheduled for treatment during 2014 and tributaries expected to be treated during 2015. Notable increased distributions for 2014 treatments were found on the East Branch of the Fox River (tributary to the Manistique River), Chub Creek, (tributary to Lake Huron's Pine River), and the Pere Marquette River (Lake Michigan). Sea Lamprey distribution in the Pere Marquette River has increased with each treatment since the removal of the weir.

3: During the 2014 field season, 67 GB surveys covering 50,000 m^2 were conducted in the upper and lower portions of the St. Clair River to supplement previous data and to fill spatial gaps where needed. Fifty-five Sea Lamprey larvae were collected during GB surveys in 2014. In addition, negotiation between the Commission secretariat and WIFN enabled intensive DWEF to be completed at 733 sites in WIFN territorial waters to provide quantitative information on Sea Lamprey habitat availability and larval densities. Although the latter was the first of a two year assessment, favorable conditions and the availability of WIFN assistants resulted in a comprehensive look at production potential for most of the area. Seven Sea Lamprey larvae were collected during DWEF sampling. By combining the 2014 GB and DWEF surveys with the previous 2011-2013 results, Sea Lamprey abundance was estimated as number per hectare for each of the four discrete substrate classes. The river-wide estimate of

larval Sea Lamprey abundance is 919,509- 1,533,983. This range represents our uncertainty in capture efficiency (catch per unit effort, CPE) given the larger sample plots (1,000-1,295 m^2) used on the St. Clair River compared with smaller 500 m^2 plots typically used on other Great Lakes tributaries.

2015 Objectives:

1: Conduct detection surveys as possible given higher priority survey needs. When new infestations are found, rank for treatment as size structure dictates. Detection survey effort will be expanded in the Marquette office as a result of a special appropriation from the State of Wisconsin.

2: Conduct distribution surveys on all streams scheduled for treatment during late 2015 and early 2016, including those streams chosen for treatment as part of the next large scale treatment scenario.

3: Complete RoxAnn and DWEF sampling in channels adjacent to WIFN, and conduct standard levels of annual assessment in the St. Clair and Detroit rivers. Add new information to the Draft Plan for Assessment and Control in the HEC.

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

2014 Outcomes:

1: Post-treatment assessments were conducted on 76 tributaries and 13 lentic areas that were treated during 2013 and 2014. Nine tributaries totaling 424 staff days of lampricide control effort ranked for treatment during 2015 based on residual Sea Lampreys. Treatments of these streams are estimated to kill 641,500 larvae basin-wide.

2: Mike Boogaard (USGS – UMESC) evaluated the release time of GB and associated emergence time of larval lampreys at 6°C, 12°C, and 21°C. Preliminary results are that lampreys took longer to emerge in colder water, a finding that could have implications to collection time and efficiency of GB assessments.

2015 Objectives:

1: Continue to conduct post-treatment assessments on all treated streams and rank streams where large residual Sea Lampreys are recovered.

2: Conduct additional trials measuring the time to emergence when GB is applied at 10°C, the temperature of many St. Clair River assessment surveys. Use this information when negotiating sampling times with permitting agencies, and integrate into larval assessment protocols as necessary.

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.

2014 Outcomes:

1: During a larval protocol meeting held in January 2015, updated protocols detailing methods to conduct ranking and distribution surveys. Discussions on how to rank lentic areas for treatment, how to calculate "effective Type 1 habitat" for ranking surveys and ideal times to conduct distribution surveys were held.

2015 Objectives:

1: Reinstate the Larval Assessment Work Group (Aaron Jubar of Service to chair) and meet in person annually to review larval protocols and other topics of concern in detail. Continued protocol discussions are necessary to promote consistency among offices throughout times of significant staff turnover.

2: Agents will work with UMESC to collect water samples in streams with low, medium, and high larval abundances as researchers attempt to quantify Sea Lamprey eDNA.

Strategy 4: Implement integrated Sea Lamprey control strategies for each lake and evaluate their effectiveness.

2014 Outcomes:

1: Planned for implementation of the 2014–2015 Large Scale Treatment Strategy. This strategy is estimated to kill 773,000 larvae by treating large producers in lakes Huron and Michigan during 2014 and 2015 (final estimated kill will be dependent on the 2014 and 2015 rank lists).

2: With the LCTF, developed "A Draft Plan for Sea Lamprey Control and Assessment in the Huron Erie Corridor" proposing GB treatment in the St. Clair River during 2016.

2015 Objectives:

1: Synthesize results of the 2012–2013 large scale treatment strategy at the stream and lake levels. Draft a final report for the 15-02 SLCB meeting.

2: Conduct distribution surveys in preparation for the next large scale treatment scenario, set to begin in 2016.

3: Work with the TTF and LCTF to continue updating HEC Assessment and Control Plan, as directed by the SLCB.

Trapping Task Force

Purpose

Coordinate optimization of trapping techniques for assessing adult Sea Lamprey populations and removing adult and out-migrating juveniles from spawning and feeding populations.

2014 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.

2014 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 was developed, presented, and accepted by the Sea Lamprey Control Board, Council of Lake Committees, and the Commission. The index value for each lake will be the sum of mark-recapture population estimates from the 5–7 streams, selected for their large populations and consistent trapping histories. This will not rely on estimating populations in streams that are not trapped, which the previous method used.

3: The Secretariat office continued to collect and assemble up to date Lake Trout abundance and wounding rate data from various agencies, generating lakewide averages for status graphs.

4: Several recent and ongoing research projects aimed at improving the assessment of adult and juvenile populations. These include testing fishwheels and ELSTs to capture adult Sea Lampreys in unique situations, and using telemetry to track movements during feeding juvenile to adult life stages. Although these technologies have not led to changes in the field program, some such as ELST show good potential.

2015 Objectives:

1: Implement the new index method to track adult Sea Lamprey lakewide abundances. This involves operating and maintaining traps at 29 index streams throughout the Great Lakes, rather than 71. Another 3–5 streams will be trapped due to obligations to operate trap and sort fishways.
2: Assemble the most recent Lake Trout abundance and wounding data, and work towards generating more regional or management unit Lake Trout abundance and wounding estimates.
3: Continue monitoring results from recent and ongoing research projects, and be prepared to use new information and methods in the SLCP when they become available.

Strategy 6: Deploy trapping methods to increase capture of adult and out-migrating juvenile Sea Lampreys.

2014 Outcomes:

1: No Department streams were identified for trapping for control in 2014. The Service conducted trapping on the Pere Marquette River in spring 2014, but did not catch any Sea Lampreys.
2: There are several recent and ongoing research projects aimed at improving the capture efficiency of adults and out-migrating juveniles for control purposes. These include understanding the spatial and diel patterns of out-migrating juveniles, and using technology such as electrical leads to guide adult and out-migrating Sea Lampreys toward and into traps. Although these technologies are not yet ready for implementation in the field program, research is ongoing.

2015 Objectives:

1: Continue trapping of out-migrating juveniles for control in newly discovered or deferred streams to mitigate escapement to the lakes, beginning in October 2015 if warranted.
2: Continue monitoring results from recent and ongoing research projects, and be prepared to implement effective new technologies and methods into the Sea Lamprey control field program when they become available.

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.

2014 Outcomes:

1: The management scale 3kPZS study by Johnson et al. is complete, and the latest analysis to determine factors influencing capture of Sea Lampreys in 3kPZS baited

traps is complete. Results show that 3kPZS application was more likely to increase trap efficiency on streams that were wide and that had low adult abundances. This generated a new question – does 3kPZS increase the probability of encountering the trap, or the probability of entering the traps after encounter?

2: The Li laboratory at Michigan State University has identified several new pheromone compounds over the past couple of years, some of which were tested for biological activity in 2014. In total, they have identified 14 compounds from larval washings (e.g. LW1 compounds 971 and 973) and 7 compounds from mating pheromones (e.g. PAMS-24 could be a territoriality pheromone).
3: The Li laboratory has had success in determining ratios of chiral compounds (potentially important for future application if chiral compounds are finally proven to be pheromones; manuscript prepared).
4: The Li laboratory has isolated several compounds with olfactory stimulatory function in Sea Lampreys (not yet tested for pheromone function).
5: Testing in the Li laboratory provided further confirmation that PZS may antagonize 3kPZS in adult female behavior, and more possible 3kPZS antagonists have been identified, which need to be further tested in future.
6: The Li laboratory found direct evidence that 3kPZS release is under close regulation of the endocrine system (manuscript in preparation).
7: The Li laboratory found direct evidence that pheromones influence biological rhythmicity of adult females through influence of "clock" genes.

2015 Objectives:

1: The 3kPZS research team of Johnson et al. will submit a proposal in 2015 to test their hypothesis explaining the mechanism by which 3kPZS increases trap efficiency.
2: Continue to identify the structure and function of Sea Lamprey pheromone components, and attempt to unequivocally confirm the pheromone function of at least one novel compound (Li lab).
3: Continue to characterize potential antagonists, including tests of potential antagonists in a quasi-natural environment (Li laboratory).
4: Define the mechanisms whereby 3kPZS affects biological rhythmicity and determine how the information may be used in Sea Lamprey control (Li laboratory)

Strategy 2: Evaluate a repellent-based method to deter Sea Lampreys from spawning areas.

2014 Outcomes:

1: In the second year of an EPA-funded project, Dr. Tom Luhring (post-doc) tested the efficacy of the alarm cue to block one tributary at a confluence of similar-sized streams and a tributary to a large river in the presence of larval odor. Preliminary data analysis indicates larval removal is necessary before blockage may be achieved with the alarm cue alone.
2: In the first year of an EPA-funded project, Dr. John Hume began examination of Push-Pull application of attractants (3kPZS) and repellents (alarm cue) to guide lampreys into barrier integrated traps at the Carp Lake outlet. Preliminary data

analysis indicates application of the alarm cue to half of the channel (side opposite the trap) decreased the time it took migrants to find the trap by 50%.

3: In the first year of a GLFC-funded project, Greg Byford examined how Sea Lampreys respond to combinations of migratory attractants (larval odor) and the alarm cue in various combinations. They tested migratory responses to whole-channel activation of the alarm cue at multiple concentrations; increasing the concentration did not alter the animals' response.

4: Istvan Imre's student is examining the effects of damage-release alarm cues and predator cues on Sea Lamprey behavior. Building upon previous research that showed several cues (e.g. PEA, extracts of dead white suckers and Sea Lampreys) induce avoidance behaviors in adult Sea Lampreys, the work in 2014 sought to determine whether there was a synergistic effect of concurrent application of different compounds, and the optimal concentration of these compounds. There was no synergistic relationship, and the optimal concentration of PEA is 2E-9 M.

2015 Objectives:

1: In 2015 the Wagner laboratory will be testing the efficacy of Push-Pull trapping in open-channel traps (downstream from a barrier).

2: Work will continue in the Wagner laboratory to compare and contrast responses to combinations of larval odor and the alarm cue.

3: Imre's group plans to move testing of PEA from the lab to the field; using a field site on the Ocqueoc River at the Silver Creek confluence to track PIT tagged Sea Lampreys to determine if the PEA can be used to deter Sea Lampreys from ascending one channel.

Strategy 4: Implement integrated strategies for Sea Lamprey control for each lake and evaluate their effectiveness.

2014 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.

2015 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 Sea Lampreys first-hand. During 2014, this display was in attendance at several large capacity events (Table 32).

Table 32. Dates and locations of public outreach performed by agents of the Sea Lamprey control program in 2014.

Date	Location	Venue	Lead Agency
January 16-20	Cleveland, OH	Mid-America Boat & Fishing Show	Service
January 22-26	Chicago, IL	Chicago Outdoor Sport Show	Service
February 6-9	Toronto, ON	Toronto Sportsmen's Show	Department
February 12-16	Duluth, MN	Duluth Boat Sports Travel and RV Show	Service
February 21-23	Thunder Bay, ON	Central Canada Outdoor Show	Department
February 28-March 2	Appleton, WI	Northeast Wisconsin Sport Fishin' Show	Service
March 1-2	Hammond, IN	Cabela's Sport Weekend	GLFC
March 15-17	Niagara Falls, ON	Niagara Sportsmen Show	GLFC
March 19	Marquette, MI	Northern Michigan University Career Fair	Service
March 20-23	Grand Rapids, MI	Ultimate Sport Show	Service
March 21-23	Marquette, MI	Boat Sport and RV Show	Service
April 5	Detroit, MI	Belle Isle Aquarium Event	GLFC
May 17-18	Walpole Island, ON	Walpole Island First Nation Pow wow	DFO
May19-23	Marquette, MI	Bay Cliff	Service
June 21	Dunkirk, NY	Great Lakes Experience	Service
June 21-22	Sarnia, ON	Aamjiwnaang First Nation Pow wow	DFO
July 6-12	LaPorte, IN	LaPorte County Fair	GLFC
August 11-17	Escanaba, MI	U. P. State Fair	Service
August 22-31	Owen Sound, ON	Salmon Spectacular	Department

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:
Shawn Robertson: Supervisor
Bruce Morrison: Supervisor
Barry Scotland: Assistant Supervisor
Alan Rowlinson: Assistant Supervisor
Tonia Van Kempen: Environmental Supervisor

Lampricide Application Coordinators: Technicians:
Peter Grey
Jamie Storozuk

Lampricide Analysis Technicians:
Jerome Keen
Richard Middaugh

Lampricide Application Technicians:
Paul Kyostia
Adam Loubert
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
Fraser Neave: Larval Supervisor (Upper Lakes)
Kevin Tallon: Larval Supervisor (Lower Lakes)

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

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

Maintenance:
Brian Greene: Supervisor
Chad Hill: Assistant

UNITED STATES FISH AND WILDLIFE SERVICE

Robert Adair, Program Manager

Ludington Biological Station – Ludington Michigan
Scott Grunder, Station Supervisor

Lampricide Control Fish Biologists:
Timothy Sullivan: Treatment Supervisor
Alex Gonzalez: Treatment Supervisor
Chris Eilers
Dan McGarry
Jenna Tews

Lampricide Control Lead Physical Science Technician:
Vacant

Lampricicde Control Physical Science Technicians:
Kevin Butterfield
Jeffrey Sartor

Lampricide Control Biological Science Technicians:
Zachary Berry (CS)
Lisa Dennis (CS)
Lauren Freitas (CS)
Todd Gerardot (CS)
Bobbie Halchishak (CS)
Barry Shier (CS)

Larval Assessment Fish Biologists:
Aaron Jubar: Larval Assessment Supervisor
Dave Keffer
Matt Lipps

Larval Assessment Biological Science Technicians:
John Ewalt
Jason Krebill
Gary Haiss (CS)
Timothy Granger (CS)
Stephanie Shaw (CS)
John Stegmeier (CS)

Maintenance Worker:
Michael Sell

Administrative Support:
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, Administrative Officer
Michael LeMay
Casey Piton
Barbara Poirier
Alana Kiple (CS)

Information Technology Support:
Larry Carmack, Supervisor
Deborah Larson

Larval Unit Supervisor: Shawn Nowicki

Lampricide Control Fish Biologists:
Lori Criger: Treatment Supervisor
Rebecca Neeley: Treatment Supervisor
Chris Gagnon
Jesse Haavisto
Sara Ruiter

Lampricide Control Lead Physical Science Technician:
Jamie Criger

Lampricide Control Physical Science Technicians:
Daniel Kochanski
Justin Oster
Patrick Wick

Lampricide Control Biological Science Technicians:
Susan Becker (CS)
Thomas Elliott (CS)
Stephen Healy (CS)
Janet McConnell(CS)
Tiffany Opalka-Myers (CS)
Randy Parker (CS)
Cory Racine (CS)
Dan Suhonen (CS)

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

Larval Assessment Biological Science Technicians:
Kyle Krysiak
Nikolas Rewald
Chad Andresen (CS)
Jarvis Applekamp (CS)
Joshua Beaulaurier (CS)
Nicholas Chartier (CS)
Rachael Guth (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: Adult Assessment /Barrier Supervisor
Pete Hrodey
Gregory Klingler

Biological Science Technicians:
Dennis Smith
Jason VanEffen
Cassie Abrams (CS)
Chad Andresen (CS)
Bruce Eldridge (CS)
Kevin Letson (CS)
Sean Soucy (CS)