SEA LAMPREY CONTROL IN THE GREAT LAKES 2015

ANNUAL REPORT TO
THE GREAT LAKES FISHERY COMMISSION

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Cover: Lake Trout with fresh (A1) Sea Lamprey mark, collected during NYSDEC's 2003 Standardized Gill Net Assessment in Lake Erie (Photo by Paul Sullivan, DFO).

The St. Clair River shoreline, adjacent to the Walpole Island First Nation Heritage Centre *(*Photo by Kevin Tallon, DFO).

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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 2015. 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 115 tributaries and 22 lentic areas. Larval assessment crews surveyed 507 Great Lakes tributaries and 50 lentic areas to assess control effectiveness, plan future TFM treatments, and establish production capacity of streams. Assessment traps were operated in 37 tributaries across the Great Lakes to estimate the index of adult Sea Lamprey abundance in each Great Lake.

Indices of adult Sea Lamprey abundance were evaluated relative to fish-community objectives for each of the lakes. In Lake Superior, the index of adult abundance was estimated to be 20,224 (95% CI; 16,715 – 23,675), which was higher than the index target of 9,664 ± 2,531. In Lake Michigan, the index of adult abundance was estimated to be 14,695 (95% CI; 13,985-16,492), which was less than the index target of 24,874 ± 8,991 and the lowest in 20 years. In Lake Huron, the index of adult abundance was estimated to be 23,968 (95% CI: 21,824 – 25,428), which was lower than the index target of 24,113 ± 11,041 for the first time in 30 years and represents a substantial reduction when compared with the 2012 estimate.. In Lake Erie, the index of adult abundance was estimated to be 7,112 (95% CI; 4,521 – 9,341), which was higher than the index target of 3,039± 883, but represents a significant decline from the historic highs observed in 2010-11. In Lake Ontario, the index of adult abundance was estimated to be 10,298 (95% CI; 6,287 – 12,997), which is lower than the index target of 11,368 ± 2,917.

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 subsist on the blood and body fluids of large-bodied fish. It is estimated that about half of Sea Lamprey attacks result in the death of their prey and on average, 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 index and Lake Trout marking targets for each of the lakes. This report outlines the program conducted by the control agents and the Commission in 2015 to meet these targets.

FISH-COMMUNITY OBJECTIVES

Each lake committee has identified qualitative goals for Sea Lamprey control which are published in their fish-community objectives. 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 Lake Trout mortality. 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 >532 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 annual performance of the SLCP is evaluated by contrasting lake-specific adult Sea Lamprey index estimates and Lake Trout marking rates with prescribed targets. Adult Sea Lamprey abundance indices are estimated by the Service and Department by summing mark-recapture estimates from a sub-set of streams that were selected based on a consistent trapping history and large Sea Lamprey spawning runs. The index approach was first used during 2015, replacing regression model estimates of lake-wide abundance that were derived from multiple variables. Lake Trout marking rates are assessed and collected by 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 adult index target for Lake Superior of 9,664 ± 2,531 Sea Lampreys was calculated from the average abundance estimated for the 5-year period, 1994-1998, when marking rates were closest to 5 marks per 100 Lake Trout >532 mm (5.2 A1-3 marks per 100 fish >532mm). In 2015 the index of adult Sea Lamprey abundance was 20,224 (jackknifed range; 16,715-23,675), which was greater than the target of 9,664. The Sea Lamprey marking rate on Lake Trout is currently at 4.5 A1-A3 marks per 100 Lake Trout >532mm, 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 adult index target for Lake Michigan of 24,874 ± 8,991 Sea Lampreys was calculated from the average abundance estimated for the 5-year period, 1988-1992, when marking rates were closest to 5 marks per 100 Lake Trout >532 mm (4.7 A1-3 marks per 100 fish >532mm). In 2015 the index of adult Sea Lamprey

abundance was 14,695 (95% CI; 13,985-16,492), which was less than the target of 24,874. The Sea Lamprey marking rate on Lake Trout is currently at 4.4 A1-A3 marks per 100 Lake Trout >532mm which represents the lowest marking rate since 1995.

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 index target for Lake Huron of 24,113 ± 11,041 Sea Lampreys was calculated as 25% of the average abundance estimated during the 5-year period prior to the publication of the fish-community objectives (1989-1993). Unlike the other Great Lakes, this explicit target was not based on observed marking rates that resulted in a tolerable annual Lake Trout mortality rate.

During 2015, the index of adult abundance in Lake Huron was estimated to be 23,968 (95% CI: 21,824 – 25,428), which was lower than the index target for the first time in the time series (1985-2015) and represents a substantial reduction when compared with the 2012 estimate. The Sea Lamprey marking rate on Lake Trout is currently 3.9 A1-A3 marks per 100 Lake Trout >532 mm. This represents the first time in the time series that the marking rate has been lower than the target of 5 marks per 100 fish.

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 adult index target for Lake Erie of 3,039± 883 Sea Lampreys was calculated from the average abundance estimated for the 5-year period, 1991-1995, when marking rates were closest to 5 marks per 100 Lake Trout >532 mm (4.4 A1-3 marks per 100 fish >532 mm). In 2015 the index of adult Sea Lamprey abundance was 7,112 (jackknifed range; 4,521-9,341), which was greater than the target of 3,039, but represents a significant decline from the historic highs observed in 2010-11. The Sea Lamprey marking rate on Lake Trout is currently 11.6 A1-A3 marks per 100 Lake Trout >532mm.

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 adult index target for Lake Ontario of 11,368 ± 2,917 Sea Lampreys was calculated from the average abundance estimated for the 5-year period, 1993-1997, when marking rates were closest to 2 marks per 100 Lake Trout >431 mm (1.6 A1 marks per fish >431 mm). In 2015 the index of adult Sea Lamprey abundance was 10,298 (jackknifed range; 6,287-12,997), which was less than the target of 11,368. The Sea Lamprey marking rate on Lake Trout is currently 1.8 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. During stream treatments, Service and Department control units administer and analyze several lampricide formulations including TFM or TFM mixed with Bayluscide (70% wettable powder or 20% emulsifiable concentrate). Specialized equipment and techniques are employed to maintain lampricide concentrations at levels that eliminate approximately 95% of resident Sea Lamprey larvae while minimizing risk to non-target organisms. To control larval populations that inhabit lentic areas and interconnecting waterways, field crews apply a bottom-release formulation of lampricide, Bayluscide 3.2% granular (gB), which is 75% effective on average.

Reporting to the Sea Lamprey Control Board (SLCB) 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 progress on SLCB charges during 2015 is presented in the LCTF section of this report.

During 2015, lampricide treatments were conducted on 115 tributaries and 22 lentic areas of the Great Lakes (Table 1). Historical control efforts compared to 2015 control efforts are presented in Figure 1.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes in 2015.

Lake	Number of Streams	Number of Lentic	Discharge (m^3/s)	Distance Treated (km)	TFM (kg) [1,2]	Bayluscide (kg) [1,3]
Superior	41	13	76.3	764.7	9,762.3	559.4
Michigan	20	3	115.5	908.0	21,308.0	156.0
Huron	28	5	209.0	754.6	23,096.9	1,713.4
Erie	7	0	7.5	172.7	1,521.3	0.1
Ontario	19	1	58.8	207.7	8,219.4	184.1
Total	**115**	**22**	**467.1**	**2,807.7**	**63,907.9**	**2,613.0**

[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.

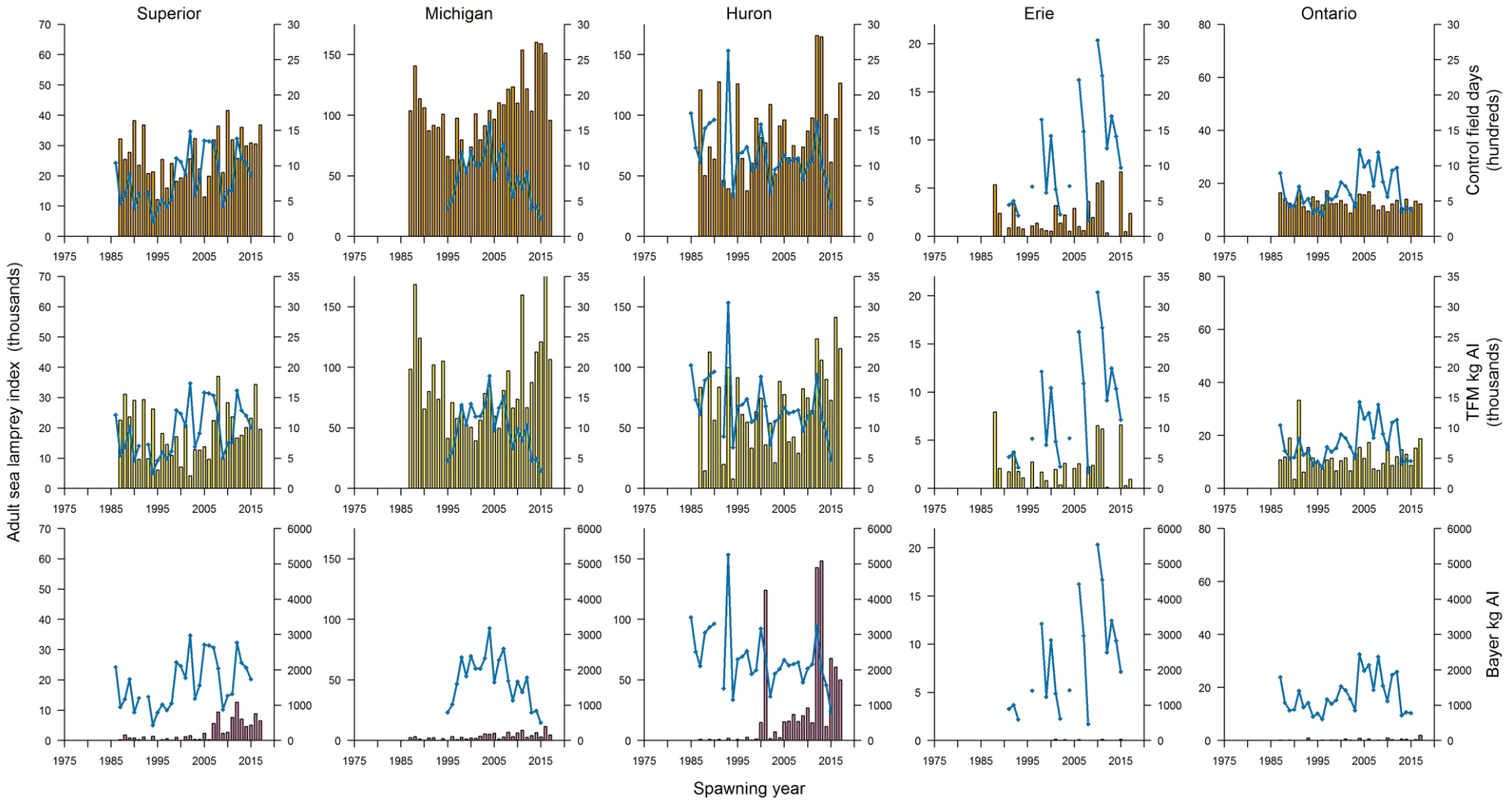

Figure 1. Row 1: Number of control field days (orange bars). Row 2: TFM used (kg active ingredient, yellow bars). Row 3: Bayluscide used (kg active ingredient, purple bars). All rows: Index of adult Sea Lampreys is shown with blue lines. All metrics plotted against the Sea Lamprey spawning year. Control 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.

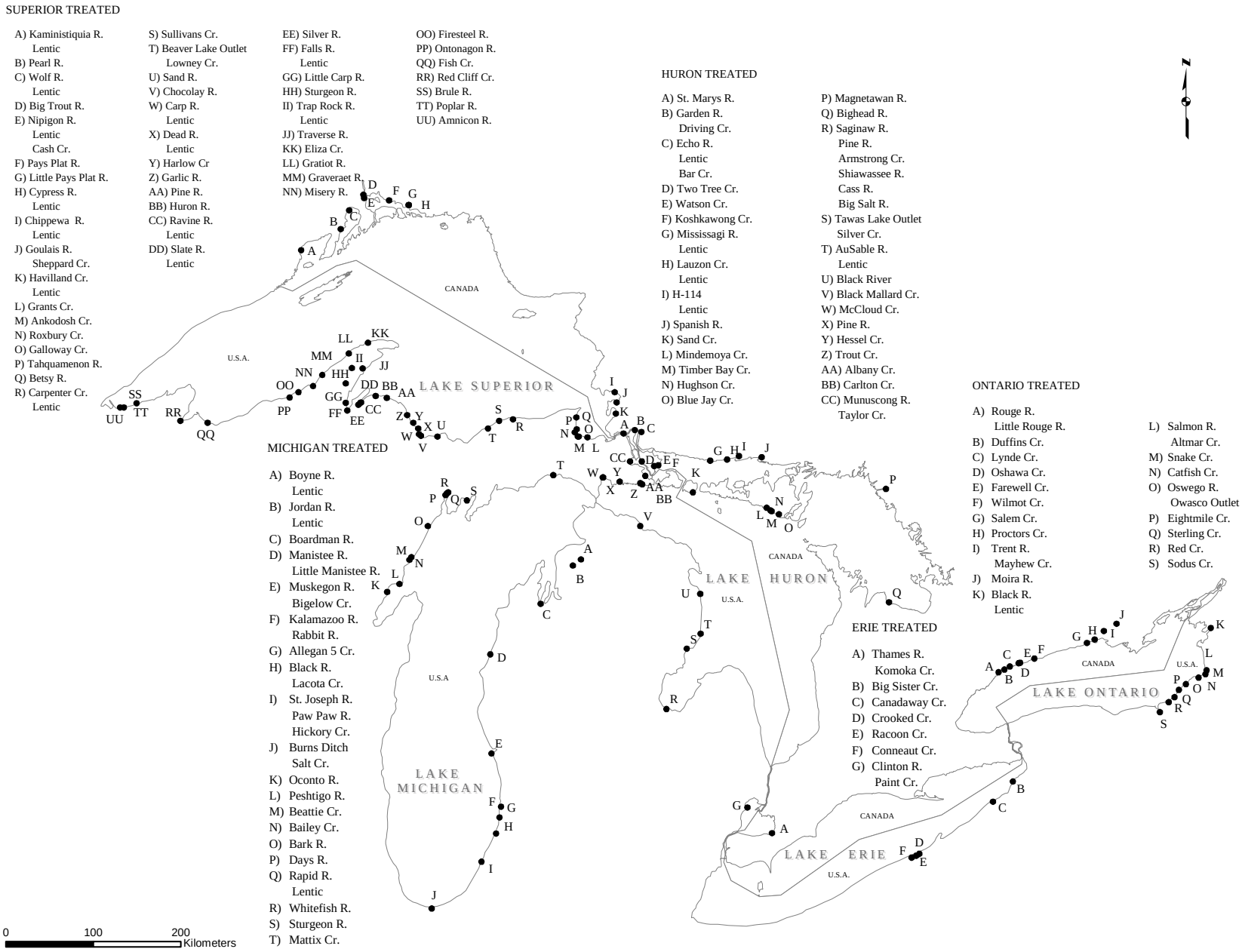

Figure 2. Location of tributaries treated with lampricide in 2015.

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 2005–2015. Fifty-three tributaries (19 Canada, 34 U.S.) are treated every 4–6 years. Details on lampricide applications to Lake Superior tributaries and lentic areas during 2015 are found in Table 2 and Figure 2.

- Lampricide treatments were completed in 41 tributaries (8 Canada, 33 U.S.) and in 13 lentic areas (6 Canada, 7 U.S.).

- GB treatments of lentic areas of Havilland Creek, the Wolf and the Carp (Marquette County) rivers were completed for the first time.

- The Graveraet River was treated for the first time since 1963 and contained high densities of Sea Lampreys throughout most of the infested length.

- The Slate River (Baraga County) lentic area was added to the treatment schedule after moderate populations of larval Sea Lampreys were found during assessment surveys.

- The Traverse and Little Carp rivers were treated under extremely low discharge conditions likely leading to low treatment efficacy. Both streams contained moderate to high densities of larval Sea Lampreys. Treatment evaluation surveys indicated high numbers of surviving larvae (residuals) from the Little Carp River, and both will be re-treated in 2016.

- The Tahquamenon River was treated in October 2015 after being deferred in 2014 due to high water.

- Eliza Creek was treated with an interrupted lampricide bank, as opposed to the traditional 12-hour continuous bank. This study was done to evaluate the effectiveness of this type treatment and its potential to protect non-target species. Preliminary analysis indicated that an interrupted treatment was less effective than a continuous treatment and did not achieve the protective effect desired.

- Coordination and support was provided by several National Park Service (NPS) employees during the Lowney Creek (Beaver Lake Outlet) treatment in Pictured Rocks National Lakeshore.

- Several members of the Red Cliff Band of Chippewa Indians assisted in pre and post-treatment assessments during the Red Cliff Creek treatment, marking beaver dam locations via GPS and assisting with post-treatment collections.

Table 2. Details on the application of lampricides to tributaries and lentic areas of Lake Superior during 2015 (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)								
Lentic	Aug-23	---	---	---	---	---	---	54.8
Pearl R.(B)	Jul-22	1.9	5.1	243.5	---	---	---	---
Wolf R.(C)	Jul-20	10.7	4.4	1001.6	---	---	11.7	---
Lentic	Aug-21	---	---	---	---	---	---	61.2
Big Trout R.(D)	Jul-18	1.3	26.7	168.1	2.5	---	---	---
Nipigon R. (E)								
Lentic	Aug-22	---	---	---	---	---	---	61.2
Cash Cr.	Oct-4	1.0	29.0	274.5	1.3	---	---	---
Pays Plat R.(F)	Jul-11	2.4	10.2	187.1	0.2	---	---	---
Little Pays Plat R.(G)	Jul-12	0.1	3.1	4.3	---	---	---	---
Cypress R.(H)	Jul-8	1.3	5.5	63.4	---	---	---	---
Lentic	Aug-20	---	---	---	---	---	---	63.1
Chippewa R. (I)								
Lentic	Jun-25	---	---	---	---	---	---	39.2
Goulais R. (J)								
Sheppard Cr.	Sep-2	0.2	13.1	29.3	---	---	---	---
Havilland Cr. (K)								
Lentic	Jun-24	---	---	---	---	---	---	23.9
Total (Canada)		**18.9**	**97.1**	**1971.8**	**4.0**	**---**	**11.7**	**303.4**
United States								
Grants Cr. (L)	Aug-29	0.1	1.3	6.4	---	---	---	---
Ankodosh Cr. (M)	Aug-28	0.3	3.5	35.4	---	---	---	---
Roxbury Cr. (N)	Aug-28	0.2	3.5	28.3	---	---	---	---
Galloway Cr. (O)	Aug-24	0.1	3.1	14.9	---	---	---	---
Tahquamenon R. (P)	Oct-4	10.8	39.8	1091.2	4.0	---	13.5	0.2
Betsy R. (Q)	Aug-25	1.6	12.9	128.8	---	---	---	---
Carpenter Cr. (R)	Jun-30	0.1	0.8	4.3	---	---	---	---
Lentic	Aug-18	---	---	---	---	---	---	13.5
Sullivans Cr. (S)	Jul-1	0.1	1.9	14.2	---	---	---	---

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]
Beaver Lake Outlet (T)								
Lowney Cr.	Aug-18	0.3	2.6	44.6	1.5	---	---	---
Sand R. (U)	Jul-15	0.3	10.1	46.0	0.2	---	---	---
Chocolay R. (V)	Jul-16	4.5	4.6	497.5	3.5	---	---	---
Carp R. (W)								
Lentic	Jun-29	---	---	---	---	---	---	11.6
Dead R. (X)								
Lentic	Jun-24	---	---	---	---	---	---	53.9
Harlow Cr. (Y)	Jul-7	0.8	10.1	94.1	---	---	---	---
Garlic R. (Z)	Jun-30	1.7	12.9	162.8	0.6	---	---	3.7
Pine R. (AA)	Jun-30	1.7	3.7	130.9	---	---	---	---
Huron R. (BB)	Sep-10	0.4	11.6	100.3	---	---	---	---
Ravine R. (CC)	Aug-28	0.1	9.8	13.2	---	---	---	---
Lentic	Sep-11	---	---	---	---	---	---	30.6
Slate R. (DD)								
lentic	Sep-11	---	---	---	---	---	---	16.5
Silver R. (EE)	Aug-27	0.5	5.5	87.5	0.6	---	---	---
Falls R. (FF)	Aug-26	0.5	1.4	210.9	---	---	---	---
Lentic	Aug-9	---	---	---	---	---	---	87.6
Little Carp R. (GG)	Aug-28	0.1	6.6	4.7	---	---	---	---
Sturgeon R. (HH)	Sep-13	7.1	83.9	813.2	0.2	---	7.7	---
Trap Rock R. (II)	Aug-28	0.6	14.5	98.4	0.2	---	---	---
Lentic	Sep-1	---	---	---	---	---	---	5.5
Traverse R. (JJ)	Aug-27	0.1	16.4	29.7	---	---	---	---
Eliza Cr. (KK)	Aug-27	0.1	1.1	5.7	---	---	---	---
Gratiot R. (LL)	Jul-9	0.3	3.1	36.3	---	---	---	---
Graveraet R. (MM)	Aug-3	0.4	15.6	85.6	0.4	---	---	---
Misery R. (NN)	Jul-8	0.7	3.4	133.0	---	---	---	---
Firesteel R. (OO)	Jul-31	0.8	74.1	305.8	0.8	---	---	---
Ontonagon R. (PP)	Sep-25	14.0	224.6	2262.0	5.2	---	---	---
Fish Cr. (QQ)	Jun-18	2.4	28.5	394.9	---	---	---	---
Red Cliff Cr. (RR)	Jun-22	0.1	5.0	15.7	---	---	---	---
Brule R. (SS)	Jun-18	5.4	12.9	721.1	---	---	---	---

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]
Poplar R. (TT)	Jun-19	0.2	21.9	45.3	---	---	---	---
Amnicon R. (UU)	Jun-21	1.0	16.9	106.6	---	---	---	---
Total (United States)		**57.4**	**667.6**	**7769.3**	**17.2**	**0.0**	**21.2**	**223.1**
Total for Lake		**76.3**	**764.7**	**9741.1**	**21.2**	**0.0**	**32.9**	**526.5**

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

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-eight tributaries have historical records of larval Sea Lamprey production, and of these, 91 tributaries have been treated with lampricides at least once during 2005–2015. Twenty-seven tributaries are treated every 3–5 years. Details on lampricide applications to Lake Michigan tributaries and lentic areas during 2015 are found in Table 3 and Figure 2.

- Lampricide applications were conducted in 20 streams and 3 lentic areas.

- 2015 was the second year of an expanded large-scale treatment strategy that prescribed treatment of the large producing streams in lakes Michigan and Huron in consecutive years to remove residual Sea Lamprey larvae. The Jordan, Manistee, Boyne, Paw Paw, and Sturgeon rivers and lentic areas offshore of the Jordan and Boyne rivers were included as part of this effort.

- Significant rainfall during the Whitefish River treatment resulted in termination of the downstream portion of the treatment. The stream is scheduled for retreatment during 2016.

- A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters led to a consecutive treatment of the Peshtigo River and was intended to remove any residual Sea Lampreys from the 2014 treatment.

- Marblehead Creek was deferred due to insufficient stream discharge.

- The mainstream of the Muskegon River was not treated in consecutive years based on results from post-treatment larval surveys that found few residual Sea Lampreys, while Bigelow Creek (Muskegon River tributary) was treated during both 2014 and 2015.

- Hickory Creek (St. Joseph River tributary) was treated for the first time since 1965.

- Allegan 5 and Salt (Burns Ditch tributary) creeks were treated for the first time.

- Lacota Creek (Black River tributary) and the Rabbit River (Kalamazoo River tributary) were treated upstream of the historical upper application points.

Table 3. Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2015 (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]
Boyne R. (A)	Jul-01	3.4	6.3	617.0	13.2	6.4	---	---
Lentic	Aug-12	---	---	---	---	---	---	15.3
Jordan R. (B)	Aug-06	5.0	36.9	1669.8	14.2	---	9.1	0.2
Lentic	Aug-12	---	---	---	---	---	---	24.5
Boardman R. (C)	Jun-15	16.6	10.6	2664.5	1.7	16.9	15.2	---
Manistee R. (D)								
Little Manistee R.	Jul-16	6.4	81.0	1386.9	13.7	---	---	---
Muskegon R. (E)								
Bigelow Cr.	Jul-21	0.8	18.5	234.9	2.7	---	---	---
Kalamazoo R. (F)								
Rabbit R.	Sep-25	3.4	77.8	1139.2	1.2	---	---	---
Allegan 5 Cr. (G)	Sep-30	0.1	2.1	9.5	---	---	---	---
Black R. (H)								
Lacota Cr.	Sep-25	0.2	8.4	43.5	2.06	---	---	---
St. Joseph R. (I)								
Paw Paw R.	Sep-09	9.9	209.0	3260.5	---	---	---	---
Hickory Cr.	Jul-08	0.8	21.3	353.8	2.9	---	---	---
Burns Ditch (J)								
Salt Cr.	Jun-20	4.7	35.7	741.2	---	---	---	---
Oconto R. (K)	Apr-27	24.9	58.1	3203.5	---	21.7	---	---
Peshtigo R. (L)	Oct-09	19.3	19.3	1738.5	0.6	---	20.2	---
Beattie Cr. (M)	Apr-23	0.5	3.1	71.5	---	---	---	---
Bailey Cr. (N)	Apr-23	0.6	1.9	47.6	0.6	---	---	---
Bark R. (O)	Apr-24	3.4	15.0	302.8	---	---	---	---
Days R. (P)	Aug-21	0.3	6.9	60.9	---	---	---	---
Rapid R. (Q)	May-07	3.9	59.4	630.7	2.9	---	---	---
Lentic	May-13	---	---	---	---	---	---	20.8
Whitefish R. (R)	May-11	9.4	122.7	2519.5	9.6	5.6	---	---
Sturgeon R. (S)	Aug-13	1.8	112.7	536.0	3.5	---	---	---
Mattix Cr. (T)	Aug-26	0.1	1.3	7.3	---	---	---	---
Total for Lake		**115.5**	**908.0**	**21239.1**	**68.9**	**50.6**	**44.5**	**60.8**

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-seven tributaries (59 Canada, 68 U.S.) have historical records of larval Sea Lamprey production. Of these, 83 tributaries (38 Canada, 45 U.S.) have been treated with lampricide at least once during 2004– 2015. Forty-five tributaries (22 Canada, 23 U.S.) are treated every 3–5 years. Details on lampricide applications to Lake Huron tributaries and lentic areas during 2015 are found in Table 4 and Figure 2.

- Lampricide applications were completed in 28 tributaries (15 Canada, 13 U.S.), 5 lentic area (4 Canada, 1 U.S.) and 304 hectares of the St. Marys River (see Table 1). Six St. Marys River plots were re-ranked based on an expected 75% reduction and were retreated within the same year to remove residual larval Sea Lampreys from the first treatment.

- The Garden River's main branch was deferred due to sub-optimal flows and temperatures during the time scheduled for treatment. Only one tributary, Driving Creek, was treated.

- 2015 was the second year of an expanded large-scale treatment strategy that prescribed treatment of the large producing streams in lakes Michigan and Huron in consecutive years to remove residual Sea Lamprey larvae. The Spanish River and Driving Creek (Garden River tributary) in Canada and the Pine (Mackinac County), Au Sable, and Shiawassee (Saginaw River tributary) rivers and Silver Creek (Tawas Lake Outlet tributary) were treated as part of this effort.

- The North Branch of the Big Salt River (Saginaw River tributary) was treated from a point further upstream than in any previous treatment and required increased effort.

- Armstrong Creek (Saginaw River tributary) and the Au Sable River lentic area were treated for the first time.

- The South Branch of the Black River was treated further upstream than in any previous treatment. Increased distribution is attributed to the replacement of a perched culvert that had previously limited access to spawning adults.

Table 4. Details on the application of lampricides to tributaries and lentic areas of Lake Huron during 2015 (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)	Jun-29	---	---	---	---	---	---	538.2
Garden R. (B)								
Driving Cr.	May-12	4.2	11.3	143.2	---	---	---	0.1
Echo R. (C)								
Lentic	Jun-23	---	---	---	---	---	---	45.3
Bar Cr.	Jun-29	0.1	1.1	2.4	---	---	---	---
Two Tree Cr. (D)	May-06	0.7	10.1	104.2	---	---	---	0.1
Watson Cr. (E)	May-06	0.2	1.5	10.8	0.3	---	---	0.2
Koshkawong Cr. (F)	Sep-19	1.0	1.5	71.4	---	---	---	0.1
Mississagi R. (G)								
Lentic	Jun-16	---	---	---	---	---	---	20.2
Lauzon Cr. (H)	Jun-17	2.1	0.9	90.0	---	---	---	---
Lentic	Jun-17	---	---	---	---	---	---	25.7
H-114 (I)	Jun-17	0.1	0.4	5.2	---	---	---	---
Lentic	Jun-18	---	---	---	---	---	---	18.4
Spanish R. (J)	Sep-19	97.6	57.0	4122.3	4.0	42.3	6.1	0.5
Sand Cr. (K)	Oct-21	0.1	4.6	53.0	---	---	---	0.1
Mindemoya Cr. (L)	Sep-10	1.2	3.5	193.0	---	---	---	0.1
Timber Bay Cr. (M)	Sep-12	0.1	3.2	8.9	1.2	---	---	0.1
Hughson Cr. (N)	Sep-12	0.1	2.8	10.7	---	---	---	0.1
Blue Jay Cr. (O)	Sep-14	0.5	9.1	119.1	0.2	---	---	0.1
Magnetawan R. (P)	Jul-21	20.9	6.9	565.8	---	---	---	0.1
Bighead R. (Q)	Aug-12	1.7	61.6	711.4	4.2	---	---	0.1
Total (Canada)		**130.6**	**175.5**	**6211.4**	**9.9**	**42.3**	**6.1**	**649.5**

Table 4. *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								
St. Marys R. (A)	Jul-08	---	---	---	---	---	---	884.9
Saginaw R. (R)								
Pine R.	May-8	7.5	50.5	1452.5	---	18.5	---	---
Armstrong Cr.	May-21	0.1	8.7	29.4	0.6	---	---	---
Shiawassee R.	May-22	7.4	78.3	2930.8	---	---	---	---
Cass R.	May-23	5.7	72.9	2956.6	---	---	---	---
Big Salt R.	Jun-5	2.0	59.6	560.4	14.5	---	---	---
Tawas Lake Outlet (S)	Jun-26	3.5	5.6	561.8	---	---	---	---
Silver Cr.	Jun-24	1.8	10.6	284.8	---	---	---	---
AuSable R. (T)	Aug-26	37.2	24.9	5741.3	10.3	---	75.3	---
Lentic	Aug-26	---	---	---	---	---	---	36.7
Black R. (U)	Aug-01	1.2	38.0	323.5	2.5	---	---	---
Black Mallard Cr. (V)	Jun-02	3.7	12.2	233.7	1.5	---	---	---
McCloud Cr. (W)	Jul-11	0.1	1.1	2.2	---	---	---	---
Pine R. (X)	Jun-04	7.3	198.2	1556.9	9.8	---	---	---
Hessel Cr. (Y)	Jul-12	0.1	1.4	19.1	1.0	---	---	0.1
Trout Cr. (Z)	Jul-10	0.2	2.4	20.5	---	---	---	---
Albany Cr. (AA)	Jul-10	0.2	1.0	25.6	---	---	---	---
Carlton Cr. (BB)	Jul-13	0.1	1.3	11.1	---	---	---	---
Munuscong R. (CC)		---	---	---	---	---	---	---
Taylor Cr.	Jul-15	0.3	12.4	125.2	---	---	---	---
Total (United States)		**78.4**	**579.1**	**16835.4**	**40.2**	**18.5**	**75.3**	**921.7**
Total for Lake		**209.0**	**754.6**	**23046.8**	**50.1**	**60.8**	**81.4**	**1571.2**

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

Lake Erie

Lake Erie has 842 tributaries (525 Canada, 317 U.S.). Twenty-nine tributaries (11 Canada, 18 U.S.) have historical records of larval Sea Lamprey production. Of these, 18 tributaries (8 Canada, 10 U.S.) have been treated with lampricides at least once during 2006-2015. Eight tributaries (3 Canada, 5 U.S.) are treated every 3-5 years. Details on lampricide applications to Lake Erie tributaries and lentic areas during 2015 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.), one of which required treatment during 2005-2015.

- Lampricide treatments were completed in 7 tributaries (1 Canada, 6 U.S.).

- Komoka (Thames River tributary), Paint (Clinton River tributary) and Big Sister creeks were treated for the first time.

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

- The infested portions of Conneaut Creek were treated in their entirety including upstream areas that had been excluded in previous treatments to protect other aquatic species.

- Crooked Creek was added to the treatment schedule after numerous large larval and metamorphosing Sea Lampreys were found during assessment surveys.

Table 5. Details on the application of lampricides to tributaries and lentic areas of Lake Erie during 2015 (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								
Thames R. (A)								
Komoka Cr.	Aug-16	0.2	2.9	25.1	---	---	---	0.1
Total (Canada)		**0.2**	**2.9**	**25.1**	---	---	---	**0.1**
United States								
Big Sister Cr. (B)	Apr-13	0.8	26.2	251.3	---	---	---	---
Canadaway Cr. (C)	May-22	0.5	3.1	142.3	---	---	---	---
Crooked Cr. (D)	Oct-11	0.1	14.5	60.0	2.9	---	---	---
Racoon Cr. (E)	Apr-28	0.3	4.2	38.9	1.2	---	---	---
Conneaut Cr. (F)	Apr-24	4.2	110.9	507.8	9.1	---	---	---
Clinton R. (G)								
Paint Cr.	May-12	1.4	10.9	482.7	---	---	---	---
Total (USA)		**7.3**	**169.8**	**1483.0**	**13.2**	---	---	**0.0**
Total for Lake		**7.5**	**172.7**	**1508.1**	**13.2**	---	---	**0.1**

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, 34 tributaries (16 Canada, 18 U.S.) have been treated with lampricides at least once during 2006-2015. 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 2015 are found in Table 6 and Figure 2.

- Lampricide applications were conducted in 19 streams (10 Canada, 9 U.S.), and in 1 lentic area.

- Altmar Creek (Salmon River tributary, New York) and the Owasco Lake Outlet (Oswego River tributary) were treated for the first time in October 2015, based on larval assessments conducted earlier in the field season.

- Timed to coincide with the TFM treatment of the Black River, 28 hectares of lentic area in the Black River estuary were treated with gB for the first time.

Table 6. Details on the application of lampricides to tributaries of Lake Ontario during 2015 (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								
Rouge R. (A)								
Little Rouge R.	Jun- 2	1.1	17.3	323.0	---	---	---	0.1
Duffins Cr. (B)	Jun-22	3.9	18.1	1138.3	---	---	---	0.1
Lynde Cr. (C)	Jun-3	1.0	24.0	190.6	---	---	---	0.1
Oshawa Cr. (D)	Jun-17	1.0	23.4	270.3	---	---	---	0.1
Farewell Cr. (E)	Jun-25	1.5	12.3	395.3	2.5	---	---	0.1
Wilmot Cr. (F)	Jun-19	0.7	19.0	273.1	---	---	---	0.1
Salem Cr. (G)	Apr-12	0.3	2.2	77.8	---	---	---	---
Proctors Cr. (H)	Apr-13	0.7	5.9	200.8	---	---	---	---
Trent R. (I)								
Mayhew Cr.	Apr-14	0.9	2.5	218.3	---	---	---	---
Moira R. (J)	Jun-01	---	---	---	---	---	---	17.2
Total (Canada)		**11.1**	**124.7**	**3087.5**	**2.5**	**0**	**0**	**17.8**
United States								
Black R. (K)	Aug-08	35.0	9.3	2941.0	---	34.4	---	---
Lentic	Aug-07	---	---	---	---	---	---	131.3
Salmon R. (L)								
Altmar Cr.	Oct-08	0.1	1.2	8.0	0.6	---	---	---
Snake Cr. (M)	Apr-19	0.3	4.1	33.7	1.0	---	---	0.1
Catfish Cr. (N)	Apr-19	4.5	1.5	261.9	---	---	---	---
Oswego R. (O)								
Owasco Outlet	Oct-08	4.4	21.6	1112.0	---	---	---	---
Eightmile Cr. (P)	Apr-16	0.9	4.5	82.5	---	---	---	0.1
Sterling Cr. (Q)	May-25	0.7	27.5	284.1	2.9	---	---	0.3
Red Cr. (R)	Apr-18	1.2	11.1	233.4	1.7	---	---	0.1
Sodus Cr. (S)	Apr-17	0.6	2.2	165.8	0.8	---	---	---
Total (United States)		**47.7**	**83**	**5122.4**	**7**	**34.4**	**0**	**131.9**
Total for Lake		**58.8**	**207.7**	**8209.9**	**9.5**	**34.4**	**0**	**149.7**

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 lampricides to provide a broader spectrum of tactics to control Sea Lampreys. During 2015, 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 trap 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 2015, the mean egg viability from 15 nests was 62%. The mean post-SMRT (2012-2015) egg viabilities (67%) are significantly higher than mean viabilities (32%) when SMRT was applied (1993-2011).

- The annual proportion of age-1 larvae (≤47mm) captured in the St. Marys River by deep-water electrofishing may provide an indication of recruitment. The proportion in 2015 was 60%. The mean proportion during post-SMRT years (74%) was higher than the mean proportion during SMRT years (42%).

Juvenile Trapping

- Trapping for out-migrating Sea Lamprey juveniles 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 five out-migrating juveniles were captured.

- Trapping for out-migrating juvenile Sea Lampreys was conducted in the Galien River (Lake Michigan) during October-December. Fyke nets were set in the mainstream and captured 30 out-migrating juveniles.

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.

Reporting to the SLCB, 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 progress on SLCB charges during 2015 is presented in the BTF section of this report.

During 2015, there were 73 Sea Lamprey barriers in the Great Lakes basin that were either purpose-built to block Sea Lampreys (47), or constructed for other purposes (27), but modified to serve a Sea Lamprey control function (Figure 3).

Data gathered during field visits to assess the status of other dams and structures were recorded in the SLCP's Barrier Inventory and Project Selection System (BIPSS) and may be used to select barrier projects, monitor inspection frequency, schedule upstream larval assessments, assess the effects of barrier removal or modifications on Sea Lamprey populations, or identify structures that are important in controlling Sea Lampreys.

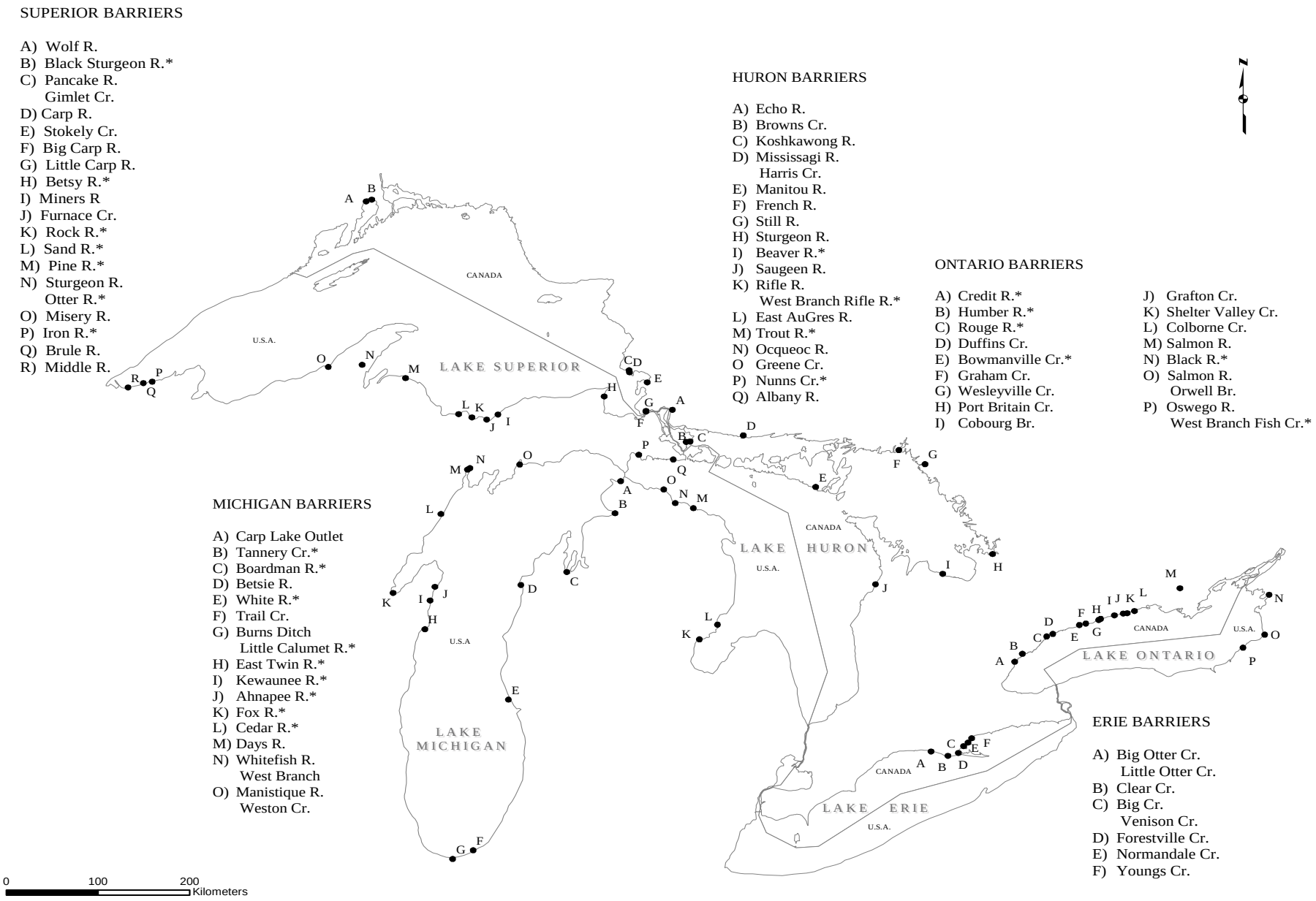

Figure 3. Locations of tributaries with Sea Lamprey barriers. Structures that have been modified or constructed by others that prevent the upstream migration of Sea Lampreys are indicated by an asterisk.

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 (BIPSS)

- Field crews visited 17 structures on tributaries to Lake Superior to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

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 and one U.S. barrier.

    - Gimlet Creek (Pancake River tributary) – Recent larval assessments indicate escapement of adult Sea Lamprey, resulting in the establishment of one age class of larvae in either 2010 or 2011. During the fall 2015, data loggers were installed to monitor flow at the barrier site.

    - Middle River – The Wisconsin Department of Natural Resources (WDNR) installed a new steel lip on the crest of the Middle River Sea Lamprey barrier during the fall of 2015.

Ensure Blockage to Sea Lamprey Migration

- Black Sturgeon River – During 2012, the Ontario Ministry of Natural Resources and Forestry (OMNRF) initiated an Environmental Assessment (EA) of the proposed decommissioning of the Camp 43 dam and construction of a new Sea Lamprey barrier 50 km upstream. More recently, the OMNRF has contracted the class EA to the KGS Group, who is developing a draft Environmental Study Report (ESR). OMNRF will provide the draft ESR for public review once completed.

- Consultations to ensure blockage at barriers in six 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
Ontonagon R.	East Br. Ontonagon R.	USFS[1]	Lower Dam	Do not concur	First blocking
Bad R.	Trib. to Krause Cr.	NFWF[2]	Gilgen Rd. culvert	Pending	Ineffective barrier
Bad R.	Four Corners Store Cr.	NFWF[2]	Four Corners Rd. culvert	Pending	Ineffective barrier
Bad R.	Sec. 33 Trib to Marengo R.	NFWF[2]	Beckman Rd. culvert	Pending	Ineffective barrier
Bad R.	Marengo R.	NFWF[2]	Marengo Lake Rd. culvert	Pending	Ineffective barrier
Huron Lake Outlet		USFWS[3]	Waterfront Park Dam	Pending	First blocking

[1]U.S. Forest Service.
[2]National Fish and Wildlife Foundation.
[3]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Ashland).

New Construction

- Bad River – USACE is the lead agency administering a project to construct a Sea Lamprey barrier in the Bad River under the Great Lakes Fishery Ecosystem Restoration program. USACE completed the feasibility study to site a new barrier and trap downstream from the Potato River junction (the location supported by the Bad River Tribe). The study indicated that the topography at this location would require a structure much larger than anticipated to block Sea Lamprey and would result in potential backwater effects. Personnel from the Service, the Natural Resources Department of the Bad River Band of Lake Superior Chippewa Indians, and GLIFWC met to discuss alternate locations.

- Whitefish River – Hydraulic analysis at the proposed barrier site was completed in 2014. However, construction of new barriers requires authorization from the OMNRF under the Federal-Provincial Agreement on Sea Lamprey Barrier Dams (1983). Previously, the province authorized new construction under the Lakes and Rivers Improvement Act, but this legislation is not binding to federal agencies. Because of uncertainty regarding authorization, the Canada-Ontario Fisheries Advisory Board has recommended a DFO-OMNRF workshop to review and revise, as necessary, the existing federal/provincial agreement and address other issues related to structures that serve a Sea Lamprey control function in Ontario. New barrier construction in Ontario streams is pending completion of this process.

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 (BIPSS)

- Field crews visited 97 structures on tributaries to Lake Michigan to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

Operation and Maintenance

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

Ensure Blockage to Sea Lamprey Migration

- 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 from the Union Street Dam during 2013-2015 found no spawning activity or larval recruitment. The Service will continue to monitor for escapement upstream from the 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 larval Sea Lampreys were collected above or below the dam during electrofishing surveys conducted during May 2015.

- 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. The Service and Department reviewed concept design plans of the proposed structure and continue to coordinate on the project.

- Cedar River – Repairs to the Powers Dam were completed by Powers Township after the dam was breeched during spring 2014. Larval assessment surveys are planned for 2016 upstream from the dam.

- Trail Creek - The Sea Lamprey barrier was inundated by high water during July, which created a large hole near the access gate to the site barrier. The hole was filled with several tons of stone.

- The Service provided field support to Michigan State University (MSU) researcher, Dr. Michael Wagner, to conduct United States Environmental Protection Agency (EPA)-funded Sea Lamprey alarm substance field trials on the Carp Lake River 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 may be effective in moving migrants into the vicinity of trap entrances when traps are sited at barriers.

- Barrier removals/modification – Consultations to ensure blockage at barriers were conducted with partner agencies at 22 sites in 14 streams (Table 8).

New Construction

- Manistique River – 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, Michigan Department of Natural Resources (MIDNR), City of Manistique, and Manistique Papers, Inc. The existing Manistique Papers, Inc. Dam was identified as the most feasible site for a new barrier. The project remained on hold while the Michigan Department of Environmental Quality completed review of the permit and wetland mitigation requirements.

- White River – 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 remained on hold due to fish passage concerns by the MIDNR.

- Little Manistee River – 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. USACE is pursuing this project under the Great Lakes Fishery Ecosystem Restoration program and is currently preparing design plans for the project, which is scheduled to be completed during 2016. Service staff met during October 2015 with USACE and MIDNR to discuss design of a new barrier.

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
Manitowoc R.		WIDNR[1]	Cato Falls Dam	Pending	First blocking
Sauk Cr.	Mineral Springs Cr.	NFWF[2]	Mineral Springs Dam	Concur	Ineffective barrier
Manistique R.		USFWS[3]	Star Cr. Rd. culvert	Concur	Ineffective barrier
Milwaukee R.	Milwaukee R.	NFWF[2]	Estabrook Dam	Pending	Ineffective barrier
Oak Cr.		WIDNR[1]	South Milwaukee Mill Dam	Concur	Limited potential
Jordan R.		USFWS[3]	Old State Rd. culvert	Concur	Ineffective barrier
Boardman R.		NFWF[2]	Sabin Dam	Conditional	Union Street Dam
Manistee R.	Trib. to Soper Cr.	USFWS[3]	Soper (Brooke) Fish Farm Dam	Concur	Upstream of blocking barrier
Manistee R.	Dutchman Cr.	USFWS[3]	Dutchman Creek Dam	Pending	Ineffective barrier
Manistee R.	Arquilla Cr.	USFWS[3]	Coates Highway culvert	Concur	Upstream of blocking barrier
Pere Marquette R.	Sanborn Cr.	USFWS[3]	Queens Highway culvert	Concur	Ineffective Barrier
Muskegon R.	Crocker Cr.	USFWS[3]	70th Ave. culvert	Concur	Upstream of blocking barrier
Grand R.		NFWF[2]	6th Street Dam	Pending	Habitat restoration
Grand R.	High Bank Cr.	USFWS[3]	Morgan Dam	Concur	Upstream of blocking structure
Grand R.		USFWS[3]	Sanitation Dam	Concur	Upstream of blocking structure
Grand R.	Rum Cr.	USFWS[3]	Old Mill Dam	Concur	Upstream of blocking structure
Grand R.	Rum Cr.	USFWS[3]	Rock Dam	Concur	Upstream of blocking structure
Kalamazoo R.		MIDNR[4]	Otesgo Dam	Concur	Upstream of blocking barrier
St. Joseph R.	Fawn R.	USFWS[3]	Fawn Creek Hatchery Dam	Concur	Upstream of blocking barrier
White R.	North Branch White R.	NFWF[2]	176th Ave. culvert	Concur	Ineffective barrier
White R	Sand Cr.	USFWS[3]	McKinley Rd. culvert	Concur	Ineffective barrier
White R.	Sand Cr.	USFWS[3]	Park Rd. culvert	Concur	Ineffective barrier

[1]Wisconsin Department of Natural Resources.
[2]National Fish and Wildlife Foundation.
[3]U.S. Fish and Wildlife Service, Fish and Wildlife Conservation Office (Green Bay).
[4]Michigan Department of Natural Resources.

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 (BIPSS)

- Field crews visited 139 structures on tributaries to Lake Huron to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

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 two Canadian barriers:

    - Still River – To avoid stop logs lifting during high flows, a locking mechanism was installed in fall 2015 which will reduce the risk of Sea Lamprey escapement.

    - Echo River – Handrails were replaced in spring 2015.

- The electrical field of the combination low-head/electrical barrier in the Ocqueoc River was active from March 10 until October 21. The barrier was electrified for 14 total days during 4 separate events 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 USACE and MIDNR regarding alternatives for preventing Sea Lamprey passage at the Cheboygan River lock. MIDNR is pursuing a refurbishment of the aging structure and the federal partners are interested in making the lock "lamprey proof" using Great Lakes Fishery and Ecosystem Restoration (GLFER) funding through USACE.

    - A study continued in the Upper Cheboygan River to seek evidence of a landlocked Sea Lamprey population and to inform lock refurbishment plans. Fyke nets were used to determine run timing and obtain morphology and statolith microchemistry data on adult lampreys in the upper river. Adult Sea Lamprey abundance in the upper river was estimated by weekly fin clipping (marking) male Sea Lampreys captured in the lower river (Lake Huron source) and released in the upper river (Schaefer mark-recapture model). Results indicated evidence that a small population of adult Sea Lampreys ($n < 200$) completed their life cycle in the upper Cheboygan River during 2013- 2015. There was no evidence of persistent upstream escapement of Sea Lampreys through the lock and dam complex. Adult Sea Lamprey assessment in the Cheboygan River will continue during 2016 as described above to determine if abundance is still very low.

- Saugeen River – In the fall, GLFC and Saugeen Ojibway Nation (SON) met in Ann Arbor, MI to formally discuss the Denny's Dam project. A result of this meeting was a formal agreement between the GLFC and SON to work together in a collaborative partnership in an attempt to resolve the Denny's Dam issue with specific respect to Sea Lamprey control. In December 2015, representatives from GLFC and SON (including engineers) met onsite to discuss project impacts and review previous construction plans.

- Nottawasaga River – Structural deterioration is evident at the Nicolston Dam near Alliston, Ontario, increasing the risk of Sea Lamprey escapement. DFO Engineering staff visited the site to conduct a topographical survey and to install data loggers to monitor hydraulic conditions at the dam in September 2015. Design drawings of the existing structure, including the fishway, were provided by OMNRF.

- Consultations to ensure blockage at barriers were conducted with partner agencies for 10 sites in 4 streams during 2015 (Table 9).

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

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Au Gres R.	Nester Cr.	NFWF[1]	Sage Lake Rd. culvert	Do not concur	First blocking
Au Sable R.	Middle Branch Big Cr.	MIDNR[2]	Big Creek Dam	Concur	Barrier repair
Au Sable R.	South Branch Pine R.	USFWS[3]	Buhl Dam	Concur	Ineffective barrier
East Au Gres R.	Smith Cr.	NFWF[1]	Webb Rd. culvert	Concur	Ineffective barrier
East Au Gres R.	Smith Cr.	NFWF[1]	Esmond Rd. culvert	Concur	Ineffective barrier
East Au Gres R.	Graham Cr.	NFWF[1]	Curtis Rd. culvert	Concur	Ineffective barrier
East Au Gres R.	Guiley Cr.	NFWF[1]	Old State Rd. culvert	Concur	Ineffective barrier
East Au Gres R.	Guiley Cr.	NFWF[1]	Parker Dam (Guiley Pond Dam)	Concur	Ineffective barrier
East Au Gres R.	Vaughn Cr.	NFWF[1]	Curtis Rd. culvert	Concur	Ineffective barrier
Mill Cr.		USFWS[3]	Mill Cr. Weir	Concur	Ineffective barrier

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

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 (BIPSS)

- Field crews visited 139 structures on tributaries to Lake Erie to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

Operation and Maintenance

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

- Repairs or improvements were conducted on three Canadian barriers:

    - Little Otter Creek – A water flow deflector was installed at the Sea Lamprey trap entrance in the summer of 2015. Handrails were repaired in fall 2015 to improve safety around the trap.

    - Young's Creek – The overhanging lip was extended to prevent a water jet from impinging entrance to the Sea Lamprey trap. Data loggers were relocated to ease future access.

    - Forestville Creek - The landowner is being consulted on rehabilitation of the access road, which is planned for 2016.

Ensure Blockage to Sea Lamprey Migration

- Cattaraugus Creek – The USACE, along with project partners Erie County and New York State Department of Environmental Conservation (NYSDEC) have approved the selected plan for the Springville Dam Ecosystem Restoration Project, restoring connectivity to approximately 70 miles of Cattaraugus Creek upstream of the Springville Dam. The selected plan will lower a portion of the existing spillway, but will still serve as a Sea Lamprey barrier. A rock riffle ramp with seasonal trapping and sorting operation is included in the design. Construction is targeted for 2018.

- Consultation to ensure blockage at barriers were conducted with partner agencies for three sites in two streams during 2015 (Table 10).

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

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Cuyahoga R.		OSMP[1]	Gorge Plant Dam	Pending	First blocking
Cuyahoga R.		Ohio EPA	Brecksville Dam	Pending	Ineffective barrier
Black R.		MIDNR[2]	Wingford Dam	Do not concur	First blocking

[1]Ohio Summit Metro Parks

[2]Michigan Department of Natural Resources.

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 (BIPSS)

- Field crews visited 23 structures on tributaries to Lake Ontario to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

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 and one U.S. barrier:

    - Duffins Creek – The water intake box and the Johnson Screen were relocated closer to the integrated 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 been successful for the 2015 operating season. The flow through the fishway will be monitored during the 2016 Sea Lamprey migration for any changes.

    - Orwell Brook –Restoration of the landowner's footbridge, which was washed out during a 2014 spring flood, was completed in 2015.

Ensure Blockage to Sea Lamprey Migration

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

- Credit River – Escapement at the Steetsville Dam on Credit River has occurred since it was rehabilitated as a Sea Lamprey barrier in the mid-2000s. Improvements, including installation of an overhanging lip, were completed during 2013-2015. Data loggers were installed in fall of 2015 to gather data on the hydraulic conditions at the barrier.

- Consultations to ensure blockage were conducted with partner agencies for two sites in two streams during 2015 (Table 11).

Table 11. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Ontario tributaries.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Gill Cr.		USACE[1]	Gill Cr. Dam	Concur	Lack of habitat
Oswego R.	Spring Br.	NFWF[2]	Stillwell Rd. culvert	Concur	Upstream of blocking barrier

[1]U.S. Army Corps of Engineers.
[2]National Fish and Wildlife Foundation.

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 an index of adult Sea Lamprey abundance 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 indices is the primary metric used to evaluate the effectiveness of the SLCP.

Reporting to the SLCB, the Larval Assessment Task Force (LATF) and the Trapping Task Force (TTF) were established 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's progress on SLCB charges during 2015 are presented in the LATF and TTF sections of this report (pages 99-101).

Larval Assessment

Tributaries considered for lampricide treatment during 2016 were assessed during 2015 to define the distribution and estimate the abundance and size structure of larval Sea Lamprey populations. Assessments were conducted with backpack electrofishers in waters <0.8 m deep, while waters ≥0.8 m in depth were surveyed with gB or by deep-water electrofishing (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 2016 based on the most cost-effective kill of larval Sea Lampreys ≥100 mm, based on estimates 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 125 tributaries (43 Canada, 82 U.S.) and 21 lentic areas (9 Canada, 12 U.S.). The status of larval Sea Lamprey populations in historically infested Lake Superior tributaries and lentic areas is listed in Tables 12 and 13.

- Surveys to estimate larval abundance were conducted in 30 tributaries (8 Canada, 22 U.S.) and in lentic areas offshore of 5 tributaries (4 Canada, 1 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 10 tributaries (5 Canada, 5 U.S.). A new population was found in Jarvis Creek, near Thunder Bay, Ontario, and is scheduled for treatment in 2016.

- Post-treatment assessments were conducted in 39 tributaries (7 Canada, 32 U.S.) and 2 lentic areas (1 Canada, 1 U.S.) to determine the effectiveness of lampricide treatments conducted during 2014 and 2015. The Marengo (Bad), West Sleeping, and Carp rivers as well as the lentic areas of the MacKenzie and Black rivers are scheduled for 2016 treatments based on the presence of residual Sea Lampreys.

- Surveys to evaluate barrier effectiveness were conducted in 13 tributaries (4 Canada, 9 U.S.).

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

- A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters led to additional surveys being conducted in 20 streams. Treatment effectiveness surveys were conducted in 8 streams. Detection surveys in 6 streams found no new infestations. Surveys to evaluate larval abundance and growth, and to rank streams for future treatments were conducted in 6 streams.

- An evaluation of larval Sea Lamprey production potential was completed on the Sturgeon River (Baraga County) upstream from the barrier by assessing larval lamprey habitat and native lamprey abundance as a surrogate for Sea Lamprey production. Results from the study are pending.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 82.90 kg (active ingredient) of gB (Table 14).

Table 12. Status of larval Sea Lampreys in Lake Superior tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2015.

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	Jul-15	---	No	---	---	Unknown
West Davignon Cr.	Jun-14	Jun-15	Yes	No	---	---	Unknown
Little Carp R.	May-08	Sep-15	---	Yes	602	602	***2016***
Big Carp R.	Sep-07	Jul-15	---	No	---	---	Unknown
Cranberry Cr.	May-11	Sep-15	No	Yes	---	---	2017
Goulais R.	Oct-12	Sep-15	Yes	Yes	---	---	***2016***[1]
Boston's Cr.	Never	Jun-14	---	No	---	---	Unknown
Horseshoe Cr.	Never	Aug-15	---	No	---	---	Unknown
Havilland Cr.	Jul-13	Aug-15	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	Sep-15	---	No	---	---	Unknown
Chippewa R.	Jul-10	Aug-15	No	Yes	21,580	450	***2016***
Unger Cr.	Jul-10	Jun-14	Yes	No	---	---	Unknown
Batchawana R.	Jun-14	Jul-14	Yes	No	---	---	***2016***[2]
Digby Cr.	Jun-13	Jul-13	Yes	---	---	---	Unknown
Carp R.	Jun-09	Sep-15	---	Yes	---	---	***2016***[1]
Pancake R.	Jun-12	Sep-15	Yes	Yes	---	---	***2016***[1]
Westman Cr.	Never	Jul-15	---	Yes	181	140	***2016***
Agawa R.	Sep-12	Jul-15	Yes	Yes	44,537	11,991	***2016***
Sand R.	Sep-71	Jul-15	---	Yes	---	---	Unknown
Baldhead R.	Never	Jul-15	---	No	---	---	Unknown
Gargantua R.	Aug-13	Jul-15	No	Yes	---	---	2018
Old Woman R.	Jul-12	Jul-14	Yes	Yes	---	---	Unknown
Michipicoten R.	Aug-14	Jul-15	Yes	No	---	---	***2016***[2]
Dog R.	Aug-63	Jul-15	---	Yes	---	---	Unknown
White R.	Jul-12	Jul-15	Yes	Yes	---	---	***2016***[2]
Pic R.	Jul-13	Jul-14	No	No	---	---	2019
Nama Cr.	Aug-14	Jul-11	---	---			2019
Little Pic R.	Aug-11	Jul-15	No	Yes	---	---	***2016***[2]
Prairie R.	Jul-94	Jul-14	---	No	---	---	Unknown

Table 12. *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
Steel R.	Jul-12	Aug-15	Yes	Yes	---	---	***2016***[1]
Pays Plat R.	Jul-15	Oct-15	No	No	---	---	***2016***[2]
Little Pays Plat Cr.	Jul-15	Aug-15	---	No	---	---	2019
Gravel R.	Jul-12	Aug-15	Yes	Yes	---	---	***2016***[1]
Little Gravel R.	Jul-13	Aug-13	Yes	---	---	---	2017
Little Cypress	Aug-14	Aug-13	---	---	---	---	Unknown
Cypress R.	Jul-15	Aug-15	Yes	Yes	---	---	2019
Jackpine R.	Never	Aug-15	---	Yes	---	---	Unknown
Jackfish R.	Jul-12	Aug-15	Yes	Yes	---	---	***2016***[1]
Nipigon R.							
Upper Nipigon R.	Aug-14	Aug-12	---	---	---	---	***2016***[2]
Lower Nipigon R.	Aug-06	Aug-15	---	Yes	---	---	***2016***[2]
Cash Cr.	Oct-15	Aug-14	---	---	---	---	2020
Polly Cr.	Jul-87	Aug-13	---	No	---	---	Unknown
Stillwater Cr.	Aug-13	Aug-15	Yes	Yes	---	---	2018
Big Trout Cr.	Jul-15	Aug-15	No	---	---	---	2019
Otter Cove Cr.	Aug-71	Jun-12	---	No	---	---	Unknown
Black Sturgeon R.	Aug-11	Aug-15	No	Yes	---	---	***2016***[2]
Big Squaw Cr.	Jun-72	Aug-14	---	No	---	---	Unknown
Wolf R.	Jul-15	Aug-15	Yes	Yes	---	---	2019
Coldwater Cr.	Jul-12	Aug-15	No	No	---	---	Unknown
Pearl R.	Jul-15	Aug-15	No	No	---	---	2019
D'Arcy Cr.	Jul-10	Aug-14	Yes	No	---	---	Unknown
Blende Cr.	Jul-13	Aug-15	Yes	Yes	---	---	2017
MacKenzie R.	Aug-13	Aug-13	Yes	---	---	---	***2016***[1]
Neebing-McIntyre FW	Jul-13	Aug-13	Yes	---	---	---	2017
Kaministiquia R.	Oct-13	Aug-15	Yes	Yes	---	---	***2016***[1]
Corbett Cr.	Jul-13	Aug-15	Yes	---			***2016***[1]
Whitefish R.	Oct-13	Aug-15	---	---			***2016***[1]
Oliver Cr.	Aug-14	Aug-15	Yes	No			***2016***[1]
Jarvis R.	Never	Aug-15	---	Yes	9,910	2,764	***2016***
Cloud R.	Jul-12	Aug-15	No	Yes	---	---	Unknown
Pine R.	Jul-73	Aug-15	---	Yes	---	---	Unknown
Pigeon R.	Jul-12	Aug-15	Yes	Yes	---	---	***2016***[2]
United States							
Waiska R.		Jul-14	No	No	---	---	Unknown
West Branch	Jul-07	Jun-15	---	Yes	73,804	47,380	***2016***
Sec 11SW Cr.	Never	Jul-13	---	Yes	---	---	Unknown
Pendills Cr.	Jul-12	Jul-14	No	No	---	---	Unknown
Grants Cr.	Aug-15	Jul-13	---	---	---	---	Unknown
Halfaday Cr.	Jul-12	Jul-14	Yes	Yes	---	---	Unknown
Naomikong Cr.	Jul-63	Jul-14	---	Yes	---	---	Unknown
Ankodosh Cr.	Aug-15	Sep-14	---	---	---	---	Unknown
Roxbury Cr.	Aug-15	Sep-14	---	---	---	---	Unknown
Galloway Cr.	Aug-15	Sep-14	---	---	---	---	Unknown
Tahquamenon R.	Oct-15	Sep-14	---	---	---	---	Unknown
Betsy R.	Aug-15	Sep-14	---	---	---	---	Unknown

Table 12. *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
Three Mile Cr.	Jun-62	Jun-14	---	Yes	---	---	Unknown
Little Two Hearted R.	Jul-12	Jun-15	No	Yes	---	---	***2016***[2]
Two Hearted R.	Jul-14	Jun-15	No	Yes	---	---	***2016***[2]
Dead Sucker R.	Aug-13	Jun-15	No	No	---	---	Unknown
Chipmunk Cr.	Sep-62	Jun-15	---	No	---	---	Unknown
Carpenter Cr.	Aug-15	Oct-15	No	---	---	---	Unknown
Sable Cr.	Sep-89	Jul-13	---	Yes	---	---	Unknown
Hurricane R.	Never	Jun-15	---	No	---	---	Unknown
Sullivans Cr.	Jul-15	Oct-15	No	Yes	---	---	Unknown
Seven Mile Cr.	Jul-67	Jun-15	---	Yes	---	---	Unknown
Beaver Lake Cr.							
Lowney Cr.	Aug-15	Aug-14	---	---	---	---	Unknown
Mosquito R.	Jun-73	Jul-14	---	No	---	---	Unknown
Miners R.							
Barrier downstream	Jul-13	Sep-15	Yes	Yes	9,322	327	***2016***
Barrier upstream	Jul-13	Jul-15	No	No	---	---	Unknown
Munising Falls Cr.	Sep-64	Jun-14	---	No	---	---	Unknown
Anna R.	Jul-13	Jul-15	No	Yes	---	---	Unknown
Tourist Park Cr.	Never	Jun-12	---	No	---	---	Unknown
Furnace Cr.							
Lower	Sep-10	Sep-15	---	Yes	1,020	46	***2016***
Upper	Sep-10	Jul-15	---	No	---	---	Unknown
Five Mile Cr.	Jul-13	Jul-15	Yes	Yes	302	134	***2016***
Au Train R.					---	---	
Upper	Jul-14	Jul-15	Yes	Yes	---	---	***2016***[2]
Lower	Jun-11	Jul-15	No	Yes	---	---	***2016***[2]
Rock R.	Jul-02	Jun-14	---	No	---	---	Unknown
Deer Lake Cr.	Aug-70	Jun-12	---	No	---	---	Unknown
Laughing Whitefish R.	Jul-14	May-15	No	Yes	---	---	Unknown
Sand R.					---	---	
Below Dam	Jul-15	Sep-15	No	---	---	---	Unknown
Above Dam	Jul-15	Sep-15	No	No	---	---	Unknown
Chocolay R.	Jul-15	Sep-15	Yes	Yes	---	---	***2016***[2]
Carp R.	Jul-14	May-15	Yes	Yes	17,523	1,623	***2016***
Dead R.	Aug-14	May-15	---	Yes			Unknown
Harlow Cr.	Jul-15	Sep-15	No	Yes	---	---	Unknown
Little Garlic R.	Aug-14	May-15	Yes	Yes	---	---	Unknown
Garlic R.	Jun-15	Sep-15	Yes	Yes	---	---	Unknown
Iron R.	Aug-13	Sep-15	Yes	Yes	17,083	1,005	***2016***
Salmon Trout R. (Marquette Co.)	Jul-12	Sep-15	Yes	Yes	---	---	***2016***[1]
Pine R.	Jun-15	Sep-15	No	Yes	---	---	Unknown
Huron R.	Sep-15	Jul-14	---	---	---	---	Unknown
Ravine R.	Aug-15	Jul-15	---	---	---	---	Unknown
Slate R.	Sep-13	Aug-15	---	No	---	---	Unknown
Silver R.	Aug-15	May-15	---	---	---	---	Unknown
Falls R.	Aug-15	Jul-13	---	---	---	---	Unknown
Six Mile Cr.	May-63	Jul-14	---	Yes	---	---	Unknown

Table 12. *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 Carp R.	Aug-15	Sep-15	Yes	---	---	---	***2016***[2]
Kelsey Cr.	Never	May-15	---	Yes	---	---	Unknown
Sturgeon R.	Sep-15	Jul-15	---	---	---	---	Unknown
Pilgrim R.	Aug-62	Jun-15	---	Yes	---	---	Unknown
Trap Rock R.	Aug-15	Oct-15	Yes	---	2,478	0	Unknown
McCallum Cr.	Aug-63	Jul-10	---	No	---	---	Unknown
Traverse R.	Aug-15	Sep-14	---	---	---	---	***2016***[2]
Little Gratiot R.	Aug-72	May-15	---	Yes	3,027	2,206	***2016***
Eliza Cr.	Aug-15	Oct-15	Yes	---	190	0	Unknown
Gratiot R.	Jul-15	Sep-15	Yes	Yes	---	---	Unknown
Smiths Cr.	May-64	Jun-14	---	No	---	---	Unknown
Boston-Lily Cr.	Aug-12	Aug-15	No	Yes	---	---	***2016***[2]
Schlotz Cr.	Never	Aug-15	---	Yes	2,771	1,039	***2016***
Salmon Trout R.	Jul-13	Sep-15	No	Yes	264	72	***2016***
Mud Lake Outlet	Oct-73	Sep-15	---	Yes	---	---	Unknown
Graveraet R.	Aug-15	Sep-15	Yes	---	1,068	72	Unknown
Elm R.	Jul-07	Aug-15	No	Yes	1,620	1,620	***2016***
Misery R.					---	---	Unknown
Barrier downstream	Jul-15	Aug-12	---	---	---	---	Unknown
Barrier upstream	Sep-00	Jun-12	---	No	---	---	Unknown
East Sleeping R.	Jul-13	Sep-15	Yes	Yes	---	---	***2016***[2]
West Sleeping R.	Jun-14	Aug-15	Yes	Yes	65,287	4,457	***2016***
Firesteel R.	Jul-15	Jun-15	---	---	---	---	***2016***[2]
Ontonagon R.	Sep-15	Aug-15	---	---	---	---	***2016***[2]
Potato R.	Jun-14	Aug-14	No	---	---	---	2017
Floodwood R.	Never	Jul-14	---	No	---	---	Unknown
Cranberry R.	Jun-14	Aug-14	No	---	---	---	2017
Mineral R.	Jun-14	Jul-15	No	Yes	12,927	0	2017
Big Iron R.	Never	Aug-15	No	Yes	---	---	Unknown
Little Iron R.	Sep-75	Aug-15	---	Yes	---	---	Unknown
Union R.	May-64	Jul-13	---	No	---	---	Unknown
Black R.	Jul-10	Aug-14	No	Yes	---	---	***2016***
Montreal R.	Jul-75	Aug-13	---	No	---	---	Unknown
Washington Cr.	Jun-80	Jul-12	---	No	---	---	Unknown
Bad R.	Oct-14	Sep-15	Yes	Yes	184,075	28,483	2017
Marengo River	Oct-14	Sep-15	Yes	Yes	75,069	5,177	***2016***
Fish Cr. (Eileen Twp)	Jun-15	Sep-15	No	---	---	---	Unknown
Sioux R.	Sep-14	Jul-15	No	No	---	---	Unknown
Pikes Cr.	Never	Sep-15	---	Yes	1,654	165	Unknown
Red Cliff Cr.	Jun-15	Aug-15	No	Yes	---	---	Unknown
Raspberry R.	Jun-63	Sep-15	---	Yes	---	---	***2016***
Sand R.	Sep-11	Aug-15	Yes	Yes	37,251	1,739	***2016***
Cranberry R. (Bayfield Iron R.	Jul-13	Jun-15	No	No	---	---	Unknown
Barrier downstream	Jul-13	Jul-15	Yes	Yes	4,608	2,258	***2016***
Barrier upstream	Oct-64	Sep-12	---	No	---	---	Unknown

Table 12. *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
Reefer Cr.	Oct-64	Sep-13	---	No	---	---	Unknown
Fish Cr. (Orienta Twp)	Oct-64	Aug-13	---	No	---	---	Unknown
Brule R.					---	---	Unknown
Barrier downstream	Jun-15	Sep-15	No	Yes	---	---	Unknown
Barrier upstream	Jun-86	Sep-12	---	No	---	---	Unknown
Poplar R.	Jun-15	Sep-15	No	Yes	---	---	Unknown
Middle R.					---	---	Unknown
Barrier downstream	Jul-13	Aug-15	No	Yes	8,772	100	2017
Amnicon R.	Jun-15	Sep-15	No	Yes	---	---	Unknown
Nemadji R.	Oct-14	Jul-15	Yes	No	---	---	Unknown
St. Louis R.	Sep-87	Aug-14	---	No	---	---	Unknown
Sucker R. (St. Louis Co.)	Never	Jun-14	---	No	---	---	Unknown
Gooseberry R.	Aug-76	Jul-15	---	No	---	---	Unknown
Splitrock R.	Aug-76	Jun-14	---	No	---	---	Unknown
Poplar R.	Jul-77	Jul-15	---	No	---	---	Unknown
Arrowhead R.	Jun-09	Jul-15	---	Yes	1,432	0	Unknown

[1] Stream being treated based on expert judgment
[2] Stream scheduled for treatment as part of Large Scale Treatment strategy.

Table 13. Status of larval Sea Lampreys in historically infested lentic areas of Lake Superior during 2015.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Goulais R.	Goulais Bay	Jul-15	Jul-15	Aug-85[1]
Havilland Cr.	Havilland Bay	Jul-14	Jul-14	Jun-15
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	Jun-15
Batchawana R.	Batchawana Bay	Sep-14	Jul-14	Jul-14[1]
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	Jul-15	Aug-12	Aug-14[1]
Gravel R.	Mountain Bay	Aug-15	Aug-15	Aug-13[1]
Little Gravel R.	Mountain Bay	Aug-15	Aug-15	Never[1]
Little Cypress R.	Cypress Bay	Aug-15	Aug-15	Never[1]
Cypress R.	Cypress Bay	Aug-14	Aug-14	Aug-15
Jackpine R.	Nipigon Bay	Jul-02	Jul-89	Never
Jackfish R.	Nipigon Bay	Aug-14	Aug-05	Never
Nipigon R.	Helen Lake	Aug-15	Aug-15	Aug-14[1]
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	Aug-15
MacKenzie R.	MacKenzie Bay	Aug-15	Aug-15	Aug-14[1]
Current R.	Thunder Bay	Aug-15	Aug-15	Aug-14
Neebing-McIntyre Floodway	Thunder Bay	Aug-14	Jul-90	Never
Kaministiquia R. (Lower)	Thunder Bay	Aug-15	Aug-15	Aug-15[1]
Pigeon R.	Pigeon Bay	Aug-15	Aug-15	Aug-10[2]
United States				
Pendills Cr.	Tahquamenon Bay	Jul-12	Jul-12	Never[2]
Grants Cr.	Tahquamenon Bay	Aug-15	Aug-15	Never[2]
Ankodosh Cr.	Tahquamenon Bay	Aug-15	Aug-15	Jul-11
Halfaday Cr.	Tahquamenon Bay	Jul-12	Jul-12	Never[2]
Roxbury Cr	Tahquamenon Bay	Aug-15	Aug-15	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	Aug-15
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 13. *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	Jun-15
Dead R.	Presque Isle Harbor	Jun-13	Jun-13	Jun-15
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	May-15	May-15	Jun-15
Ravine R.	Huron Bay	Aug-14	Aug-14	Jun-12
Slate R.	Huron Bay	Aug-15	Aug-15	Sep-15
Silver R.	Huron Bay	Aug-14	Aug-14	Aug-11[1]
Falls R.	Huron Bay	Jul-15	Jul-15	Sep-15
Trap Rock R.	Torch Lake	Jun-14	Jun-14	Sep-15
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-15	Aug-15	Sep-14[1]
Fish Cr. (Eileen Twp.)	Chequamegon Bay	Aug-15	Aug-06	Never[2]
Red Cliff Cr.	Buffalo Bay	Aug-11	Jun-97	Never
Sand R. (Bayfield Twp.)	Sand Bay	Aug-15	Aug-15	Aug-10[2]
Amnicon R.	Superior Bay	Aug-15	Aug-12	Never

[1] Scheduled for treatment during 2016
[2] Low-density larval population monitored with 3.2% granular Bayluscide surveys

Table 14. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Superior for larval assessment purposes during 2015.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Goulais R. (lentic)	2.80	0.50
Chippewa R. (lotic)	1.68	0.30
Michipicoten R. (lotic)	1.40	0.25
White R. (lotic)	3.36	0.60
Little Pic R. (lentic)	1.68	0.30
Gravel R. (lentic)	1.68	0.30
Little Gravel R. (lentic)	2.80	0.40
Little Cypress R. (lentic)	1.40	0.25
Nipigon R. (Lake Helen) (lentic)	1.68	0.30
Nipigon R. (lotic)	5.04	0.90
Black Sturgeon R. (lotic)	3.36	0.60
Wolf R. (lotic)	0.84	0.15
Pearl R. (lotic)	0.84	0.15
MacKenzie R. (lentic)	1.68	0.30
Current R. (lentic)	0.84	0.15
Kaministiquia R. (lotic)	3.36	0.60
Pigeon R. (lentic)	1.68	0.30
Pigeon R. (lotic)	0.56	0.10
Total (Canada)	**36.68**	**6.45**
United States		
Grants Creek (Lentic)	2.32	0.41
Ankodosh Creek (Lentic)	2.32	0.41
Roxbury Creek (Lentic)	2.32	0.41
Au Train River (Lotic)	0.87	0.16
Laughing Whitefish River (Lotic)	0.87	0.16
Dead River (Lotic)	2.32	0.41
Garlic River (Lotic)	2.90	0.52
Iron River (Lotic)	0.29	0.05
Slate River (Lentic)	2.90	0.52
Silver River (Lentic)	3.48	0.62
Falls River (Lentic)	2.90	0.52
Sturgeon River (Lentic)	3.19	0.57
Sturgeon River (Lotic)	0.44	0.08
Pilgrim River (Lotic)	0.87	0.16
Salmon Trout River (Lotic)	0.15	0.03
Ontonagon River (Lotic)	0.44	0.08
Ontonagon River (Lotic)	0.29	0.05
Black River (Lentic)	2.32	0.41
Black River (Lotic)	2.90	0.52
Fish Creek (Eileen Twp.) (Lentic)	1.74	0.31
Fish Creek (Eileen Twp.) (Lotic)	0.58	0.10
Sand River (Bayfield) (Lentic)	2.32	0.41
Sand River (Bayfield) (Lotic)	1.16	0.21
Iron River (Lotic)	1.16	0.21
Middle River (Lotic)	1.16	0.21
Amnicon River (Lentic)	2.32	0.41
Amnicon River (Lotic)	1.16	0.21
Nemadji River (Lotic)	0.53	0.09
Total (United States)	**46.22**	**8.25**
Total for Lake	**82.90**	**14.70**

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

Lake Michigan

- Larval assessment surveys were conducted on 121 tributaries and 14 lentic areas. The status of larval Sea Lamprey populations in historically infested Lake Michigan tributaries and lentic areas is presented in Tables 15 and 16.

- Surveys to estimate the abundance of larval Sea Lampreys were conducted in 20 tributaries.

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 45 tributaries. A special appropriation from the State of Wisconsin to enhance Sea Lamprey control in Wisconsin waters led to additional surveys being conducted in 6 of these streams that had no history of infestation. No new Sea Lamprey infestations were discovered. The results of 22 gB surveys completed in the Fox River; Green Bay, Wisconsin, were also negative for Sea Lampreys.

- Post-treatment assessments were conducted in 22 tributaries and 4 lentic areas to determine the effectiveness of lampricide treatments during 2014 and 2015. Surveys indicated no additional treatments were required.

- Surveys to evaluate barrier effectiveness were conducted in 13 tributaries. Of these, surveys to evaluate habitat and determine presence/absence of native or Sea Lampreys were conducted in the Root, Oak, and Menomonee (Milwaukee River tributary) rivers, upstream from the first Sea Lamprey barrier on each stream. These surveys were required to assess barrier removal requests. Larval habitat was limited and no lampreys were detected.

- A two-year evaluation of larval and juvenile Sea Lamprey production potential was completed on Grand River tributaries upstream from the 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 2014-2015 study are pending.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 40.08 kg (active ingredient) of gB (Table 17).

Table 15. Status of larval Sea Lampreys in Lake Michigan tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2015.

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	Jun-15	No	Yes	---	---	2017[1]
Lower	Aug-13	Jul-15	No	No	---	---	2017[1]
Paquin Cr.	Oct-87	May-15	---	Yes	---	---	Unknown
Davenport Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Hog Island Cr.	Sep-13	Jun-14	No	---	---	---	2017[2]
Sucker R.	Jun-61	May-15	---	Yes	---	---	Unknown
Black R.	Jun-13	Sep-15	No	Yes	79,075	0	2017[2]
Mattix Cr.	Aug-15	May-15	---	---	---	---	Unknown
Mile Cr.	Oct-13	Aug-14	Yes	No	---	---	Unknown
Millecoquins R.	Sep-13	Jul-15	Yes	Yes	79,840	670	2017[2]
Rock R.	Sep-13	Jun-14	Yes	---	---	---	Unknown
Crow R.	Aug-13	Jun-14	No	---	---	---	2017[1]
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	---	---	2017[1]
Swan Cr.	Jul-13	Aug-14	No	No	---	---	Unknown
Seiners Cr.	May-84	May-12	---	Yes	---	---	Unknown
Milakokia R.	Jul-13	Sep-15	Yes	Yes	48,236	24,896	***2016***
Bulldog Cr.	Sep-13	Jun-14	No	---	---	---	Unknown
Gulliver Lake Outlet	Sep-13	Jun-14	No	---	---	---	Unknown
Marblehead Cr.	Sep-13	Jun-15	Yes	---	---	---	***2016***
Manistique R.	Sep-14	Oct-15	Yes	Yes	515,692	4,676	***2016***
Southtown Cr.	Jul-13	Jun-15	No	No	---	---	Unknown
Thompson Cr.	Never	Jun-14	---	Yes	---	---	Unknown
Johnson Cr.	Jun-13	Jun-15	No	No	---	---	Unknown
Deadhorse Cr.	Sep-13	Jun-14	Yes	---	---	---	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	Aug-15	No	Yes	428	0	2017[1]
Little Fishdam R.	May-01	Jul-15	---	No	---	---	Unknown
Big Fishdam R.	Sep-11	Jul-15	Yes	Yes	29,846	5,777	***2016***
Sturgeon R.	Aug-15	Aug-15	---	---	---	---	2017[1]
Ogontz R.	Oct-14	Aug-15	Yes	---	5,870	2,825	***2016***
Squaw Cr.	May-12	Jun-15	No	Yes	---	---	2017[1]
Hock Cr.	May-81	Aug-14	---	Yes	---	---	Unknown
Whitefish R.	May-15	Aug-15	Yes	---	28,013	5,441	***2016***
Rapid R.	May-15	Jul-15	Yes	---	---	---	2017[1]
Tacoosh R.	Oct-14	May-15	No	---	---	---	Unknown

Table 15. *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-15	Jul-15	---	---	---	---	***2016***
Barrier upstream	Oct-11	Jul-14	Yes	No	---	---	Unknown
Escanaba R.	Never	Jun-15	---	Yes	---	---	Unknown
Portage Cr.	Oct-09	May-14	---	Yes	---	---	Unknown
Ford R.	Oct-14	May-15	Yes	---	---	---	2017[2]
Sunnybrook Cr.	May-71	Jun-13	---	Yes	---	---	Unknown
Bark R.	Apr-15	Jun-15	No	---	---	---	Unknown
Cedar R.	Oct-14	Jun-15	No	---	---	---	2017[2]
Sugar Cr.	May-08	Jun-15	---	No	---	---	Unknown
Arthur Bay Cr.	Jun-10	Jun-15	---	Yes	---	---	Unknown
Rochereau Cr.	Apr-63	Aug-14	---	No	---	---	Unknown
Johnson Cr.	May-10	Jun-15	---	No	---	---	Unknown
Bailey Cr.	Apr-15	Jul-15	Yes	---	---	---	Unknown
Beattie Cr.	Apr-15	Jul-15	Yes	---	---	---	Unknown
Springer Cr.	Apr-13	Jun-15	No	No	---	---	Unknown
Menominee R.	Jun-07	Jun-15	---	Yes	18,596	9,298	***2016***
Little R.	Aug-77	Jul-14	---	No	---	---	Unknown
Peshtigo R.	Oct-15	Sep-15	---	---	---	---	Unknown
Oconto R.	Apr-15	Sep-15	No	No	---	---	Unknown
Pensaukee R.	Nov-77	Jun-15	---	No	---	---	Unknown
Suamico R.	Never	Jun-12	---	Yes	---	---	Unknown
Ephraim Cr.	Apr-63	Jun-15	---	No	---	---	Unknown
Hibbards Cr.	May-07	May-14	---	Yes	---	---	2017[1]
Whitefish Bay Cr.	May-87	Jun-15	---	Yes	705	282	***2016***
Shivering Sands Cr.	Apr-12	May-14	Yes	No	---	---	Unknown
Lilly Bay Cr.	Apr-63	May-14	---	No	---	---	Unknown
Bear Cr.	May-75	Jul-15	---	No	---	---	Unknown
Door Co. 23 Cr.	May-07	Sep-15	---	Yes	198	18	Unknown
Silver Creek	Never	Jul-15	---	Yes	---	---	Unknown
Ahnapee R.	Apr-64	Sep-15	---	No	---	---	Unknown
Three Mile Cr.	May-14	Aug-14	Yes	No	---	---	Unknown
Kewaunee R.							
Barrier downstream	May-75	Jul-15	---	Yes	---	---	Unknown
Barrier upstream	May-75	Jul-15	---	Yes	---	---	Unknown
Casco Cr.	May-14	Jul-15	Yes	No	---	---	Unknown
Scarboro Cr.	May-75	Jul-15	---	Yes	---	---	Unknown
East Twin R.	Oct-08	Aug-14	---	Yes	---	---	Unknown
Fischer Cr.	May-87	Jul-15	---	No	---	---	Unknown
French Farm Cr.	Never	May-15	---	No	---	---	Unknown
Carp Lake Outlet	Sep-13	May-15	No	Yes	---	---	2017
Big Stone Cr.	Sep-13	Oct-13	No	---	---	---	Unknown
Big Sucker R.	Sep-13	Sep-13	---	---	---	---	Unknown
Wycamp Lake Outlet	Sep-13	Jun-14	No	---	---	---	Unknown
Bear R.	Never	Jun-14	---	No	---	---	Unknown
Horton Cr.	Sep-13	Jun-14	No	---	---	---	2017
Boyne R.	Jul-15	Sept-15	No	---	---	---	2019[2]

Table 15. *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
Porter Cr.	Sep-13	Jun-14	---	No	---	---	2017
Jordan R.	Aug-15	May-15	---	---	---	---	2019[2]
Monroe Cr.	Aug-13	Jun-14	No	---	---	---	Unknown
Loeb Cr.	Aug-13	Jun-14	---	---	---	---	Unknown
McGeach Cr.	Oct-99	May-15	---	No	---	---	Unknown
Elk Lake Outlet	Jul-11	Jun-14	No	No	---	---	Unknown
Yuba Cr.	May-06	Jun-14	---	No	---	---	Unknown
Acme Cr.	Aug-63	May-15	---	No	---	---	Unknown
Mitchell Cr.	Jun-13	May-15	No	Yes	---	---	2018
Boardman R. (lower)	Aug-15	Aug-15	---	---	---	---	2019
Boardman R. (mid.)	Aug-15	Aug-15	---	---	---	---	2019
Hospital Creek	Aug-15	Aug-15	---	---	---	---	2019
Leo Cr.	Never	Jun-13	---	No	---	---	Unknown
Leland River	Never	Jun-14	---	No	---	---	Unknown
Good Harbor Cr.	Jul-10	May-15	---	No	---	---	Unknown
Crystal R.	Nov-11	Jun-14	No	No	---	---	Unknown
Platte R. (upper)	Jun-14	May-15	Yes	Yes	---	---	2017[2]
Platte R. (middle)	Jun-14	May-15	---	---	---	---	2017[2]
Platte R. (lower)	Jun-14	May-15	Yes	Yes	---	---	2017[2]
Betsie R.	Jul-14	May-15	No	No	---	---	2017[2]
Bowen Cr.	Jun-09	Jul-15	---	No	---	---	Unknown
Big Manistee R.	Aug-13	Oct-15	No	Yes	---	---	***2016***[2]
Bear Cr.	Jul-13	Oct-15	No	Yes	---	---	***2016***[2]
L. Manistee R.	Jul-15	Jul-15	No	---	---	---	2018[2]
Gurney Cr.	Aug-09	Jul-15	---	Yes	3,841	549	***2016***
Cooper Cr.	Jul-08	Jul-15	---	No	---	---	Unknown
Lincoln R.	Jun-14	Oct-14	No	---	---	---	2018[2]
Pere Marquette R.	Sep-14	Aug-15	Yes	Yes	---	---	2017[2]
Bass Lake Outlet	Aug-78	Jul-15	---	No	---	---	Unknown
Pentwater R. (N. Br.)	Jul-13	Oct-15	Yes	Yes	139,721	8,017	***2016***
South Branch	Never	Oct-09	---	No	---	---	Unknown
Lambricks Cr.	Sep-84	Aug-14	---	No	---	---	Unknown
Stony Cr.	Jun-10	Oct-15	---	No	---	---	Unknown
Flower Cr.	Jun-11	Sep-15	No	Yes	---	---	2017
White R.	Sep-14	May-15	No	--	---	---	2017[2]
Duck Cr.	Jul-84	May-15	---	No	---	---	Unknown
Muskegon R.	Sep-14	May-15	Yes	---	---	---	2017[2]
Brooks Cr.	Sep-14	May-15	No	---	---	---	2017[2]
Cedar Cr.	Sep-14	May-15	No	---	---	---	2017[2]
Bridgeton Cr.	Sep-14	May-15	No	---	---	---	2017[2]
Minnie Cr.	Sep-14	May-15	No	---	---	---	2017[2]
Bigelow Cr.	Jul-15	Jun-15	---	---	---	---	2017[2]
Big Bear Cr.	Aug-70	May-15	---	No	---	---	Unknown
Mosquito Cr.	Sep-68	Aug-14	---	No	---	---	Unknown
Black Cr.	Aug-08	Jul-13	---	No	---	---	Unknown
Grand R.	Never	Jul-12	---	No	---	---	Unknown
Norris Cr.	Aug-08	May-15	---	No	---	---	Unknown

Table 15. *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
Lowell Cr	Sep-65	Jun-13	---	No	---	---	Unknown
Buck Cr.	Sep-65	Oct-15	---	No	---	---	Unknown
Rush Cr.	Sep-65	Oct-15	---	No	---	---	Unknown
Sand Cr.	Jun-07	Oct-15	---	No	---	---	Unknown
Crockery Cr.	Jul-12	May-15	No	Yes	---	---	2017
Bass R.	Aug-04	Oct-15	---	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	Jun-15	No	No	---	---	Unknown
Sand Cr.	Sep-10	Sep-15	---	Yes	---	---	2017
Mann Cr.	Oct-12	Sep-15	Yes	Yes	6,626	1,046	***2016***
Rabbit R.	Sep-15	Jul-15	No	---	---	---	Unknown
Swan Cr.	Jul-13	Sep-15	No	No	---	---	Unknown
Allegan 3 Cr.	Sep-65	Jul-13	---	No	---	---	Unknown
Allegan 4 Cr.	Oct-78	May-15	---	Yes	---	---	Unknown
Allegan 5 Cr.	Jul-14	Oct-15	---	---	---	---	Unknown
Black R.							
North Branch	Jun-77	May-15	---	No	---	---	Unknown
Middle Branch	Sep-15	Jul-14	---	Yes			2019
South Branch	Never	Sep-15	---	Yes	---	---	Unknown
Brandywine Cr.	Aug-85	Sep-14	---	No	---	---	Unknown
Rogers Cr.	May-98	Sep-15	---	Yes	---	---	2017
St. Joseph R.	Never	Jul-10	---	No	---	---	Unknown
Lemon Cr.	Oct-65	Sep-11	---	No	---	---	Unknown
Pipestone Cr.	May-14	Oct-14	---	--	---	---	Unknown
Meadow Dr.	Oct-65	Sep-11	---	No	---	---	Unknown
Hickory Cr.	Jul-15	Aug-15	No	---	---	---	Unknown
Paw Paw R.	Sep-15	Jun-15	---	---	---	---	2018
Blue Cr.	Sep-15	Jun-15	---	---	---	---	2018
Mill Cr.	Sep-15	Jun-15	---	---	---	---	2018
Brandywine Cr.	Sep-15	Jun-15	---	---	---	---	2018
Brush Cr.	Sep-15	Jun-15	---	---	---	---	2018
Hayden Cr.	Sep-15	Jun-15	---	---	---	---	2018
Campbell Cr.	Sep-15	Jun-15	---	---	---	---	2018
Galien R. (N. Br.)	Oct-10	Sep-15	---	Yes	9,078	1,057	***2016***
E. Br. & Dowling Cr.	Oct-10	Sep-15	---	No	---	---	***2016***
S. Br. & Galina Cr.	Oct-12	Sep-15	---	Yes	---	---	***2016***
Spring Cr.	Oct-12	Sep-15	---	Yes	---	---	***2016***
S. Br. Spring Cr.	Oct-12	Sep-15	---	Yes	---	---	***2016***

Table 15. *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
State Cr.	Apr-14	Jul-14	---	---	---	---	Unknown
Trail Cr.	Apr-14	Sep-15	---	No	---	---	Unknown
Donns Cr.	May-66	Sep-15	---	No	---	---	Unknown
Burns Ditch	Jun-15	Sep-15	No	---	---	---	Unknown

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

Table 16. Status of larval Sea Lampreys in historically infested lentic areas of Lake Michigan during 2015.

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)	Aug-15	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)	Jul-15	Jul-15	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 (Offshore)	Sep-11	Aug-94	Never
Ogontz R.	Big Bay De Noc (Offshore)	Jul-15	Jul-15	Sep-14
Whitefish R.	Little Bay De Noc	Jun-13	Aug-93	Never[1]
Rapid R.	Little Bay De Noc	Jul-14	Jun-13	May-15
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	Jun-15	Jul-13	Jun-10
Beattie Cr.	Green Bay	Jul-08	Jul-85	Never
Menominee R.	Green Bay	Sep-15	Sep-15	Never[1]
Peshtigo R.	Green Bay	Sep-15	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	Aug-15
Porter Cr.	Lake Charlevoix	Jun-14	Jun-14	Sep-13
Jordan R.	Lake Charlevoix	Jun-14	Jun-14	Aug-15
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)	Jul-15	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-15	Jul-08	Never[1]
	Manistee Lake (Little Manistee – Offshore)	Jul-15	Jul-08	Jul-08

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

Table 17. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Michigan for larval assessment purposes during 2015.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Black River (Lentic)	2.32	0.41
Millecoquins River (Lentic)	2.32	0.41
Manistique River (Lentic)	1.16	0.21
Manistique River (Lotic)	1.74	0.31
Sturgeon River (Lentic)	2.32	0.41
Ogontz River (Lentic)	1.16	0.21
Days River (Lentic)	1.16	0.21
Escanaba River (Lentic)	2.32	0.41
Escanaba River (Lotic)	1.74	0.31
Ford River (Lentic)	2.32	0.41
Cedar River (Lentic)	2.32	0.41
Menominee River (Lentic)	2.32	0.41
Peshtigo River (Lentic)	2.32	0.41
Fox River (Lotic)	6.38	1.14
Kewaunee River (Lotic)	1.74	0.31
Boardman R. (lentic)	1.68	0.30
Manistee R. (lotic)	4.76	0.85
Total for Lake	**40.08**	**7.13**

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

Lake Huron

- Larval assessment surveys were conducted on 100 tributaries (39 Canada, 61 U.S.) and 14 lentic areas (5 Canada, 9 U.S.). The status of larval Sea Lamprey populations in historically infested Lake Huron tributaries and lentic areas are presented in Tables 18 and 19.

- Surveys to estimate abundance of larval Sea Lampreys were conducted in 25 tributaries (10 Canada, 15 U.S.) and 2 lentic areas (1 Canada; 1 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 20 tributaries (2 Canada; 18 U.S.). A new population of Sea Lampreys was found in the Gogomain River.

- Post-treatment assessments were conducted in 26 tributaries (11 Canada; 15 U.S.) to determine the effectiveness of lampricide treatments during 2014 and 2015. The Root and Garden rivers are scheduled for 2016 treatments based on the presence of residual Sea lampreys.

- Surveys to evaluate barrier effectiveness in 9 tributaries (2 Canada; 7 U.S.) revealed no evidence of escapement.

- Monitoring of larval Sea Lampreys in the St. Marys River continued during 2015. Eight hundred ninety six geo-referenced sites were sampled using deep-water electrofishers. Surveys were conducted according to a stratified, systematic sampling design. The larval Sea Lamprey population in the St. Marys River was estimated to be 0.7 million (95% confidence limits 0.1-1.3 million).

- More than 6,800 Sea Lamprey larvae were collected for research purposes from the Black and Cass rivers.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 44.76 kg (active ingredient) of gB (Table 20).

Table 18. Status of larval Sea Lampreys in Lake Huron tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2015.

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.	Jul-15	Aug-15	Yes	Yes	721,000	---	***2016***
Whitefish Ch.	Oct-13	Sep-15	Yes	Yes	49,167	933	***2016***
Root R.	Sep-14	Oct-15	---	---	16,697	9,601	***2016***
Garden R.	Jul-14	Aug-15	Yes	Yes	1,181,999	143,404	***2016***
Driving Cr.	May-15	May-15	---	---	---	---	2018
Echo R.							
Upper	Jul-11	Jun-15	No	No	---	---	Unknown
Lower	Sep-71	Aug-91	---	No	---	---	Unknown
Bar & Iron Cr.	Jun-15	Jun-15	---	---	---	---	2019
Bar R.	Oct-11	Jul-14	No	No	---	---	Unknown
Sucker Cr.	Apr-12	Jul-15	No	No	---	---	Unknown
Two Tree R.	May-15	Jul-15	No	No	---	---	Unknown
Richardson Cr.	Aug-11	Jun-14	No	No	---	---	Unknown
Watson Cr.	May-15	Jul-15	No	Yes	---	---	2019
Gordon Cr.	Sep-11	Jun-14	No	No	---	---	Unknown
Browns Cr.	Sep-11	Aug-15	No	Yes	709	118	***2016***
Koshkawong R.	May-15	Jul-15	No	---	---	---	2019
No Name (H-65)	Jun-13	Jun-15	No	Yes	---	---	Unknown
No Name (H-68)	Sep-75	Sep-15	---	Yes	---	---	2017
MacBeth Cr.	Jun-67	Jun-14	---	Yes	---	---	Unknown
Thessalon R.							
Upper	Aug-11	Jul-15	No	Yes	---	---	2019
Lower	Jul-14	Jul-14	No	---	---	---	2017
Livingstone Cr.	Jun-13	Jun-15	No	No	---	---	Unknown
Mississagi R.	Aug-13	Jun-14	No	No	---	---	2017[1]
Harris/Bolton Cr.	Jul-12	Aug-15	No	Yes	4,655	0	2017
Blind R.	May-84	Jun-15	---	No	---	---	Unknown
Lauzon R.	Jun-15	Jun-15	No	No	---	---	Unknown
Spragge Cr.	Oct-95	Jun-15	No	No	---	---	Unknown
No Name (H-114)	Jun-15	Jun-15	No	Yes	---	---	Unknown
Marcellus Cr.	Jun-13	Jun-15	No	No	---	---	Unknown
Serpent R.							
Main	Jun-12	Aug-15	No	Yes	69,479	799	***2016***
Grassy Cr.	Jun-11	Jun-15	No	Yes	---	---	***2016***[1]
Spanish R.							
Main	Sep-15	Sep-12	---	---	---	---	2020
LaCloche Cr.	Jun-14	Sep-15	No	No	---	---	2019
Birch Cr.	Jun-14	Jun-15	No	No	---	---	2018
Aux Sables R.	Sep-15	Sep-14	---	---	---	---	2020
Kagawong R.	Aug-67	Jun-15	---	No	---	---	Unknown
Unnamed (H-267)	May-11	Jun-15	No	Yes	---	---	2017
Silver Cr.	May-11	Aug-15	No	Yes	24,091	7,367	***2016***
Sand Cr.	Oct-15	Jul-12	---	---	---	---	2020
Mindemoya R.	Sep-15	Aug-15	---	---	---	---	2020
Timber Bay Cr.	Sep-15	Jun-14	---	---	---	---	2020

Table 18. *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.	Sep-15	Sep-14	---	---	---	---	2020
Manitou R.	Aug-13	Jun-14	No	No	---	---	2018
Blue Jay Cr.	Sep-15	Jun-15	---	---	---	---	2020
Kaboni Cr.	Oct-78	Jun-15	---	---	---	---	Unknown
Chikanishing R.	Jun-03	May-15	---	---	---	---	Unknown
French R. System							
O.V. Channel	Jun-12	May-15	Yes	Yes	---	---	Unknown
Wanapitei R.	Jun-11	May-15	No	No	---	---	Unknown
Key R. (Nesbit Cr.)	Sep-72	May-15	---	No	---	---	Unknown
Still R.	Jun-96	May-15	No	Yes	---	---	Unknown
Magnetawan R.	Jul-15	Aug-15	No	---	---	---	2019
Naiscoot R.	May-13	May-15	No	Yes	19,009	809	***2016***
Shebeshekong R.	Never	Jun-13	---	No	---	---	Unknown
Boyne R.	May-13	May-15	No	Yes	---	---	2017
Musquash R.	Aug-13	May-14	No	No	---	---	Unknown
Simcoe/Severn	Never	May-14	---	Yes	---	---	Unknown
Coldwater R.	Never	Sep-15	---	No	---	---	Unknown
Sturgeon R.	Apr-12	May-14	No	No	---	---	Unknown
Hog Cr.	Sep-78	Sep-15	---	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	Sep-15	Yes	Yes	81,804	21,209	***2016***
Marl Cr.	Apr-13	Jun-13	No	No	---	---	Unknown
Pretty R.	May-72	May-15	---	No	---	---	Unknown
Silver Cr.	Sep-82	May-15	---	No	---	---	Unknown
Bighead R.	Aug-15	Sep-15	No	No	---	---	2018
Bothwells Cr.	Jun-79	May-15	---	No	---	---	Unknown
Sydenham R.	Jun-72	May-15	---	No	---	---	Unknown
Sauble R.	Jun-04	May-15	---	Yes	---	---	2017
Saugeen R.	Jun-71	May-14	---	No	---	---	Unknown
Bayfield R.	Jun-70	May-13	---	No	---	---	Unknown
United States							
Mission Cr.	Never	Jun-12	---	No	---	---	Unknown
Frenchette Cr.	Never	Jun-12	---	No	---	---	Unknown
Ermatinger Cr.	Never	Jun-12	---	No	---	---	Unknown
Charlotte R.	Oct-11	Jul-14	---	No	---	---	Unknown
Little Munuscong R.	Oct-10	Aug-15	---	Yes	101,727	8,185	***2016***
Big Munuscong R.	Jun-99	Jun-12	---	No	---	---	Unknown
Taylor Cr.	Jul-15	Sep-15	No	---	---	---	Unknown
Carlton Cr.	Jul-15	Sep-15	No	Yes	---	---	Unknown
Canoe Lake Outlet	May-70	Apr-13	---	No	---	---	Unknown
Caribou Cr.	Jun-11	Sep-14	No	Yes	---	---	Unknown

Table 18. *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
Gogomain River	Never	Aug-15	---	Yes	1,378	919	***2016***
Bear Lake Outlet	Jun-11	Aug-15	No	Yes	2,881	152	***2016***
Carr Cr.	Jun-13	Jun-15	---	Yes	---	---	Unknown
Joe Straw Cr.	Jun-13	Jun-15	---	No	---	---	Unknown
Huron Point Cr.	Jun-13	Aug-15	No	Yes	---	---	Unknown
Saddle Cr.	Never	Oct-12	---	No	---	---	Unknown
Albany Cr.	Jul-15	Sep-15	No	---	---	---	Unknown
Barrier upstream	Jul-07	Aug-15	No	No	---	---	Unknown
Trout Cr.	Jul-15	Sep-15	No	---	---	---	Unknown
Beavertail Cr.	May-11	Jun-14	No	Yes	---	---	Unknown
Prentiss Cr.	May-11	Jul-15	Yes	Yes	7,050	176	2017
McKay Cr.	May-11	May-14	Yes	Yes	---	---	Unknown
Flowers Cr.	Jun-13	Apr-13	---	---	---	---	Unknown
Ceville Cr.	Jun-13	Aug-15	No	Yes	2,272	393	***2016***
Hessel Cr.	Jul-15	Sep-15	No	---	---	---	Unknown
Steeles Cr.	May-11	Aug-15	No	Yes	491	197	***2016***
Nunns Cr.	Aug-13	Sep-15	---	---	---	---	***2016***
Barrier upstream	May-96	Sep-15	---	Yes	1,456	1,456	***2016***
Pine R.	Jun-15	Sep-14	Yes	Yes	---	---	Unknown
McCloud Cr.	Jul-15	Sep-15	No	---	---	---	Unknown
Carp R.	Jun-14	Aug-15	Yes	Yes	292,444	0	Unknown
Martineau Cr.	Jun-12	Aug-15	No	Yes	1,631	544	***2016***
Hoban Cr.	Jun-12	Jun-15	No	No	---	---	Unknown
266-20 Cr.	Aug-76	Jul-15	---	No	---	---	Unknown
Beaugrand Cr.	Never	Jul-15	---	Yes	285	250	***2016***
Little Black R.	May-67	May-14	---	No	---	---	Unknown
Cheboygan R.	Oct-83	Sep-15	---	Yes	---	---	Unknown
Laperell Cr.	May-00	Jun-13	---	No	---	---	Unknown
Meyers Cr.	Sep-99	Jun-13	---	No	---	---	Unknown
Maple R.	Sep-12	Sept-15	No	Yes	---	---	***2016***[1]
Pigeon R.	Aug-12	Sept-15	Yes	Yes	---	---	***2016***[1]
Little Pigeon R.	Aug-12	Sept-15	No	No	---	---	Unknown
Sturgeon R.	Sep-12	Sept-15	Yes	Yes	---	---	***2016***[1]
Elliot Cr.	Jun-13	Jul-15	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	Aug-15	Yes	Yes	1,028	228	***2016***
Grace Cr.	Jun-13	Aug-15	No	Yes	529	0	2017
Black Mallard Cr.	May-15	Aug-15	Yes	Yes			2018
Seventeen Cr.	Jul-12	Jun-13	No	No	---	---	Uknown
Ocqueoc R.							
Barrier downstream	Jun-13	Sep-15	No	Yes	23,868	4,187	***2016***
Barrier upstream	Oct-14	Jun-15	No	No	---	---	Unknown
Johnny Cr.	Sep-70	Sep-11	---	No	---	---	Unknown

Table 18. *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
Schmidt Cr.							
Lower	Jun-13	Sep-13	No	Yes	---	---	2017
Upper	May-08	Jun-13	---	No	---	---	Unknown
Nagels Cr.	Never	Jun-15	---	No	---	---	Unknown
Trout R.							
Barrier Downstream	Jun-13	Jun-15	No	Yes	7,516	1,444	***2016***
Barrier upstream	Oct-07	Jun-15	---	No	---	---	Unknown
Swan R.	Jun-10	Jul-15	---	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-15	Yes	Yes	10,445	335	***2016***
Squaw Cr.	Jun-13	Sep-13	---	No	---	---	Unknown
Devils R.	Oct-14	Jun-15	No	No	---	---	2018
Black R.	Aug-15	Aug-15	Yes	---	---	---	2019
Mill Cr.	Never	Jun-15	---	No	---	---	Unknown
Au Sable R.	Jul-15	Sep-15	Yes	---	---	---	2018
Pine R.	May-87	Sep-15	---	No	---	---	Unknown
Tawas Lake Outlet	Jun-15	Aug-15	No	No	---	---	2018
Cold Cr.	Jul-13	Aug-15	No	Yes	---	---	2017
Sims Cr.	Jul-09	Jun-14	---	No	---	---	Unknown
Grays Cr.	Sep-05	Jun-14	---	No	---	---	Unknown
Silver Cr.	Jun-15	Aug-15	No	No	---	---	2018
East Au Gres R.	Jul-13	Aug-15	No	Yes	50,513	3,988	***2016***
Au Gres R.	Apr-14	Aug-15	Yes	Yes	---	---	2017
Rifle R.	Aug-14	Aug-15	No	No	---	---	2017
Saginaw R.							
Shiawassee R.	May-15	Sep-15	Yes	Yes	---	---	2017
Cass R.	May-15	Sep-15	No	No	---	---	2018
Juniata Cr.	May-15	Sep-15	No	No	---	---	2018
Scott Drain	May-15	Sep-15	No	No	---	---	2018
Goodings Cr.	May-15	Sep-15	No	No	---	---	2018
Perry Creek	May-15	Sep-15	---	No	---	---	2018
West Wells Cr.	May-15	Sep-15	No	No	---	---	2018
Flint River	Never	Sep-15	---	No	---	---	Unknown
Armstrong Cr.	May-15	Sep-15	No	No	---	---	2018
Tittabawassee R.	Never	Jun-13	---	No	---	---	Unknown
Chippewa R.	May-14	Sep-15	No	Yes	145,457	46,431	***2016***
Pine R.	May-15	Oct-15	No	No	---	---	***2016***
Carroll Cr.	May-14	Oct-15	No	Yes	---	---	2017
Big Salt R.	May-15	Sep-15	No	No	---	---	***2018***
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	---	No	---	---	Unknown

Table 19. Status of larval Sea Lampreys in historically infested lentic areas of Lake Huron during 2015.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Echo River	Echo Lake	Jul-14	Jul-14	Jun-15
	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-15	Jun-15	Jun-15[2]
Lauzon R.	North Channel	Jun-14	Jun-14	Jun-15
Unnamed (H-114)	North Channel	Sep-14	Sep-14	Jun-15
Kagawong R.	Mudge Bay	Jun-15	Jun-15	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	Aug-15	Aug-15	Jun-12
United States				
Caribou Cr.	Caribou Cr. (Offshore)	Jul-13	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	Aug-15	Aug-15	Never[1]
McCloud Cr.	St. Martin Bay	Aug-15	Aug-15	Never
Carp R.	St. Martin Bay	Aug-15	Jun-12	Jun-14
Martineau Cr.	Horseshoe Bay	Aug-15	Sep-14	Never[1]
Cheboygan R.	Straits of Mackinac	Sep-15	Aug-93	Never
Sturgeon R.	Burt Lake	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)	Aug-15	Sep-14	Aug-15
East Au Gres R.	East Au Gres R.	Aug-15	Jun-86	Never

[1] Low-density larval population monitored with Bayluscide 3.2% Granular Sea Lamprey lampricide surveys.
[2] Scheduled for treatment during 2016.

Table 20. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Huron for larval assessment purposes during 2015.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Mississagi R. (lentic)	4.20	0.75
Blind R. (lotic)	0.84	0.15
Serpent R. (lotic)	3.36	0.60
Whitefish R. (lotic)	0.84	0.15
Kagawong R. (lentic)	0.84	0.15
French R. System (lotic)	3.92	0.70
Key R. (lotic)	0.56	0.10
Still R. (lentic)	1.40	0.25
Still R. (lotic)	0.28	0.05
Magnetawan R. (lentic)	1.68	0.30
Bighead R. (lentic)	0.56	0.10
Bighead R. (lotic)	1.12	0.20
Sauble R. (lotic)	1.68	0.30
Total (Canada)	**21.28**	**3.80**
United States		
Little Munuscong River (Lotic)	0.87	0.16
Gogomain River (Lotic)	0.73	0.13
Pine River (Lentic)	2.90	0.52
McCloud Creek (Lentic)	1.74	0.31
Carp River (Lentic)	2.32	0.41
Martineau Creek (Lentic)	2.32	0.41
Cheboygan R. (lentic)	1.12	0.20
Cheboygan R. (lotic)	1.12	0.20
Thunder Bay R. (lentic)	1.12	0.20
Thunder Bay R. (lotic)	1.12	0.20
Au Sable R. (lentic)	2.80	0.50
Au Sable R. (lotic)	3.92	0.70
East Au Gres R. (lentic)	0.84	0.15
Au Gres R. (lentic)	0.56	0.10
Total (United States)	**23.48**	**4.19**
Total for Lake	**44.76**	**7.99**

[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 completed in 2015 to provide quantitative information on larval Sea Lamprey habitat and densities. This year was the second of a two year assessment, where larval densities in this portion of the St. Clair River were found to be very low.

- Larval assessments were conducted on 65 tributaries (30 Canada, 35 U.S.) and offshore of 1 U.S. tributary. The status of larval Sea Lampreys in historically infested Lake Erie tributaries and lentic areas is presented in Tables 21 and 22.

- Surveys to detect new larval populations were conducted in 38 tributaries (22 Canada, 16 U.S.). No new populations were discovered.

- Post-treatment assessments were conducted in 6 tributaries (1 Canada, 5 U.S.) to determine the effectiveness of lampricide treatments conducted during 2014 and 2015. Canadaway Creek will be treated again in 2016 based on the presence of residual Sea Lampreys.

- Surveys to evaluate barrier effectiveness were conducted in 14 tributaries (5 Canada, 9 U.S.).

- 2.4 ha of the St. Clair River was surveyed with gB, including the upper river and the three main delta channels. Twenty-four Sea Lampreys were captured throughout the river with no additional areas of high density detected.

- 1.1 ha of the Detroit River was surveyed with gB by the Department and Service crews. No Sea Lamprey larvae were collected.

- The second of a two year DWEF project in WIFN territorial waters on the St. Clair River was completed. No lampreys were collected in 2015 and only 7 Sea Lamprey larvae were collected in 2014.

- Larval Sea Lampreys were found upstream of the Bradley Creek confluence on the Catfish River system. Treatment is scheduled for 2016.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 22.96 kg (active ingredient) of gB (Table 23).

Table 21. Status of larval Sea Lampreys in Lake Erie tributaries with a history of Sea Lamprey production, and estimates of abundance from tributaries surveyed during 2015.

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	Apr-15	---	No	---	---	Unknown
Catfish Cr.	Never	Apr-15	---	Yes	---	---	***2016***
Bradley Cr.	Jun-13	Oct-15	Yes	Yes	---	---	***2016***
Silver Cr.	Oct-09	May-14	---	No	---	---	Unknown
Big Otter Cr.	Sep-13	Sep-15	No	Yes	---	---	***2016***
South Otter Cr.	Aug-10	Jun-15	---	No	---	---	Unknown
Clear Cr.	May-91	May-14	---	No	---	---	Unknown
Big Cr.	Sep-13	Sep-15	No	Yes	---	---	***2016***
Forestville Cr.	Aug-13	May-14	No	No	---	---	Unknown
Normandale Cr.	Jun-87	May-14	---	No	---	---	Unknown
Fishers Cr.	Jun-87	Jun-15	---	No	---	---	Unknown
Young's Cr.	Aug-13	Jun-15	No	No	---	---	Unknown
United States							
Buffalo R.	Never	Jun-14	---	No	---	---	Unknown
Buffalo Cr.	Jun-13	Jun-14	No	No	---	---	Unknown
Cayuga Cr.	Apr-15	Jun-14	---	---	---	---	Unknown
Cazenovia Cr.	Sept-13	Jun-14	No	---	---	---	Unknown
Big Sister Cr.	Apr-15	Sept-15	---	Yes	---	---	Unknown
Delaware Cr.	Jun-13	Aug-15	No	No	---	---	Unknown
Cattaraugus Cr.	Apr-13	Aug-15	Yes	Yes	---	---	***2016***
Halfway Br.	Oct-86	Apr-13	---	No	---	---	Unknown
Canadaway Cr.	Apr-15	Sept-15	Yes	No	---	---	***2016***
Chautauqua Cr.	Never	Jul-13	---	No	---	---	Unknown
Crooked Cr.	Oct-15	Aug-15	---	---	---	---	Unknown
Raccoon Cr.	May-15	Aug-15	No	No	---	---	Unknown
Conneaut Cr.	May-15	Aug-15	No	No	---	---	Unknown
Wheeler Cr.	Never	Aug-15	---	No	---	---	Unknown
Grand R.	Apr-13	Aug-15	No	Yes	---	---	***2016***
Chagrin R.	Never	Aug-15	---	No	---	---	Unknown
Lake St. Clair Tributaries							
St. Clair R.	Never	May-15	---	Yes	---	---	Unknown
Black R.	Never	Sep-15	---	No	---	---	Unknown
Mill Cr.	Never	May-13	---	No	---	---	Unknown
Pine R.	Apr-88	July-15	---	No	---	---	Unknown
Belle R.	Never	May-14	---	No	---	---	Unknown
Clinton R.	Never	July-15	---	Yes	---	---	Unknown
Paint Cr.	May-15	Jun-15	No	---	---	---	Unknown
Thames R.	Never	May-13	---	Yes	---	---	Unknown
Komoka Cr.	Aug-15	Oct-15	Yes	No	---	---	Unknown

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

Table 22. Status of larval Sea Lampreys in historically infested lentic areas of Lake Erie during 2015.

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	Aug-15	Jun-87	Never[1]

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

Table 23. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Erie for larval assessment purposes during 2015.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
St. Clair R. (lotic)	7.28	1.30
Detroit R. (lotic)	2.80	0.50
Total (Canada)	**10.08**	**1.80**
United States		
Grand R. (lentic)	0.56	0.10
Grand R. (lotic)	0.56	0.10
Chagrin R. (lotic)	1.12	0.20
Portage R. (lotic)	0.56	0.10
St. Clair R. (lotic)	6.72	1.20
Detroit R. (lotic)	3.36	0.60
Total (United States)	**12.88**	**2.30**
Total for Lake	**22.96**	**4.10**

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

Lake Ontario

- Larval assessments were conducted on 96 tributaries (65 Canada, 31 U.S.). The status of larval Sea Lampreys in historically infested Lake Ontario tributaries and lentic areas is presented in Tables 24 and 25.

- Surveys to estimate abundance of larval Sea Lampreys were conducted in 7 tributaries (5 Canada, 2 U.S.).

- Surveys to detect the presence of new larval Sea Lamprey populations were conducted in 67 tributaries (50 Canada, 17 U.S.). A new population, which included multiple age classes and juveniles was discovered in the Owasco Lake Outlet (Oswego River System), as a follow-up on a report that spawning adults had been observed.

- Post-treatment assessments were conducted in 16 tributaries (10 Canada, 6 U.S.) to determine the effectiveness of lampricide treatments conducted during 2014 and 2015. Surveys indicated no additional treatments were required.

- Surveys to evaluate barrier effectiveness were conducted in 8 tributaries (6 Canada, 2 U.S.).

- In 2015, two tributaries to the Credit River system were found to be infested for the first time. Multiple age classes including larval and juvenile life stages were found and are scheduled for treatment during 2016.

- Altmar Creek, a previously uninfested tributary to New York's Salmon River, was found to contain multiple age classes, including juvenile Sea Lampreys.

- Surveys were completed on Bowmanville Creek to evaluate the production potential of Sea Lamprey upstream from the Goodyear Veyance Dam by quantitatively assessing larval habitat and native lamprey abundance and distribution as a surrogate for Sea Lampreys. The larval population estimate of American Brook Lamprey (*Lethenteron appendix)* for the watershed above the Goodyear Veyance Dam was 267,969.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 9.24 kg (active ingredient) of gB (Table 26).

Table 24. Status of larval Sea Lampreys in Lake Ontario tributaries with a history of Sea Lamprey production and estimates of abundance from tributaries surveyed during 2015.

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	Jun-15	---	Yes	---	---	Unknown
Grindstone Cr.	Never	Jun-14	---	Yes	---	---	Unknown
Bronte Cr.	Jun-13	Aug-13	Yes	Yes	---	---	***2016***[1]
Sixteen Mile Cr.	Jun-82	Jul-14	No	No	---	---	Unknown
Credit R.	Jun-14	Oct-15	Yes	Yes	137,603	91,289	***2016***
Humber R.	Never	Jun-14	---	No	---	---	Unknown
Rouge R.	Jun-11	Jun-15	---	Yes	---	---	Unknown
Little Rouge. R.	Jun-15	Jun-15	No	No	---	---	Unknown
Petticoat Cr.	Sep-04	Jul-14	No	No	---	---	Unknown
Duffins Cr.	Jun-15	Jul-15	No	No	---	---	2018[1]
Carruthers Cr.	Sep-76	Jul-13	No	No	---	---	Unknown
Lynde Cr.	Jun-15	Jul-15	No	No	---	---	2018[1]
Oshawa Cr.	Jun-15	Jul-15	Yes	No	---	---	2018[1]
Farewell Cr.	Jun-15	Jul-15	Yes	No	---	---	2018[1]
Bowmanville Cr.	May-14	Jul-14	No	No	---	---	2017[1]
Wilmot Cr.	Jun-15	Jul-15	No	No	---	---	2018[1]
Graham Cr.	May-96	Jul-15	---	No	---	---	Unknown
Wesleyville Cr.	Oct-02	Jul-14	No	No	---	---	Unknown
Port Britain Cr.	Apr-12	Jul-15	---	Yes	5,930	1,399	**2016**
Gage Cr.	May-71	Jul-13	---	No	---	---	Unknown
Cobourg Br.	Oct-96	Jun-15	---	Yes	---	---	Unknown
Covert Cr.	Jun-13	Jun-15	Yes	No	14,050	2,632	***2016***
Grafton Cr.	May-14	Jul-14	No	No	---	---	Unknown
Shelter Valley Cr.	Sep-03	Jul-15	---	Yes	454	151	***2016***
Colborne Cr.	May-14	Jul-14	No	No	---	---	Unknown
Salem Cr.	Jun-15	Jul-15	Yes	No	---	---	2018[1]
Proctor Cr.	Jun-15	Jul-15	Yes	No	---	---	Unknown
Smithfield Cr.	Sep-86	Jul-15	No	No	---	---	Unknown
Trent R. (Canal System)	Sep-11	May-14	No	Yes	---	---	Unknown
Mayhew Cr.	Jun-15	Jul-15	No	No	---	---	2018[1]
Moira R.	Jun-15	Jul-15	Yes	No	---	---	Unknown
Salmon R.	Jun-00	Jun-15	---	Yes	2,935	677	***2016***
Napanee R.	Never	Jul-15	---	Yes	---	---	Unknown
United States							
Black R.	Aug-15	Aug-14	---	---	---	---	2018[1]
Stony Cr.	Sep-82	Aug-14	---	No	---	---	Unknown
Sandy Cr.	Never	Aug-14	---	No	---	---	Unknown
South Sandy Cr.	Apr-13	Aug-15	No	Yes	---	---	***2016***[1]

Table 24. *continued*

Tributary	Last Treated	Last Surveyed	Status of Larval Lamprey Population (surveys since last treatment) Residuals Present	Recruitment Evident	Estimate of Overall Larval Population	Abundance Estimate of Larvae >100mm	Expected Year of Next Treatment
Skinner Cr.	Apr-05	Aug-15	---	No	---	---	Unknown
Lindsey Cr.	Jun-14	Aug-15	Yes	Yes	---	---	2017[1]
Blind Cr.	May-76	Aug-14	---	No	---	---	Unknown
Little Sandy Cr.	May-13	Aug-15	No	Yes	---	---	***2016***[1]
Deer Cr.	Apr-04	Aug-14	No	No	---	---	Unknown
Salmon R.	May-14	Aug-14	Yes	Yes	---	---	2017[1]
Orwell Brook	May-14	Aug-15	No	No	---	---	Unknown
Trout Brook	May-14	Aug-14	Yes	Yes	---	---	2017[1]
Altmar Cr.	Oct-15	Aug-15	---	---	---	---	2017[1]
Grindstone Cr.	Apr-13	Aug-15	Yes	Yes	---	---	***2016***[1]
Snake Cr.	Apr-15	Aug-15	No	No	---	---	2017[1]
Sage Cr.	May-78	Jul-13	---	No	---	---	Unknown
Little Salmon R.	Apr-12	Aug-14	No	Yes	---	---	2017[1]
Butterfly Cr.	May-72	Apr-12	No	No	---	---	Unknown
Catfish Cr.	Apr-15	Aug-14	No	Yes	---	---	2018[1]
Oswego R.							
Black Cr.	May-81	Aug-14	No	No	---	---	Unknown
Big Bay Cr.	Sep-93	Aug-15	No	No	---	---	Unknown
Scriba Cr.	Jun-10	Apr-14	No	No	---	---	Unknown
Fish Cr.	Jun-13	Aug-15	No	Yes	---	---	***2016***[1]
Carpenter Br.	May-94	Apr-12	No	No	---	---	Unknown
Putnam Br./ Coldsprings Cr.	May-96	Aug-15	No	No	---	---	Unknown
Hall Br.	Never	Aug-15	---	No	---	---	Unknown
Crane Br.	Never	Apr-12	---	No	---	---	Unknown
Skaneateles Cr.	Never	Oct-10	---	No	---	---	Unknown
Owasco Outlet	Oct-15	Aug-15	---	---	---	---	Unknown
Rice Cr.	May-72	Aug-15	---	No	---	---	Unknown
Eight Mile Cr.	Apr-15	Aug-15	Yes	Yes	---	---	Unknown
Nine Mile Cr.	May-11	Aug-14	No	Yes	---	---	Unknown
Sterling Cr.	May-15	Aug-15	Yes	Yes	---	---	2018[1]
Blind Sodus Cr.	May-78	Jul-13	---	No	---	---	Unknown
Red Cr.	Apr-15	Aug-15	No	Yes	---	---	Unknown
Wolcott Cr.	May-79	Aug-14	No	No	---	---	Unknown
Sodus Cr.	Apr-15	Aug-15	No	No	---	---	Unknown
Forest Lawn Cr.	Never	Aug-15	---	Yes	59	59	Unknown
Irondequoit Cr.	Never	Aug-14	---	No	---	---	Unknown
Larkin Cr.	Never	Aug-15	---	No	---	---	Unknown
Northrup Cr.	Never	Aug-15	---	No	---	---	Unknown
Salmon Cr.	Apr-05	Aug-15	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-15	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 knowledge.
[2]Stream being treated based on geographic efficiency.

Table 25. Status of larval Sea Lampreys in historically infested lentic areas of Lake Ontario during 2015.

Tributary	Lentic Area	Last Surveyed	Last Survey Showing Infestation	Last Treated
Canada				
Duffins Cr.	Duffins Cr. - lentic	Aug-15	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	Aug-15

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

Table 26. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Ontario for larval assessment purposes during 2015.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Credit R. (lotic)	1.68	0.30
Duffins Cr. (lotic)	0.84	0.15
Black R. (lotic)	0.56	0.10
Moira R. (lotic)	1.68	0.30
Salmon R. (lotic)	1.68	0.30
Napanee R. (lotic)	1.68	0.30
Cataraqui Canal (lotic)	1.12	0.20
Total (Canada)	**9.24**	**1.65**
Total for Lake	**9.24**	**1.65**

[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. The Commission contracts the Service's Green Bay Fish and Wildlife Conservation Office (GBFWCO) to calculate marking statistics and Lake Trout abundance estimates to better understand the damage caused by Sea Lampreys.

Lake Superior

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

- Based on standardized spring assessment data, the marking rate during 2015 was 4.5 A1-A3 marks per 100 Lake Trout >532mm (Figure 4). The marking rate is below the target for the first time since 1994.

- The MIDNR provided data on the frequency of juvenile Sea Lampreys attached to fishes caught by sport charter fishers during 2015.

    - A total of 107 juvenile Sea Lampreys were collected from 8 management districts: 107 were attached to Lake Trout and none were attached to Chinook Salmon. Attachment rates during 2015 were 1.92 per 100 Lake Trout (n=5,574) and 0.00 per 100 Chinook Salmon (n=100), which was higher for the attachment rate on Lake Trout during 2014 (0.02 per 100 lake trout) but the same for the attachment rate on Chinook Salmon during 2014 (0.00 per 100 Chinook Salmon).

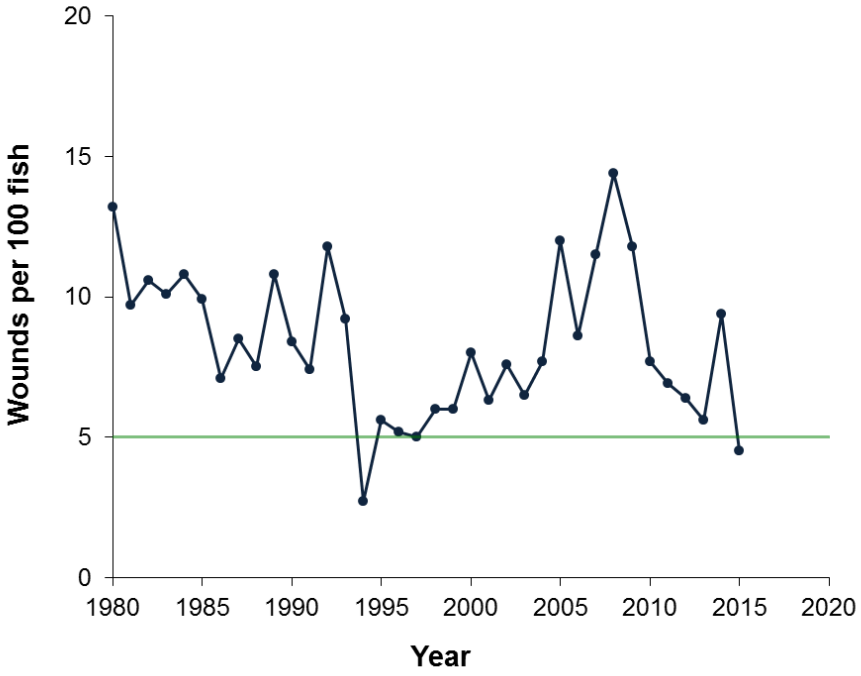

Figure 4. Average number of A1-A3 marks per 100 Lake Trout >532 mm caught during April-June assessments in Lake Superior 1980 – 2015. The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout.

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, Service, and United States Geological Survey (USGS), and analyzed by the Service's GBFWCO.

- Based on standardized fall assessment data, the marking rate during 2015 was 4.4 A1-A3 marks per 100 Lake Trout >532mm. 2015 represents the lowest marking rate observed since 1993 (Figure 5).

- The MDNR and WDNR provided data on the frequency of juvenile Sea Lampreys attached to fish caught by sport charter fishers during 2015.

    - A total of 514 juvenile Sea Lampreys were collected from 14 management districts: 156 were attached to Lake Trout and 358 were attached to Chinook Salmon. Attachment rates during 2015 were 0.26 per 100 Lake Trout (n=60,647) and 0.55 per 100 Chinook Salmon (n=64,619), which were lower than the attachment rates on Lake Trout and Chinook Salmon during 2014 (0.43 and 0.6, respectively).

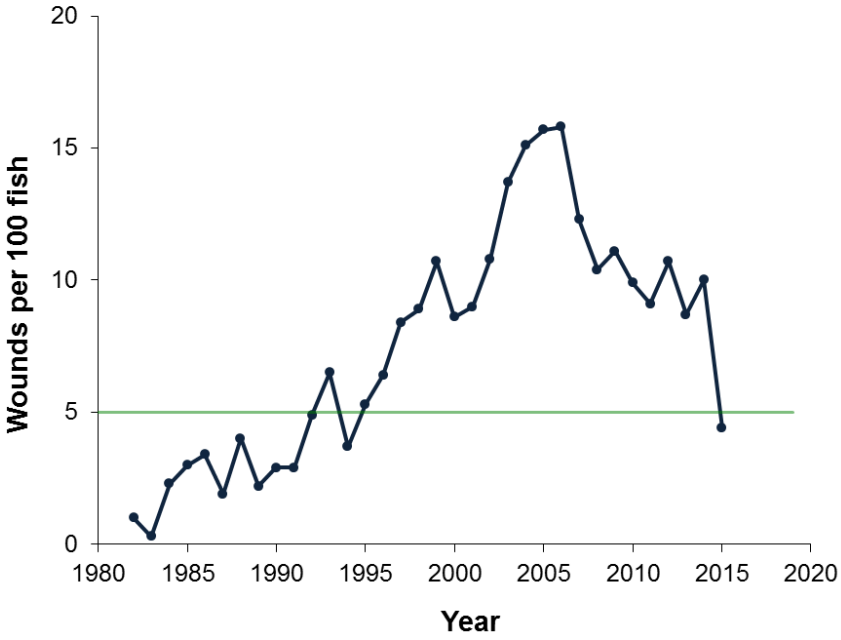

Figure 5. Average number of A1-A3 marks per 100 Lake Trout >532 mm from standardized fall assessments in Lake Michigan 1982 – 2015. The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout.

Lake Huron

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

- Based on standardized spring assessment data, the marking rate during 2015 was 3.9 A1-A3 marks per 100 Lake Trout >532 mm. The marking rate had been greater than the target of 5 per 100 Lake Trout since 1983 (Figure 6), but has decreased to below target for the first time in the time series.

- Marking rates on Lake Whitefish and ciscoes have been increasing and may be important initial hosts for juvenile Sea Lampreys.

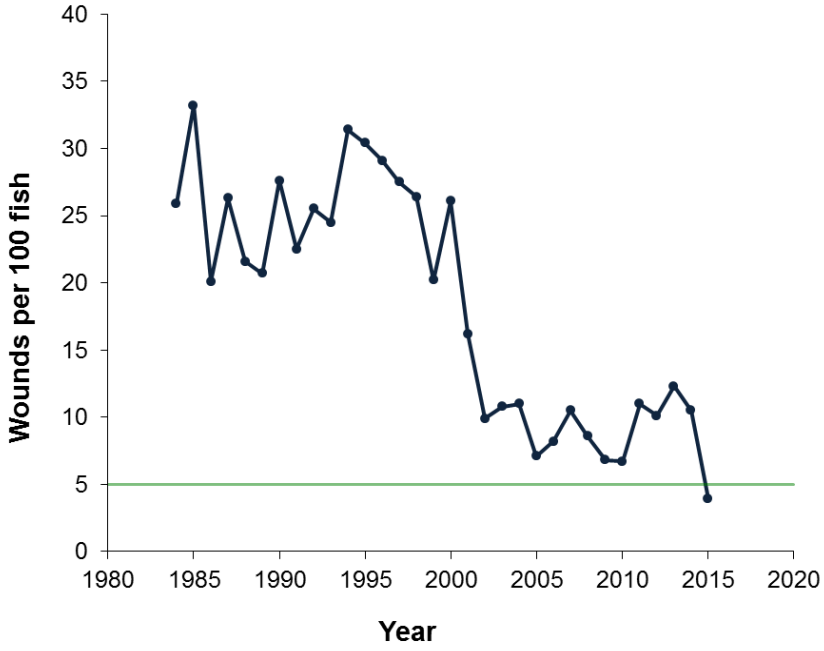

Figure 6. Average number of A1-A3 marks per 100 Lake Trout >532 mm caught in U.S. waters during spring assessments in Lake Huron 1984-2015. The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout.

- Canadian commercial fisheries in northern Lake Huron continued to provide parasitic juvenile Sea Lampreys in 2015, 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, is used as an index of juvenile Sea Lamprey abundance in northern Lake Huron. Although the data for 2015 is not yet available, the CPUE value for 2014 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 2015, fyke nets were fished for a total of 545 net days, capturing 27 out-migrating juveniles (0.05 juveniles per net day; Figure 8).

- The MDNR provided data on the frequency of juvenile Sea Lampreys attached to fishes caught by sport charter fishers during 2015.

    - A total of 140 juvenile Sea Lampreys were collected from 6 management districts: 131 were attached to Lake Trout and 9 were attached to Chinook Salmon. Attachment rates during 2015 were 1.57 per 100 Lake Trout (n=8,340) and 3.41 per 100 Chinook Salmon (n=264), which were higher than the attachment rates on Lake Trout and Chinook Salmon during 2014 (1.43 and 2.82, respectively).

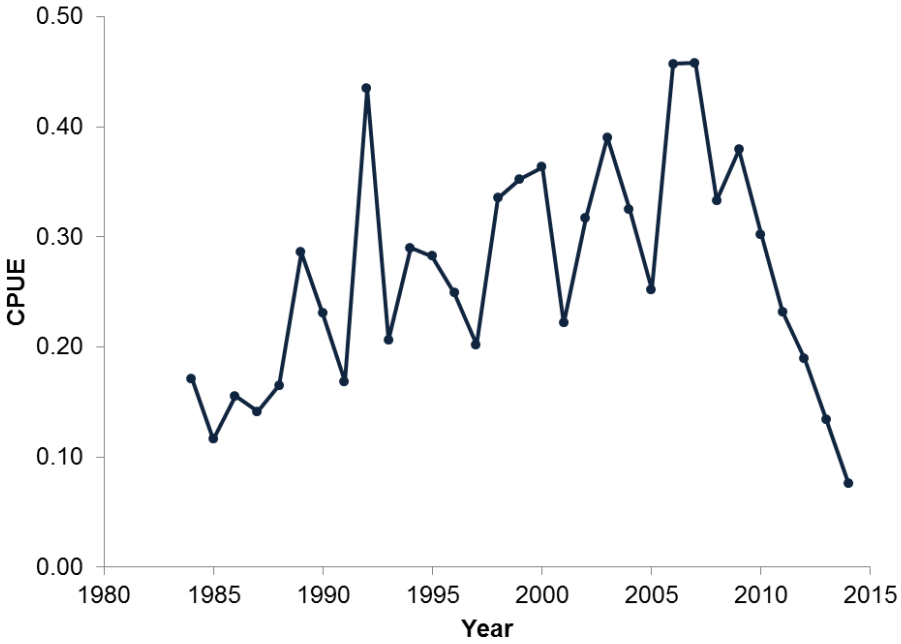

Figure 7. Northern Lake Huron commercial fisheries index showing CPUE (number of parasitic juvenile Sea Lampreys per km of gillnet per night) for 1984-2014.

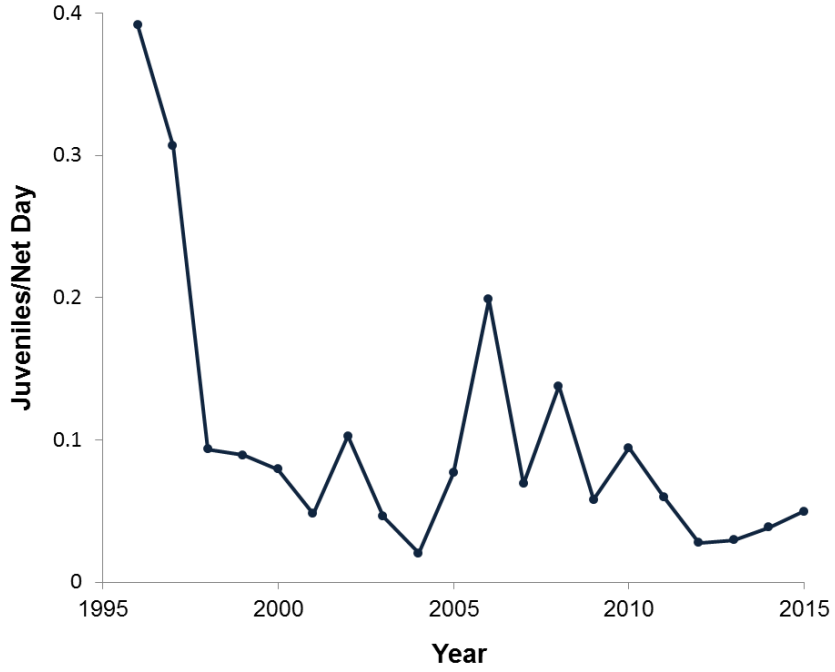

Figure 8. CPUE (number of out-migrating juvenile Sea Lampreys per net day) of fall fyke netting in the St. Marys River during 1996-2015.

Lake Erie

- Lake Trout marking data for Lake Erie are provided by the 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 2015 was 11.6 A1-A3 marks per 100 Lake Trout >532 mm, down from 17.6 in 2014. The marking rate has been greater than the target for the last 10 years (Figure 9).

- In cooperation with Walpole Island First Nation, the GLFC and partners completed the first year of an annual index for out-migrating juvenile Sea Lampreys in the St. Clair River (SCR). Nine floating fyke nets were deployed in December, 2015 in the main SCR shipping channel and captured 392 juvenile Sea Lampreys over a period of 33 days (1.35 juveniles per net day).

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

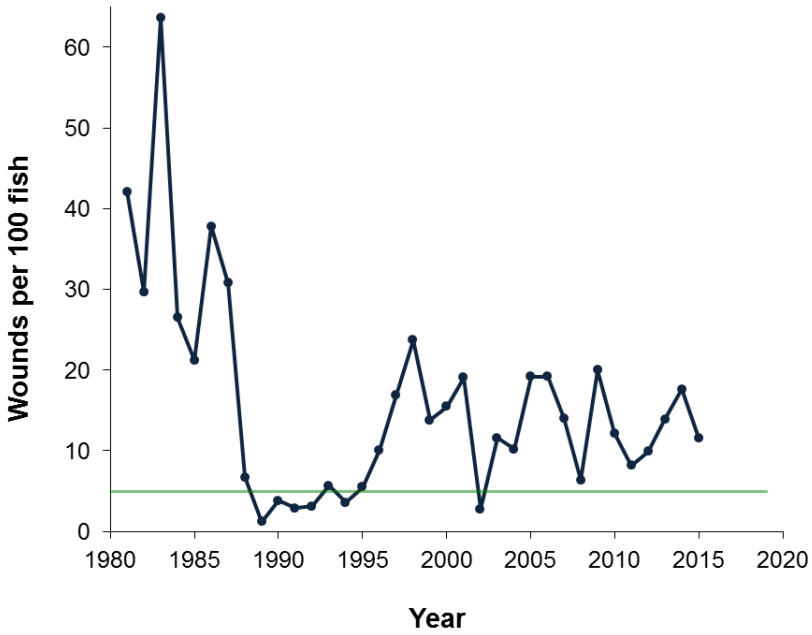

Figure 9. Average number of A1-A3 marks per 100 Lake Trout >532 mm from standardized fall assessments. The horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout 1981-2015.

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 2015 was 1.8 A1 marks per 100 Lake Trout >431 mm. The current marking rate is below target (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, 2015.

    - An estimated 2,375 juvenile Sea Lampreys were observed by anglers. The percent composition of salmonine host species to which lampreys were attached was Coho Salmon (0.00%), Chinook Salmon (64.81%), Rainbow Trout (10.19%), Brown Trout (12.04%), and Lake Trout (12.96%). Attachment rates were 1.78 per 100 trout and salmon in the west region, 1.44 in the west central region, 1.30 in the east central region, and 1.30 in the east region. In comparison to 2014, attachment rates were higher in the west and west central regions (1.34 and 0.87 respectively) and lower in the east and east central regions (2.15 and 1.61 respectively).

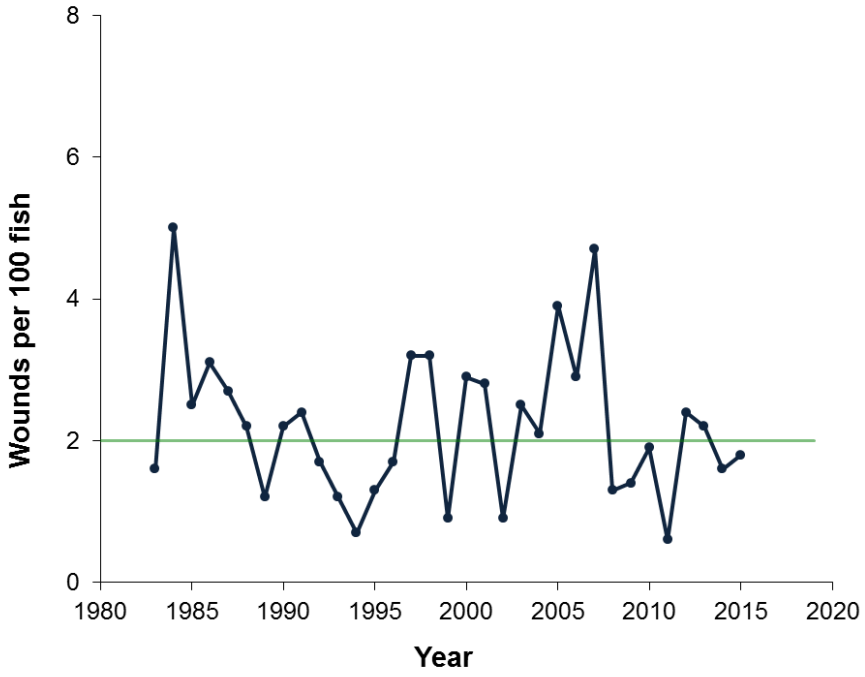

Figure 10. Number of A1 marks per 100 Lake Trout >431 mm from standardized fall assessments in Lake Ontario 1983-2015. The horizontal line represents the target of 2 A1 marks per 100 Lake Trout.

Adult Assessment

An annual index of adult Sea Lamprey abundance is derived by summing individual population estimates from traps operated in a specific suite of streams (index streams) during spring and early summer. Mark-recapture estimates are attempted in each index stream, however, in the absence of an estimate due to an insufficient number of marked or recaptured Sea Lampreys, abundance is estimated using the annual pattern of adult abundance observed in all streams and years, and adjusted to the stream-specific average abundance estimate in the time series. The index targets are estimated as the mean of indices during a period within each Lake when marking rate was considered acceptable, or the percentage of the mean that would be deemed acceptable.

Lake Superior

- A total of 820 Sea Lampreys were captured in 10 tributaries, 7 of which are index locations. Adult population estimates based on mark-recapture were obtained from 4 of the 7 index locations; the other 3 (Bad, Brule and Middle rivers) were estimated using the relative annual pattern of abundance (Table 27, Figure 21).

- The index of adult Sea Lamprey abundance was 20,224 (jackknifed range; 16,715-23,675), which was greater than the target of 9,664 (Figure 11-12). The index target was estimated as the mean of indices during a period with acceptable marking rates 1994-1998.

- Adult Sea Lamprey migrations were monitored in the Middle, Bad, Misery, and Silver rivers through cooperative agreements with GLIFWC, and in the Brule River with the WIDNR.

- Several adult Sea Lampreys were observed spawning on September 9 just prior to the Huron River treatment. Overall, five adult Sea Lampreys were collected during post-treatment surveys.

- An eel-ladder style trap (ELST) was tested at the Brule River trapping site. This was the second year of a two year study to determine if passage success differs between ELST ramps and smooth ramps, and between Sea Lampreys and teleosts. Early observations indicated that ELST ramps passed only Sea Lampreys while smooth ramps passed mostly teleosts and a small number of Sea Lampreys.

- A resistance weir was installed in the Brunsweiler River (Bad River tributary) to field test its functionality. The weir was installed and operated as intended. Several fish were captured, but no Sea Lampreys due in part to low water velocity at the trap. Further testing is planned for 2016.

- The SLCP assisted the USGS with deployment of an experimental trap with a pulsed direct current lead in the Chocolay River during 2015. The electric lead was activated every other night to determine how many more Sea Lampreys were captured when the electric lead was on. The trap captured more Sea Lampreys during nights when the electric lead was on (n=83) versus when the electric lead was off (n=36). Additional analysis is ongoing.

Table 27. Information collected regarding adult Sea Lamprey captured in assessment traps or nets in tributaries of Lake Superior during 2015 (letter in parentheses corresponds to streams in Figure 4).

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 R. (A)	199	648	31	---	---	---	---	---	---
Big Carp R.[3] (B)	4	---	---	---	---	---	---	---	---
Total or Mean (Canada)	**204**	---	---	---	---	---	---	---	---
United States									
Tahquamenon R. (C)	144	333	43	6	83	435	429	184	223
Betsy R. (D)	49	116	42	3	33	447	462	201	211
Rock R. (E)	183	616	30	23	61	398	413	145	150
Silver R.[3] (F)	17	---	---	---	---	---	---	---	---
Misery R.[3] (G)	39	80	49	10	20	402	399	167	182
Bad R. (H)	55	---	---	1	0	---	345	---	94
Brule R. (I)	128	---	---	2	50	418	430	240	226
Middle R. (J)	1	---	---	---	---	---	---	---	---
Total or Mean (U.S.)	**616**	---	---	**45**	**51**	**410**	**411**	**162**	**171**
Total or Mean (for lake)	**820**	---	---	**45**	**51**	**410**	**411**	**162**	**171**

[1] The number of Sea Lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined using external characteristics.
[3] Not an index location.

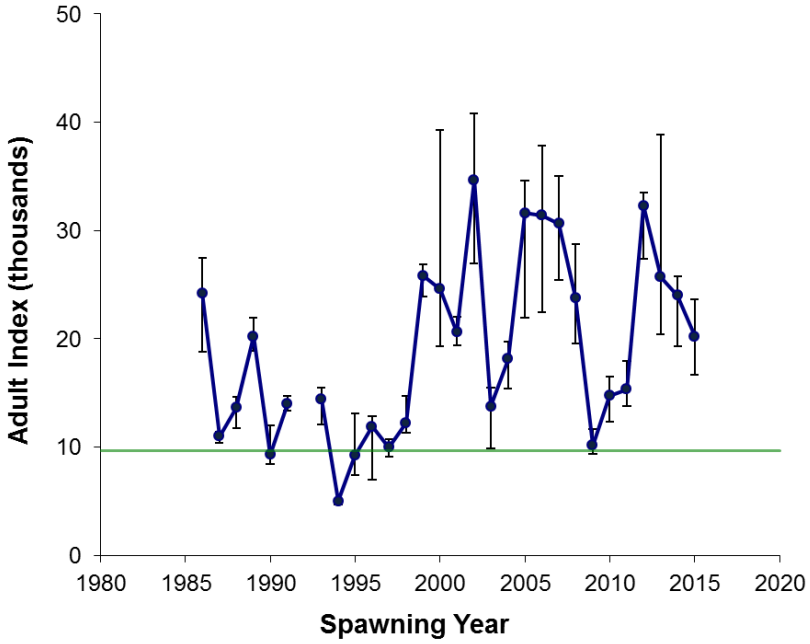

Figure 11. Index estimates with jackknifed ranges (vertical bars) of adult Sea Lampreys 1986 – 2015. The adult index in 2015 was 20,224 with jackknifed range (16,715-23,675). The point estimate was greater than the target of 9,700 (green horizontal line).

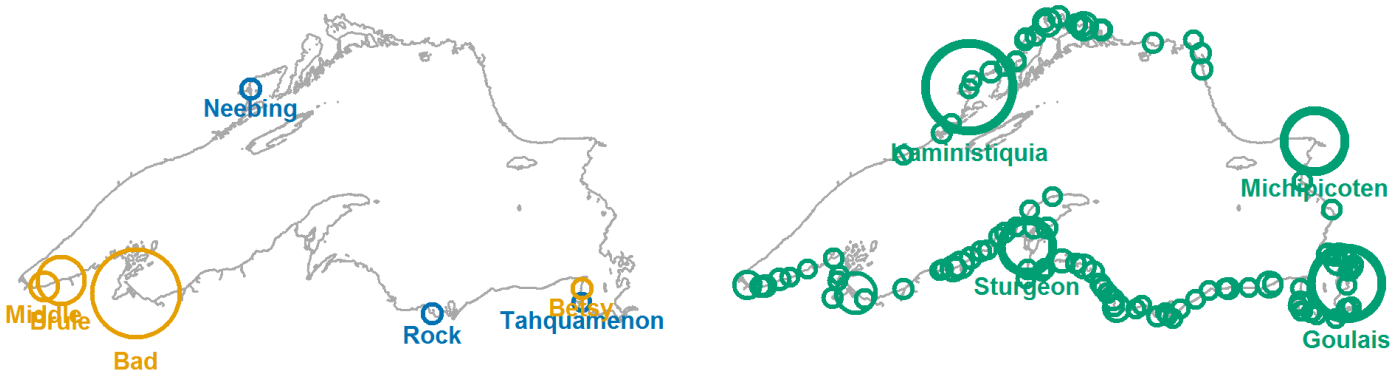

Figure 12. LEFT: Estimated index of adult Sea Lampreys during the spring spawning migration, 2015. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Kaministiquia 6,600,000; Goulais 5,000,000; Michipicoten 4,100,000; Sturgeon 3,300,000).

Lake Michigan

- A total of 9,002 Sea Lampreys were trapped at 8 sites in 8 tributaries (Table 28, Figure 21).

- The index of adult Sea Lamprey abundance was 14,695 (95% CI; 13,985-16,492), which was less than the target of 24,874 (Figure 13-14). The index target was estimated at 0.56 times the mean of indices (1995-1999).

- Adult Sea Lamprey migrations were monitored in the Boardman and Betsie rivers through a cooperative agreement with the Grand Traverse Band of Ottawa and Chippewa Indians.

Table 28. Information collected regarding adult Sea Lamprey captured in assessment traps or nets in tributaries of Lake Michigan during 2015 (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
Carp Lake Outlet (A)	575	910	63	43	56	470	462	223	228
Boardman R. [3] (B)	128	---	---	---	---	---	---	---	---
Betsie R. (C)	619	1,548	40	141	65	471	472	237	256
Big Manistee R. (D)	258	968	27	4	25	485	476	301	346
St. Joseph R. (E)	322	832	39	38	50	503	505	263	268
Trail Cr. [3] (F)	119	156	76	51	61	461	489	222	247
Peshtigo R. (G)	1,010	1,316	77	88	58	500	491	260	261
Manistique R. (H)	5,971	9,121	65	372	51	484	483	237	248
Total or Mean	**9,002**	**---**	**---**	**737**	**55**	**481**	**482**	**239**	**252**

[1] The number of Sea Lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined by using external characteristics.
[3] Not an index location.

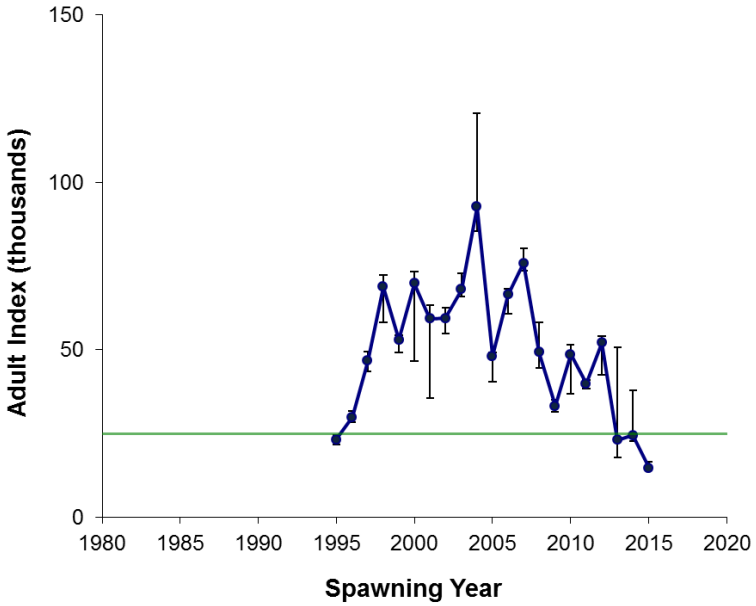

Figure 13. Index estimates with jackknifed ranges (vertical bars) of adult Sea Lampreys 1995 – 2015. The adult index in 2015 was 15,000 with jackknifed range (14,000-16,000). The point estimate met the target of 25,000 (green horizontal line).

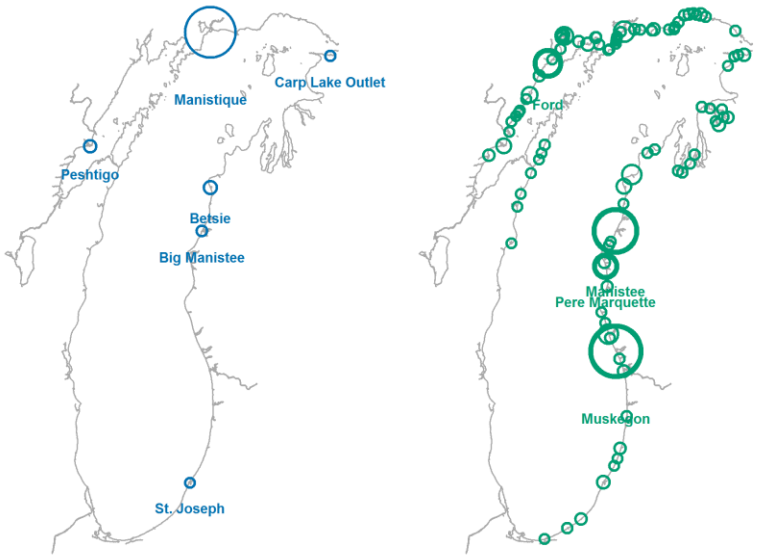

Figure 14. LEFT: Estimated index of adult Sea Lampreys during the spring spawning migration, 2015. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Muskegon 4,500,000; Manistee 3,600,000; Ford 1,800,000; Pere Marquette 1,400,000).

Lake Huron

- A total of 13,551 Sea Lampreys were trapped in 6 tributaries, all of which are index locations. Adult population estimates based on mark-recapture were obtained from all 6 tributaries (Table 29, Figure 21).

- The index of adult Sea Lamprey abundance was 23,968 (jackknifed range; 21,842-25,482), which was less than the target of 24,113 (Figure 15-16). The index target was estimated as 0.25 times the mean of indices between 1989 and 1993.

- A total of 2,100 adult Sea Lampreys were captured in traps operated in the St. Marys River at the Clergue Generating Station in Canada, and the USACE and Cloverland Electric plants and compensating gates in the U.S. The estimated population in the river was 6,092 Sea Lampreys and trapping efficiency was 34%.

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

- The results of a 2-year collaboration between the SLCP and Eastern Michigan University in the Ocqueoc and Cheboygan rivers indicate that increasing ramp angle, water velocity on the ramp, and the amount of attractant water for the trap, increases capture of Sea Lampreys entering Eel Ladder-Style Traps (ELST). Analysis to determine optimal water velocities and ramp angles is in progress. A synthesized male sex pheromone (3kPZS) was also applied to the ELST entrance at the Cheboygan River to evaluate changes in trap entrance and capture rates. The results of this investigation were inconclusive. Results from this study will improve our ability to passively sort Sea Lampreys from teleost fishes at Sea Lamprey trap sites, and improve fish passage.

- The SLCP assisted MSU with EPA-funded Sea Lamprey alarm substance field trials on the Ocqueoc River. The team tested whether the natural Sea Lamprey alarm cue (a repellent) may be combined with the partial pheromone 3kPZS (an attractant) in a Push-Pull configuration to guide migrants into a trap in a free-flowing river channel (i.e., a trap not associated with a barrier). The work will continue in 2016.

- The SLCP assisted the USGS with deployment of an experimental trap with a pulsed direct current lead in Bridgeland Creek (tributary to Thessalon River) during 2014-2015. The electric lead was activated every night to determine the cost and effectiveness of using this type of trap on streams with no physical barrier. The portable trap with electric lead was similar in cost and effectiveness to a physical barrier and trap located 50 m upstream.

Table 29. Information collected regarding adult Sea Lamprey captured in assessment traps or nets in tributaries of Lake Huron during 2015 (letter in parentheses corresponds to stream in Figure 21).

						Mean Length (mm)		Mean Weight (g)	
Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Males	Females	Males	Females
Canada									
St. Marys R. (A)	2,100	6,092	34	2,100	63	---	---	---	---
Echo R. (B)	796	1,487	54			---	---	---	---
Thessalon R. (C)						---	---	---	---
Bridgeland Cr.	1,213	2,382	51	1,199	58	---	---	---	---
Total or Mean (Canada)	**4,109**	---	---	**3,299**	**61**	---	---	---	---
United States									
East Au Gres R. (D)	233	749	31	9	78	246	256	256	242
Ocqueoc R. (E)	1,900	4,277	44	86	56	459	482	213	235
Cheboygan R. (F)	7,309	8,981	81	1,267	50	476	476	222	236
St. Marys R. (A)	See Canada	See Canada	See Canada	17	82	502	487	272	262
Total or Mean (U.S.)	**9,442**	---	---	**1,379**	**51**	**473**	**476**	**223**	**236**
Total or Mean (for Lake)	**13,551**	---	---	**4,678**	**58**	**473**	**476**	**223**	**236**

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

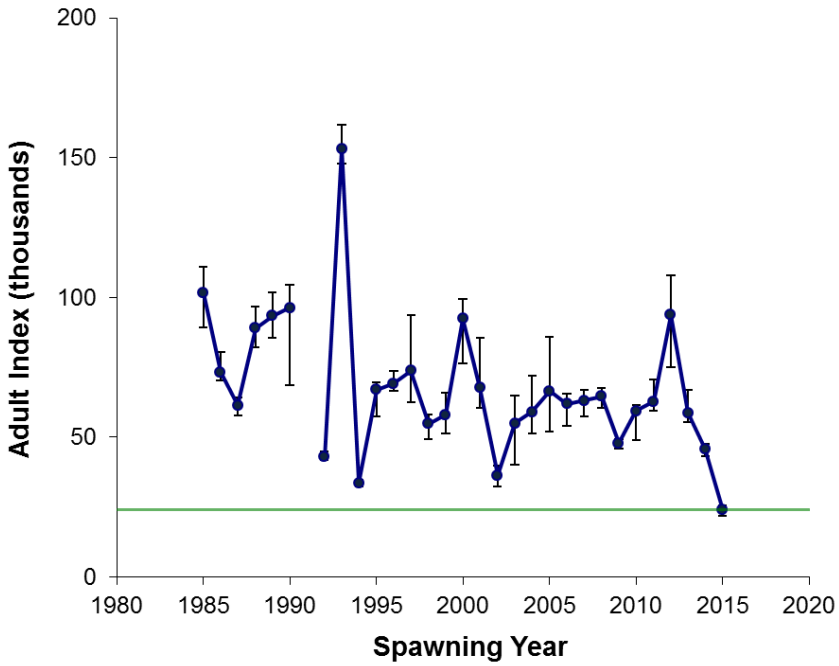

Figure 15. Index estimates with jackknifed ranges (vertical bars) of adult Sea Lampreys 1985-2015. The adult index in 2015 was 24,113 with jackknifed range (21,842-25,482). The point estimate was slightly above the target of 24,000 (green horizontal line).

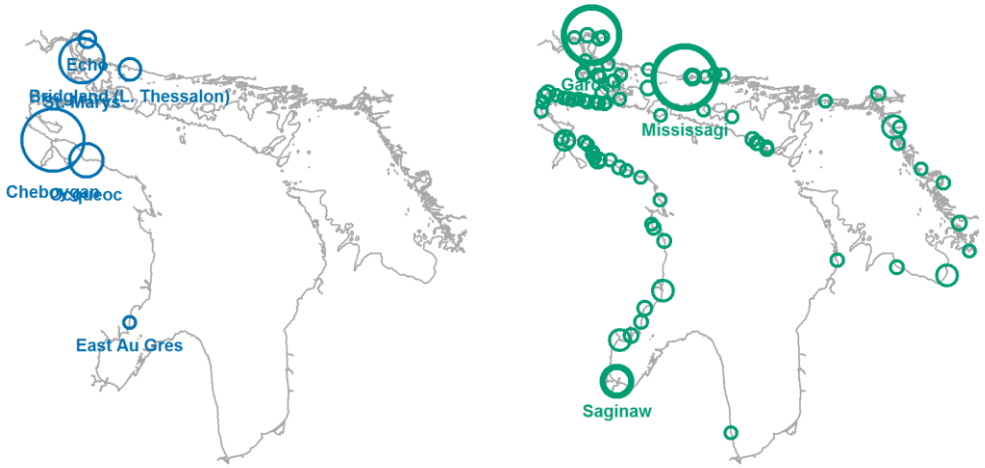

Figure 16. LEFT: Estimated index of adult Sea Lampreys during the spring spawning migration, 2015. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Mississagi 8,100,000; Garden 7,000,000; Saginaw 2,700,000).

Lake Erie

- A total of 2,486 Sea Lampreys were trapped in 5 tributaries during 2015, all of which are index locations. Adult population estimates based on mark-recapture were obtained from all 5 tributaries (Table 30, Figure 21).

- The index of adult Sea Lamprey abundance was 7,112 (jackknifed range; 4,521-9,341), which was greater than the target of 3,039 (Figure 17-18). The index target was estimated as the mean of indices during a period with acceptable marking rates (1991-1995).

- The adult Sea Lamprey migration was monitored in Cattaraugus Creek through a cooperative agreement with the Seneca Nation Tribe.

- New trap inserts at the Cattaraugus Creek index site were deployed during 2015. Guide rails to aid in trap deployment were installed by Service personnel during fall 2015.

Table 30. Information collected regarding Sea Lamprey adults captured in assessment traps or nets in tributaries of Lake Erie during 2015 (letter in parentheses corresponds to stream in Figure 21).

						Mean Length (mm)		Mean Weight (g)	
Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Males	Females	Males	Females
Canada									
Big Otter Cr. (A)	---	---	---	---	---	---	---	---	---
Little Otter Cr.	57	222	26	---	---	---	---	---	---
Big Cr. (B)	1,053	1513	70	---	---	---	---	---	---
Young's Cr. (C)	108	180	60	---	---	---	---	---	---
Total or Mean (Canada)	**1.218**	**---**	**---**	---	---	---	---	---	---
United States									
Cattaraugus Cr. (D)	1,026	3,984	26	6	67	391	266	283	319
Grand R. (E)	242	1,213	20	9	89	449	420	222	152
Total or Mean (U.S.)	**1,268**	**---**	**---**	**15**	**80**	**430**	**317**	**243**	**263**
Total or Mean (for Lake)	**2.486**	**---**	**---**	**15**	**80**	**430**	**317**	**243**	**263**

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

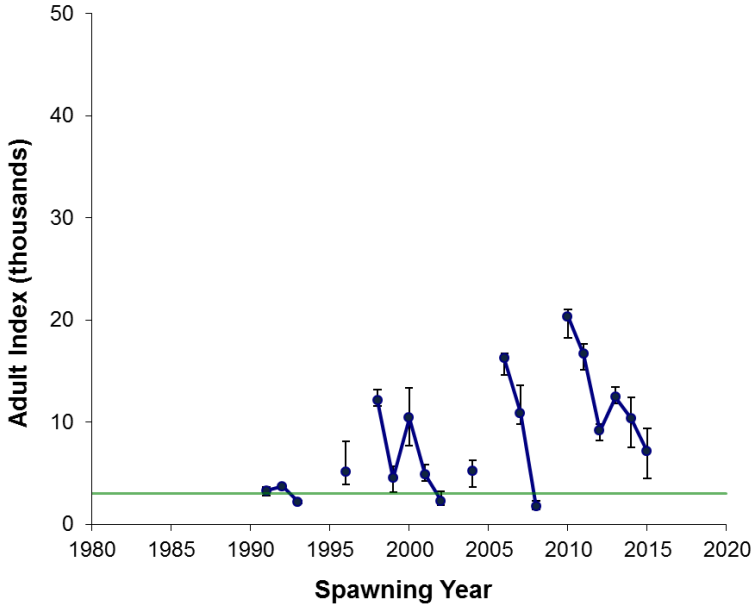

Figure 17. Index estimates with jackknifed ranges (vertical bars) of adult Sea Lampreys 1991-2015. The adult index in 2015 was 7,112 with jackknifed range (4,521-9,341). The point estimate was above the target of 3,039 (green horizontal line).

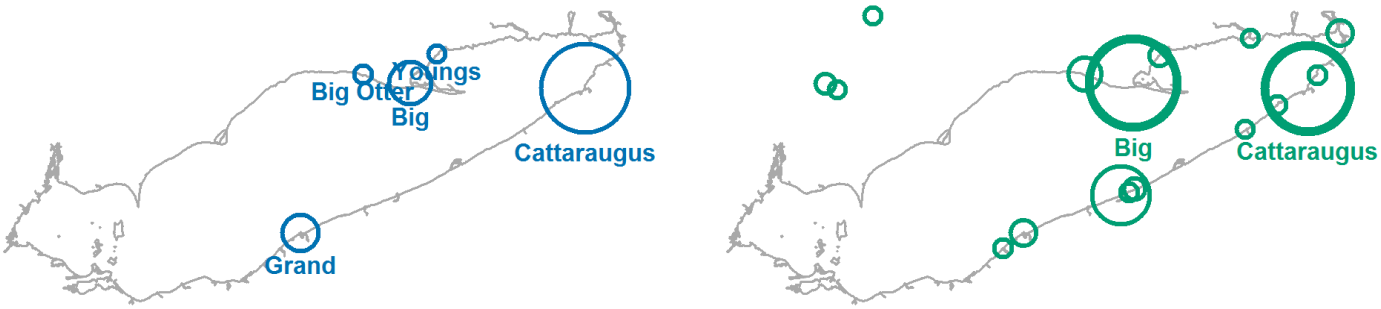

Figure 18. LEFT: Estimated index of adult Sea Lampreys during the spring spawning migration, 2015. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Big 130,000; Cattaraugus 130,000).

Lake Ontario

- A total of 4,184 Sea Lampreys were trapped in 8 tributaries, 5 of which are index locations. Adult population estimates based on mark-recapture were obtained from 4 of the 5 index locations; the other (Bowmanville Cr.) was estimated using the relative annual pattern of abundance (Table 31, Figure 21).

- The index of adult Sea Lamprey abundance was 10,298 (jackknifed range; 6,287-12,997), which was less than the target of 11,368 (Figure 19-20). The index target was estimated as the mean of indices during a period with acceptable marking rates (1993-1997).

Table 31. Information collected regarding Sea Lamprey adults captured in assessment traps or nets in tributaries of Lake Ontario during 2015 (letter in parentheses corresponds to stream in Figure 4). Tributaries that are not index locations are denoted with a [3].

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)	1,249	1,733	72	124	50	479	475	246	246
Duffins Cr. (B)	233	441	53	23	52	524	480	311	251
Bowmanville Cr. (C)	25	---	---	5	80	509	511	268	298
Cobourg Cr.[3] (D)	168	265	66	54	59	475	457	249	207
Salmon R.[3] (E)	4	---	---	---	---	---	---	---	---
Total or Mean (Canada)	**1,679**	**---**	**---**	**206**	**53**	**484**	**472**	**255**	**239**
United States									
Black R. (F)	2,316	6,434	36	173	59	504	504	267	277
Salmon R.(G)									
Orwell Br.[3]	40	390	10	1	0	---	456	---	228
Sterling Cr. (H)	149	797	19	17	47	497	483	297	295
Total or Mean (U.S.)	**2,505**	**---**	**---**	**191**	**58**	**503**	**501**	**269**	**279**
Total or Mean (for lake)	**4,184**			**397**	**55**	**493**	**485**	**262**	**257**

[1] The number of Sea Lampreys used to determine percent males, mean length, and mean weight.
[2] Gender was determined using external characteristics.
[3] Not an index location.

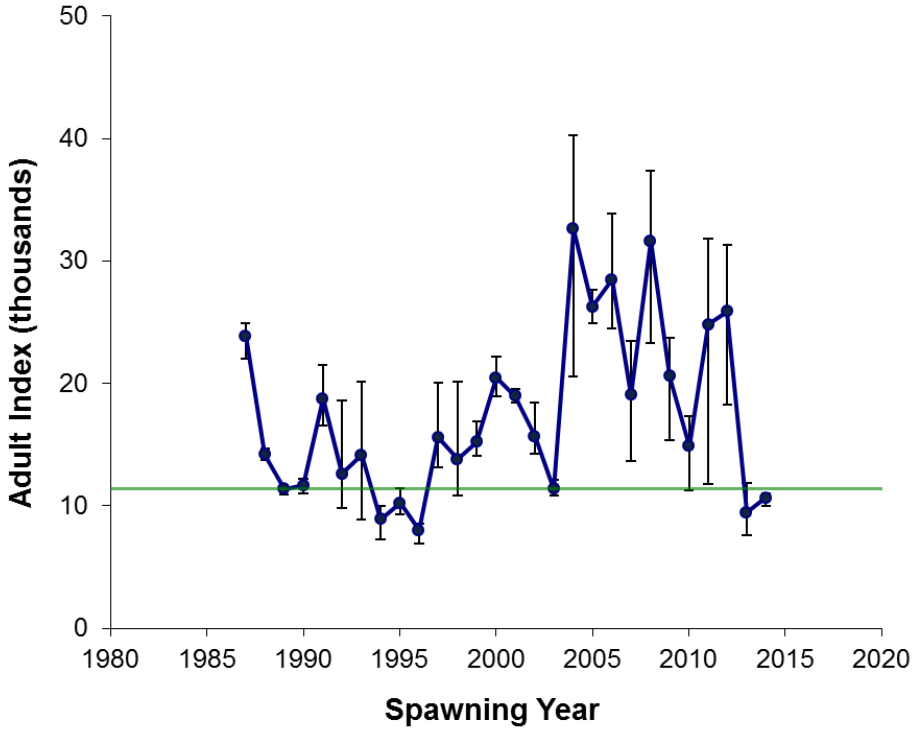

Figure 19. Index estimates with jackknifed ranges (vertical bars) of adult Sea Lampreys 1987-2015. The adult index in 2015 was 10,298 with jackknifed range (6,287-12,997). The point estimate met the target of 11,368 (green horizontal line).

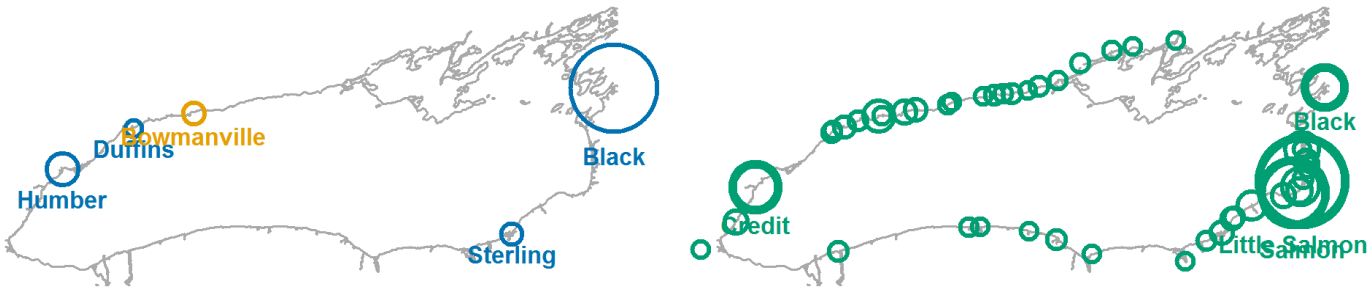

Figure 20. LEFT: Estimated index of adult Sea Lampreys during the spring spawning migration, 2015. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval Sea Lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Salmon 1,400,000; Little Salmon 970,000; Credit 590,000; Black 470,000).

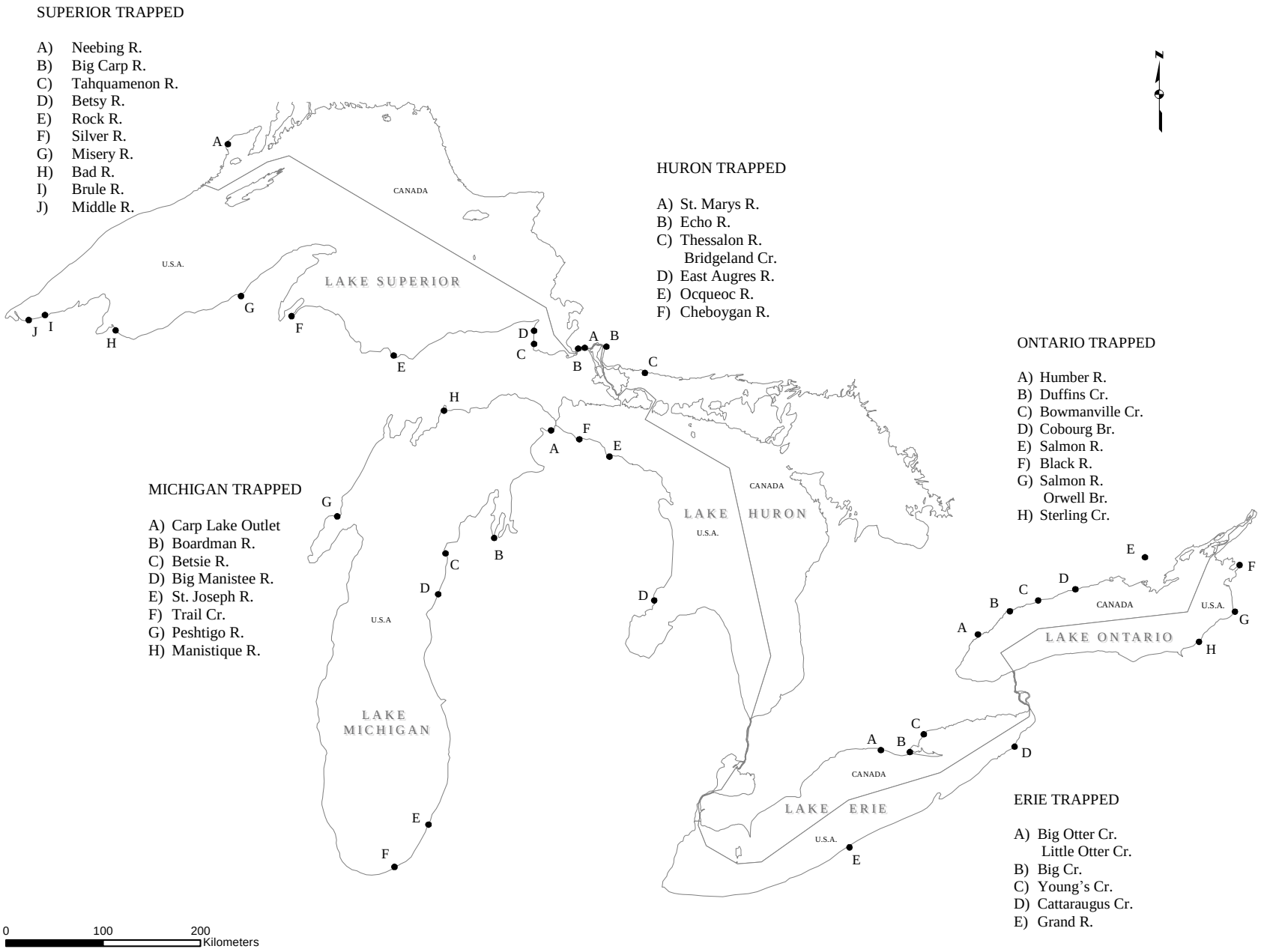

Figure 21. Locations of tributaries where assessment traps were operated during 2015.

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 (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 2015, the following ES offices reviewed the effect of scheduled lampricide applications on listed species within their jurisdiction. Concurrence with proposed conservation measures and determinations of "no effect" or "not likely to adversely affect" was received by:

- Bloomington Field Office
- Columbus Ohio Field Office
- East Lansing Field Office
- New York Field Office
- Pennsylvania Field Office
- Twin Cities Field Office

Programmatic Review

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

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 2015, the following state regulatory offices reviewed listed species within their jurisdiction and issued permits to conduct lampricide applications:

- Minnesota Department of Natural Resources
- Michigan Department of Natural Resources
- Indiana Department of Natural Resources
- Ohio Department of Environmental Protection
- Pennsylvania Department of Environmental Protection
- New York Department of Environmental Protection

Studies

Granular Bayluscide Study

The Service's Risk Management Team (RMT) and the USGS, Upper Midwest Environmental Sciences Center (UMESC) conducted field studies to determine the concentration of niclosamide (2', 5-dichloro-4'-nitrosalicylanilide) in the water column and sediment following two granular Bayluscide applications in the Au Train River (Alger County, Michigan). This work will be replicated on the St. Clair River (St. Clair County, Michigan) during 2016.

Non-target Surveys

Technical Operating Procedure 029

A field trial of the recently drafted *Protocol for Biological Surveys and Collections* (TOP 029) was conducted on the Rapid and Whitefish (Lake Michigan), Chocolay, Sand, Garlic, Pine and Trap Rock rivers, and Eliza (Lake Superior) and Conneaut (Lake Erie) creeks. Randomly chosen sites were selected and surveyed for non-target mortality. Collections were recorded and used to determine the appropriate amount of sampling time for future surveys.

Conneaut Creek

Pennsylvania - Surveys were conducted post-treatment at 3 sites in the 6 mile section of designated Hornyhead Chub (HHC; *Nocomis biguttatus*) habitat in the upper portion of Conneaut Creek following the TFM treatment. No dead HHC's were found which supported the 2014 toxicity test results that demonstrated the fish are not sensitive to TFM at concentrations used to treat streams.

Ohio - The RMT led the non-target survey of Conneaut Creek in Ohio waters during the spring treatment. A total of 138 non-target organisms were collected in about 21 miles of the Ohio section of the mainstream. Stonecats (47; *Noturus flavus*), Mudpuppies (44; *Necturus maculosus*), both know to be sensitive to TFM, and Central Stonerollers (20; *Campostoma anomalum*) accounted for most of the organisms collected.

Representatives of the Ohio Department of Natural Resources, Ohio Environmental Protection Agency and The Nature Conservancy participated in the collection effort.

Field Protocols

Both federal and state listed species are included in protocols that are annually developed by the RMT for field staff. The protocols detail conservation measures to be followed where Sea Lamprey control activities are scheduled near areas occupied by listed species. During 2015, the following protocols were implemented to protect and avoid disturbance to federal- and state- listed species:

- *Protocol to protect and avoid disturbance to federal- and state-listed endangered, threatened, candidate, proposed, or special concern species and critical or proposed critical habitats in or near Great Lakes streams scheduled for lampricide treatments in the United States during 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 granular Bayluscide assessments in the United States during 2015*.

The protocols provided field personnel with a list of protected species, their known locations, and measures to avoid and protect. No mortality or disturbance was observed during 2015 for the 139 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 2015, NEPA was required for new cooperative agreements for the following actions:

- Red Cliff lampricide treatment
- Betsie River adult Sea Lamprey trapping
- Boardman River adult Sea Lamprey trapping
- St. Marys River adult Sea Lamprey trapping

Federal Insecticide, Fungicide and Rodenticide Act

Reports were prepared to comply with the 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 32).

Table 32. Summary of 6(a)(2) reports submitted for incidents of non-target mortality during 2015.

Lake	Stream	Mortality	Freq	Comments
Superior	Brule R.[1]	Stonecats (*Noturus flavus*)	138	Sensitive to TFM
Huron	Pine R.[2]	Stonecats	278	pH drop
	Bighead R.[1]	River chub (*Nocomis micropogon*) Shiner species (*Luxilus spp.*) White sucker (*Catostomus commersonii*) Blacknose dace (*Rhinichtys atratulus*)	200 100 100 100	Downstream of AP site and unexpected pH drop at night
Erie	Conneaut Cr.[1]	Rainbow darters (*Etheostoma caeruleum*)* Mudpuppies (*Necturus maculosus*)** Stonecats **	58 65 59	Prior electrofishing stress* Sensitive to TFM**
Ontario	Sterling Cr.[1]	Logperch (*Percina caprodes*)	55	Sensitive to TFM and unexpected pH drop during the night

[1] TFM. [2] 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.

2015 Membership

Brian Stephens (Chair), Bruce Morrison, Shawn Robertson (Department); Lori Criger, Alex Gonzalez, Cheryl Kaye, Stephen Lantz, Rebecca Neely, Tim Sullivan, Lisa Walter (Service); Jean Adams (USGS/GLFC); Mike Boogaard, Terry Hubert, Karen Slaght (USGS); Michael Wilkie (Wilfred Laurier University); Dale Burkett, Mike Siefkes, Pete Hrodey (GLFC Secretariat).

Progress towards goals described in the GLFC Vision:

Goal 1: Suppress Sea Lamprey populations to target levels.

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

2015 Outcomes:

1. Where applicable, strategies were employed to reduce the number of Sea Lamprey that survive treatment and increase the effectiveness of individual stream treatments. Backwater and isolated areas in the target stream that don't receive lethal doses of lampricide were treated in conjunction with the main application to prevent survival and/or escapement in these refugia areas. Lampricide concentrations were targeted to be greater than 10% above theoretical values due to some uncertainty with the predictive chart levels. With the exception of outside agency constraints (i.e. state, provincial, hydro generation) streams were scheduled for treatment in the optimal time of year to ensure sufficient discharge. As the field season continued into the fall period, streams were 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 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. Where practical, DFO conducted lampricide treatments in the US that were geographically closer to its headquarters to reduce travel time.

3. Crews from both USFWS and DFO worked together to complete the St. Marys granular Bayluscide treatment plots. The shallow draft jet drive granular Bayluscide spray boat was used in shallow water plots to maximize coverage.

4. A study to compare continuous (also termed "long and low") and interrupted lampricide applications as a strategy to treat high alkaline water sturgeon streams was completed. A report is pending.

5. Three treatments (Marblehead Creek; Lake Michigan, Garden River; Lake Huron and Cayuga Creek (tributary to Buffalo Creek); Lake Erie) from the 2015 rank list were deferred due to unfavorable environmental conditions. However, treatments to Sheppard Creek, a tributary to the Goulais River and Slate River lentic (Lake Superior), Bar Creek, a tributary to the Echo River (Lake Huron), Altmar Creek, a tributary to the Salmon River and Owasco Outlet, a tributary to the Oswego River system (Lake Ontario) were added and completed based on larval assessments conducted during the 2015 field season.

2016 Objectives:

1. Treat all streams listed on the 2016 treatment rank list.

2. 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 2016.

3. 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.

4. Develop an optimized schedule jointly between the agents to realize efficiencies in travel and effectively utilize DFO staff conducting or assisting with treatments in Michigan.

5. Support and provide input into research that investigates Sea Lamprey sensitivity and non-target effects of species to lampricides, which may lead to new control strategies.

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

2015 Outcomes:

1. Lampricide analysis and water chemistry data from treatments in 2015 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.

2016 Objectives:

1. Review past treatment history and larval assessment information for streams ranked for treatment in 2016 to identify impediments to effectiveness and develop strategies to increase efficacy.

2. At the direction of the SLCB, work with other task forces to plan work that will measure effectiveness of lampricide applications.

3. Assist UMESC in field studies in support of the development of a niclosamide bar.

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.

2015 Outcomes:

1. Implemented the second year of the 2014-15 large scale treatment strategy.

2. Assistance to the LATF to develop possible control strategies in the Huron-Erie Corridor as directed by SLCB is ongoing.

2016 Objectives:

1. Optimize stream treatment schedules to facilitate the implementation of the next large scale treatment strategy which targets Lake Superior in 2016.

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 USACOE on the construction, operation, and maintenance of Sea Lamprey barriers.

2015 Membership

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

2015 Outcomes:

Outcome 1: Planning continued on 13 barrier construction projects to prevent Sea Lampreys from accessing spawning habitat.

Outcome 2: Routine maintenance at all purpose-built Sea Lamprey barriers was completed to ensure adult Sea Lampreys do not have access to spawning habitat.

Outcome 3: Inspection of approximately 300 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.

Outcome 4: Review of twenty-nine fish passage projects was initiated or completed to determine the effect of fish passage and dam or culvert removals to Sea Lamprey control operations.

Outcome 5: Completed electrofishing surveys and habitat assessments conducted upstream of barriers of concern in the Grand, Clinton, and Sturgeon rivers and Bowmanville Creek to quantify potential infestation risk; barrier inspections were also completed to verify historical information and at locations not currently represented in the barrier database.

Outcome 6: Completed electrofishing surveys and habitat assessments in five historically negative watersheds to assess potential infestation risk; barrier inspections were also completed at locations not currently represented in the barrier database.

2016 Objectives:

Objective 1: Initiate rebuild of Denny's Dam on the Saugeen River (Lake Huron), subject to successful consultation between OMNR and Saugeen Ojibway Nation to ensure that Sea Lampreys remain blocked at Denny's Dam.

Objective 2: Initiate construction of the Manistique River (Lake Michigan) sea lamprey barrier to prevent Sea Lampreys from migrating upstream to spawning habitat.

Objective 3: Complete design for rebuilding the Harpersfield Dam on the Grand River (Lake Erie) as a Sea Lamprey barrier. Plan for construction in FY18 to ensure that Sea Lampreys remain blocked at the Harpersfield Dam.

Objective 4: Members remain engaged in the process to reach a decision point regarding the Black Sturgeon River (Lake Superior) Camp 43 dam.

Objective 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 white-water rapids area in downtown Grand Rapids.

Objective 6: Continue working on priority GLFER barrier projects with the U. S. Army Corps of Engineers: Bad (Lake Superior) and Little Manistee rivers (Lake Michigan) to limit Sea Lamprey access to spawning habitat.

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

Objective 8: Investigate retrofit of the Big Otter Creek (Lake Erie) Black Bridge railway crossing to function as a Sea Lamprey barrier.

Objective 9: Investigate use of existing surrogate species data to predict infestation risk upstream of blocking barriers.

Objective 10: 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.

2015 Outcomes:

Outcome 1: Participated in a field experiment in the Ocqueoc River to test use of the alarm cue as a short-range repellent in push-pull trapping. However, extreme flooding and limited availability of research animals prevented completion of the experiment. The experiment will be completed during 2016 pending an extension from EPA.

Outcome 2: Participated in a field experiment in the Ocqueoc River to determine whether exposure to the larval odor (pheromone) alters Sea Lamprey response to the alarm cue. Preliminary analysis indicates that exposure to the alarm cue in combination with the larval odor does slow the lamprey's progression, but does not significantly alter the tendency to move upstream.

Outcome 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 prepared a TAP document that outlined options for control in the Upper Cheboygan, which included push-pull trapping and the sterile male release technique.

2016 Objectives:

Objective 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.

Objective 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.

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

Objective 4: Submit a technical assistance proposal to test NEMO as a seasonal barrier to block a natural Sea Lamprey run in the Black Mallard River over three years with the goal of eliminating the need for lampricide treatment.

Objective 5: Submit a research proposal to evaluate the use of the repellent in trap-and-pass fishways in the Great Lakes (to selectively remove Sea Lampreys from passing fishes).

Objective 6: The CWG will continue to assess the upper Cheboygan River population during 2016 to confirm that adult populations upstream of the Cheboygan Lock and Dam complex are small. The CWG plans to develop a proposal (to Sea Lamprey Research Board) to apply SMRT in the upper river in 2017-2019 following the 2016 lampricide treatment.

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.

2015 Membership

Fraser Neave (Interim Chair), Mike Steeves, Brian Stephens and Kevin Tallon (Department); Bob Frank and Aaron Jubar, (Service); Jean Adams and Chris Holbrook (USGS); Travis Brenden (Quantitative Fisheries Center, MSU); Pete Hrodey 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.

2015 Outcomes:

1: Detection surveys were conducted on 180 tributaries basin-wide during 2015. Six Wisconsin tributaries of Lake Michigan were assessed as part of a special appropriation from the State of Wisconsin. New populations were found in Gogomain River, a Lake Superior tributary and Owasco Lake Outlet, a Lake Ontario tributary that is part of the Oswego River System. Owasco Lake Outlet was treated in 2015 and Gogomain River ranked for treatment in 2016.

2: Distribution surveys were conducted during 2015 in tributaries scheduled for treatment in 2015 and 2016. Notable increased distributions were found on Catfish Creek (Lake Erie), New York's Salmon River (Lake Ontario), and Credit River (Lake Ontario).

3: During the 2015 field season, 48 gB surveys covering 24,000 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. Twenty-four Sea Lamprey larvae were collected during gB surveys. The second of a two year deep-water electrofishing of the Walpole Island channels was completed in 2015; no lamprey were collected. Only seven Sea Lamprey larvae were collected in 2014. Granular Bayluscide surveys were also conducted on the Detroit River; 22 plots covering 1,100 m^2 captured zero Sea Lamprey larvae.

2016 Objectives:

1: Conduct detection surveys as required. When new infestations are found, rank for treatment as size structure dictates.

2: Conduct distribution surveys where required for 2016 and 2017 treatments.

3: Conduct standard levels of annual assessment in the St. Clair River. 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.

2015 Outcomes:

1: Post-treatment assessments were conducted on 109 tributaries and 5 lentic areas that were treated during 2014 and 2015. Any tributaries that had substantial residual populations were ranked for re-treatment.

2: Mike Boogaard (USGS – UMESC) conducted further work on emergence time of larval lampreys following gB applications at 8˚C, 10˚C, and 16˚C. Results showed that lampreys took significantly longer to emerge in colder water, a finding that resulted in a minor revision of the deep-water survey protocol. Granular Bayluscide assessments in cold water situations will be avoided where possible, but surveys will be extended by 15 minutes where this cannot be accommodated.

2016 Objectives:

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

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.

2015 Outcomes:

1: The Larval Assessment Work Group was reinstated, meeting in conjunction with the Sea Lamprey Workshop in February 2016. At this meeting expert judgement stream timing, larval protocol revisions, Lake Michigan targeted stream list and cold-water granular Bayluscide applications were discussed.

2016 Objectives:

1: If required, hold another Larval Assessment Work Group meeting 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.

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

2015 Outcomes:

1: Prepared for implementation of the first year of the 2016–2018 targeted streams strategy for Lake Superior tributaries.

2*:* A rough draft of the results of the 2012-2013 targeted streams strategy was assembled.

2016 Objectives:

1: Complete the summary of the 2012–2013 targeted streams strategy. Draft a final report for the 16-02 SLCB meeting.

2: Conduct distribution surveys in preparation for the next set of targeted streams in Lake Michigan in 2017.

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 transforming Sea Lampreys from spawning and feeding populations.

2015 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.

2015 Outcomes:

1: A new Adult Index method was implemented in 2015. This method of tracking lake wide abundance of adult Sea Lamprey replaces the former method that relied more heavily on modeled population estimates. Mark-recapture population estimates were obtained from 25 of the 29 index streams that were trapped throughout the Great Lakes. .

2: The Commission Secretariat office continued to collect and assemble up to date Lake Trout abundance and wounding rate data from various agencies, generating lake-wide averages for status graphs.
3: There are several recent and ongoing research projects aimed at improving the assessment of adult and juvenile Sea Lamprey populations. These include testing fishwheels and eel-ladder style traps (ELST) 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.

2016 Objectives:

1: Operate and maintain 37 trap sites throughout the Great Lakes. These include the 29 index streams, for which populations will be estimated using mark-recapture, and another 8 non-index streams.
2: Assemble the most recent Lake Trout abundance and wounding data, and compare the time series trends in of these metrics along with adult Sea Lamprey abundance.
3: Continue monitoring results from recent and ongoing research projects, and be prepared to implement effective new technologies and methods into the SLCP when they become available.

Strategy 6: Deploy trapping methods to increase capture of adult and recently metamorphosed Sea Lampreys.

2015 Outcomes:

1. During fall 2015, the Service deployed fyke nets in the Bad River (Superior), Galien River (Michigan) and Cattaraugus Creek tributaries Coon and Derby brooks (Erie) and captured a total of 38 out-migrating juveniles (5, 30 and 3, respectively). Fyke netting was planned in a small section of the Root River where several large residual larvae were found, but water levels remained too high to deploy nets.
2. There are several recent and ongoing research projects aimed at improving the capture efficiency of adults and out-migrating juveniles for control purposes. No new methods were deployed in 2015.
3. A workgroup was formed to address the long standing question of whether trapping for control can be cost-effective. A general framework for trapping adult Sea Lampreys is in development.

2016 Objectives:

1: Continue trapping out-migrating juveniles for control in newly discovered or deferred streams to mitigate escapement to the lakes.

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.

3: Continue to develop a trapping for control framework, and evaluate if there are any circumstances where trapping for control is likely to be successful.

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.

2015 Outcomes:

1: The Weiming Li laboratory at MSU has identified several new pheromone compounds over the past couple of years, some of which were tested for biological activity in 2015. 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). However, no pheromone combinations tested were as effective at attracting or retaining ovulating females as washings from spermiated males.

2: Testing in the Li laboratory provided further confirmation that tri-sulfated PZS and PZS block ovulated female attraction to spermiated male washings in equimolar mixtures (10^{-12} M), and actually repulse ovulating females from spermiated male washings at higher concentrations (10^{-11} M).

3: The pheromone workgroup began the process of updating the Chemosensory Communication Strategy.

2016 Objectives:

1. Continue to identify the structure and function of Sea Lamprey pheromone components.

2. Continue to characterize potential antagonists, including tests of potential antagonists in a quasi-natural environment (single stream).

3. The pheromone workgroup will update the Chemosensory Communication Strategy.

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

2015 Outcomes:

1. A post-doc in the Michael Wagner laboratory at MSU began examination of Push-Pull application of attractants (3kPZS) and repellents (alarm cue) to guide lampreys into an open-channel trap (downstream from a barrier). Severe flooding and low availability of experimental animals prevented completion of the experiment.

2. A student in the Wagner laboratory examined how Sea Lampreys respond to combinations of migratory attractants (larval odor) and the alarm cue in several contrasting scenarios to ascertain

whether the animal consistently chooses the safest option when given a choice. In the absence of upstream sources of larval odor, Sea Lampreys behaved in a risk-averse fashion, consistently choosing the safest option.

3. Another student in the Wagner laboratory completed an experiment examining the larval Sea Lamprey response to the alarm cue. The study suggests larval Sea Lampreys detect and respond to an alarm cue released by dead adult conspecifics, and the nature of the response is inhibitory in that downstream movement in the laboratory was reduced after exposure. Based on these findings we hypothesize that short-term exposure to the alarm cue would likely result in retraction into the burrow, consistent with exposure to perceived predation risk.

4. Istvan Imre's laboratory at Algoma University found that migratory Sea Lampreys showed strong avoidance behavior to PEA in the laboratory, but did not avoid a tributary (or sides of streams) with PEA in field trials. Trials were done in Silver Creek (Ocqueoc R.) only. The Sea Lampreys did, however, avoid the tributary (and sides of streams) with dead Sea Lamprey extract present.

2016 Objectives:

1. Continue work to isolate and identify the chemical structure of the Sea Lamprey alarm cue (Wagner Laboratory and Nair Laboratory, MSU).
2. Develop a larval response assay to facilitate testing of isolated odor fractions and compounds from the Sea Lamprey alarm cue.
3. Complete testing of Push-Pull trapping using the alarm cue in open channel applications (barrier-free trapping).
4. Complete a preliminary experiment to determine whether post-metamorphic Sea Lamprey (transformers) respond to the alarm cue.
5. Imre's laboratory hopes to test whether migratory Sea Lampreys show the same pattern of behavior to PEA in other streams, pending the approval of a new research proposal.

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

2015 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.

2016 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 2015, this display was in attendance at several large capacity events (Table 33).

Table 33. Dates and locations of public outreach performed by agents of the SLCP in 2015.

Date	Location	Venue	Lead Agency
January 23-25	Columbus, OH	Ohio Musky Show	GLFC
February 13-16	Toronto, ON	Spring Fishing and Boat Show	Department
February 18-22	Duluth, MN	Duluth Boat, Sports, Travel and RV Show	Service
February 27 -March 1	Thunder Bay, ON	Central Canada Outdoor Show	Department
March 7	Firelands, OH	Annual Captains Meeting	GLFC
March 14-15	Hammond, IN	Cabela's Spring Great Outdoor Days	GLFC
March 19-22	Grand Rapids, MI	Ultimate Sport Show	Service
April 22	Lansing, MI	MDNR Earth Day	Materials
May 15	Auburn Hills, MI	Clinton River Water Festival	GLFC
May 16-17	Walpole Island, ON	Walpole Island First Nation Pow Wow	Department/GLFC
May 27	Cheboygan, MI	Cheboygan River Trap Field Trip	HBBS
May 29-30	Port Huron, MI	Blue Water Sturgeon Festival	GLFC
June 5	Michigan City, IN	Conference on the Environment	GLFC
July 12-14	Lansing, MI	Lansing Fish Rodeo	Service
June 14	Detroit, MI	Kids Fishing Feast 2015	GLFC
June 17	Toronto, ON	TV Ontario	GLFC
June 20	Alpena, MI	Hooked 4 Life Fishing Clinic and Derby	HBBS
June 20-21	Sarnia, ON	Aamjinwnaang Pow Wow	Department/GLFC
July 8	Port Clinton, OH	Ohio Governor's Day	GLFC
August 4	Duluth, MN	Great Lakes Aquarium Teachers Workshop	Advisor
August 28-30	Cheboygan, MI	Northern Michigan's Outdoor Sports Expo	HBBS
August 28 -September 6	Owen Sound, ON	Owen Sound Salmon Spectacular	Department
September 3-7	Traverse City, MI	Traverse City Welcome Centre	HBBS
September 13	Hudson Lake Recreation Area, MI	Great Outdoors Youth Jamboree	GLFC
September 26	Michigan City, IN	Trail Creek Boat Access Opening	GLFC

PERMANENT EMPLOYEES OF THE SEA LAMPREY CONTROL PROGRAM

FISHERIES AND OCEANS CANADA

Sea Lamprey Control Centre – Sault Ste. Marie, Ontario Canada
Paul Sullivan, Division Manager

Section Head, Control: Brian Stephens

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

Lampricide Application Coordinators: Technicians:
Peter Grey: Supervisor
Jamie Storozuk: Supervisor

Lampricide Analysis Technicians:
Jerome Keen
Richard Middaugh

Lampricide Application Technicians:
Zach Allan
Sarah Daniher
Kathy Hansen
Paul Kyostia
Melissa Landry
Joe Lachowsky
Adam Loubert
Matt McAulay
Sean Nickle
Chris Sierzputowski
Jamie Smith
John Tibbles

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
Nathan Coombs
Jennifer Hallett
Sarah Larden
Sean Morrison
Andrea Phippen
Jeff Rantamaki
Thomas Voigt

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

Maintenance:
Brian Greene: Supervisor
Chad Hill: Assistant

UNITED STATES FISH AND WILDLIFE SERVICE

Robert Adair, Sea Lamprey Program Manager
Aaron Woldt, Deputy Assistant Regional Director, Fisheries

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

(CS) Career Seasonal

UNITED STATES FISH AND WILDLIFE SERVICE (CONTINUED)

Robert Adair, Sea Lamprey Program Manager
Aaron Woldt, Deputy Assistant Regional Director, Fisheries

Marquette Biological Station – Marquette, Michigan

Katherine Mullett, Station Supervisor

Administrative Support:
Tracy Demeny, Administrative Officer
Michael LeMay
Vacant
Barbara Poirier
Alana Kiple (CS)

Information Technology Support:
Christopher Roberts, Supervisor
Deborah Larson

Larval Unit Supervisor: Shawn Nowicki

Lampricide Control Fish Biologists:
Lori Criger: Treatment Supervisor
Christopher Gagnon: Treatment Supervisor

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)
Vacant (CS)
Stephen Healy (CS)
Janet McConnell(CS)
Tiffany Opalka-Myers (CS)
Randy Parker (CS)
Cory Racine (CS)
Dan Suhonen (CS)

Larval Assessment Fish Biologists:
Robert Frank: Larval Assessment Supervisor
Lynn Kanieski
Matthew Symbal

Larval Assessment Biological Science Technicians:
Jake VanEffen
Nikolas Rewald
Vacant (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
Chad Anderson: Biological Science Technician

Maintenance Worker:
David Magno

Adult Unit Supervisor : Jessica Barber

Fish Biologists:
Pete Hrodey: Adult Assessment /Barrier Supervisor
Kevin Mann
Gregory Klingler
Vacant

Barrier and Trapping Biological Science Technicians:
Dennis Smith
Kevin Letson
Cassie Abrams (CS)
Vacant (CS)
Sean Soucy (CS)

(CS) Career Seasonal

Dale Burkett (left), Sea Lamprey Control Program Director with the Commission, presenting Bob Adair, retired Service Sea Lamprey Control Program Manager with a congratulatory letter of recognition for his years of service and accomplishments with the Sea Lamprey Control Program (Photo by Mara Koenig/USFWS).


2015 recipients of DFO's Prix d'Excellence award in recognition of their research and development of a more and efficient water delivery system for lampricide treatments on large rivers. Left to right: Michelle Wheatley, *Regional Director Science,* Chad Hill, Joe Hodgson, Bhuwani Paudel, Brian Greene, Leslie MacLean, *Associate Deputy Minister,* Jamie Smith, Chris Sierzputowski, Andrea Cyr, *Associate Regional Director,* and Peter Grey (Photo by Melanie McCaig, DFO).

Great Lakes Fishery Commission Commissioner Jim McKane (left) presents Rod McDonald with the 2015 Vernon C. Applegate Award for Outstanding Contributions to Sea Lamprey Control. The award was presented to Mr. McDonald on June 10, 2015, during the Great Lakes Fishery Commission's annual meeting, held in Grand Rapids, Michigan (Photo by Ted Lawrence, GLFC).