SEA LAMPREY CONTROL IN THE GREAT LAKES 2023

ANNUAL REPORT TO
THE GREAT LAKES FISHERY COMMISSION

Jess Barber
U.S. Fish and Wildlife Service
Marquette, Michigan
United States

Tonia Van Kempen
Fisheries and Oceans Canada
Sault Ste. Marie, Ontario
Canada

Cover: U.S. Fish and Wildlife Service staff conducting sea lamprey control activities in the Gooseberry River (a tributary of Lake Superior) estuary.
Photo credit: Lori Criger (U.S. Fish and Wildlife Service).

Report compiled by: Jesse Haavisto and Sara Ruiter, U.S. Fish and Wildlife Service, Marquette, MI.

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Jess Barber
United States Fish and Wildlife Service
Marquette, Michigan

Tonia Van Kempen
Fisheries and Oceans Canada
Sault Ste. Marie, Ontario

EXECUTIVE SUMMARY

This report summarizes sea lamprey control operations conducted by Fisheries and Oceans Canada and the United States Fish and Wildlife Service in the Great Lakes during 2023, which were consistent with those prescribed in the Great Lakes Sea Lamprey Control Plan (2011) to achieve sea lamprey abundance and marking targets. Lampricide treatments were conducted on 114 tributaries and 21 lentic areas. Operation of 73 barriers, (48 purpose-built, 25 modified to serve as a sea lamprey barrier) to block sea lamprey migration and serve as an alternative control to the use of lampricides. Larval assessment crews surveyed 601 Great Lakes tributaries and 77 lentic areas to assess control effectiveness, plan future lampricide treatments, and establish the capacity of streams to produce sea lampreys. Assessment traps were operated in 29 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 62,265 (95% CI: 55,928 – 68,602), which is greater than the index target of 10,421. In Lake Michigan, the index of adult abundance was estimated to be 24,282 (95% CI: 20,359 – 28,205), which is less than the target of 34,982. In Lake Huron, the index of adult abundance was estimated to be 33,640 (95% CI: 32,435 – 34,845), which is greater than the target of 31,274. In Lake Erie, the index of adult abundance was estimated to be 3,455 (95% CI; 3,290 – 3,620), which is greater than the target of 3,263. In Lake Ontario, the index of adult abundance was estimated to be 56,000 (95% CI; 52,543 – 59,457), which is greater than the target of 14,065.

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 impede 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 up to 18 kg (40 lbs) of fish production is lost to 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 help establish and maintain self-sustaining stocks of lake trout and other salmonids by minimizing sea lamprey impacts on these stocks. This report outlines the program's efforts during 2023 to meet these goals.

FISH COMMUNITY OBJECTIVES

Each lake committee has identified qualitative goals for sea lamprey control, which are published in lake-specific fish community objectives. During 2004, each lake committee 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 consecutive five-year period when sea lamprey marking rates were closest to 5 A1-A3 marks per 100 lake trout >532 mm, considered to represent a tolerable annual rate of sea lamprey induced lake trout mortality. A target of adult sea lamprey abundance was calculated for each lake from the average index of abundance over the same five-year period. Similarly, a target was developed for Lake Ontario from the estimated average sea lamprey 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 was calculated as 25% of the estimated average during the consecutive five-year period with the lowest sea lamprey marking rate prior to the completion of the fish community objectives (1989–1993).

The annual performance of the SLCP is evaluated by comparing lake-specific adult sea lamprey abundance indices and lake trout marking rates against established targets. Adult sea lamprey abundance indices are estimated by the Service and Department by tallying mark-recapture estimates from a sub-set of streams within each lake that were selected based on a consistent trapping history and reliable sea lamprey spawning runs. 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.*

Sea lamprey control supports fish community objectives for lake trout and other species:

- *Achieve and maintain genetically diverse self-sustaining populations of lake trout that are similar to those found in the lake prior to 1940, with lean lake trout being the dominant form in nearshore waters, siscowet lake trout the dominant form in offshore waters, and humper lake trout a common form in eastern waters and around Isle Royale.*

- *Maintain self-sustaining populations of lake whitefish within the range of abundance observed during 1990-99.*

The adult index target for Lake Superior of 10,421 sea lamprey was estimated as the mean of indices during 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). The 2023 index of adult abundance for Lake Superior was 62,265 (95% CI: 55,928 – 68,602), which is greater than the index target. The number of A1-A3 marks on lake trout from spring assessments in 2022 was 6.6 marks per 100 lake trout >532mm. The spring 2023 assessment data is currently being compiled.

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 can have a direct effect on 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 34,982 sea lamprey was estimated as the mean of indices during the 5-year period, 1995-1999, when marking rates were closest to 5 marks per 100 lake trout >532 mm (8.9 A1-3 marks per 100 fish >532mm), and multiplied by 5/8.9. Unlike the other Great Lakes, this target was not based on observed consecutive years of marking rates that resulted in a tolerable annual lake trout mortality rate. The 2023 index of adult abundance for Lake Michigan was 24,282 (95% CI: 20,359 – 28,205), which is less than the target. The number of A1-A3 marks on lake trout from fall assessments in 2022 was 2.2 marks per 100 lake trout >532mm. The fall 2023 assessment data is currently being compiled.

Lake Huron

The Lake Huron Committee established the following specific goals 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.*

The 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 31,274 sea lamprey was estimated as 0.25 times the mean of indices during the 5-year period of lowest sea lamprey abundance prior to the publication of the fish community objectives (1989-1993). Unlike the other Great Lakes, this target was not based on observed consecutive years of marking rates that resulted in a tolerable annual lake trout mortality rate. The 2023 index of adult abundance in Lake Huron was estimated to be 33,640 (95% CI: 32,435 – 34,845), which is greater than the index target. The number of A1- A3 marks on lake trout from spring assessments in 2022 was 5.3 marks per 100 lake trout >532mm. The spring 2023 assessment data is currently being compiled.

Lake Erie

The Lake Erie Committee established the following goal and indicator of success for sea lamprey control in Lake Erie:

- *Suppress abundance of sea lamprey to levels that will not impede achievement of any fish community objective, especially for coldwater species of low abundance.*

- *Reduce sea lamprey abundance to levels specified in the sea lamprey management plan administered by the Commission.*

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 lamprey.

The adult index target for Lake Erie of 3,263 sea lamprey was estimated as the mean of indices during 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). The 2023 index of adult abundance in Lake Erie was estimated to be 3,455 (95% CI; 3,290 – 3,620), which is greater than the index target. The number of A1-A3 marks on lake trout from fall assessments in 2022 was 4.0 marks per 100 lake trout >532mm. The fall 2023 assessment data is currently being compiled.

Lake Ontario

The Lake Ontario Committee established the following goal and indicators of success for sea lamprey control in Lake Ontario:

- *Control sea lamprey—suppress abundance of sea lamprey to levels that will not impede achievement of objectives for lake trout and other fish.*

- *Spawning-phase adult sea lamprey abundance in Lake Ontario tributaries below targets identified in the sea lamprey management plan.*

- *Number of A-1 marks on lake trout and other species below targets.*

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

- *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 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 is calculated using A1 marks exclusively, which have been more consistently recorded on Lake Ontario. 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 14,065 sea lamprey was estimated as the mean of indices during 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). The 2023 index of adult abundance in Lake Ontario was estimated to be *56,000 (95% CI; 52,543 – 59,457)*, which is greater than the index target. The number of A1 marks on lake trout from fall assessments in 2022 was 3.1 marks per 100 lake trout >431mm. The fall 2023 assessment data is currently being compiled.

LAMPRICIDE CONTROL

Tributaries harboring larval sea lamprey are treated periodically with lampricides to eliminate or reduce larval populations before they recruit to the lake as feeding juveniles. During stream treatments, Department and Service control units administer and analyze several lampricide formulations including 3-trifluoromethyl-4-nitrophenol (TFM) or TFM mixed with Bayluscide (20% emulsifiable concentrate). Specialized equipment and techniques are employed to maintain lampricide concentrations at levels that eliminate approximately 93% 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, granular Bayluscide 3.2% (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 lamprey 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. Progress on SLCB charges during 2023 is presented in the LCTF section of this report.

During 2023, lampricide treatments were conducted on 114 tributaries and 21 lentic areas of the Great Lakes (Table 1). The time series of control effort metrics are presented in Figure 1.

Table 1. Summary of lampricide applications in tributaries of the Great Lakes in 2023.

Lake	Number of Streams	Number of Lentic Areas	Discharge (m^3/s)	Distance Treated (km)	TFM (kg) [1,2]	Bayluscide (kg) [1,3]
Superior	71	16	112	1,059	16,465	368
Michigan	19	1	99	942	23,792	130
Huron	20	3	107	404	9,593	1,618
Erie	0	0	0	0	0	0
Ontario	4	1	31	175	2,859	133
Total	**114**	**21**	**349**	**2,580**	**52,709**	**2,249**

[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.

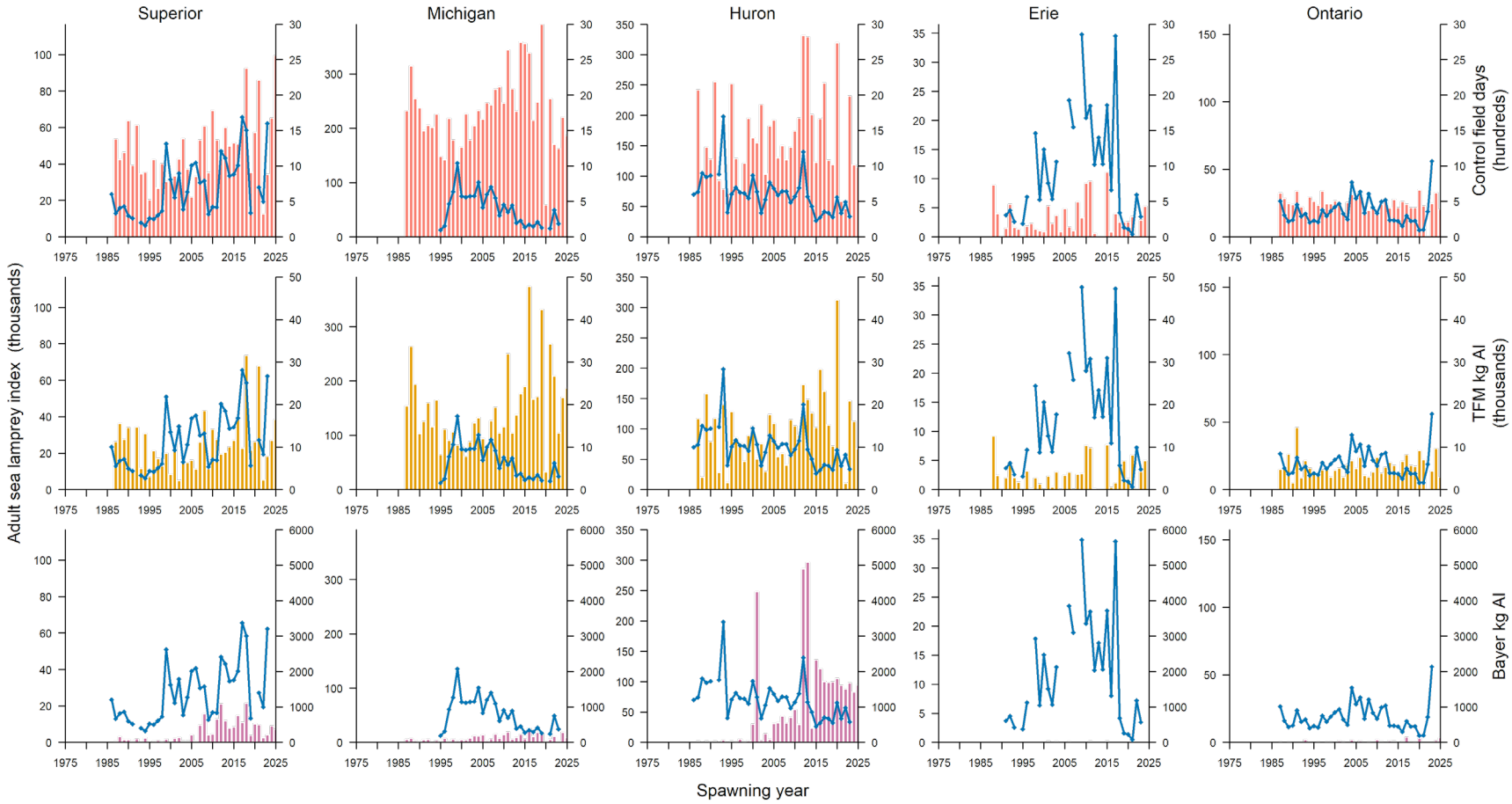


Figure 1. Row 1: Number of control field days (orange bars). Row 2: TFM used (kg active ingredient, yellow bars). Row 3: Bayluscide used (kg active ingredient, purple bars). All rows: Index of adult sea lampreys is shown with blue lines. All metrics plotted against the sea lamprey spawning year. Control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

Lak Supt=rior

A) Grams Cr. (Leork only)
BJ M111Cr.
C) Nnonukong Cr.
D) Ankodosh Cr.
E) Roxbury Cr. (Lentic)
F) Galloway Cr.
G) Tahquarnenon R.

0) Miners R.
P) Amrn R. (Lentic)
(!) Fun,;ice Cr
R) Five Mile Cr.
S) Au Trail1 R.
T) Deer Luke Cr.
U) L 111gh_ing Whitdlsh R.

AA) S;)L.non. TroUl R.
TITI) Pine R.
CC) Huron R.
DD) Ravine R
EE) Sl,He R..
FF) Silver R.
GG) foils R

JJ) Trap l(ock IC (Lentic)
.JJ) Elina Cr. (Lemic)
KK) Gratiot R.
LL) Bos.to11-L1\y Cr.
MM) Salmon Trou1R.
NN) Gravcract R.
00) W. Sleepi11g R.

QQ) FliJ1tskel R.
RR) Ontonagon R.
SS) Sand R.
TT) Iron R
UU) 1iddlc R.
VV) Amnicon R.
WW) K.nif R. (Lmtir.:)

AAA) Kamini:;1iquia R. (Lt'=nlit: only)
BBB) MocKenzie R. (Lentic)
CCC) Illende Cr.
DOD) Coldw.11er Cr
EEE) WolfR
FFF) Oner Cove Cr. (Lcntic only)
GGG) Big Trout Cr.

KKK) Stod R
LLL) Old Woman R.
MMM) Gnrgant1H1 R.
NN-_K') Aga\va R. (Lentic only)
000) Westman Cr.
PPP) PancakcR.
QQQ) Bntdmw<.urn R.

Tl) Three Mile Cr.

V) Sam.IR. .

TTTI) Stmgcon R.

PP) fires.tee] R

XX) Gooseben-y R. (Lentic)

HHH) Nipigon R. (Leniic)

RRR) Chippewa R. (Lentic only)

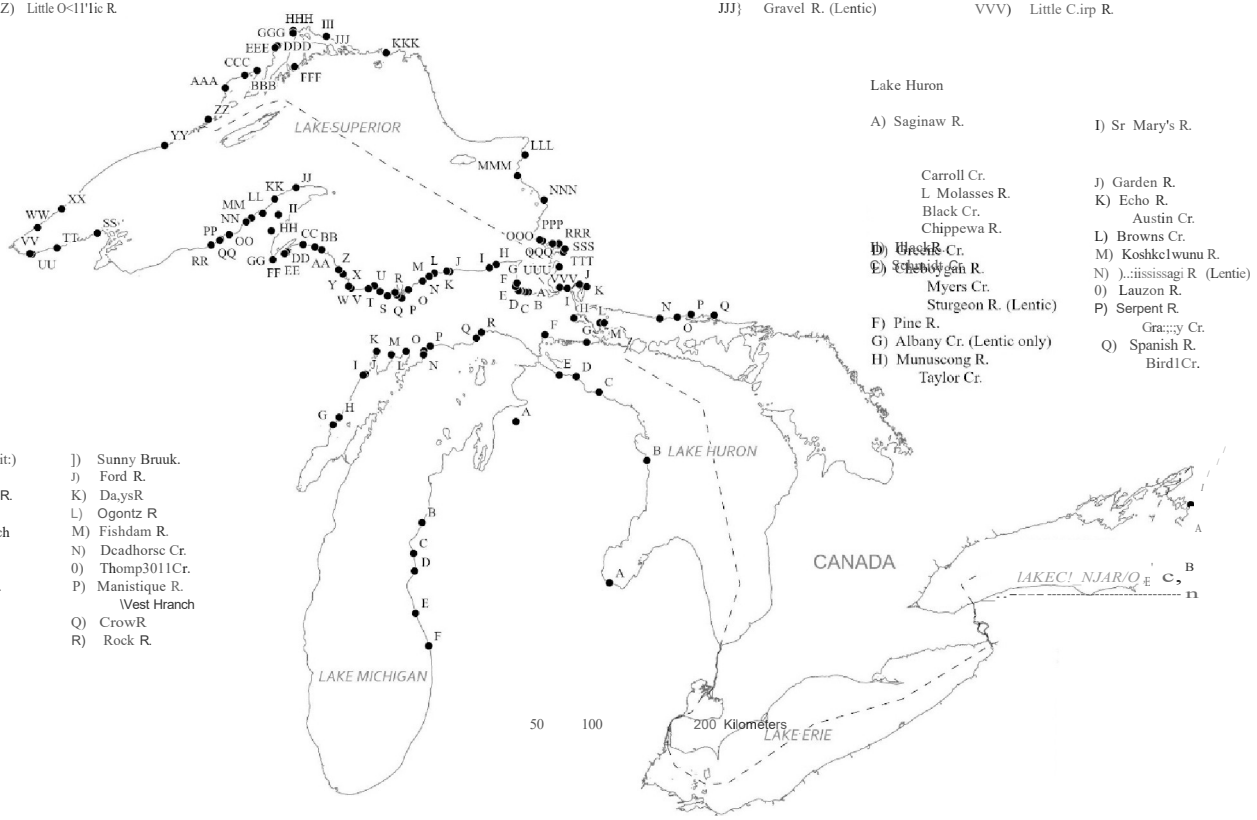
I) Tv, o Hcart1.·d River
J) Cmvcmcr Cr. (Lemle)
Kl Sable Cr.
L) Sulliva1 ls Cr.
M) Seven Mile *Cr.*
N) Bc.:ivcr Lake Cr.
Beaver Cr.

WJ Chocolay R
X) Ca , R
Y) Harlow Cr.
Z) Little O<11'1ic R.

YY) Arrowhead R. (Lenti1.·)
ZZ) Cloud R

Still,vater Cr. (Lentic)
Cash Cr.
Ill) L Grnvel R.
JJJ} Gravel R. (Lentic)

SSS} Sawmill Cr.
TIT) Harmony R.
U iU) Guulai:. R.
VVV) Little C.irp R.



Lake Huron

A) Saginaw R.
Carroll Cr.
L Molasses R.
Black Cr.
Chippewa R.
D) Black R.
E) Cheboygan R.
Myers Cr.
Sturgeon R. (Lentic)
F) Pine R.
G) Albany Cr. (Lentic only)
H) Mumuscong R.
Taylor Cr.

I) Sr Mary's R.
J) Garden R.
K) Echo R.
Austin Cr.
L) Browns Cr.
M) Koshkc1wunu R.
N)).:iississagi R (Lentic)
0) Lauzon R.
P) Serpent R.
Gra:;;;y Cr.
Q) Spanish R.
Bird1Cr.

Lake Michigan

A) Porkr Cr. (Lenlit:)
H) Manis1ee R.
C) Pere [vlurquetle R.
D) Pentwater R
North Branch
E) White R
F) Grnnd R.
Crockery Cr.
Rogue R.
Ci) Springer Cr.
H) Bailey Cr.

]) Sunny Bruuk.
J) Ford R.
K) Da,ysR
L) Ogontz R
M) Fishdam R.
N) Deadhorsc Cr.
0) Thomp3011Cr.
P) Manistique R.
\Vest Hranch
Q) CrowR
R) Rock R.

50 100 200 Miles

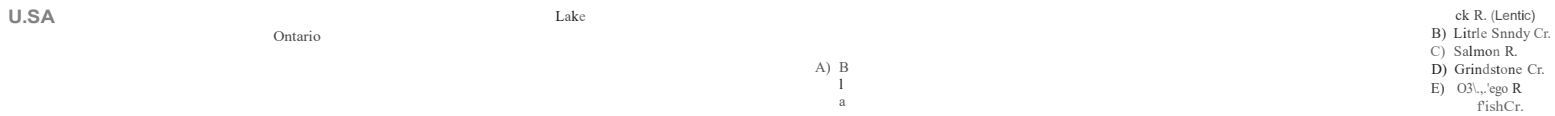


Figure 2. Location of tributaries treated with lampricides during 2023.

Lake Superior

Lake Superior has 1,566 tributaries (833 Canada, 733 U.S.). One hundred seventy-two tributaries (59 Canada, 113 U.S.) have records of larval sea lamprey production. Of these, 130 tributaries (45 Canada, 85 U.S.) have been treated with lampricides at least once during 2014-2023. Sixty tributaries (24 Canada, 36 U.S.) are treated every 3-5 years. Details on lampricide applications to Lake Superior tributaries and lentic areas during 2023 and tributary locations are found in Table 2 and Figure 2, respectively.

- Lampricide treatments were conducted in 71 tributaries (20 Canada, 51 U.S.) and 16 lentic areas (8 Canada, 8 U.S.; Table 2).

- Lentic plots offshore from the Arrowhead, Gooseberry, and Knife rivers in northern Minnesota were treated for the first time.

- Archambeau Creek (Beaver Creek system) in the Pictured Rocks National Lakeshore Wilderness Area, Mill Creek (Chippewa County) and the Knife River were treated for the first time. The Gooseberry River was treated for the first time since 1976.

- The Gravel River lentic treatment was paused due to observations of round whitefish non-target mortality during application. The remainder of the plot will be completed in 2024.

- Low water conditions presented challenges throughout the field season. Several streams were treated under historically low stream discharge. The Jarvis River and a portion of the Cloud River were not treated due to insufficient flow and are rescheduled for treatment in 2024.

- High densities of large larvae/transformers were observed during treatments of Harlow Creek and the Flintsteel, Firesteel, Iron, Sand, and Ontonagon rivers (western Lake Superior).

- During 2023, high densities of large larvae and transformers were detected in Sucker Run (tributary to Deer Lake, Alger County) and in the Sand River (Marquette County) upstream from the barrier. Both streams were added to the treatment schedule and successfully treated in early October.

Table 2. Details on the application of lampricides to tributaries and lentic areas of Lake Superior during 2023 (letter in parentheses cor responds to location of stream in Figure 2). Lampricide quantities are reported as kg of active ingredient.

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
United States							
Grants Cr. (A)							
Lentic	Sep-05	---	---	---	---	---	4.6
Mill Cr. (B)	Sep-01	0.1	1.1	4.5	---	---	---
Naomikong Cr. (C)	Sep-16	0.2	3.9	41.0	0.9		0.1
Ankodosh Cr. (D)	Oct-01	0.4	2.1	61.8	---	---	---
Roxbury Cr. (E)	Oct-02	0.2	4.2	33.9	---	----	---
Lentic	Sep-05	---	---	---	---	---	13.8
Galloway Cr. (F)	Oct-12	0.2	6.1	39.7	---	---	---
Tahquamenon R. (G)	Sep-29	8.5	44.4	1,985.2	13.4	---	---
Three Mile Cr. (H)	Sep-30	0.0	2.6	0.7	---	---	---
Two Hearted R. (I)	Aug-01	4.5	90.0	663.4	1.2	---	---
Carpenter Cr. (J)	Aug-30	0.0	0.2	1.5	---	---	---
Lentic	Sep-06	---	---	---	---	---	15.3
Sable Cr. (K)	Sep-18	0.2	0.2	34.0	---	---	---
Sullivans Cr. (L)	Sep-19	0.1	2.3	27.5	---	---	---
Seven Mile Cr. (M)	Aug-19	0.6	2.4	89.1	---	---	---
Beaver Lake Cr. (N)							
Little Beaver Cr. System	Aug-18	0.1	3.4	11.8	0.1	---	---
Miners R. (O)	Sep-14	0.4	1.8	107.7	---	---	---
Anna R. (P)	Jun-27	1.1	9.2	154.5	7.0	---	---
Lentic	Jul-18	---	---	---	---	---	9.2
Furnace Cr. (Q)	Sep-15	0.3	0.6	42.7	---	---	0.1
Five Mile Cr. (R)	Jun-27	0.0	1.0	0.7	---	---	---
Au Train R. (S)	Sep-16	6.5	30.6	1,508.6	0.4	---	---
Deer Lake Cr. (Sucker Run) (T)	Oct-11	0.1	0.5	2.3	0.0	---	---
Laughing Whitefish R. (U)	Jun-24	0.2	12.7	79.4	0.4	---	---
Sand R. (V)	Jul-26	0.3	2.4	17.8	---	---	---
Upper Sand R.	Oct-12	0.5	10.9	80.8	1.2	---	---
Chocolay R. (W)	Jul-21	5.2	44.4	832.2	1.3	---	---
Carp R. (X)	Jul-20	4.3	8.9	490.7	1.91	---	---

Table 2. *Continued*

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
Harlow Cr. (Y)	May-16	2.1	8.0	167.6	-	---	---
Little Garlic R. (Z)	Aug-23	0.3	9.3	40.0	0.7	---	---
Salmon Trout R. (AA)	Aug-22	2.8	16.6	300.2	2.2	---	---
Pine R. (BB)	Aug-23	0.6	3.5	44.5	---	---	---
Huron R. (CC)	Jun-09	0.7	11.6	87.5	0.2	---	---
Ravine R. (DD)	Sep-11	0.1	8.7	29.7	1.3	---	---
Slate R. (EE)	Sep-09	0.2	1.0	28.6	--	---	---
Silver R. (FF)	Sep-07	1.0	4.7	196.0	0.9	---	0.1
Falls R. (GG)	Sep-13	1.1	0.5	221.7	---	---	---
Sturgeon R. (HH)	Sep-29	7.1	90.1	873.5	0.4	9.7	---
Trap Rock R. (II)	Jun-23	0.5	13.2	80.1	0.30	---	6.7
Eliza Cr. (JJ)	Jun-26	0.0	1.1	5.2	---	---	---
Gratiot R. (KK)	Jun-24	0.2	1.3	25.9	---	---	---
Boston-Lily Cr. (LL)	Jun-27	0.1	4.5	14.1	0.3	---	---
Salmon Trout R. (MM)	Jun-13	1.4	0.6	133.4	---	---	---
Graveraet R. (NN)	May-16	0.5	13.2	81.6	1.5	---	---
West Sleeping R. (OO)	Sep-27	0.0	6.9	7.4	-	---	---
Firesteel R. (PP)	Jul-07	1.3	61.2	326.1	3.0	---	---
Flintsteel R. (QQ)	May-12	1.3	23.5	183.1	4.5	---	---
Ontonagon R. (RR)	Sep-15	14.7	209.2	2,631.8	5.9	---	---
Sand R. (SS)	Jun-10	0.3	11.6	70.5	1.5	---	---
Iron R. (TT)	Jun-11	1.7	3.1	312.2	---	---	---
Middle R. (UU)	Jun-25	0.2	8.2	27.5	---	---	---
Amnicon R. (VV)	Jun-09	0.4	17.9	70.5	---	---	---
Knife R. (WW)	Jun-25	0.8	1.1	148.7	---	---	9.8
Gooseberry R. (XX)	Jun-23	0.7	1.6	177.7	---	---	5.5
Arrowhead R. (YY)	Jun-28	4.5	0.6	237.9	---	---	35.5
Total (United States)		**78.6**	**818.7**	**12,833.9**	**50.5**	**9.7**	**100.7**
Canada							
Cloud R. (ZZ)	Jul-25	0.0	0.7	1.6	---	---	---
Kaministiquia R. (AAA) Lentic	Oct-19	---	---	---	---	---	18.4
Mackenzie R. (BBB)	Jul-12	0.6	0.6	60.2	---	---	---

Table 2. *Continued*

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
Lentic	Oct-17	---	---	--	---	---	46.5
Blende Cr. (CCC)	Jul-14	0.0	4.8	10.1	---	---	0.0
Coldwater Cr. (DDD)	Jul-17	0.8	19.2	327.3	---	---	0.1
Wolf R. (EEE)	Jul-23	2.8	4.4	621.6	0.2	---	0.0
Otter Cove Cr. (FFF)	Jul-05	---	---	---	---	---	1.0
Big Trout Cr. (GGG)	Jul-18	0.1	12.1	32.7	---	---	---
Nipigon R. (HHH)							
Lentic	Oct-14	---	---	---	---	---	37.4
Cash Cr.	Jul-13	0.5	28.7	214.6	---	---	---
Stillwater Cr.	Jul-12	0.1	2.0	16.1	0.4	---	0.1
Lentic	Oct-13	---	---	---	---	---	27.6
Little Gravel R. (III)	Jul-25	0.1	6.1	5.5	0.2	---	0.0
Gravel R. (JJJ)	Jul-23	0.8	13.9	392.3	---	---	---
Lentic	Oct-11	---	---	---	---	---	58.2
Steel R. (KKK)	Aug-22	3.5	7.1	265.8	---	---	0.0
Old Woman R. (LLL)	Aug-15	0.8	15.9	77.2	---	---	0.1
Gargantua R. (MMM)	Aug-16	0.2	1.4	14.6	---	---	0.0
Agawa R. (NNN)							
Lentic	Oct-21	---	---	---	---	---	27.0
Westman Cr. (OOO)	Oct-26	0.1	0.8	3.2	0.2	---	---
Pancake R. (PPP)	May-17	2.8	8.4	139.8	---	---	0.2
Batchawana R. (QQQ)	Jun-27	5.9	12.5	439.8	0.8	---	0.1
Chippewa R. (RRR)							
Lentic	Jul-11	---	---	---	---	---	39.8
Sawmill Cr. (SSS)	May-15	0.2	0.5	7.3	---	---	---
Harmony R. (TTT)	May-15	0.9	2.9	30.2	---	---	---
Goulais R. (UUU)	Jun-22	12.7	95.3	892.8	3.7	---	0.5
Little Carp R. (VVV)	May-11	0.5	2.6	22.1	---	---	---
Total (Canada)		**33.1**	**239.9**	**3,574.7**	**5.6**	---	**256.9**
Total for Lake		**111.7**	**1,058.6**	**16,408.6**	**56.1**	**9.7**	**357.6**

[1]Stream discharges of <0.05 are recorded as 0.0.

[2]Granular Bayluscide amounts less than <0.05 are recorded as 0.0.

Lake Michigan

Lake Michigan has 511 tributaries. One hundred twenty-nine tributaries have records of larval sea lamprey production, and of these, 78 tributaries have been treated with lampricides at least once during 2014-2023. Thirty-four tributaries are treated every 3-5 years. Details on lampricide applications to Lake Michigan tributaries and lentic areas during 2023 and tributary locations are found in Table 3 and Figure 2, respectively.

- Lampricide treatments were conducted in 19 tributaries and 1 lentic area (Table 3).
- Department and Service personnel collaborated to treat the Manistee River.
- Thompson Creek was treated for the first time.
- Sunny Brook was treated for the first time since 1971.
- The Rogue River (Grand River) was treated for the second time; it was last treated in 2008.
- Low water conditions presented challenges throughout the field season. Several streams were treated under historically low stream discharge. Marblehead and Seiners creeks were not treated due to insufficient discharge and have been rescheduled for 2024.

Table 3. Details on the application of lampricides to tributaries and lentic areas of Lake Michigan during 2023 (letter in parentheses corresponds to location of stream in Figure 2). Lampricide quantities are reported as kg of active ingredient.

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
Porter Cr. (A)	Jul-20	0.3	1.4	103.4	---	---	---
Lentic	Jul-20	---	---	---	---	---	8.0
Manistee R. (B)	Aug-18	43.9	127.5	9,166.2	16.6	91.8	---
Pere Marquette R. (C)	Aug-04	13.5	193.1	3,627.1	7.0	21.8	---
Pentwater R. (D)	Jul-22	1.6	22.5	452.0	3.6	---	---
White R. (E)	Jun-11	15.3	148.2	4,860.4	11.7	---	---
Grand R. (F)							
Crockery Cr.	Jun-09	1.0	33.3	344.8	2.1	---	---
Rogue R.	Jun-12	4.0	11.6	1,254.5	---	---	---
Springer Cr. (G)	May-28	0.0	1.4	13.4	0.1	---	---
Bailey Cr. (H)	May-03	0.6	1.9	68.3	---	---	---
Sunny Br. (I)	Apr-28	0.4	1.6	21.6	---	---	---
Ford R. (J)	May-25	7.4	194.7	2,772.2	3.4	8.4	---
Days R. (K)	Sep-07	0.3	6.8	57.3	0.2	---	0.0
Ogontz R. (L)	Apr-28	6.0	16.7	399.7	0.6	---	---
Fishdam R. (M)	Apr-29	3.1	25.9	327.0	1.1	---	---
Deadhorse Cr. (N)	Sep-09	0.0	3.9	9.0	---	---	---
Thompson Cr. (O)	Jun-25	0.2	1.0	53.4	---	---	---
Manistique R. (P)							
West Br. and Star Cr.	Jun-21	0.5	23.5	69.7	---	---	---
Crow R. (Q)	Jun-24	0.5	2.6	131.9	---	---	---
Rock R. (R)	Jun-24	0.1	3.2	14.1	---	---	---
Total for Lake		**98.5**	**820.8**	**23,746.1**	**46.3**	**121.9**	**8.0**

[1]Stream Discharge of <0.05 are recorded as 0.0.
[2]Granular Bayluscide amounts of <0.05 are recorded as 0.0.

Lake Huron

Lake Huron has 1,761 tributaries (1,334 Canada, 427 U.S.). One hundred thirty tributaries (61 Canada, 69 U.S.) have records of larval sea lamprey production. Of these, 77 tributaries (36 Canada, 41 U.S.) have been treated with lampricide at least once during 2014-2023. Forty-three tributaries (23 Canada, 20 U.S.) are treated every 3-5 years. Details on lampricide applications to Lake Huron tributaries and lentic areas during 2023 and tributary locations are found in Table 4 and Figure 2, respectively.

- Lampricide treatments were conducted in 20 tributaries (9 Canada, 11 U.S.) and in 3 lentic areas (1 Canada, 2 U.S.; Table 4).

- A total of 293.3 hectares of larval habitat in the St. Marys River was treated with granular Bayluscide (Table 4).

- Three tributaries were treated for the first time: Austin Creek (Echo River), Black Creek (Saginaw River) and Little Molasses River (Saginaw River).

- Lampricide treatments were deferred in 8 streams and 1 lentic area and are rescheduled for treatment in 2024:

    - The Nottawasaga River, the Naiscoot River and the Bighead River lentic treatments were deferred and have been rescheduled for 2024 pending further discussion with First Nation communities.

    - The Root River, Bear Lake Outlet, Beaver Dam Creek, and Driving Creek (Garden River) were not treated due to insufficient discharge.

    - The Tobacco River (Saginaw River) was not treated due to unfavorable controlled flow conditions.

    - The Pine River (Saginaw River) was not treated due to low dissolved oxygen concentrations.

Table 4. Details on the application of lampricides to tributaries and lentic areas of Lake Huron during 2023 (letter in parentheses corresponds to location of stream in Figure 2). Lampricide quantities are reported as kg of active ingredient.

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
United States							
Saginaw R. (A)							
Carroll Cr.	May-15	0.4	13.7	99.6	---	---	---
L. Molasses R.	May-12	2.2	23.3	272.6	1.1	---	---
Black Cr.	May-13	0.2	6.1	20.1	---	---	---
Chippewa R.	May-26	15.6	120.7	3,320.6	3.2	---	28.2
Black R. (B)	Apr-28	4.4	36.0	750.5	4.9	---	---
Schmidt Cr. (C)	Apr-30	0.7	0.6	94.2	---	---	---
Green Cr. (D)	Sep-05	0.0	0.3	3.7	---	---	---
Cheboygan R. (E)							
Myers Cr.	Sep-02	0.1	3.1	19.9	0.6	---	---
Sturgeon R.	Sep-04	5.1	40.2	1,137.8	6.2	12.0	---
Lentic	Sep-06	---	---	---	---	---	33.7
Pine R. (F)							
Black Cr.	Sep-18	0.3	17.4	57.7	0.9	---	---
Albany Cr. (G)							
Lentic	Sep-13	---	---	---	---	---	22.0
Munuscong R. (H)							
Taylor Cr.	Sep-14	0.4	9.5	144.4	2.6	---	0.1
Total (United States)		**29.3**	**270.9**	**5,920.9**	**19.3**	**12.0**	**84.0**
Canada							
St. Marys R. (I)	Jul-18	---	---	---	---	---	1,385.8
Garden R. (J)	Aug-10	4.0	60.5	409.3	3.1	---	0.5
Echo R. (K)							
Austin Cr.	Oct-19	0.1	0.3	7.5	---	---	---
Browns Cr. (L)	May-04	0.4	0.9	14.9	---	---	0.0
Koshkawong R. (M)	May-04	2.2	1.6	140.5	0.6	---	0.1
Mississagi R. (N)	Aug-11	65.0	49.3	2,824.9	---	43.3	0.1
Lentic	Jul-13	---	---	---	---	---	91.9
Lauzon Cr. (O)	May-10	5.3	0.9	10.8	--	---	---

Table 4. *Continued*

Tributary	Date	Discharge (m^3/s) [1]	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)[2]
Serpent R. (P)							
Grassy Cr.	May-09	0.4	2.7	10.8	---	---	0.1
Spanish R. (Q)							
Birch Cr.	Oct-14	0.7	16.9	63.7	0.4	---	0.1
Total (Canada)		**78.0**	**133.1**	**3,648.5**	**4.2**	**43.3**	**1,478.5**
Total for Lake		**107.3**	**404.0**	**9,569.4**	**23.5**	**55.3**	**1,562.5**

[1]Stream Discharge of <0.05 are recorded as 0.0.
[2] Granular Bayluscide amounts of <0.05 are recorded as 0.0.

Lake Erie

Lake Erie has 842 tributaries (525 Canada, 317 U.S.). Thirty tributaries (11 Canada, 19 U.S.) have records of larval sea lamprey production. Of these, 15 tributaries (5 Canada, 10 U.S.) have been treated with lampricides at least once during 2014-2023. Seven tributaries (2 Canada, 5 U.S.) are treated every 3-5 years. 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 (1 Canada, 1 U.S.).

- No Lake Erie tributaries or lentic areas were treated with lampricides during 2023.

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, 35 tributaries (18 Canada, 17 U.S.) have been treated with lampricides at least once during 2014-2023. Twenty-six tributaries (13 Canada, 13 U.S.) are treated every 3-5 years. Details on lampricide applications to Lake Ontario tributaries and lentic areas during 2023 and tributary locations are found in Table 5 and Figure 2, respectively.

- Lampricide applications were completed in 4 tributaries (0 Canada, 4 U.S) and in 1 lentic area (0 Canada; 1 U.S.; Table 5).

- The Little Salmon River and the Little River (Fish Creek, Oswego River) were not treated due to insufficient discharge and have been rescheduled for treatment in 2024.

- The Black River lentic plot, deferred in 2022, was successfully treated with granular Bayluscide.

Table 5. Details on the application of lampricides to tributaries and lentic areas of Lake Ontario during 2023 (letter in parentheses corresponds to location of stream in Figure 2). Lampricide quantities are reported as kg of active ingredient.

Tributary	Date	Discharge (m^3/s)	Distance Treated (km)	Liquid TFM (kg)	Solid TFM (kg)	Emulsifiable Concentrate Bayluscide (kg)	Granular Bayluscide (kg)
United States							
Black R. (A)							
Lentic	May-26	---	---	---	---	---	131.7
Little Sandy Cr. (B)	May-31	0.4	9.0	57.3	---	---	0.1
Salmon R. (C)	Jun-03	22.5	56.6	1,659.1	3.1	---	0.4
Grindstone Cr. (D)	May-26	0.5	54.5	185.7	0.2	---	0.2
Oswego R. (E)							
Fish Cr.	Jun-02	7.8	55.2	951.9	1.7	---	0.6
Total (United States)		**31.2**	**175.4**	**2,854.1**	**5.0**	**---**	**133.0**
Total for Lake		**31.2**	**175.4**	**2,854.1**	**5.0**	**---**	**133.0**

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 lamprey. During 2023, barriers and juvenile trapping were the alternative control methods deployed. Other methods that are currently being investigated include attractants (e.g. pheromones), repellents (e.g. alarm cues), and new trap designs.

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 barrier sites not operated or maintained by the SLCP.
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.
    d. Where structures 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. Progress on SLCB charges during 2023 is presented in the BTF section of this report.

The Commission has invested in 73 barriers in the Great Lakes basin (Figure 3). Of these, 48 were purpose-built as sea lamprey barriers and 25 were constructed for other purposes but have been modified to block sea lamprey migrations.

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) database and may be used to: 1) select barrier projects; 2) monitor inspection frequency; 3) schedule upstream larval assessments; 4) assess the effects of barrier removal or modifications on sea lamprey populations; or 5) identify structures that are important in controlling sea lamprey.

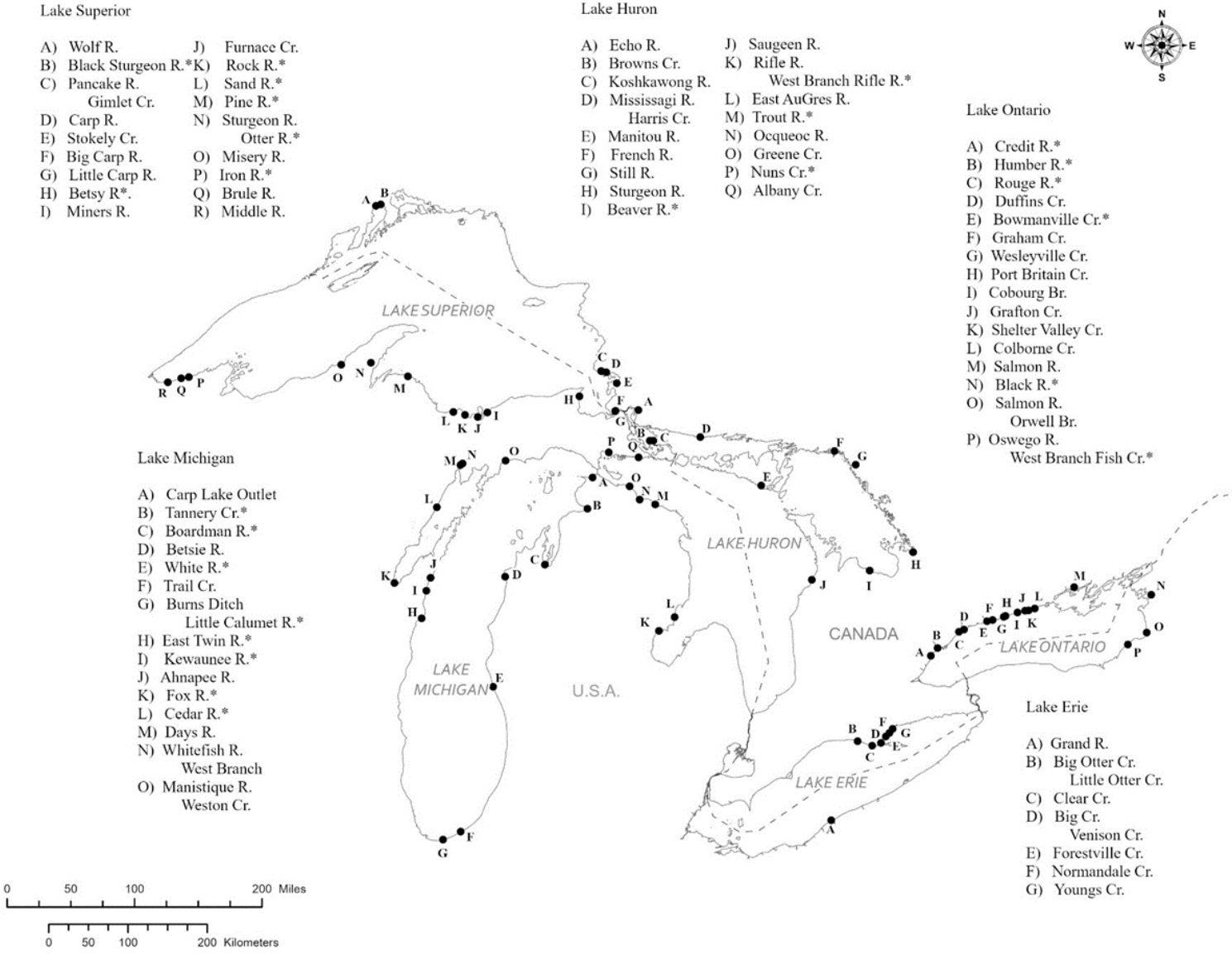


Figure 3. Locations of tributaries with sea lamprey barriers. An asterisk indicates structures that have been modified or constructed by others to prevent the upstream migration of sea lamprey.

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 inspected 20 structures in the Lake Superior watershed during 2023. This data will be used to evaluate sea lamprey blocking potential and update the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 7 barriers (6 Canada, 1 U.S.).

- Engineering inspections were completed at all Canadian SLC barriers.

Ensure Blockage to Sea Lamprey Migration

- Recent escapement events have been documented on the Middle and Sand (Marquette County) rivers. Investigations into barrier and stream conditions are being conducted to identify escapement routes. Remote sensing water level loggers will be installed to identify when the required 18" drop to block sea lampreys has been lost. Engineering firms will perform barrier inspections to identify any structural deficiencies that may have led to escapement. Service staff will continue larval sea lamprey assessment surveys upstream of the barriers to monitor for recruitment.

- Salmon Trout River – The Service and GLFC are working with Stanton Township to identify ways to modify or remove two dams on the Salmon Trout River under Township ownership. A feasibility study is underway to identify actions to remove liability of the structures from the Township while continuing to block sea lamprey access to upstream spawning habitat.

- Partner agencies were consulted to ensure sea lamprey blockage at barriers at 13 sites in 12 streams during 2023 (Table 6).

Table 6. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Superior tributaries during 2023.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Brule R.	Little Bois Brule	TU[1]	Ranger Rd. culvert	Concur	Upstream of blocking barrier
Brule R.	Sandy Run Cr.	TU[1]	Hwy 27 culvert	Concur	Upstream of blocking barrier
Boston R.	Lily Cr.	TU[1]	Salo Rd. culvert	Concur	Limited upstream potential
Chicago Cr.	Chicago Cr.	TU[1]	Blueberry Rd. culvert	Concur	Limited upstream potential
Dead R.	Connors Cr.	TU[1]	County Rd. AAP culvert	Concur	Upstream of blocking barrier

Table 6. *Continued*

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Pikes Cr.	Pikes Cr.	TU[1]	Jammer Hill Rd. culvert	Concur	Limited upstream potential
Silver R.	Kalio Cr.	TU[1]	Skanee Rd. culvert	Concur	Limited upstream potential
Sioux River	Little Sioux R.	TU[1]	Little Sioux culvert	Concur	Limited upstream potential
Sand Point Wetland	Sand Point Wetland	NPS[2]	Sand Point Rd. culvert	Concur	Ineffective barrier
Michigamme R.	Michigamme R.	MRBWR[3]	Republic Dam	Concur	Upstream of blocking barrier
Sucker R.	Sucker R.	GLFC[4]	H-58 Rd. culvert	Concur	Upstream barrier conditional
St. Louis R.	St. Louis R.	ECT[5]	Billings Dr. culvert	Concur	Limited upstream potential
Middle R.	Middle R.	DCW[6]	Middle R. Sea Lamprey Barrier	Do Not Concur	First blocker

[1]Trout Unlimited, [2]National Park Service, [3]Michigamme River Basin Water Resources Improvement Tax Increment Finance Authority, [4]Great Lakes Fishery Commission, [5]ECT Engineering, [6]Douglas County Wisconsin

New Construction

- Sucker River – The Sucker River (Grand Marais) project is at 60% design to replace perched culverts at the H-58 road crossing with a free-span bridge. A site for the seasonal sea lamprey barrier has been determined and design is underway. The project reconnects approximately 20 miles of stream while blocking sea lamprey from accessing 95 stream miles of critical spawning and rearing habitat.

- Neebing River – The installation of a permanent sea lamprey trap at the Neebing River barrier, in Thunder Bay, is expected to be completed during 2024.

Lake Michigan

The Commission has invested in 15 barriers on Lake Michigan (Figure 3). Of these, 7 were purpose-built as sea lamprey control barriers and 8 were constructed for other purposes but have been modified to block sea lamprey migrations.

Barrier Inventory and Project Selection System

Field crews inspected 81 structures in the Lake Michigan watershed during 2023. This data will be used to evaluate sea lamprey blocking potential and update the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and a safety inspection was performed on 1 barrier.

Ensure Blockage to Sea Lamprey Migration

- Boardman River – A project to investigate selective bi-directional fish passage (FishPass) at Union Street Dam has restarted after a litigation hold. Construction will commence after project partners reach an agreement on changes in project cost that occurred due to the delays caused by the legal cases. Assessment projects have been ongoing including those associated with image recognition software, fish movement, as well as energy and nutrient dynamics.

- Grand River – The Grand River (Michigan) sea lamprey barrier project has slowed as permitting issues in the downstream reach are being addressed. The Michigan Department of Natural Resources (MIDNR) and Service replaced aging stop logs in the 6th Street Dam's fishway to help maintain sea lamprey blockage. These agencies will develop an operational protocol for stop log installation and removal to best coordinate sea lamprey blockage in the spring and coho salmon passage during the fall.

- Kalamazoo River – The Service and GLFC have partnered with the MIDNR to identify alternatives to improve sea lamprey blockage on Swan Creek (tributary to the Kalamazoo River) in conjunction with the removal of the Swan Creek Dam. The MIDNR has contracted the engineering firm AECOM to perform a feasibility study for dam removal which includes three alternatives that address sea lamprey blockage.

- Barrier removals/modification – Partner agencies were consulted to ensure blockage at barriers at 42 sites in 14 streams (Table 7).

Table 7. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Michigan tributaries during 2023.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #1	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #2	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #3	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #4	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #5	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #6	Concur	Upstream of blocking barrier
Betsie R.	Dair Cr.	FBVT[1]	Dair Cr. culvert #7	Concur	Upstream of blocking barrier
Cold Cr.	Cold Cr.	FBVT[1]	Cold Cr. culvert #1	Concur	Ineffective barrier
Cold Cr.	Cold Cr.	FBVT[1]	Cold Cr. culvert #2	Concur	Ineffective barrier
Cold Cr.	Cold Cr.	FBVT[1]	Cold Cr. culvert #3	Concur	Ineffective barrier
Cooper Cr.	Cooper Cr.	TU[2]	Morton Rd. culvert #1	Concur	Limited upstream potential

Table 7. *Continued*

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Gurney Cr.	Gurney Cr.	TU[2]	Morton Rd. culvert #2	Concur	Ineffective barrier
Kalamazoo R.	Portage Cr.	CP[3]	Elijah Root Dam	Concur	Upstream of blocking barrier
Leland R.	Cedar Run Cr.	CRA[4]	E Run Rd. culvert	Concur	Upstream of blocking barrier
Leland R.	Cedar Run Cr.	CRA[4]	E Alpine Rd. culvert	Concur	Upstream of blocking barrier
Manistee R.	Pine Cr.	TU[2]	Pine Cr. Rd. culvert	Concur	Limited upstream potential
Manistee R.	Sickle Cr.	TU[2]	Sickle Cr. culvert	Concur	Limited upstream potential
Manistee R.	Chief Cr.	TU[2]	Chief Cr. culvert	Concur	Limited upstream potential
Manistee R.	Slagle. Cr.	TU[2]	28 ½ Rd. culvert	Concur	Upstream of blocking barrier
Manistee R.	Slagle Cr.	TU[2]	FR7252 Rd. culvert	Concur	Upstream of blocking barrier
Millecoquins R.	McAlpine Cr.	Huron Pines	McAlpine Trout Pond Dam	Concur	Low chance for infestation
Mitchell Cr.	W Br. 4-mile Cr.	CRA[4]	W Br. 4-mile Cr. culvert #1	Concur	Ineffective barrier
Mitchell Cr.	W Br. 4-mile Cr.	CRA[4]	W Br. 4-mile Cr. culvert #2	Concur	Ineffective barrier
Mitchell Cr.	Vanderlip Cr.	CRA[4]	Vanderlip crossing #1	Concur	Ineffective barrier
Mitchell Cr.	Vanderlip Cr.	CRA[4]	Vanderlip crossing #2	Concur	Ineffective barrier
Mitchell Cr.	Vanderlip Cr.	CRA[4]	Vanderlip crossing #3	Concur	Ineffective barrier
Mitchell Cr.	Vanderlip Cr.	CRA[4]	Vanderlip crossing #4	Concur	Upstream of blocking barrier
Muskegon R.	Little Bear Cr.	WMSRDC[5]	Tyler Rd. culvert	Concur	Upstream of blocking barrier
Muskegon R.	Green Cr.	WMSRDC[5]	Buys Rd. culvert #1	Concur	Ineffective barrier
Muskegon R.	Green Cr.	WMSRDC[5]	Buys Rd. culvert #2	Concur	Ineffective barrier
Muskegon R.	Bigelow Cr.	TU[2]	Croton Rd. culvert	Concur	Ineffective barrier
Muskegon R.	Bear Cr.	MCD[6]	Roberts Rd. culvert	Concur	Upstream of blocking barrier
Muskegon R.	Buckhorn Cr.	MTU[7]	Buckhorn Cr. Dam	Concur	Upstream of blocking barrier
Paw Paw R.	Cowslip Cr.	USFWS[8]	Unnamed Dam	Concur	Upstream of blocking barrier
Pere Marquette R.	Baldwin R.	CRA[4]	Baldwin R. Hatchery Dam	Concur	Upstream of blocking barrier

Table 7. *Continued*

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Stover Cr.	Stover Cr.	TOTM[9]	Stover Cr. Dam	Concur	Upstream of blocking barrier
White R.	Skeel Cr.	WMSRDC[5]	Skeel Rd. Dam	Concur	Upstream of blocking barrier
White R.	Unnamed trib.	WMSRDC[5]	148th Ave culvert	Concur	Upstream of blocking barrier
White R.	Osborn Cr.	WMSRDC[5]	152nd Ave culvert	Concur	Upstream of blocking barrier
White R.	W Br. White R.	FVTU[10]	13th Ave Dam	Concur	Upstream of blocking barrier
White R.	W Br. White R.	FVTU[10]	White R. culvert	Concur	Upstream of blocking barrier

[1]Friends of the Betsie Valley Trail, [2]Trout Unlimited, [3]City of Portage, [4]Conservation Resource Alliance, [5]West Michigan Shoreline Regional Development Commission, [6]Muskegon Conservation District, [7]Michigan Technological University, [8]U.S. Fish and Wildlife Service, [9]Tip of the Mitt Watershed Council, [10]Fox Valley Trout Unlimited

New Construction

- Manistique River – The MIDNR acquired 35 acres of land for the Manistique River sea lamprey barrier project. An additional 2 parcels remain to be purchased. Barrier design will be initiated in June 2024 with construction tentatively scheduled to begin in 2026. The Service continues to work with the City of Manistique to relocate the municipal waterline that currently runs across the existing dam. Large woody debris resting on the upstream dam face was removed in October 2023.

- Little Manistee River – The Service continues to work with the MIDNR and USACE staff to improve the blocking capability of the Little Manistee River weir and egg take facility through the construction of a new spillway and permanent sea lamprey trap. The project has reached the 90% design phase. Construction is tentatively planned for 2024 and expected to take two years to complete.

- Pere Marquette River – The Service continues to work with the Village of Baldwin, MIDNR and Conservation Resource Alliance to identify options for replacing the failed Baldwin River Hatchery Dam with a sea lamprey barrier. The engineering firm, AECOM, has provided project partners with the Final Alternatives Evaluation Report outlining design alternatives for dam removal and sea lamprey barrier location.

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 inspected 81 structures in the Lake Huron watershed during 2023. This data will be used to evaluate sea lamprey blocking potential and update the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 9 barriers (5 Canada, 4 U.S.).

- Engineering inspections were completed at all Canadian SLC barriers.

- Ocqueoc River – The electrical barrier was activated April 2023 and operated intermittently throughout the sea lamprey spawning run. The system was shut down for the season and winterized in August.

- Koshkawong River – Remediation of the barrier is expected to be completed in 2024.

Ensure Blockage to Sea Lamprey Migration

- Trout River – Project partners contracted with Barr Engineering to complete a feasibility study identifying alternatives for dam replacement as a result of the Michigan Department of Environment, Great Lakes, and Energy (MIEGLE) dam safety inspection rating of 'poor' for the Trout River dam. The project partners completed emergency repairs to a section of collapsed wing wall preventing further scour of the dam's abutment.

- Nunns Creek – Planning continued with the Sault Tribe of Chippewa Indians for a feasibility study on the Nunns Creek sea lamprey barrier. Project goals include improving sea lamprey blockage while simultaneously expanding rearing capabilities of the attached hatchery complex. The engineering firm Green Watershed Restoration was selected to perform the feasibility study.

- Saginaw River (Cass River) – Data collection has begun to complete a feasibility study for Caro Dam focused on alternatives from dam rehabilitation to removal. Project partners include the GLFC, Service, Tuscola County Economic Development Corporation, MIDNR, MIEGLE, and the dam owner. The engineering firm Stantec Consulting Services was selected to conduct the study.

- Partner agencies were consulted to ensure blockage at barriers for 7 sites in 4 tributaries during 2023 (Table 8).

Table 8. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Huron tributaries during 2023.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Au Sable R.	E. Br. Au Sable R.	MTU[1]	Grayling Fish Hatchery	Concur	Upstream of blocking barrier
Au Sable R.	Unnamed trib.	Huron Pines	Mio Walley Pond Dam	Concur	Limited upstream potential
Cheboygan R.	Twin Lakes Cr.	Huron Pines	Roberts Lake Dam	Concur	Limited upstream potential
Cheboygan R.	Black R.	Huron Pines	Sparr Rd. culvert	Concur	Upstream of blocking barrier

Table 8. *Continued*

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Flowers Cr.	Flowers Cr.	Huron Pines	Nordquist Rd. culvert	Concur	Ineffective barrier
Rifle R.	Rifle Cr.	Huron Pines	Fisk Dam	Concur	Upstream of blocking barrier
Rifle R.	Houghton Cr.	Huron Pines	Sanback Dam	Concur	Limited upstream potential

[1]Michigan Trout Unlimited

Lake Erie

The Commission has invested in 7 purpose-built sea lamprey barriers on Lake Erie (Figure 3).

Barrier Inventory and Project Selection System (BIPSS)

Field crews inspected 15 structures in the Lake Erie watershed during 2023. This data will be used to evaluate sea lamprey blocking potential and update the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 7 barriers (7 Canada, 0 U.S.).

- Engineering inspections were completed at all Canadian SLC barriers.

Ensure Blockage to Sea Lamprey Migration

- Clinton River – Project partners completed a stream geomorphology study above Yates Mill Dam to provide guidance on stream channel modifications for resolving the formation of a bypass channel around this sea lamprey barrier. Project partners are working together to review the recommendations and plan a course of action.

- Huron River – The engineering firm GEI has been contracted to perform a feasibility study for the Flat Rock & Huroc dams fish passage project. The study will focus on developing alternatives from repair to full removal of the dams. The Service and GLFC are involved in alternative design discussions ensuring sea lamprey infrastructure is considered to allow for a rapid response should the river become infested with sea lamprey.

- Partner agencies were consulted to ensure blockage at 2 barrier sites in 1 tributary (Table 9).

Table 9. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Erie tributaries during 2023.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Huron R.	Willow Run Cr.	WC[1]	Tyler Dam	Concur	Upstream of blocking barrier
Huron R.	Willow Run Cr.	WC[1]	Beyer Dam	Concur	Upstream of blocking barrier

[1]Washtenaw County

New Construction

- Grand River – Harpersfield Dam on the Grand River (OH) was retrofitted with a second steel lip on the upper barrier step remediating a nappe vibration which occurred under certain flow rates. The nappe break lip has pulled away from the structure in many sections and requires repair. The Service is working to identify a long-term solution to prevent any further deterioration of the structure.

- Conneaut Creek – Partners continued to pursue construction of a sea lamprey barrier in Conneaut Creek. The feasibility study is approaching completion and identifies the preferred barrier design and location. During September 2023, an outreach meeting with landowners was held to provide updated project metrics and to inform them of potential impacts to their property. Additional meetings with impacted landowners and the public will continue in 2024.

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 inspected 9 structures in the Lake Ontario watershed during 2023. This data will be used to evaluate sea lamprey blocking potential and update the BIPSS.

Operation and Maintenance

- Routine maintenance, spring start-up, and safety inspections were performed on 11 barriers (10 Canada, 1 U.S.).

- Engineering inspections were completed at all Lake Ontario sea lamprey control barriers.

Ensure Blockage to Sea Lamprey Migration

- Partner agencies were consulted to ensure blockage at barriers for 7 sites in 2 tributaries during 2023 (Table 10).

Table 10. Status of concurrence requests for barrier removals, replacements, or fish passage projects in Lake Ontario tributaries during 2023.

Mainstream	Tributary	Lead Agency	Project	SLCP Position	Comments
Little Salmon R.	Little Salmon R.	TU[1]	Ames Mill Dam	Conditional	Seasonal requirements
Little Salmon R.	Black Cr.	TU[1]	Youngs Mill Dam	Conditional	Seasonal requirements
Little Salmon R.	Little Salmon R.	TU[1]	Little Salmon Dam	Conditional	Seasonal requirements
Seneca R.	Onondaga Cr.	OEI[2]	Tully Farm Rd. culvert	Concur	Ineffective barrier
Seneca R.	Onondaga Cr.	OEI[2]	Unnamed Dam	Concur	Ineffective barrier
Seneca R.	W Br. Onondaga Cr.	OEI[2]	Cornwall Rd. culvert #1	Concur	Ineffective barrier
Seneca R.	W Br. Onondaga Cr.	OEI[2]	Cornwall Rd. culvert #2	Concur	Ineffective barrier

[1]Trout Unlimited, [2]Onondaga Environmental Institute

New Construction

- Feasibility studies are being planned for sea lamprey barriers on the Little Salmon River and Grindstone Creeks for completion in 2024.

- South Sandy Creek – The Monitor Mills Dam was breached in 2022 with a large section of the spillway collapsing. Project partners including the GLFC, Department, Service, and New York Department of Environmental Conservation have initiated discussions to perform a feasibility study to repair the dam. Partners have initiated a Request for Interest to identify potential engineering firms to complete the report.

Juvenile Trapping For Control

Out-migrating juvenile sea lamprey were trapped in 10 tributaries of Lake Superior, 2 tributaries of Lake Michigan, and 7 tributaries of Lake Huron from September through December using elver nets, fyke nets, hoop nets, and screw traps to mitigate escapement due to treatment deferrals, barrier breaches, and in streams close to program headquarters (Table 11).

- The Great Lakes Indian Fish and Wildlife Commission and Keweenaw Bay Indian Community supported juvenile trapping efforts in multiple Lake Superior streams through cooperative agreement with the Service (Table 11).

Table 11. Sea lamprey catch from juvenile trapping during 2023.

Lake	Stream	Field Station	Juveniles
Superior	Lower Marengo R. (Bad R.)	GLIFWC[2]	2
Superior	Middle R. (Below Barrier)*	GLIFWC[2]	2
Superior	Middle R. (Mouth)*	GLIFWC[2]	199
Superior	Cranberry R.	KBIC[3]	237
Superior	Little Carp R.	KBIC[3]	0
Superior	Potato R. (MI)	KBIC[3]	0
Superior	Traverse R.	KBIC[3]	32
Superior	Firesteel R.	KBIC[3]	0
Superior	Harlow Cr.*	USFWS[4]	1
Superior	Sand R. (Alger County)	USFWS[4]	3
Superior	Deer Lake Outlet	USFWS[4]	17
Michigan	Bills Cr.	USFWS[4]	20
Michigan	Furlong Cr.	USFWS[4]	0
Huron	Root R.	DFO[1]	163
Huron	Black Mallard Cr.	USGS[5]	3
Huron	Long Lake Outlet	USGS[5]	1
Huron	Maple R. (Cheboygan R.)	USGS[5]	20
Huron	Pigeon R. (Cheboygan R.)	USGS[5]	0
Huron	Silver Cr.	USGS[5]	0
Huron	Sturgeon R. (Trib. to Cheboygan R.)	USGS[5]	4
	Total		**704**

* Streams treated with lampricide in 2023, [1] Fisheries and Oceans Canada, [2] Great Lakes Indian Fish and Wildlife Commission, [3] Keweenaw Bay Indian Community, [4] U.S. Fish and Wildlife Service, [5] U.S. Geological Survey

Supplemental Control

Supplemental controls are tactics that supplement the two primary sea lamprey control strategies, lampricides and sea lamprey barriers, by reducing reproduction and capturing transformed sea lamprey. During 2020, the Commission initiated a long-term study to evaluate supplemental control on up to 13 streams where lampricide treatments are challenging or barriers were recently removed (Figure 4).

Supplemental controls were deployed in 4 Lake Huron streams during 2020-2023:

- Black Mallard River – A seasonal electric sea lamprey barrier has been operated since 2016. Larval recruitment has not been documented upstream of the seasonal barrier since 2017. During 2020-2023, enhanced trapping of adult sea lamprey also occurred downstream of the electrical barrier. During 2021 and 2022, about 100 sterile males were released upstream of the electrical barrier to mate with any female sea lamprey that may have escaped upstream.

- Pigeon, Sturgeon, Maple rivers (Cheboygan River Watershed) – Sterile male release occurred during 2017-2019. The sterilization facility was not operated in 2020 due to COVID-19 travel restrictions. Sterile males were released in 2021 (2,000), 2022 (3,325), and 2023 (3,925).

    - In the Maple River, evidence of the 2020-year class upstream of the former Lake Kathleen Dam was documented. The stream has not been treated with lampricide

since 2016, and treatment has been recommended during 2024. The timing and extent of any lampricide treatments will be coordinated with partners and will need to consider the endangered Hungerford's Crawling Water Beetle (*Brychius hungerfordi*).

- In the Sturgeon River, a year class of larvae recruited in 2020 and this population was treated during 2023. The Sturgeon River was last treated during 2016.

- In the Pigeon River, multiple year classes of larvae were present in 2022 with larvae present upstream of the former Song of the Morning impoundment. The Pigeon River was treated with lampricide during 2022. Larval assessment during 2023 determined that the treatment was highly effective.

- Benefits to sea lamprey control – Deployment of supplemental controls on the Pigeon, Sturgeon, Maple, and Black Mallard rivers has delayed lampricide treatment and resulted in a redirection of ~ $700,000 of lampricide control effort that was used to kill sea lampreys in other streams. Out-migrating juveniles have been removed in traps with a total removal of 1,158 juveniles since 2020.

Baseline data were collected prior to supplemental control deployment in nine streams 2020-2023 and a proposal to expand supplemental control deployments starting in 2024 was approved by the Great Lakes Fishery Commission:

- Crews surveyed all life stages of sea lamprey in the Cranberry River, Potato River, Traverse River, Bills Creek (Whitefish River), Furlong Creek (Millecoquins River), Root River, Crystal Creek (Root River), Long Lake Outlet, and Silver Creek (Tawas Lake Outlet) starting in 2020 and continuing through 2023 (Table 12).

- Combinations of supplemental controls will be deployed in these nine streams starting in 2024 and continuing through 2029 (Table 13).

- A novel aspect of this work is the application of close-kin mark-recapture to characterize changes in sea lamprey recruitment and larval growth before and after application of supplemental controls.

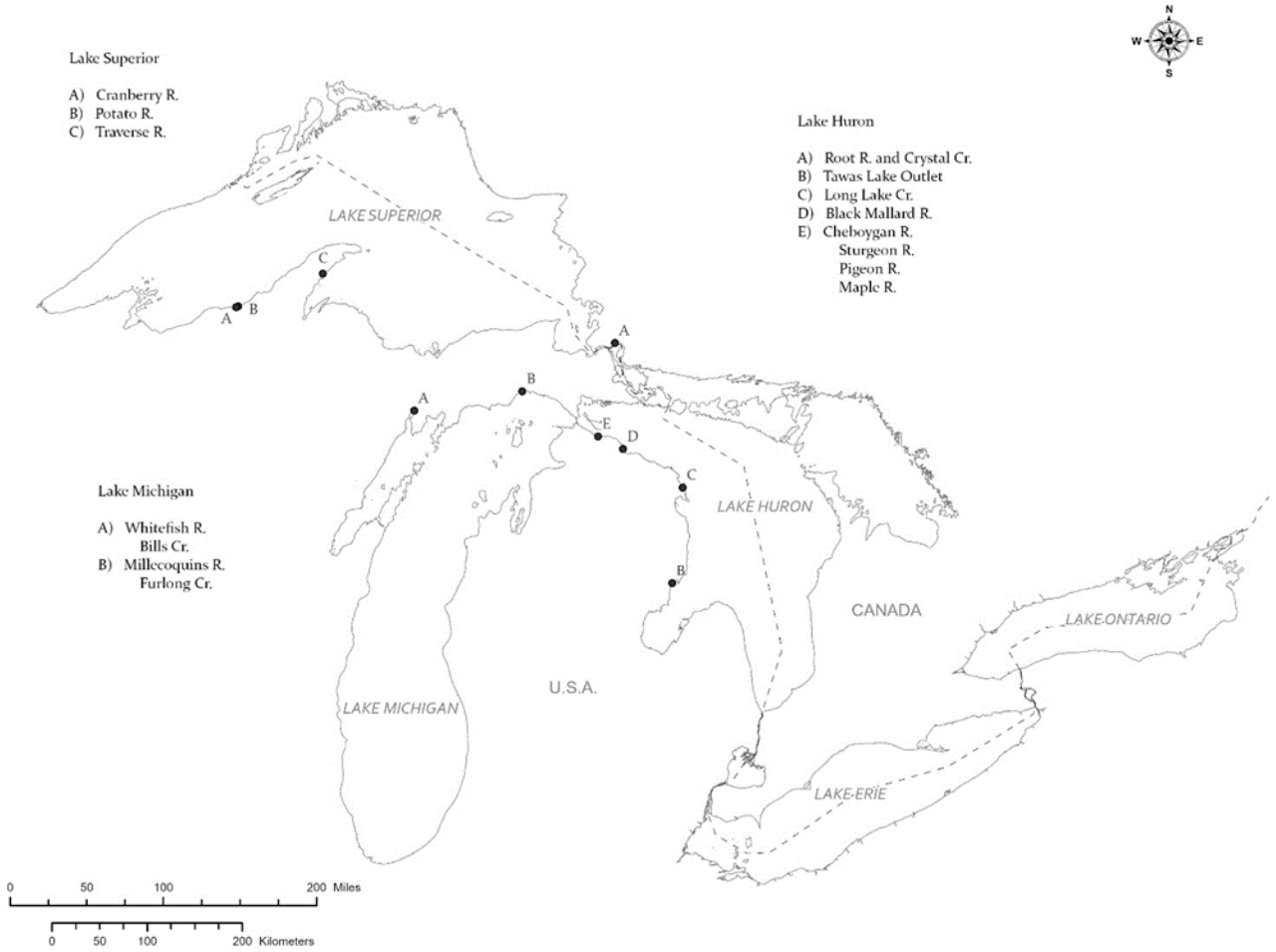


Figure 4. Location of streams where supplemental sea lamprey controls are likely to be tested and evaluated in an adaptive management framework. These streams regularly produce larval sea lamprey, are wadable, near cooperator field offices, and are places where larval production is difficult to control using barriers or lampricides. Furlong Creek is a tributary to the Millecoquins River. Bills Creek is a tributary to the Whitefish River. Crystal Creek is a tributary to the Root River.

Table 12. Streams where adult sea lamprey abundance, larval sea lamprey, juvenile sea lamprey, and habitat were assessed during 2020-2023 to describe effectiveness of ongoing supplemental controls (streams in **bold**) or collect baseline conditions before application of additional supplemental controls.

Lake	Stream	Adult Abundance Range 2020-2023	Larval Surveys 2020-2023	Habitat Surveys 2020-2023	Larvae Captured 2020-2023	Juveniles Trapped 2020-2023	Last Lampricide Treatment	Next Expected Lampricide Treatment
Superior	Cranberry	22-488	54	56	1012	565	Sep-2022	Sep-2024
Superior	Potato	0-10	50	109	1	1	Jun-2021	June-2025
Superior	Traverse	72-296	52	24	649	122	May-2021	June-2024
Michigan	Furlong	24-40	69	83	63	176	May-2022	May-2025
Michigan	Bills	14-29	52	74	631	30	Apr-2022	May-2024
Huron	Root/Crystal	47-84	120	79	1582	181	Sep-2021	May-2024
Huron	Tawas Lake Outlet	< 10	74	35	459	0	Aug-2022	Sep-2025
Huron	Long Lake Outlet	37-310	63	22	584	1	Aug-2021	Aug-2025
Huron	**Black Mallard**	51-102	74	35	4	4	May-2019	TBD
Huron	**Sturgeon**	0-60	129	7	256	7	Aug-2023	TBD
Huron	**Pigeon**	20-107	135	63	806	58	Sep-2022	TBD
Huron	**Maple**	< 10	91	110	205	13	Aug-2016	May-2024
Total			963	697	6252	1158		

		REMOVE	DIVERT	DISRUPT		
Start Year	Stream	50% effective trapping array	Seasonal electric barrier	Sterile males	Antagonist	Replicate
2017	Mallard	1, Physical	1			1
2024	Long Lake	1, Physical	1			2
2025	Furlong		1	100		1
2025	Cranberry		1	300		2
2024	Traverse	2, Chemosensory, Physical		600		1
2024	Silver	1 , Chemosensory		100	1	2
2025	Bills	1, Physical		300		3
2026	Root	1, Physical		350		4
2026	Crystal	1, Physical		350		5
2017	Pigeon			650		1
2017	Sturgeon			650		2
2017	Maple			650		3
2026	Potato			300		4
	Sum	8	4	4350	1	13

Figure 5. Commission approved supplemental control deployment portfolio highlighting the year supplemental controls (SupCons) will be deployed and if adult sea lamprey will be removed, diverted, or disrupted. Replicate number indicates the number of streams using the same combination of SupCon tactics. Alarm cue and 3kPZS are used as components of trapping systems that produce removal rates of 50% or more (Chemosengsory). Physical tactics such as screens and rock ramps will be used to produce removal rates of 50% or more (Physical).

Sterile Male Release Technique

The Sterile Male Release Technique (SMRT) was discontinued as an alternative control method in the St. Marys River in 2012 after being implemented during 1997-2011. Monitoring of embryo viability (proportion of embryos that were alive at stage 12 of development) continues to provide insight into the effectiveness of SMRT.

- In 2023, the mean embryo viability of 10 nests sampled was 58% (Figure 6).

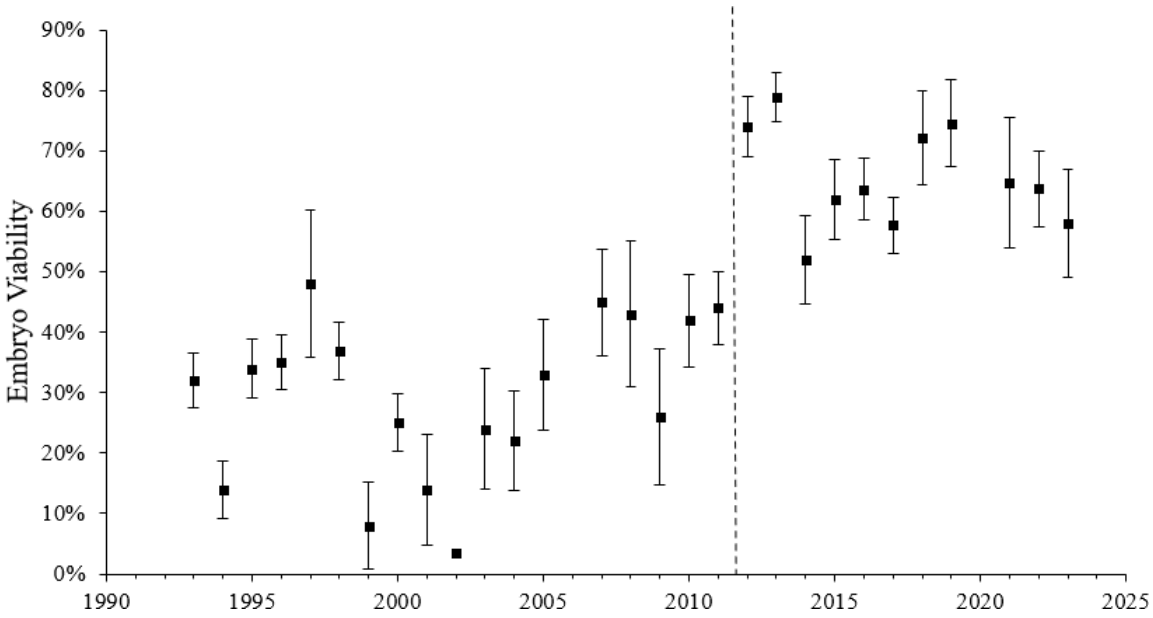


Figure 6. Mean annual embryo viability in the St. Marys River rapids during and after application of the sterile-male release technique (SMRT). The error bars represent SEs (not calculated for 2002 because only one sample was obtained). The vertical dashed line indicates the discontinuation of SMRT after 2011.

ASSESSMENT

The SLCP has three assessment metrics:

- Larval assessment, conducted by the Service and Department, determines the 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.

- Juvenile assessment, undertaken by other fishery management agencies, 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 in some lakes to monitor sea lamprey populations over time.

- Adult assessment, conducted by the Service and Department, 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. Task Force progress on SLCB charges during 2023 are presented in the LATF and TTF sections of this report.

Larval Assessment

Tributaries considered for lampricide treatment during 2024 were assessed during 2022 and 2023 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). Additional surveys are used to define the distribution of sea lamprey within a stream, detect new populations, or evaluate lampricide treatments.

Lake Superior

- Larval assessments were conducted in 197 tributaries (61 Canada, 136 U.S.) and 34 lentic areas (7 Canada, 27 U.S.). The status of larval sea lamprey populations in historically infested Lake Superior tributaries and lentic areas is presented in Table 13.

- Surveys to estimate larval sea lamprey abundance were conducted in 12 tributaries (10 Canada, 2 U.S.) and 8 lentic areas (8 Canada, 0 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 80 tributaries (22 Canada, 58 U.S.). Three new populations of larvae were discovered: Lester River (lentic) and Stewart River in Minnesota, and Aguasabon River in Ontario.

- Post-treatment assessments were conducted in 45 tributaries (14 Canada, 31 U.S.) and 9 lentic areas (1 Canada, 8 U.S.) to determine the effectiveness of lampricide treatments conducted during 2022 and 2023. Firesteel, West Sleeping, Eliza, Michipicoten and Cloud rivers are scheduled for treatment in 2024 based on residual populations following the most recent treatment. Lentic areas of the Carp and Anna rivers are planned for treatment as geographic efficiencies in 2024 based on residual populations.

- Surveys to evaluate barrier effectiveness were conducted in 15 tributaries (3 Canada, and 12 U.S.). Multiple year classes were found upstream of the barriers on Sand River (Marquette County) and Middle River. Sand River was treated in 2023 and the Middle River is scheduled to be treated in 2024. A small population of sea lamprey was found upstream of the Neebing River barrier.

- Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 84.69 kg active ingredient of 3.2% gB (28.75 kg Canada, 55.94 kg U.S.; Table 14).

Table 13. Status of larval sea lamprey in Lake Superior tributaries with a history of sea lamprey production.

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Canada			
East Davignon Cr.	May-72	Sep-23	May-72
West Davignon Cr.	Jun-14	Jun-23	Jun-23
Little Carp R.	May-23	Jun-23	Jun-22
Big Carp R.	Sep-07	Jun-22	Aug-08
Cranberry Cr.	Aug-22	Jul-23	Jul-21
Goulais R.	Jun-23	Oct-23	Oct-23
Goulais Bay	Oct-16	Jul-18	Jul-18
Boston's Cr.	Never	Oct-23	Aug-20
Horseshoe Cr.	Never	Aug-20	Aug-59
Havilland Cr.	Oct-19	May-22	Jun-19
Havilland Bay	Jun-15	Jun-21	Jun-21
Stokely Cr.	Jun-08	May-22	Sep-17
Havilland Bay	Aug-11	Jun-21	Jun-21
Tier Cr.	Never	Jul-23	Jun-61
Harmony R.	Jun-14	Jun-22	Jun-22
Batchawana Bay	Oct-22	Jul-21	Jul-21
Government Cr.	Never	Jun-22	Jun-12
Sawmill Cr.	Aug-18	Aug-22	Aug-22
Jones Landing Cr.	Never	Aug-20	Jun-66
Tiny Cr.	Never	Jul-23	Aug-19
Chippewa R.	Aug-20	Jul-21	Jul-21
Batchawana Bay	Jul-21	Sep-22	Sep-22
Unnamed (S-1009)	Oct-19	Aug-22	Aug-20
Unger Cr.	Jul-10	Jul-23	Jul-23
Batchawana R.	Jun-23	Oct-23	Oct-23
Batchawana Bay	Sep-21	Oct-23	Oct-23
Digby Cr.	Jun-13	Jul-23	Jul-19
Carp R.	Aug-20	Aug-22	Jul-19
Batchawana Bay	Jul-18	Sep-23	Sep-23
Pancake R.	Jun-19	Aug-22	Aug-22
Pancake Bay	Jun-19	Sep-23	Sep-23
Westman Cr.	Oct-23	Jul-23	Jul-23
Agawa R.	Jul-19	Jul-23	Jul-23
Agawa Bay	Aug-10	Aug-22	Aug-22
Sand R.	Sep-71	Aug-22	Aug-22
Baldhead R.	Never	Jul-23	Jul-23
Gargantua R.	Sep-18	Aug-21	Aug-21
Old Woman R.	Jul-18	Aug-22	Aug-22
Michipicoten R.	Oct-22	Jul-23	Jul-23
Michipicoten R. (Estuary)	Aug-19	Aug-21	Aug-21
Dog R.	Aug-63	Aug-22	Aug-22
White R.	Jul-16	Aug-22	Jul-15
Pic R.	Jul-19	Jul-23	Jul-23

Table 13. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Little Pic R.	Aug-22	Jul-23	Aug-21
Prairie R.	Jul-19	Aug-22	Aug-22
Steel R.	Aug-2023	Aug-22	Aug-22
Aguasabon R.	Never	Aug-23	Aug-23
Pays Plat R.	Jun-22	Aug-23	Aug-18
Pays Plat Bay	Never	Aug-18	Aug-16
Little Pays Plat Cr.	Jun-22	Aug-23	Aug-23
Gravel R.	Aug-19	Sep-22	Sep-22
Mountain Bay	Oct-22	Aug-21	Aug-21
Little Gravel R.	Jul-18	Sep-22	Sep-22
Mountain Bay	Oct-22	Aug-21	Aug-21
Little Cypress R.	Aug-14	Sep-22	Aug-17
Cypress Bay	Aug-16	Aug-15	Aug-15
Cypress R.	Jul-22	Aug-23	Aug-23
Cypress Bay	Jul-19	Sep-21	Aug-18
Jackpine R.	Never	Aug-23	Aug-23
Nipigon Bay	Sep-21	Aug-23	Aug-23
Jackfish R.	Jul-22	Aug-23	Aug-23
Nipigon Bay	Never	Aug-14	Aug-05
Nipigon R.			
Upper Nipigon R.	Aug-19	Aug-23	Aug-23
Lake Helen lentic	Oct-22	Aug-23	Aug-23
Lower Nipigon R.	Aug-Oct-23	Aug-23	Aug-23
Nipigon R (Lower) lentic	Oct-22	Aug-23	Aug-23
Cash Cr.	Oct-15	Sep-22	Sep-22
Lake Helen lentic	Oct-22	Sep-21	Sep-21
Polly Cr.	Jul-18	Sep-22	Sep-22
Polly Lake lentic	Jul-87	Aug-17	Jul-90
Stillwater Cr.	Aug-19	Sep-22	Sep-22
Nipigon Bay	Sep-18	Aug-23	Aug-23
Big Trout Cr.	Jul-23	Jul-23	Jul-22
Nipigon Bay	Oct-11	Aug-23	Aug-23
Otter Cove Cr.	Aug-23	Aug-23	Aug-23
Black Sturgeon R.	Aug-16	Aug-23	Aug-23
Black Bay	Never	Aug-21	Jul-04
Valley Cr.	Jun-72	Aug-23	Aug-71
Wolf R.	Jul-18	Aug-23	Sep-22
Black Bay	Aug-15	Aug-21	Aug-16
Coldwater Cr.	Jul-23	Aug-23	Aug-23
Black Bay	Aug-19	Aug-23	Aug-18
Pearl R.	Jul-19	Sep-22	Aug-18
D'Arcy Cr.	Jul-19	Aug-23	Aug-18
Black Bay	Jun-17	Aug-17	Aug-16
Blende Cr.	Jul-23	Aug-23	Sep-21
MacKenzie R.	Jul-23	Sep-22	Sep-22
MacKenzie Bay	Oct-23	Aug-23	Aug-23
Wild Goose Cr.	Jul-18	Sep-22	Aug-20
Current R.			
Thunder Bay	Sep-18	Aug-23	Aug-23

Table 13. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Neebing-McIntyre FW	Jul-22	Aug-23	Aug-23
Kaministiquia R.	Oct-22	Aug-23	Aug-23
Slate R.	Oct-22	Sep-21	Sep-21
Corbett Cr.	Oct-22	Sep-21	Sep-21
Whitefish R.	Oct-22	Aug-23	Aug-23
Oliver Cr.	Oct-22	Sep-22	Sep-21
Jarvis R.	Jun-17	Aug-23	Aug23
Cloud R.	Jul-23	Aug-23	Aug-23
Pine R.	Jul-18	Aug-	Aug-17
Pigeon R.	Sep-22	Sep-21	Sep-21
Pigeon Bay	Aug-10	Sep-21	Sep-21
United States			
Waiska R.	Jul-07	Sep-22	Jun-18
West Branch	Jul-21	May-21	May-21
Sec. 11SW Cr.	Never	Jul-23	Jun-21
Pendills Cr.	Jul-12	Sep-23	Jul-23
Tahquamenon Bay	Never	Sep-22	Jul-12
Grants Cr.	Aug-15	Jul-23	Jul-23
Tahquamenon Bay	Sep-23	Jul-22	Jul-22
Halfaday Cr.	Jul-12	Jun-22	Aug-21
Tahquamenon Bay	Never	Sep-22	Jul-12
Mill Creek (Chippewa)	Sep-23	Sep-22	Jun-22
Naomikong Cr.	Sep-23	Jun-22	Jun-22
Tahquamenon Bay	Never	Sep-23	
Ankodosh Cr.	Oct-23	Jun-22	Jun-22
Tahquamenon Bay	Jul-18	Jul-22	Jul-22
Roxbury Cr.	Oct-23	Sep-22	Jun-22
Tahquamenon Bay	Oct-23	Jul-22	Jul-22
Galloway Cr.	Oct-23	Sep-22	Sep-22
Tahquamenon Bay	Never	Aug-21	Aug-21
Tahquamenon R.	Sep-23	Aug-23	Aug-23
Betsy R.	Sep-22	Jul-23	Jul-23
Three Mile Cr.	Sep-23	Sep-22	May-22
Little Two Hearted R.	Jul-21	May-22	May-22
Two Hearted R.	Aug-23	Aug-23	Jul-23
Dead Sucker R.	Aug-13	Aug-21	May-19
Sucker R.	Aug-22	Oct-23	Oct-23
Grand Marais Harbor	Never	Oct-23	Sep-18
Chipmunk Cr.	Sep-62	Jun-23	Sep-61
Carpenter Cr.	Aug-23	Jun-22	Jun-22
West Bay	Aug-23	Oct-22	Oct-22
Sable Cr.	Sep-23	Jun-22	Jun-22
Hurricane R.	Never	Jun-21	Aug-08
Sullivans Cr.	Sep-23	Jun-22	Jun-22
Seven Mile Cr.	Aug-23	Jun-22	Jun-22
Beaver Lake Cr.			
Beaver Lk Outlet	Jul-18	Jun-23	Aug-17

Table 13. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Lowney Cr.	Aug-22	Jun-23	Jun-23
Little Beaver Cr.	Aug-23	Jun-22	Jun-22
Arsenault Cr.	Aug-23	Jun-22	Jun-22
Beaver Lake	Never	Jun-21	Jun-21
Little Beaver Lake	Never	Jun-21	Jun-21
Mosquito R.	Jun-73	Jun-22	Oct-72
Miners R.			
Barrier downstream	Sep-23	Jul-19	Jun-21
Barrier upstream	Jul-13	Jun-21	May-12
Miners Lake Lentic	Jun-11	Sep-13	Sep-13
Munising Falls Cr.	Sep-64	Jun-20	Jun-14
Anna R.	Jun-23	Sep-23	Jul-22
Munising Bay	Jul-23	Sep-23	Sep-23
Tourist Park Cr.	Never	Jul-22	Jul-10
Furnace Cr.			
Lower	Sep-23	Jul-22	Jul-22
Upper	Sep-10	Jul-23	Aug-09
Furnace Bay	Aug-22	Jul-23	Jul-23
Furnace Lake – Near Outlet	Never	Jul-20	May-12
Furnace Lake – Offshore Hanson Cr.	Never	Jul-17	Jul-09
Furnace Lake – Offshore Gongeau Cr.	Never	Jul-17	Jul-09
Five Mile Cr.	Jun-23	Sep-23	Jul-22
Five Mile Cr. Lentic	Never	Jul-16	Jul-16
Au Train R.			
Lower	Sep-23	Jun-23	Oct-21
Upper	Sep-23	Oct-23	Jul-22
Au Train Lake	Never	Jun-23	May-23
Rock R.	Jul-02	May-23	Aug-97
Deer Lake Cr.	Oct-23	Oct-23	Oct-23
Laughing Whitefish R.	Jun-23	Sep-23	Sep-23
Sand R.			
Below Dam	Jul-23	Oct-22	Oct-22
Above Dam	Oct-23	Oct-23	Oct-23
Chocolay R.	Jul-23	Sep-23	May-23
Carp R.	Jul-23	Sep-23	Sep-23
Carp R. lentic	Aug-22	Jul-23	Jul-23
Dead R.	Aug-22	Jul-23	Jul-23
Presque Isle Harbor	Jul-19	Jul-23	Jun-21
Compeau Cr.	Never	Jun-22	Jun-12
Harlow Cr.	May-23	Oct-23	Apr-23
Harlow Lake – offshore Bismark Cr.	May-21	May-23	May-23
Little Garlic R.	Aug-23	May-23	May-23
Little Garlic R. lentic	Jun-12	Jul-20	Jul-20
Garlic R.	Aug-22	Sep-23	Sep-23
Garlic R. lentic	Never	Jul-23	Sep-05
Saux Head Lake	May-22	May-23	May-23
Iron R.	Sep-19	Jul-23	Jul-23
Salmon Trout R.	Aug-23	Jul-22	Jul-22

Table 13. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Pine R. (Marquette Co.)	Aug-23	Jul-22	Jul-22
Huron R.	Jun-23	Oct-23	Oct-23
Ravine R.	Sep-23	Jun-23	Jul-22
Huron Bay	Sep-15	Jun-23	Jun-23
Slate R.	Sep-23	May-23	Jul-22
Huron Bay	Aug-17	Jun-23	Jun-23
Silver R.	Sep-23	May-23	May-23
Huron Bay	Aug-17	Jun-23	Jun-23
Falls R.	Sep-23	May-23	Jun-06
L'anse Bay	Sep-22	Jun-23	Jun-23
Six Mile Cr.	Sep-18	Jul-22	Jun-17
L'anse Bay	Never	Jun-23	Jun-18
Little Carp R.	May-22	Jul-22	Jun-21
Keweenaw Bay	Never	Jun-23	
Kelsey Cr.	Never	May-23	Aug-16
Sturgeon R.	Sep-23	May-23	Oct-22
Pike River	Never	Jul-11	May-21
Pilgrim R.	Aug-21	Aug-21	Sep-20
Trap Rock R.	Jun-23	Oct-23	Oct-23
Torch Lake	Jun-23	May-22	May-22
McCallum Cr.	Aug-63	Sep-21	May-94
Traverse R.	May-21	Oct-23	Oct-23
Little Gratiot R.	Jun-16	Jun-22	May-15
Eliza Cr.	Jun-23	Oct-23	Oct-23
Eagle Harbor	Jul-20	Oct-23	Sep-19
Gratiot R.	Jun-23	Oct-23	Jul-22
Smiths Cr.	May-64	Jun-23	May-64
Boston-Lily Cr.	Jun-23	Oct-23	Oct-23
Schlotz Cr.	Oct-21	Aug-22	Sep-20
Salmon Trout R. (Houghton Co.)	Jun-23	Aug-22	Aug-22
Mud Lake Outlet	Sep-18	Aug-22	Aug-22
Hungarian Cr.	May-22	Apr-22	Sep-21
Torch Lake	May-22	Aug-22	Sep-21
Graveraet R.	May-23	Sep-23	Sep-23
Elm R.	Aug-16	Jul-23	Aug-21
Misery R.			
Barrier downstream	Jul-22	Sep-22	Aug-21
Barrier upstream	Aug-00	Jun-23	Sep-08
East Sleeping R.	Jul-22	Sep-22	Oct-21
West Sleeping R.	Sep-23	Jul-22	Jul-22
Firesteel R.	Jul-23	Sep-23	Sep-23
Flintsteel R.	May-23	Jul-23	Aug-21
Ontonagon R.	Sep-23	Jul-23	Jul-23
Potato R.	Jun-21	Oct-23	Oct-23
Floodwood R.	Never	Aug-22	Aug-85
Cranberry R. (Ontonagon Co.)	Jul-22	Oct-23	Sep-21
Mineral R.	Jul-22	Sep-22	Sep-22
Mineral R. lentic	Never	Aug-19	Sep-11

Table 13. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Big Iron R.	Never	Aug-22	Jul-15
Little Iron R.	Jul-22	May-23	Oct-21
Union R.	May-64	Oct-20	Aug-62
Black R.	Sep-21	Aug-22	Jul-17
Black River Harbor	Sep-19	Aug-22	Jul-19
Montreal R.	Jul-75	Aug-22	Jul-10
Washington Cr.	Jun-80	Jul-12	Sep-82
Bad R.	Sep-21	Aug-23	Aug-23
Fish Cr. (Eileen Twp)	May-22	Aug-22	Aug-22
Chequamegon Bay	Never	Jul-21	Aug-06
Sioux R.	Jul-19	Jun-23	Aug-18
Pikes Cr.	May-16	Aug-23	Aug-18
Red Cliff Cr.	May-22	Aug-22	Jul-21
Buffalo Bay	Never	Aug-11	Aug-03
Raspberry R.	May-16	Jun-23	Sep-15
Sand R. (Bayfield Co.)	Jun-23	Ayg-23	Jun-23
Sand Bay	Aug-10	Jul-21	Aug-15
Cranberry R. (Bayfield Co.)	Jun-17	Jun-23	Jun-23
Iron R.			
Barrier downstream	Jun-23	Aug-23	Aug-22
Barrier upstream	Oct-64	Aug-22	Never
Reefer Cr	Oct-64	Jun-22	Jun-16
Fish Cr. (Orienta Twp)	Oct-64	Aug-23	Aug-63
Brule R.			
Barrier downstream	Jun-18	Aug-23	Apr-22
Barrier upstream	Jun-86	Aug-23	Sep-87
Brule R. Lentic	Never	Aug-22	Aug-22
Poplar R.	Jun-22	Aug-23	Aug-23
Middle R.			
Barrier downstream	Jun-23	Aug-23	Aug-22
Barrier upstream	Jun-02	Aug-23	Jun-23
Amnicon R.	Jun-23	Aug-23	Aug-23
Amnicon R. Lentic	Never	Aug-22	Aug-18
Nemadji R.	Jun-22	Aug-22	Aug-21
St. Louis R.	Sep-87	Aug-23	Aug-23
Lester R.	Never	Aug-23	Never
Lester R. Lentic	Never	Aug-23	Aug-23
Sucker R. (St. Louis Co.)	Never	Aug-22	Sep-89
Knife River	Jun-23	Sep-23	Sep-23
Knife R. Lentic	Aug-23	Aug-22	Aug-22
Stewart R.	Never	Aug-23	Aug-23
Gooseberry R.	Jun-23	Sep-23	Aug-22
Gooseberry R. Lentic	Aug-23	Aug-22	Aug-22
Splitrock R.	Aug-76	Aug-22	Aug-21
Poplar R.	Jun-18	Aug-23	Aug-21
Poplar R. Lentic	Never	Aug-23	Never
Arrowhead R.	Jun-23	Sep-23	Sep-23
Arrowhead R. Lentic	Aug-23	Aug-22	Aug-22

Table 14. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Superior for larval assessment purposes during 2023.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Canada		
Batchawana River	2.13	0.45
Carp River	0.71	0.15
Pancake River	0.95	0.20
Michipicoten River	1.42	0.30
Pic River	2.84	0.60
Little Pic River	0.47	0.10
Aguasabon River	0.95	0.20
Pays Plat River	0.47	0.10
Jackpine River	0.95	0.20
Jackfish River	0.71	0.15
Nipigon River	5.20	1.10
Big Trout Creek	1.42	0.30
Otter Cover Creek	1.18	0.25
Black Sturgeon River	1.66	0.35
Coldwater Creek	1.42	0.30
D'Arcy Creek	0.35	0.075
Mackenzie River	2.13	0.45
Current River	0.95	0.20
Kaministiquia River	2.84	0.60
Total (Canada)	**28.75**	**6.075**
United States		
Naomikong Cr. (Lentic)	0.98	0.21
Sucker R. (Lentic)	1.96	0.41
Anna R. (Lentic)	1.47	0.31
Furnace Cr. (Lentic)	2.20	0.47
Au Train R.	0.49	0.10
Au Train R. (Au Train Lake)	5.88	1.25
Deer Lake Cr. (Deer Lake)	2.20	0.47
Chocolay R.	0.98	0.21
Carp R. (Lentic)	1.71	0.36
Dead R.	1.47	0.31
Dead R. (Lentic)	1.47	0.31
Harlow Cr. (Harlow Lake)	1.47	0.31
Garlic R. (Saux Head Lake)	1.47	0.31
Garlic R. (Lentic)	1.47	0.31
Iron R.	0.98	0.21
Ravine R. (Lentic)	1.47	0.31
Slate R. (Lentic)	1.96	0.41
Silver R. (Lentic)	2.45	0.52
Falls R. (Lentic)	1.96	0.41
Six Mile Cr. (Lentic)	1.47	0.31

Table 14. *Continued*

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Little Carp R. (Lentic)	0.98	0.21
Eliza Cr. (Lentic)	1.96	0.41
Pikes Cr. (Lentic)	1.47	0.31
Flag R.	0.49	0.10
Iron R.	0.98	0.21
Middle R. (Lentic)	0.98	0.21
Amnicon R.	1.47	0.31
St. Louis R.	5.98	1.25
Lester R. (Lentic)	1.96	0.41
Knife R.	1.22	0.26
Gooseberry R.	0.98	0.21
Split Rock R. (Lentic)	0.98	0.21
Poplar R. (Lentic)	0.98	0.21
Total (United States)	**55.94**	**11.82**
Total for Lake	**84.69**	**17.895**

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

Lake Michigan

- Larval assessments were conducted in 129 tributaries and 26 lentic areas. The status of larval sea lamprey populations in historically infested Lake Michigan tributaries and lentic areas is presented in Table 15.

- Surveys to estimate larval sea lamprey abundance were conducted in two tributaries.

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 35 tributaries. No new infestations were identified.

- Post-treatment assessments were conducted in 19 tributaries and 2 lentic area to determine the effectiveness of lampricide treatments conducted during 2022 and 2023. The Rock River, Manistique River lentic (inside breakwall), Porter Creek and Porter Creek lentic area are scheduled for treatment in 2024 based on residual larval populations.

- Surveys to evaluate barrier effectiveness were conducted in 6 tributaries. Sea lampreys were found in Prairie Creek, which is a tributary to the Grand River upstream of the 6th Street Dam. Prairie Creek ranked for treatment in 2024.

- Larval assessment surveys were conducted in 26 non-wadable lentic and lotic areas using 37.85 kg active ingredient of 3.2% gB (Table 16).

Table 15. Status of larval sea lamprey in Lake Michigan tributaries with a history of sea lamprey production.

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Brevort R.			
Upper	May-21	Aug-23	Aug-23
Lower	May-21	May-23	May-23
Brevort Lake	May-21	May-22	Jun-19
Paquin Cr.	Jun-19	Aug-23	Sep-18
Paquin Cr. Lentic	Never	Sep-18	Sep-18
Davenport Cr.	Sep-13	May-22	Aug-11
Hog Island Cr.	May-21	May-23	May-23
Hog Island Cr.	Jun-07	Jul-21	Jul-18
Lentic			
Sucker R.	Jun-61	May-23	Jul-21
Black R.	May-21	Sep-23	Sep-23
Black R. lentic	Jun-76	Sep-22	Aug-11
Mattix Cr.	Aug-15	May-23	Jun-14
Mile Cr.	May-17	May-22	Jun-19
Mile Cr. Lentic	Aug-68	Jun-18	Jun-08
Millecoquins R.	Jul-21	Aug-23	Aug-23
Furlong Cr.	May-22	Jun-23	Oct-21
Millecoquins Lake	Never	Jun-19	Jun-14
Rock R.	Jun-23	Sep-23	Sep-23
Crow R.	Jun-23	Sep-23	Aug-22
Cataract R.	Sep-19	Jun-23	Jun-23
Cataract R. lentic	Never	Jul-23	Jul-23
Pt. Patterson Cr.	Jul-13	Jun-23	Jun-23
Hudson Cr.	Aug-19	Jun-23	Jun-23
Swan Cr.	Sep-21	Jun-23	Jun-23
Seiners Cr.	Aug-17	Aug-22	Aug-22
Milakokia R.	Sep-21	May-22	Jul-19
Seul Choix Bay	Never	Jul-19	Jul-80
Bulldog Cr.	Jun-13	Jun-23	Sep-13
Gulliver Lake Outlet	Sep-19	Jun-23	Sep-18
Marblehead Cr.	Jun-19	Aug-22	Aug-22
Marblehead Cr.	Never	Jun-23	Jun-23
Lentic			
Manistique R.	Jun-23	Jun-23	Jun-23
Inside Breakwalls	Oct-22	Jun-23	Jun-23
Outside Breakwalls	Oct-22	Jun-23	Jun-23
Southtown Cr.	Jul-13	Jun-23	Aug-12
Thompson Cr.	Jun-23	Jun-23	Aug-22
Johnson Cr.	Jun-13	May-22	Sep-12
Deadhorse Cr.	Sep-23	Aug-22	Aug-22
Deadhorse Cr.	Never	Jun-23	Oct-64
Lentic			
Gierke Cr.	Never	May-22	Jun-04
Bursaw Cr.	May-22	Jun-23	Jun-23
Bursaw Cr. Lentic	Never	Jul-11	Jul-11
Parent Cr.	Aug-17	Sep-23	Sep-23
Parent Cr. Lentic	Never	Jun-23	Jun-23

Table 15. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Poodle Pete Cr.	Aug-17	Sep-23	Aug-21
Poodle Pete Cr.	Never	Jun-23	Jun-23
Lentic			
Valentine Cr.	May-21	Sep-23	Jul-19
Big Bay de Noc	Never	Sep-11	Aug-94
Little Fishdam R.	May-01	Jun-23	Jul-04
Big Fishdam R.	Apr-23	Jul-23	Aug-22
Sturgeon R.	Jul-22	Jun-23	Jun-23
Big Bay de Noc	Never	Jul-23	Aug-15
Ogontz R.	Apr-23	Jul-23	Jul-23
Big Bay de Noc	Sep-14	Jul-23	Jul-15
South Mino-kwe Cr.	Aug-17	Jun-23	Jun-23
Hock Cr.	May-17	Sep-23	Jun-23
Whitefish R.	Jun-22	Oct-23	Oct-22
Haymeadow Creek	Jun-22	Sep-23	Sep-22
Little Bay de Noc	Jun-83	Jul-23	Jul-11
Rapid R.	Oct-20	Jul-23	Jul-23
Little Bay de Noc	May-15	Jul-23	Jul-16
Tacoosh R.	Oct-14	Jul-23	Jul-14
Days R.			
Barrier downstream	Sep-23	Jul-23	Aug-18
Barrier upstream	Aug-17	May-23	Aug-17
Little Bay de Noc	Aug-14	Jul-23	Aug-13
Escanaba R.	Never	Jul-23	Jul-06
Portage Cr.	May-17	Sep-23	May-21
Portage Bay	Never	Aug-17	Aug-82
Ford R.	May-23	Oct-23	Oct-23
Green Bay	Oct-14	Jul-23	Jul-23
Sunnybrook Cr.	Apr-23	Oct-23	Aug-22
Bark R.	May-17	Jul-23	Jul-23
Green Bay	Never	Jul-16	Sep-98
Cedar R.	May-21	Sep-23	Jul-23
Green Bay	May-10	Jul-23	Jul-16
Sugar Cr.	May-21	Sep-23	Sep-21
Fowler Creek	Never	Apr-23	Aug-22
Arthur Bay Cr.	May-21	Sep-23	Sep-21
Rochereau Cr.	Apr-63	Apr-23	Jul-62
Johnson Cr.	Apr-17	Sep-23	Aug-22
Bailey Cr.	May-23	Sep-23	Aug-22
Green Bay	Never	Aug-18	Aug-18
Beattie Cr.	May-19	Sep-23	May-21
Springer Cr.	May-23	Sep-23	Sep-23
Menominee R.	Jul-16	May-21	Jun-19
Green Bay	Jul-16	Aug-17	Sep-15
Little R.	Aug-77	May-21	Aug-77
Peshtigo R.	Sep-20	Sep-22	Sep-23
Oconto R.	Sep-21	Sep-23	Sep-23
Pensaukee R.	Nov-77	May-21	Sep-85
Suamico R.	Never	May-21	May-67

Table 15. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Ephraim Cr.	Apr-63	May-22	Apr-61
Hibbards Cr.	May-07	May-22	Oct-09
Whitefish Bay Cr.	May-16	Aug-21	Jun-15
Shivering Sands Cr.	Apr-12	Aug-21	May-14
Lily Bay Cr.	Apr-63	Aug-21	May-63
Bear Cr.	May-75	May-23	May-23
Door Co. 23 Cr.	May-19	May-23	May-23
Silver Cr.	Never	Aug-21	Jul-15
Ahnapee R.	Apr-64	May-23	Apr-64
Three Mile Cr.	Apr-21	May-23	Jun-19
Kewaunee R.			
Barrier downstream	May-75	May-23	May-98
Barrier upstream	May-75	May-22	Aug-13
Casco Cr.	May-14	May-22	Aug-14
East Twin R.	Apr-17	May-23	Jun-19
Fischer Cr.	May-87	May-22	May-87
French Farm Cr.	Never	Oct-21	Jun-10
French Farm Cr.	Never	Aug-23	Jun-10
Carp Lake Outlet	Jun-17	Sep-23	Aug-23
Big Stone Cr.	Sep-13	Aug-23	Aug-10
Big Sucker R.	Sep-13	Aug-23	Sep-13
Wycamp Lake Outlet	Jul-17	Oct-21	Aug-16
Bear R.	Never	Sep-23	Never
Bear R. Lentic	Jun-07	Sep-23	Jun-08
Horton Cr.	Jun-17	Aug-23	Aug-23
Horton Cr. Lentic	Jun-19	Sep-23	Sep-23
Boyne R.	Aug-21	Sep-23	Sep-23
Boyne R. Lentic	Jun-17	Sep-22	Jun-14
Porter Cr.	Jul-23	Sep-23	Sep-23
Porter Cr. Lentic	Jul-23	Oct-23	Oct-23
Jordan R.	Jul-22	Sep-23	Sep-23
Jordan R. Lentic	Jul-18	Oct-23	Jun-14
Monroe Cr.	Aug-13	Jun-19	Jun-13
Loeb Cr.	Aug-13	Jun-19	Aug-11
McGeach Cr.	Oct-99	May-15	Jun-98
Elk Lake Outlet	Jun-17	Jun-23	Jun-23
Yuba Cr.	May-06	Jun-23	Aug-05
Acme Cr.	Aug-63	Jun-22	Jul-73
Mitchell Cr.	Jul-17	Jun-23	Aug-20
Boardman R. (lower)	Aug-15	Jun-22	Jun-14
Boardman R. (middle)	Aug-15	Jun-23	Sep-14
Boardman R. Lentic	Jun-17	Sep-22	Jun-16
Hospital Cr.	Jul-18	Jun-23	Jun-23
Leo Cr.	Never	Jun-22	Jul-95
Leland River Lentic	Never	Sep-22	Jun-13
Good Harbor Cr.	Jul-10	Sep-21	Sep-09
Crystal R.	Apr-19	Oct-23	Sep-18

Table 15. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Platte R. (upper)	Jun-22	Jun-23	Jun-23
Platte R. (middle)	Jun-22	Sep-23	Sep-20
Loon Lk. Lentic	Sep-22	Sep-23	Sep-23
Platte R. (lower)	Jun-22	Sep-23	Sep-18
Betsie R.	Jun-22	Jun-23	Nov-21
Bowen Cr.	Jun-09	Aug-23	Oct-19
Big Manistee R.	Aug-23	Jul-21	Oct-19
Bear Cr.	Aug-23	Aug-23	Jul-23
Pine Cr.	Aug-23	Jul-23	Jul-23
L. Manistee R.	Jun-21	Aug-23	Aug-23
L. Manistee R.	Jul-11	Jul-21	Sep-05
Lentic			
Gurney Cr.	Jun-16	Aug-19	Jul-15
Cooper Cr.	Jul-08	Jun-22	Sep-07
Lincoln R.	Jul-20	Jul-23	Jul-23
Pere Marquette R.	Aug-23	Oct-23	Jul-22
Bass Lake Outlet	Aug-78	Jun-22	Aug-75
Pentwater R. (N. Br.)	Jul-23	Sep-23	Jun-18
South Branch	Never	Jul-22	Jun-83
Lambricks Cr.	Sep-84	Jul-22	Sep-84
Stony Cr.	Sep-20	May-23	May-23
Flower Cr.	Jul-17	Jul-23	May-17
White R.	Jul-23	Sep-23	Sep-23
Duck Cr.	Jul-84	Jul-23	Aug-95
Muskegon R.	Aug-22	Sep-23	Sep-23
Brooks Cr.	Aug-22	Jul-22	Sep-21
Cedar Cr.	Aug-22	Jul-22	Sep-21
Bridgeton Cr.	Aug-22	Jul-22	Sep-21
Minnie Cr.	Aug-22	Jul-22	Sep-21
Bigelow Cr.	Aug-22	Oct-23	Oct-23
Big Bear Cr.	Aug-70	Jul-19	Aug-70
Mosquito Cr.	Jul-69	Aug-14	Jul-07
Black Cr.	Aug-08	Jul-19	Aug-08
Grand R.	Never	Aug-22	Never
Norris Cr.	Jun-17	Aug-22	Sep-16
Lowell Cr	Sep-65	Aug-22	Jun-65
Buck Cr.	Sep-65	Aug-22	Sep-65
Rush Cr.	Sep-65	Aug-22	Sep-62
Sand Cr.	Jun-07	Aug-22	Jun-07
Crockery Cr.	Jun-23	Sep-23	Apr-23
Bass R.	Aug-04	Aug-22	Sep-03
Rogue R.	Jun-23	Aug-22	Aug-22
Prairie Cr.	Never	Sep-23	Sep-23
Pigeon R.	Oct-64	Sep-19	May-62
Pine Cr.	Oct-64	Sep-19	May-62
Gibson Cr.	Jul-84	Sep-22	Jun-83
Kalamazoo R.	Oct-65	Aug-20	Never

Table 15. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Bear Cr.	Apr-19	Aug-23	Aug-23
Sand Cr.	Sep-10	Aug-23	May-17
Mann Cr.	Jul-16	Aug-23	Sep-15
Rabbit R.	Sep-15	Sep-23	Jul-14
Swan Cr.	Jun-21	Aug-23	Oct-21
Allegan 3 Cr.	Sep-65	Aug-22	Jun-62
Allegan 4 Cr.	Oct-78	Sep-23	Sep-23
Allegan 5 Cr.	Sep-15	Sep-23	Jul-14
Black R.			
North Branch	Jun-77	Oct-23	May-21
Middle Branch	Jul-21	Oct-23	May-21
South Branch	May-17	Oct-23	May-21
Brandywine Cr.	Aug-85	Sep-23	Jul-21
Rogers Cr.	May-18	May-22	Jun-16
St. Joseph R.	Never	Jul-19	Never
Lemon Cr.	Oct-65	Jul-23	Jun-65
Pipestone Cr.	May-21	Jul-23	Jul-21
Meadow Dr.	Oct-65	Oct-23	Apr-62
Hickory Cr.	May-21	Jul-23	Sep-19
Farmers Cr.	May-21	Jul-23	Jul-23
Paw Paw R.	Sep-21	Jul-23	May-22
Blue Cr.	Sep-15	Jul-23	Jul-23
Mill Cr.	Sep-21	Jul-23	Jul-23
Brandywine Cr.	Sep-17	Jul-23	Jul-17
Brush Cr.	Sep-15	Jul-23	Jun-15
Hayden Cr.	Sep-21	Jul-23	Jul-23
Campbell Cr.	Sep-18	Jul-23	Sep-18
Ritter Cr.	Sep-17	Jul-23	Oct-16
Galien R. (N. Br.)	Jun-16	Oct-23	Sep-15
E. Br. & Dowling Cr.	Oct-10	Oct-23	Sep-09
S. Br. & Galena Cr.	Aug-21	Oct-23	Oct-23
Spring Cr.	Aug-21	Oct-23	May-16
S. Br. Spring Cr.	Aug-21	Oct-23	Sep-19
State Cr.	Apr-14	May-19	Sep-13
Trail Cr.	Apr-14	Oct-23	Aug-18
Donns Cr.	May-66	May-19	May-66
Burns Ditch	Jul-99	Oct-23	Oct-21
Little Calumet R.	Never	Oct-23	Oct-23
Salt Cr.	May-18	Oct-23	Jun-19

Table 16. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Michigan for larval assessment purposes during 2023.

Tributary	Bayluscide (kg)[1]	Area Surveyed (ha)
Millecoquins R.	0.49	0.10
Cataract R (Lentic)	0.98	0.21
Marblehead Cr. (Lentic)	0.96	0.41
Manistique R. (Lentic)	2.94	0.62
Deadhorse Cr. (Lentic)	1.47	0.31
Parent Cr. (Lentic)	1.47	0.31
Poodle Pete Cr. (Lentic)	1.47	0.31
Fishdam R. (Lentic)	0.98	0.21
Sturgeon R. (Lentic)	0.98	0.21
Ogontz R. (Lentic)	1.96	0.41
Whitefish R. (Lentic)	1.72	0.36
Rapid R. (Lentic)	1.96	0.41
Days R. (Lentic)	1.96	0.41
Escanaba R.	1.23	0.26
Ford R. (Lentic)	1.96	0.41
Cedar R. (Lentic)	1.96	0.41
Peshtigo R.	1.72	0.36
Oconto R.	0.71	0.15
Kewaunee R.	1.72	0.36
East Twin R.	0.49	0.10
Bear River (Lentic)	0.92	0.20
Horton Creek (Lentic)	1.66	0.35
Porter Creek (Lentic)	1.89	0.40
Jordan River (Lentic)	1.89	0.40
Elk Lake Outlet	0.94	0.20
Platte River (Loon Lk. Lentic)	1.42	0.30
Total for Lake	**37.85**	**8.18**

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

Lake Huron

- Larval assessments were conducted in 154 tributaries (71 Canada, 83 U.S.) and 17 lentic areas (5 Canada, 12 U.S.). The status of larval sea lamprey populations in historically infested Lake Huron tributaries and lentic areas is presented in Table 17.

- Surveys to estimate larval sea lamprey abundance were conducted in 21 tributaries (17 Canada, 4 U.S.) and 2 lentic areas (2 Canada, 0 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 74 tributaries (43 Canada, 31 U.S.). New infestations were discovered in Shawanawa Landing Creek (near Parry Sound, ON) and Flood Creek (Cockburn Island).

- Post-treatment assessments were conducted in 20 tributaries (9 Canada, 11 U.S.) and two lentic areas (1 Canada, 1 U.S.) to determine the effectiveness of lampricide treatments conducted during 2022 and 2023. Watson Creek and Mississagi River estuary are scheduled for treatment in 2024 based on residual larval populations.

- Surveys to evaluate barrier effectiveness were conducted in Echo River, Koshkawong River and Browns Creek (Canada) and Albany Creek, Cheboygan, Ocqueoc, Trout and Saginaw rivers (U.S.). Sea lamprey infestations were discovered in Albany Creek, Echo River and Ocqueoc River upstream of their respective barriers. Albany Creek and Ocqueoc River ranked for treatment in 2024.

- Larval sea lamprey surveys were conducted in the St. Marys River according to a stratified, systematic sampling design. Using a deep-water electrofishing unit, 812 geo-referenced sites were sampled. The larval sea lamprey population in the St. Marys River was estimated to be 598,000 (95% CI; 270,000 to 930,000).

- Larval assessments were conducted in non-wadable lentic and lotic areas using 32.23 kg active ingredient of 3.2% gB (17.04 kg Canada, 15.19 kg U.S.; Table 18).

Table 17. Status of larval sea lamprey in Lake Huron tributaries with a history of sea lamprey production.

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Canada			
St. Marys R.	Sep-23	Sep-23	Sep-23
Whitefish Channel	Jun-21	Sep-23	Sep-23
Root R.	Sep-21	Aug-22	Aug-22
Garden R.	Aug-23	Aug-23	Nov-22
Maud & Driving Cr.	Jul-20	Aug-23	Aug-23
Echo R.			
Main	Jul-11	Oct-23	Oct-23
Bar & Iron Cr.	Aug-20	Oct-23	Oct-23
Austin Cr.	Oct-23	Sep-23	Sep-23
Echo Lake	Sep-20	Oct-23	Oct-23
Solar Lake	Jul-87	Jul-06	May-90
Stuart Lake	Jul-80	May-90	May-90
Bar R.	Oct-11	Jul-23	Jul-10
Sucker Cr.	May-18	Jul-23	Sep-17
Sucker Cr. (lentic)	Jul-84	Sep-16	Jun-13
Two Tree R.	May-15	May-22	Jul-14
Two Tree R. (lentic)	Never	Aug-81	Aug-81
Richardson Cr.	Sep-16	Jun-22	Jul-16
Watson Cr.	May-21	Sep-23	Jul-23
Gordon Cr.	May-18	Sep-23	Sep-23
Gordon Cr. (lentic)	Jul-84	Jul-18	Aug-91
Browns Cr.	May-16	Jun-23	Jun-23
Browns Cr. (lentic)	Aug-87	Jul-18	Aug-91
Koshkawong R.	May-18	Aug-23	Sep-22
Koshkawong R. (lentic)	Never	Jul-17	Aug-91

Table 17. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
No Name (H-65)	May-22	Jun-23	Jul-21
No Name (H-68)	Jun-19	Aug-23	Jul-18
North Channel	Never	Apr-12	May-95
MacBeth Cr.	Jun-19	Aug-20	Jun-18
Thessalon R.			
Upper	Sept-18	Sep-23	Sep-17
Patten Lake Cr.	Jul-17	Sep-23	Sep-16
Lower	Oct-22	Sep-23	Aug-20
Livingstone Cr.	May-22	Jul-23	Jul-23
Mississagi R.	Jul-22	Sep-23	Sep-23
Harris/Bolton Cr.	Aug-19	Jun-23	Sep-20
North Channel	Jul-23	Sep-23	Sep-23
Blind R.	May-84	Jun-19	Jun-05
Lauzon R.	May-23	Sep-23	Jul-22
North Channel	Jun-19	Jul-22	Jul-22
Spragge Cr.	Oct-95	May-18	Jun-98
No Name (H-114)	May-22	Aug-23	Jul-21
North Channel	Jun-15	Sep-18	Sep-14
Marcellus Cr.	Jun-13	Aug-23	Sep-11
Serpent R.			
Main	Jun-21	Sep-23	Sep-23
Grassy Cr.	May-23	Jul-22	Jul-22
Spanish R.			
Main	Sep-15	Jun-23	Jun-23
LaCloche Cr.	Oct-18	Jun-23	Sep-17
Birch/Beaudin Cr.	Oct-23	Sep-22	Sep-22
Aux Sables R.	Sep-15	Jun-23	Jun-23
Kagawong R.	Aug-67	Jul-21	Aug-16
Mudge Bay	Aug-87	Jun-19	Jun-15
Unnamed (H-267)	Apr-17	Jul-22	Sep-20
Silver Cr.	Sep-22	Jun-23	Jul-21
Floods Cr.	Never	Aug-23	Aug-23
Sand Cr.	Jun-21	Aug-23	Aig-23
Mindemoya R.	May-17	Jul-23	Jun-23
Providence Bay	Jul-81	Jul-22	Jul-88
Timber Bay Cr.	Sep-20	Jul-23	Jun-23
Hughson Cr.	Sep-20	Jun-23	Jun-23
Manitou R.	Sep-20	Jun-23	Jun-23
Michael's Bay	Oct-20	Jul-21	Sep-17
Blue Jay Cr.	Sep-22	Jun-23	Jul-21
Blue Jay Cr. (lentic)	Jun-18	Jul-21	Sep-17
Kaboni Cr.	Oct-78	May-18	Jul-78
Chikanishing R.	Jun-18	Jun-23	Jun-23
French R. System			
O.V. Channel	Jun-12	May-23	Sep-15
Wanapitei R.	Jun-11	Jun-21	Jun-08
Key R. (Nesbit Cr.)	Sep-72	Jun-21	Aug-73
Still R.	Jul-17	May-23	May-16

Table 17. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Byng Inlet	Jun-12	May-23	May-23
Magnetawan R.	Jul-22	May-23	May-23
Naiscoot R.	May-18	Sep-23	Sep-23
Shebeshekong R.	Never	May-23	May-23
Boyne R.	Sep-18	May-23	May-18
Georgian Bay	Never	Jun-23	May-16
Musquash R.	Aug-13	Jun-22	Jun-21
Simcoe/Severn System	Never	Jun-22	May-19
Georgian Bay	Aug-18	Jun-22	May-19
Sturgeon R.	Apr-12	Jun-22	Sep-09
Sturgeon Bay	Never	May-14	Jun-99
Hog Cr.	Sep-78	Jun-22	Aug-78
Lafontaine Cr.	Jun-68	Jun-22	May-67
Nottawasaga R.			
Mainstream	Jul-21	Oct-21	Oct-21
Boyne R.	Jul-21	May-23	May-19
Bear Cr.	Jun-13	May-23	Apr-11
Pine R.	Jul-21	May-23	May-23
Marl Cr.	Apr-13	May-23	May-11
Pretty R.	May-72	Jun-22	May-72
Silver Cr.	Sep-82	Jun-23	Sep-82
Bighead R.	Jun-22	Jun-23	Jun-23
Bighead R. (lentic)	Aug-18	May-22	May-22
Bothwells Cr.	Jun-79	May-22	Aug-83
Sydenham R.	Jun-72	May-22	Jul-71
Sauble R.	Jun-04	May-22	May-18
Saugeen R.	Jun-71	May-22	May-95
Bayfield R.	Jun-70	May-22	Sep-73
United States			
Mission Cr.	Never	Sep-23	Sep-23
Frechette Cr.	Never	Sep-21	Jul-81
Ermatinger Cr.	Never	Sep-21	Jun-12
Ditch Cr	Never	Sep-23	Sep-23
Charlotte R.	Oct-11	Sep-21	Jun-17
Beaver Dam Cr.	Never	Sep-23	Jun-22
Little Munuscong R.	Oct-21	May-22	Sep-21
Big Munuscong R.	Jun-99	May-23	May-23
Taylor Cr.	Sep-23	Sep-21	Sep-21
Gogomain R.	Jul-16	Sep-23	Jun-18
Carlton Cr.	Oct-18	Sep-23	Sep-23
Canoe Lake Outlet	May-70	Apr-13	May-69
Caribou Cr.	Oct-19	Aug-23	Aug-23
Caribou Cr. Lentic	May-18	Aug-23	Jul-21
Bear Lake Outlet	Sep-16	Sep-22	Sep-22
Carr Cr.	Jun-13	May-23	May-23
Joe Straw Cr.	Jun-13	May-23	May-23
Saddle Cr.	Never	Jul-21	May-02

Table 17. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Huron Point Cr.	May-18	Aug-23	Aug-23
Albany Cr.			
Barrier downstream	May-21	May-23	May-23
Barrier upstream	Sep-01	Aug-23	Aug-23
Albany Bay	Sep-23	Jul-21	Jul-21
Trout Cr.	Jul-15	May-21	Aug-19
Trout Cr. Lentic	Never	Aug-19	Jul-11
Beavertail Cr.	Jul-18	May-23	Jul-21
Prentiss Cr.	Oct-19	Aug-23	Aug-23
McKay Cr.	May-21	Sep-23	Sep-23
McKay Bay	Never	Sep-18	Jul-11
Flowers Cr.	Jun-13	May-23	May-11
Flowers Bay	Never	Jun-12	Jul-80
Ceville Cr.	Jul-16	May-23	Jul-15
Hessel Cr.	Sep-21	May-22	Aug-19
Steeles Cr.	Sep-21	May-22	Aug-19
Nunns Cr.			
Barrier downstream	Jul-16	May-23	May-14
Barrier upstream	Jul-16	May-19	Jun-15
St. Martin Bay	Never	Jul-23	Aug-87
Pine R.	Sep-23	Aug-23	Aug-23
St. Martin Bay	Jun-21	Jul-21	Jul-17
McCloud Cr.	Jul-15	May-21	May-17
St. Martin Bay	Never	Aug-15	Aug-15
Carp R.	Jul-21	Aug-23	Aug-23
St. Martin Bay	Jul-21	Jul-21	Aug-19
Martineau Cr.	Jul-16	May-23	May-17
Horseshoe Bay	Never	Aug-19	Sep-14
Hoban Cr.	Jun-12	Jul-21	May-11
266-20 Cr.	Aug-76	May-22	Sep-94
Beaugrand Cr.	Jun-16	Sep-23	Jul-15
Little Black R.	Oct-21	Sep-23	Sep-23
Cheboygan R.	Oct-83	Aug-23	Aug-23
Cheboygan R. lentic	Never	Jun-19	Aug-93
Laperell Cr.	May-00	Aug-23	Sep-22
Meyers Cr.	Sep-23	Sep-22	Sep-22
Maple R.	Aug-16	Jun-23	Jun-23
Pigeon R.	Sep-22	Jun-23	Jun-23
Little Pigeon R.	Aug-12	Sep-19	Jun-10
Sturgeon R.	Sep-23	Sep-22	Sep-22
Sturgeon R. lentic	Sep-23	Sep-22	Sep-22
Elliot Cr.	Oct-21	Sep-23	Sep-23
Duncan Bay	Never	Sep-22	Jul-12
Greene Cr.			
Barrier downstream	Sep-23	Sep-23	Sep-23
Barrier upstream	Jun-07	May-22	Jun-13
Grass Cr.	Aug-22	May-22	May-21
Mulligan Cr.	Jun-16	Sep-23	Jun-18

Table 17. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Mulligan Cr. lentic	Never	Aug-21	Aug-16
Grace Cr.	Oct-18	Sep-23	Sep-23
Black Mallard Cr.			
Lower	Jun-18	Jun-23	Jul-19
Black Mallard Lake	Never	Jun-23	Jun-10
Upper	May-15	Aug-21	Aug-21
Seventeen Cr.	Jul-12	May-21	Jul-12
Ocqueoc R.			
Hammond Bay lentic	Never	Jun-23	Aug-21
Barrier upstream	Sep-18	Jun-23	Jun-23
Barrier downstream	Aug-22	Jun-23	Jun-23
Johnny Cr.	Sep-70	Jun-23	Jun-23
Hammond Bay Cr. lentic	Never	Jun-23	Sep-17
Schmidt Cr.			
Lower	Apr-23	Jun-23	May-22
Upper	May-08	Jul-21	May-08
Nagels Cr.	Never	Jul-21	Jun-09
Trout R.			
Barrier downstream	Oct-21	Jun-23	Jun-23
Barrier upstream	Oct-07	Jun-23	Jun-07
Swan R.	Jun-10	Jun-23	Jun-10
Grand Lake Outlet	Never	Jun-23	May-03
Middle Lake Outlet	Jun-67	Oct-23	Aug-66
Long Lake Outlet	Aug-21	Oct-23	Oct-23
Devils Lake lentic	Never	Jun-23	Jun-23
Cranberry Cr.	Jun-13	Oct-23	Oct-11
Devils R.	Oct-14	Oct-23	Aug-13
Thunder Bay	Never	Jun-21	Aug-76
Black R.	Apr-23	Aug-23	Sep-22
Mill Cr.	Never	Sep-22	May-98
Au Sable R.	Aug-22	Sep-23	Sep-23
Au Sable. R lentic	Aug-15	Sep-21	Sep-14
Pine R.	May-87	Sep-19	Sep-94
Tawas Lake Outlet	Jun-15	Jul-21	Jun-14
Cold Cr.	Aug-18	Jun-22	May-17
Sims Cr.	Jul-09	Jun-22	Aug-08
Grays Cr.	Sep-05	Jun-22	Jul-04
Silver Cr.	Aug-22	Aug-23	Aug-23
East Au Gres R.	Oct-22	Aug-23	Jun-22
East Au Gres R. lentic	Never	Jun-22	Jun-86
Au Gres R.	Sep-18	Sep-23	Jun-19
Rifle R.	Aug-21	Sep-23	Sep-23
Saginaw R.			
Shiawassee R.	May-21	Aug-23	Jun-19
Cass R.	Jun-22	Aug-23	Sep-22
Flint R.	Never	Jun-22	Jul-14
Armstrong Cr.	May-15	Jun-22	Jul-14
Tittabawassee R.	Jun-18	Aug-23	Aug-22
Sanford Dam upstream	Never	Sep-22	Sep-22

Table 17. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Black Creek	May-23	Jul-23	Aug-22
Molasses River	May-23	Jul-23	Aug-22
Chippewa R.	May-23	Jul-23	Jul-23
Chippewa R. gravel pits	May-23	Aug-23	Aug-23
Pine R.	Jun-22	Jul-23	Jul-23
Carroll Cr.	May-23	Aug-23	Aug-22
Big Salt R.	Jun-22	May-23	Oct-21
Rock Falls Cr.	Never	Jun-19	Jun-69
Elm Creek	Never	Jul-23	Jul-63
Cherry Cr.	Never	May-23	Jul-77
Mill Cr.	May-85	May-23	Sep-13

Table 18. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Huron for larval assessment purposes during 2023.

Tributary	Bayluscide(kg)[1]	Area Surveyed (ha)
Canada		
Echo River (Lentic)	1.42	0.30
Mississagi R. (Lentic and Lotic)	2.84	0.60
Boyne River (Lentic)	0.71	0.15
Serpent River	1.42	0.30
Moon River	0.71	0.15
Spanish River	2.13	0.45
LaCloche River	0.71	0.15
Unnamed (H-2031)	0.24	0.05
Chikanishing River	1.42	0.30
French River	0.47	0.10
Still R.	1.42	0.30
Magnetawan River (Bying Inlet)	2.84	0.60
Shebeshekong River	0.71	0.15
Total (Canada)	**17.04**	**3.60**
United States		
Mission Cr. (Lentic)	0.49	0.10
Beaver Dam Cr. (Lentic)	0.98	0.21
Gogomain R.	0.12	0.025
Caribou Cr. (Lentic)	1.47	0.31
Nuns Cr. (Lentic)	1.96	0.41
Cheboygan River	1.42	0.30
Black Mallard River (Lentic)	0.24	0.05
Ocqueoc River (Lentic)	1.66	0.35
HBBS Creek (Lentic)	0.47	0.10
Long Lake Creek (Devils Lake)	0.94	0.20
Au Sable River	0.94	0.20
Saginaw River (Cass River)	0.24	0.05
Saginaw River (Tittabawassee River)	1.42	0.30

Table 18. *Continued*

Tributary	Bayluscide(kg)[1]	Area Surveyed (ha)
Saginaw River (Upper Chippewa River)	2.84	0.60
Total (United States)	**15.19**	**3.205**
Total for Lake	**32.23**	**6.805**

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

Lake Erie

- Larval assessments were conducted in 68 tributaries (15 Canada, 53 U.S.). The status of larval sea lamprey in historically infested Lake Erie tributaries and lentic areas is presented in Table 19.

- Surveys to estimate larval sea lamprey abundance were conducted in 1 tributary (0 Canada, 1 U.S.) and 0 lentic areas.

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 48 tributaries (9 Canada, 39 U.S.). A new sea lamprey infestation was discovered in the River Raisin.

- Surveys to evaluate barrier effectiveness were conducted in Normandale and Big Creek (Canada), and Cayuga Creek (Buffalo River), Clinton, Cuyahoga, and Huron (MI) rivers (U.S.). All barriers were found to be effective in limiting sea lamprey infestations.

- Larval assessment surveys were conducted in non-wadable lotic areas including the Detroit River and St. Clair River using 11.84 kg active ingredient of 3.2% gB (6.14 kg Canada, 5.7 kg U.S.; Table 20). No sea lampreys were collected in the Detroit River.

Table 19. Status of larval sea lamprey in Lake Erie tributaries with a history of sea lamprey production.

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Canada			
East Cr.	Jun-87	Jun-22	Jun-13
Catfish Cr.	Apr-16	Jun-22	Apr-15
Bradley Cr.	Apr-16	Jun-22	Oct-15
Silver Cr.	May-18	Jul-23	Jun-17
Big Otter Cr.	Sep-21	Jul-23	May-19
South Otter Cr.	Aug-10	Jun-22	Aug-09
Clear Cr.	May-91	Jun-22	May-91
Big Cr.	Jul-21	Jul-23	May-19
Forestville Cr.	Aug-13	Jun-22	Jun-13
Normandale Cr.	Jun-87	Jul-21	Apr-08
Fishers Cr.	Jun-87	Jun-22	May-04
Young's Cr.	Aug-13	Jun-22	Jul-12
Ussher's Cr.	Never	Jul-21	Jun-17
Buffalo R.			
Buffalo Cr.	Apr-19	Aug-23	Jul-18

Table 19. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Cayuga Cr.	Apr-19	Aug-23	Jul-18
Cazenovia Cr.	Apr-19	Aug-23	Jul-18
United States			
Big Sister Cr.	Apr-15	Jul-21	Jun-14
Delaware Cr.	Jun-13	Jul-21	Jul-12
Cattaraugus Cr.	May-22	Aug-23	Aug-23
Lentic Lake Erie	Never	Jul-17	Aug-12
Halfway Br.	Oct-86	Jul-21	Jul-85
Canadaway Cr.	May-16	Aug-23	May-16
Chautauqua Cr.	Never	Aug-23	Jul-12
Crooked Cr.	Apr-19	Aug-23	Aug-23
Racoon Cr.	May-22	Aug-23	Jul-21
Conneaut Cr.	Apr-19	Aug-23	Aug-23
Conneaut Harbour	Never	Sep-19	Jul-16
Wheeler Cr.	Never	Jul-19	Oct-87
Grand R.	Apr-22	Aug-23	Aug-23
Fairport Harbour	Never	Sep-19	Jun-87
Chagrin R.	Never	Jul-23	Sep-21
Huron R.	May-18	Jul-23	May-18
River Raisin	Never	Sep-23	Sep-23
Lake St. Clair			
St. Clair R.	Never	Jun-23	Jun-23
Black R.	Never	May-23	Jul-07
Pine R.	Apr-88	May-23	Jun-16
Belle R.	Never	May-23	May-96
Clinton R.	Never	Jun-23	May-17
Paint Cr.	May-15	Jun-23	May-14
Thames R.	Never	Jul-23	Never
Komoka Cr.	Aug-15	Jul-23	May-17
Pine R.	Jun-18	Aug-19	Sep-18
St. Martin Bay	May-18	Sep-18	Jul-17

Table 20. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Erie for larval assessment purposes during 2023.

Tributary	Bayluscide(kg)[1]	Area Surveyed (ha)
Canada		
Detroit River	4.49	0.95
Dedrich Creek	0.47	0.10
Lynn Creek	0.71	0.15
Nanticoke Creek	0.47	0.10
Total (Canada)	**6.14**	**1.3**
United States		
St. Clair River	5.7	1.20
Total (United States)	**5.7**	**1.20**

Table 20. *Continued*

	Bayluscide(kg)[1]	Area Surveyed (ha)
Total for Lake	**11.84**	**2.50**

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

Lake Ontario

- Larval assessments were conducted in 53 tributaries (21 Canada, 32 U.S.). The status of larval sea lamprey in historically infested Lake Ontario tributaries and lentic areas is presented in Table 21.

- Surveys to estimate larval sea lamprey abundance were conducted in 14 tributaries (6 Canada, 8 U.S.).

- Surveys to detect new larval sea lamprey populations were conducted in 3 tributaries (1 Canada, 2 U.S.). No new sea lamprey infestations were identified.

- Surveys to evaluate barrier effectiveness were conducted in Duffins Creek, Oshawa Creek, Bowmanville Creek, Graham Creek, Cobourg Brook, and Salem Creem (Canada) and Salmon River and Fish Creek, Oswego River (U.S.). Sea lampreys were caught upstream of the McConnelsville Dam on Fish Creek, however the Camden Barrier on the West Branch of Fish Creek was found to be effective. The Duffins Creek barrier continues to be ineffective.

- Larval assessment surveys were conducted in non-wadable lotic areas including the Gananoque River (Canada) and Black River (U.S.) using 4.12 kg active ingredient of 3.2% gB (0.47 kg Canada, 3.65 kg U.S; Table 22).

Table 21. Status of larval sea lamprey in Lake Ontario tributaries with a history of sea lamprey production.

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Canada			
Niagara R.	Never	May-22	Jun-14
Ancaster Cr.	May-03	Jun-22	Jun-15
Grindstone Cr.	Never	Jul-23	Jun-14
Bronte Cr.	May-22	Oct-23	Oct-23
Sixteen Mile Cr.	Jun-82	Aug-23	May-05
Credit R.	Jul-22	Aug-23	Aug-23
Humber R.	Never	Aug-21	Never
Rouge R.	Jun-11	Oct-23	Oct-23
Little Rouge. R.	Jun-15	Oct-23	Oct-23
Petticoat Cr.	Sep-04	Aug-23	Jun-16
Duffins Cr.	Aug-21	Aug-23	Aug-23
Duffins Cr. (Lentic)	Never	Aug-15	Aug-15
Carruthers Cr.	Sep-76	Aug-23	Jul-78
Lynde Cr.	Apr-22	Jun-22	Oct-21
Oshawa Cr.	Aug-21	Aug-23	Aug-23
Oshawa Cr. (Lentic)	Never	Jul-13	Oct-81
Farewell Cr.	Apr-22	Jun-22	Aug-21
Bowmanville Cr.	Aug-21	Aug-23	Aug-23

Table 21. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Wilmot Cr.	Aug-21	Aug-23	Aug-23
Wilmot Cr. (Lentic)	Never	Aug-11	Aug-11
Graham Cr.	Aug-21	Aug-23	Jul-21
Wesleyville Cr.	Oct-02	Jun-21	May-04
Port Britain Cr.	Apr-19	Jun-22	Jun-21
Gage Cr.	May-71	Jun-22	Apr-71
Cobourg Br.	Oct-96	Aug-23	Jul-18
Covert Cr.	May-19	Aug-23	Jun-21
Grafton Cr.	Jun-17	Oct-23	Oct-23
Shelter Valley Cr.	Oct-21	May-22	May-22
Colborne Cr.	Apr-19	Jun-21	Jun-21
Salem Cr.	Aug-21	Aug-23	Aug-23
Proctor Cr.	Aug-21	Oct-23	Oct-23
Smithfield Cr.	Sep-86	Jun-22	May-86
Trent R. (Canal)	Sep-11	Sep-21	Sep-21
Mayhew Cr.	May-19	Aug-23	Jun-21
Moira R.	Jun-15	May-22	Jul-19
Salmon R.	Jun-16	Jun-22	Jul-19
Napanee R.	Never	Jun-22	Jul-15
United States			
Black R.	Aug-22	May-23	May-23
Black R. (Lentic)	May-23	Aug-18	Aug-18
Stony Cr.	Sep-82	Jun-23	May-81
Sandy Cr.	Never	June-23	Apr-10
South Sandy Cr.	Jun-22	May-23	May-23
Skinner Cr.	Apr-05	May-23	May-23
Lindsey Cr.	Jun-22	May-23	May-23
Blind Cr.	May-76	May-23	Oct-75
Little Sandy Cr.	Jun-23	May-23	Jul-22
Little Sandy Cr. (Lentic)	Never	Aug-18	Aug-18
Deer Cr.	Apr-04	Jul-22	Sep-06
Salmon R.	Jun-23	Jul-22	Jul-22
Orwell Brook	Aug-21	Apr-23	Apr-14
Trout Brook	Jun-23	Apr-23	Apr-23
Altmar Cr.	Jun-18	Apr-23	Aug-19
Grindstone Cr.	May-23	Apr-23	Apr-23
Snake Cr.	May-22	May-23	May-23
Sage Cr.	May-78	May-23	May-23
Little Salmon R.	Jun-22	Jul-22	Jul-22
Butterfly Cr.	May-72	May-23	Jun-70
Catfish Cr.	Jun-22	Jun-23	Jun-23
Oswego R.			
Black Cr.	May-81	Aug-21	Jun-04
Big Bay Cr.	Sep-93	Aug-21	Aug-94
Scriba Cr.	May-19	Jul-22	Jul-22
Fish Cr.	Jun-23	May-23	May-23
Carpenter Br.	May-94	Aug-21	Apr-94
Putnam Br./ Coldsprings Cr.	May-96	Jul-22	Apr-05

Table 21. *Continued*

Tributary	Last Treated	Last Surveyed	Last Survey Showing Infestation
Hall Br.	Never	Aug-21	Aug-77
Crane Br.	Never	Aug-21	Jun-81
Owasco Outlet	Jun-19	Jul-22	Jul-22
Rice Cr.	May-72	May-23	Jun-70
Eight Mile Cr.	May-22	May-23	May-23
Nine Mile Cr.	Jun-22	May-23	May-23
Sterling Cr.	May-22	May-23	May-23
Unnamed Cr.	May-19	Jul-22	Aug-19
Blind Sodus Cr.	May-78	May-23	May-23
Red Cr.	Apr-18	May-23	May-23
Wolcott Cr.	May-79	Jun-23	Jun-23
Sodus Cr.	Apr-15	Jun-23	Jun-23
Forest Lawn Cr.	Never	Jun-23	Aug-21
Irondequoit Cr.	Never	Jul-22	Apr-09
Larkin Cr.	Never	Jul-22	May-07
Northrup Cr.	Never	Jul-22	Aug-78
Salmon Cr.	Apr-05	Jun-23	Aug-17
Sandy Cr.	Apr-14	Jun-23	Aug-14
Oak Orchard Cr.			
Marsh Cr.	Apr-14	Jun-23	Aug-14
Johnson Cr.	Apr-10	Jun-23	Jun-09
Third Cr.	May-72	Jun-23	Sep-72
First Cr.	May-95	Jun-23	Sep-94

Table 22. Details on application of granular Bayluscide to tributaries and lentic areas of Lake Ontario for larval assessment purposes during 2023.

Tributary	Bayluscide(kg)[1]	Area Surveyed (ha)
Canada		
Gananoque River	0.47	0.10
Total (Canada)	**0.47**	**0.10**
United States		
Black River	2.35	0.50
Catfish Creek	0.47	0.10
Eighteenmile Creek	0.83	0.18
Total (United States)	**3.65**	**0.78**
Total for Lake	**4.12**	**0.88**

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

Juvenile Assessment

The juvenile life stage is assessed through the interpretation of marking rates by feeding juvenile sea lamprey 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 target 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.

Lake Superior

- Lake trout marking data for Lake Superior are provided by the MIDNR, Minnesota Department of Natural Resources (MNDNR), Wisconsin Department of Natural Resources (WIDNR), GLIFWC, Chippewa-Ottawa Resource Authority (CORA), KBIC, Grand Portage Band of Lake Superior Chippewa Indians, and the Ontario Ministry of Natural Resources and Forestry (OMNRF). Due to COVID-19 travel restrictions, lake trout marking data was not collected in 2020. Spring assessment data from 2023 is currently being analyzed.

- Based on standardized spring assessment data, the marking rate during 2022 was 6.6 A1-A3 marks per 100 lake trout >532mm, which is greater than the target of 5 marks per 100 fish (Figure 7).

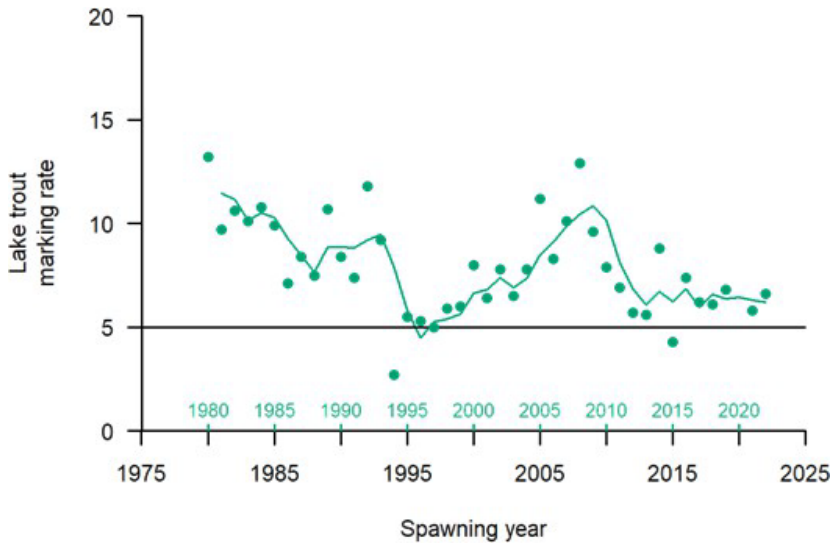


Figure 7. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments on Lake Superior plotted against the sea lamprey spawning year, including the three-year moving average (line). The two-year (2021-2022) average marking rate of 6.2 was above the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were sampled. Data unavailable for 2020 due to limitations from the COVID-19 pandemic.

Lake Michigan

- Lake trout marking data for Lake Michigan are provided by MIDNR, WIDNR, Illinois Department of Natural Resources, Indiana Department of Natural Resources, CORA, Service, and USGS.

- Based on standardized fall assessment data, the marking rate during 2022 was 2.2 A1-A3 marks per 100 lake trout >532mm, which is less than the target of 5 marks per 100 fish (Figure 8). Fall assessment data from 2023 is currently being analyzed.

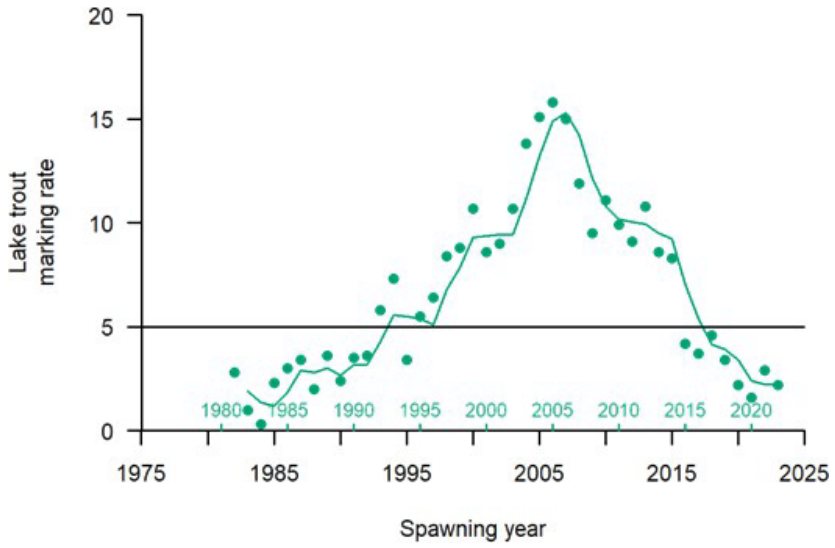


Figure 8. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments on Lake Michigan during August-November plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (2020-2022) average marking rate of 2.2 is less than the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were sampled.

Lake Huron

- Lake trout marking data for Lake Huron are provided by the MIDNR, CORA, USGS, and OMNRF. Spring assessment data from 2023 is currently being analyzed.

- Based on standardized spring assessment data, the marking rate during 2022 was 5.3 A1-A3 marks per 100 lake trout >532 mm, which is greater than the target of 5 marks per 100 fish (Figure 9).

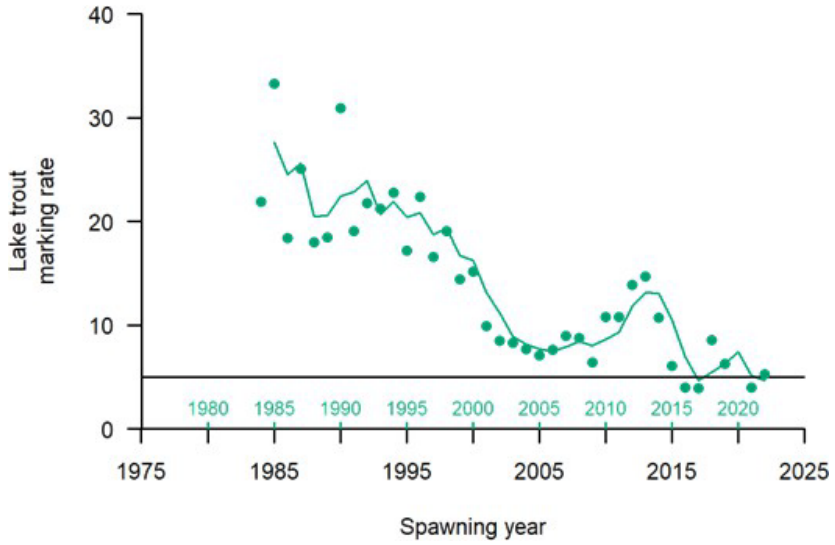


Figure 9. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments on Lake Huron plotted against the sea lamprey spawning year, including the three-year moving average (line). The two-year (2021-2022) average marking rate of 4.6 met the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were sampled. Data unavailable for 2020 due to limitations from the COVID-19 pandemic.

- Canadian commercial fisheries in northern Lake Huron continued to provide parasitic juvenile sea lamprey in 2023, along with associated catch information including date, location, and host species. The total number of sea lamprey captured each year, along with effort data provided by commercial fishers to the OMNRF, is used as an index of juvenile sea lamprey abundance in northern Lake Huron. The effort data from 2023 has yet to be analyzed (Figure 10).

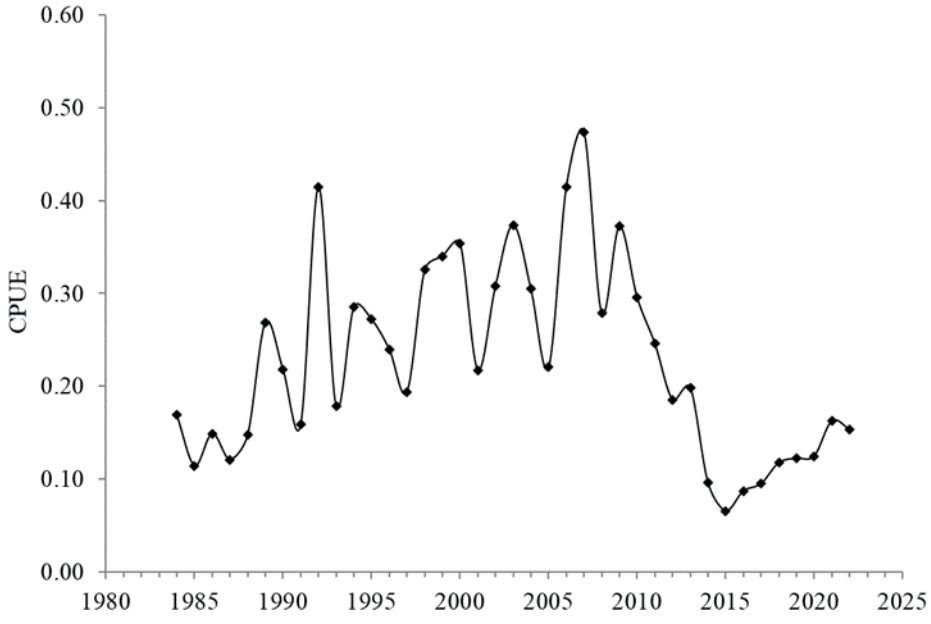


Figure 10. Northern Lake Huron commercial fisheries index showing CPUE (number of parasitic juvenile sea lamprey per km of gillnet per night) for 1984-2022.

- Standardized trapping for out-migrating juveniles in the St. Marys River has been discontinued due to safety concerns and low number of juveniles collected.

Lake Erie

- Lake trout marking data for Lake Erie are provided by the NYDEC, Pennsylvania Fish and Boat Commission (PAFBC), USGS, and OMNRF.

- Based on standardized fall assessment data, the marking rate during 2022 was 4.0 A1-A3 marks per 100 lake trout >532 mm, which is less than the target of 5 marks per 100 fish. Fall assessment data from 2023 is currently being analyzed (Figure 11).

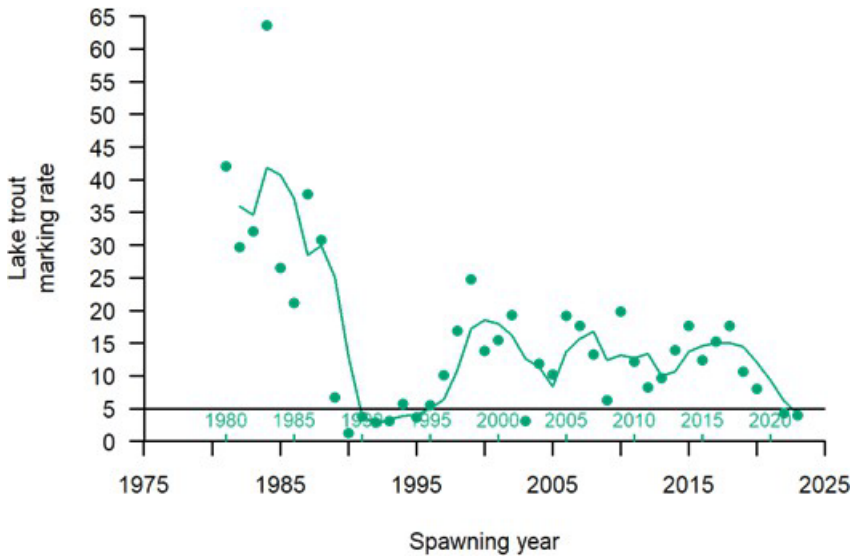


Figure 11. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments on Lake Erie plotted against the sea lamprey spawning year, including the three-year moving average (line). The two-year (2021-2022) average marking rate of 4.2 met the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were sampled. Data unavailable for 2020 due to limitations from the COVID-19 pandemic.

Lake Ontario

- Lake trout marking data for Lake Ontario are provided by USGS, OMNRF, and NYDEC.

- Based on standardized fall assessment data, the marking rate during 2022 was 3.1 A1 marks per 100 lake trout >431 mm which is greater than the target of 2 A1 marks per 100 lake trout target. Fall assessment data from 2023 is currently being analyzed (Figure 12).

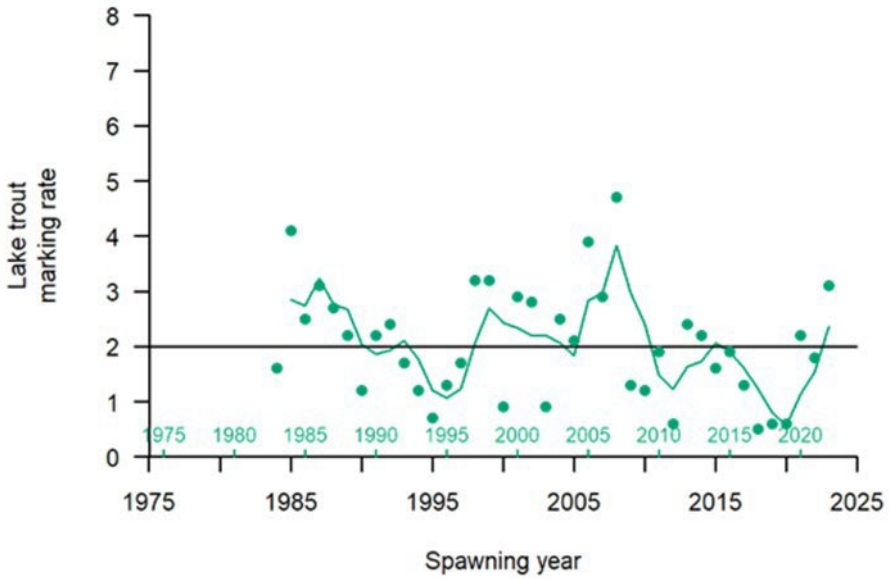


Figure 12. Number of A1 marks per 100 lake trout > 431 mm from standardized assessments on Lake Ontario plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (2020-2022) average marking rate of 2.4 is greater than target of 2 A1 marks per 100 lake trout > 431 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

Adult Assessment

Assessment traps used to intercept adult sea lamprey during the spawning migration are operated throughout the Great Lakes basin, to remove sea lamprey from rivers, facilitate passage of native fish, and generate mark-recapture estimates of adult sea lamprey populations (Figure 13). An annual lake-wide index of adult sea lamprey abundance is derived by summing individual abundance estimates from assessment traps operated in a specific suite of streams (index streams) during spring and early summer. Stream-specific abundance estimates are derived using Petersen mark-recapture methods. In the absence of a stream-specific estimate due to an insufficient number of marked or recaptured sea lamprey, population abundance for that stream and year is estimated using a model based on trap efficiency and dynamics of abundance from other tributaries. 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.

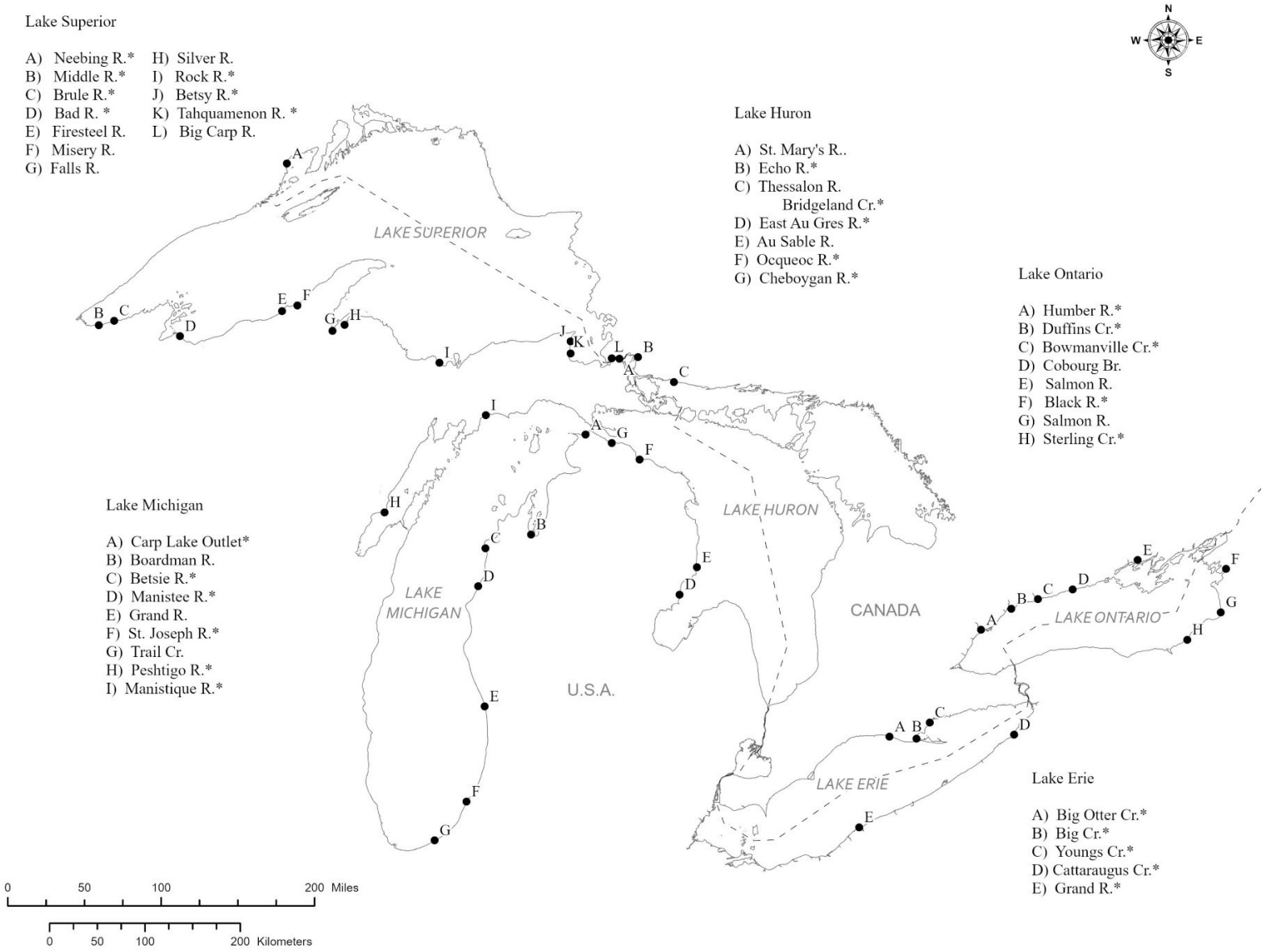


Figure 13. Locations of tributaries where assessment traps were operated during 2023. An asterisk indicates index locations.

Lake Superior

- Adult sea lampreys (n=5,054) were captured in 12 tributaries during 2023, 7 of which were index locations (Table 23, Figure 13). Adult population estimates based on mark-recapture data were obtained from all 7 index streams.

- The index of adult sea lamprey abundance was 62,265 *(95% CI; 55,928 – 68,602)*, which is greater than the target of 10,421 (Figure 14).

- Adult sea lamprey migrations were assessed in the Bad, Brule, Firesteel, Middle, Misery, and Silver rivers through cooperative agreements with GLIFWC and KBIC.

- A barrier-integrated permanent trap is expected to replace portable traps on the Neebing River for the 2025 trapping season to improve trapping efficiency and safety.

Table 23. Information regarding adult sea lamprey captured in assessment traps or nets in tributaries of Lake Superior during 2023 (letter in parentheses corresponds to streams in Figure 13).

Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Canada									
Neebing R. (A)	109	213	52	55	51	441	442	186	200
Big Carp R.[3] (L)	9	---	---	8	75	474	519	249	305
Total or Mean (Canada)	**118**	---	---	**63**	**54**	**446**	**447**	**197**	**207**
United States									
Tahquamenon R. (K)	827	17,087	4	14	63	462	447	218	233
Betsy R. (J)	671	4,385	15	32	55	476	443	235	217
Rock R. (I)	229	648	35	40	48	451	422	210	172
Silver R.[3] (H)	7	56			57				
Falls R.[3] (G)	33	176	16	5	36	432	438	189	167
Misery R.[3] (F)	166	374	42	69	51	407	403	171	179
Firesteel R.[3] (E)	87	87			51				
Bad R. (J)	550	12,357	4	14	56	419	405	200	166
Brule R. (K)	809	2,573	31	90	55	439	441	213	209
Middle R. (B)	1,557	25,003	6	26	56	452	455	229	218
Total or Mean (U.S.)	**4,936**	---	---	**290**	**59**	**439**	**431**	**207**	**197**
Total or Mean (for Lake)	**5,054**	**---**	**---**	**353**	**58**	**440**	**434**	**205**	**199**

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

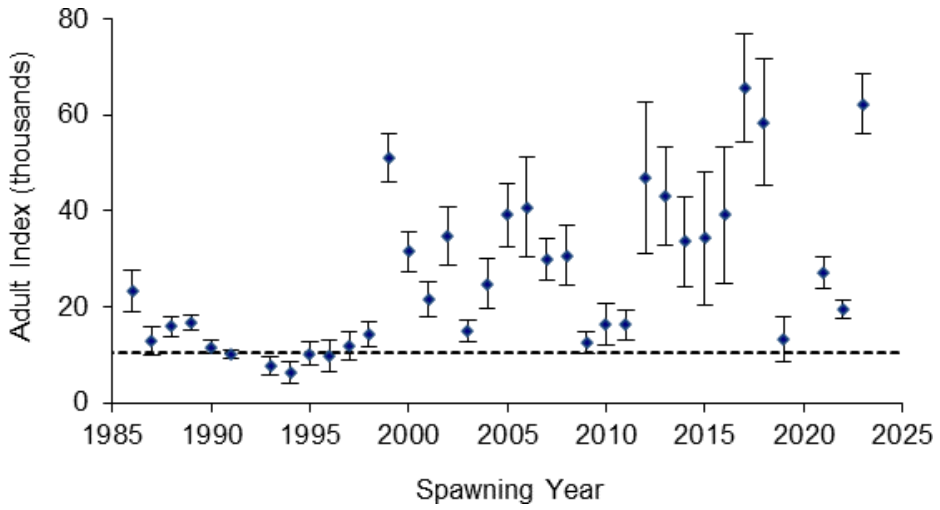


Figure 14. Index estimates with 95% confidence intervals of adult sea lampreys in Lake Superior. The target of 10,421 is represented by the dotted horizontal line. The index target was estimated as the mean of indices during a period with acceptable marking rates (1994-1998).

Lake Michigan

- Adult sea lampreys (n=7,205) were captured in 9 tributaries during 2023, 6 of which were index locations (Table 24, Figure 13). Adult population estimates based on mark-recapture data were obtained from all 6 index streams.

- The index of adult sea lamprey abundance was 24,282 (95% CI: 20,359 – 28,205), which is less than the target of 34,982 (Figure 15).

- Adult assessment traps and fyke nets set on the Grand River captured 150 sea lampreys resulting in a stream-wide population estimate of 1,150 lampreys. The 6th Street Dam trap location attributed to 97% of the total catch.

- Adult assessment traps were operated in the Boardman River through a cooperative agreement with the Grand Traverse Band of Ottawa and Chippewa Indians.

- Low trapping efficiency on the Big Manistee River continues to be of concern and is under investigation by Service staff.

Table 24. Information regarding adult sea lamprey captured in assessment traps or nets in tributaries of Lake Michigan during 2023 (letter in parentheses corresponds to stream in Figure 13).

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)	2,354	3,004	78	180	48	482	484	237	257
Boardman R.[3] (B)	82	214	37	29	49	453	474	217	251
Betsie R. (C)	499	1,295	38	41	50	482	474	250	253
Big Manistee R. (D)	335	11,407	3	7	54	504	463	299	288
Grand R.(E)[3]	150	1,150	12	18	56	500	520	258	320
Manistique R.(I)	2,272	4,062	54	97	49	496	496	262	278
Peshtigo R. (H)	1,127	2,818	39	47	52	506	499	268	262
St. Joseph R. (F)	272	1,696	15	16	36	506	499	269	269
Trail Cr.[3] (G)	114	---	---	---	50	---	---	---	---
Total or Mean (for lake)	**7,205**	**---**	**---**	**435**	**55**	**488**	**488**	**249**	**264**

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

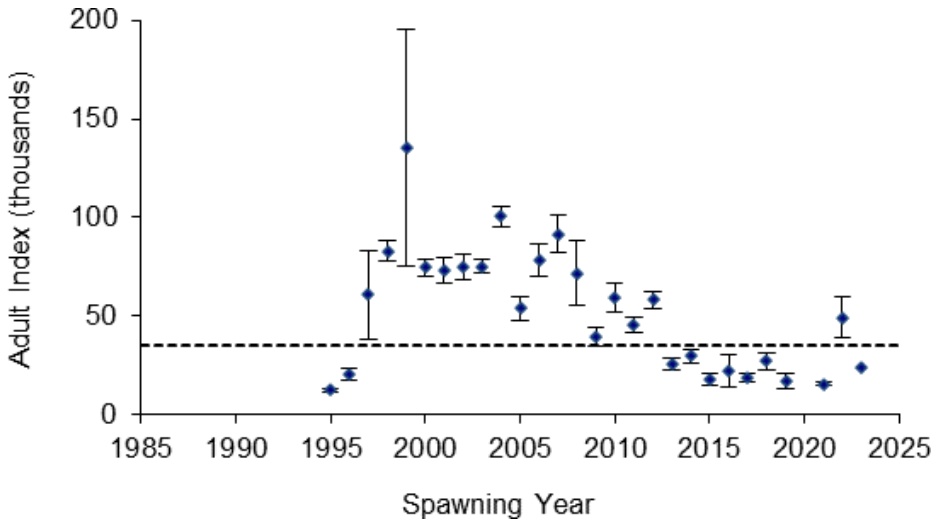


Figure 15. Index estimates with 95% confidence intervals of adult sea lampreys in Lake Michigan. The dotted horizontal line represents the target of 34,982. The index target was estimated as 5/8.9 times the mean of indices (1995-1999).

Lake Huron

- Adult sea lampreys (n=24,245) were trapped in 7 tributaries during 2023, 6 of which were index locations (Table 25, Figure 13). Population estimates were generated for all 6 index streams using mark-recapture data.

- The index of adult sea lamprey abundance was 33,640 (95% CI: 32,435 – 34,845), which is greater than the target of 31,274 (Figure 16).

- The Service, MIDNR, and USACE continue to pursue the construction of a permanent sea lamprey trap on the Au Sable River using Great Lakes Fishery and Ecosystem Restoration (GLFER) funds. Portable assessment traps on the Au Sable River were operated in 2022 and 2023 to determine the optimum location for a permanent trap.

- Construction of the permanent trap on the East Au Gres River was completed in December of 2022 and operated during the 2023 trapping season. Trapping efficiencies at this site increased 19% in 2023.

Table 25. Information regarding adult sea lamprey captured in assessment traps or nets in tributaries of Lake Huron during 2023 (letter in parentheses corresponds to stream in Figure 13).

Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Mean Length (mm) Males	Mean Length (mm) Females	Mean Weight (g) Males	Mean Weight (g) Females
Canada									
St. Marys R. (A)	1,742	5,567	31	44	50	489	484	261	260
Echo R. (B)	889	5,099	17	30	67	466	479	214	254
Thessalon R. (C)									
Bridgeland Cr.	1,876	3,240	58	94	56	475	488	219	246
Total or Mean (Canada)	**4,507**	---	---	**168**	**57**	**476**	**485**	**228**	**251**
United States									
East Au Gres R. (D)	394	1,061	36	53	85	492	483	257	228
Au Sable R.[3] (E)	2	4	---	---	50	---	---	---	---
Ocqueoc R. (F)	813	1,053	75	71	39	461	478	215	244
Cheboygan R. (G)	13,301	17,620	75	350	52	480	487	232	249
St. Marys R. (A)	(Canada)	(Canada)	(Canada)	---	---	---	---	---	---
Total or Mean (U.S.)	**19,738**	---	---	**474**	**52**	**479**	**485**	**233**	**247**
Total or Mean (for Lake)	**24,245**	**---**	---	**642**	**53**	**478**	**485**	**232**	**248**

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

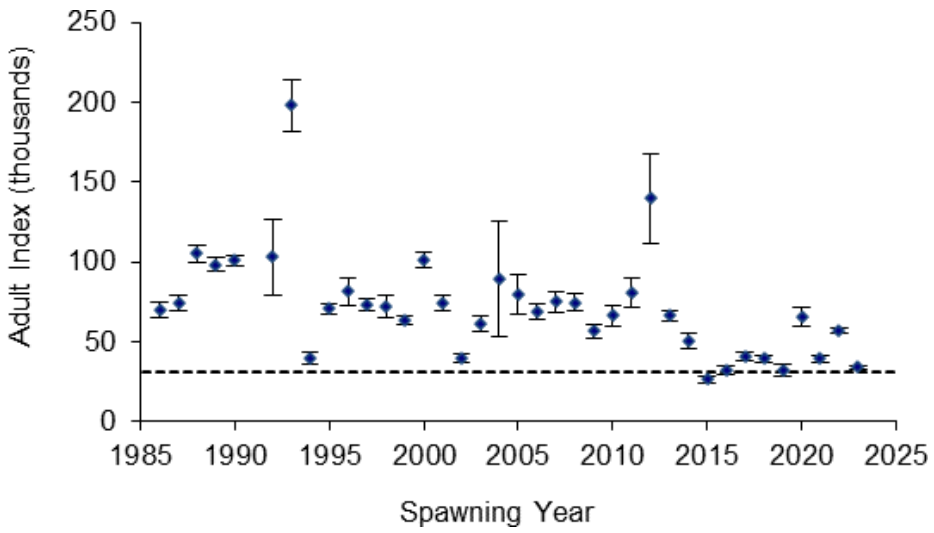


Figure 16. Index estimates with 95% confidence intervals of adult sea lampreys in Lake Huron. The horizontal dotted line represents the index target of 31,274. The index target was estimated as 0.25 times the mean of indices between 1989 and 1993.

Lake Erie

- Adult sea lampreys (n=1,170) were trapped in 5 index streams in 2023 (Table 26, Figure 13). Adult population estimates based on mark-recapture data were obtained from 4 of 5 index streams. The population estimate was modeled for Cattaraugus Creek due to insufficient recaptures of marked sea lamprey.

- The index of adult sea lamprey abundance was 3,455 (95% CI; 3,290 – 3,620), which is greater than the target of 3,263 (Figure 17).

- Fyke nets were not deployed in Conneaut Creek in 2023. A seasonal electric barrier was operated in 2022 and 2023 to determine if it would be a feasible alternative control tool to block lamprey from infesting the upper reaches of the creek. Larval sea lampreys have not been found upstream of the seasonal electric barrier since it was put into service in 2022.

Table 26. Information regarding adult sea lamprey captured in assessment traps or nets in tributaries of Lake Erie during 2023 (letter in parentheses corresponds to stream in Figure 13).

Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Canada									
Big Otter Cr. (A)									
Little Otter Cr.[4]	94	525	18	16	44	479	468	260	247
Big Cr. (B)	883	1,285	69	220	56	518	507	278	280
Young's Cr. (C)[4]	33	75	44	13	46	519	443	317	207
Total or Mean (Canada)	1,010	---	---	249	55	516	500	279	273
United States									
Cattaraugus Cr.[4] (D)	53	2,756	---	---	68	---	---	---	---
Grand R. (E)	107	276	37	31	59	507	512	385	418
Total or Mean (U.S.)	**160**	**---**	**---**	**31**	**42**	**507**	**513**	**385**	**418**
Total or Mean (for Lake)	**1,170**	**---**	**---**	**280**	**54**	**515**	**501**	**288**	**293**

[1]The number of sea lamprey used to determine percent males, mean length, and mean weight. [2] Gender was determined using external characteristics. [3] Not an index location. [4] Model used for population estimate.

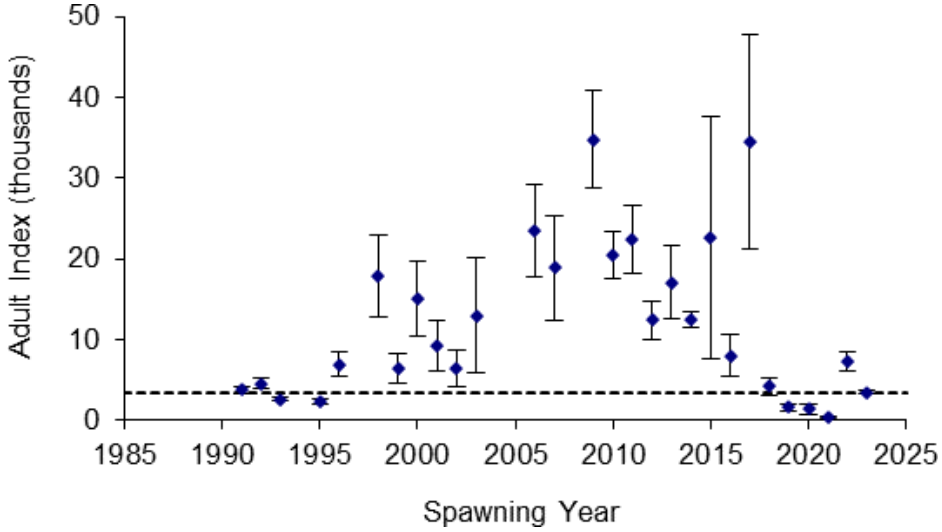


Figure 17. Index estimates with 95% confidence intervals of adult sea lampreys in Lake Erie. The dotted horizontal line represents the index target of 3,263. The index target was estimated as the mean of indices during a period with acceptable marking rate (1991-1995).

Lake Ontario

- Adult sea lampreys (n=23,151) were trapped in 8 tributaries during 2023, 5 of which were index locations (Table 27, Figure 13). Adult population estimates based on mark-recapture data were obtained from all 5 index locations.

- The index of adult sea lamprey abundance was 56,000 (95% CI; 52,543 – 59,457), which is greater than the target of 14,065 (Figure 17).

Table 27. Information regarding adult sea lamprey captured in assessment traps or nets in tributaries of Lake Ontario during 2023 (letter in parentheses corresponds to stream in Figure 13).

Tributary	Number Caught	Adult Estimate	Trap Efficiency (%)	Number Sampled[1]	Percent Males[2]	Mean Length (mm)		Mean Weight (g)	
						Males	Females	Males	Females
Canada									
Humber R. (A)	16,234	29,123	56	222	48	495	495	278	276
Duffins Cr. (B)	1,348	6,148	22	105	48	504	501	274	278
Bowmanville Cr. (C)	1,969	2,942	67	209	61	496	495	275	289
Cobourg Cr.[3] (D)	1,373	2,132	64	271	49	486	480	245	247
Salmon R.[3] (E)	3	---	---	---	---	---	---	---	---
Total or Mean (Canada)	**20,927**	**—**	**—**	**807**	**52**	**494**	**491**	**266**	**269**
United States									
Black R.[4] (F)	1,381	14,814	9	32	59	505	434	289	175
Salmon R.(G) Orwell Br.[3]	339	4,402	7	9	49	514	481	302	313
Sterling Cr. (H)	504	2,973	15	40	54	503	505	285	300
Total or Mean (U.S.)	**2,224**	**—**	**—**	**81**	**54**	**505**	**475**	**288**	**254**
Total or Mean (for lake)	**23,151**	**—**	**—**	**888**	**52**	**495**	**489**	**269**	**267**

[1]The number of sea lamprey used to determine percent males, mean length, and mean weight, [2]Gender was determined using external characteristics, [3]Not an index location, [4]Model used for population estimate

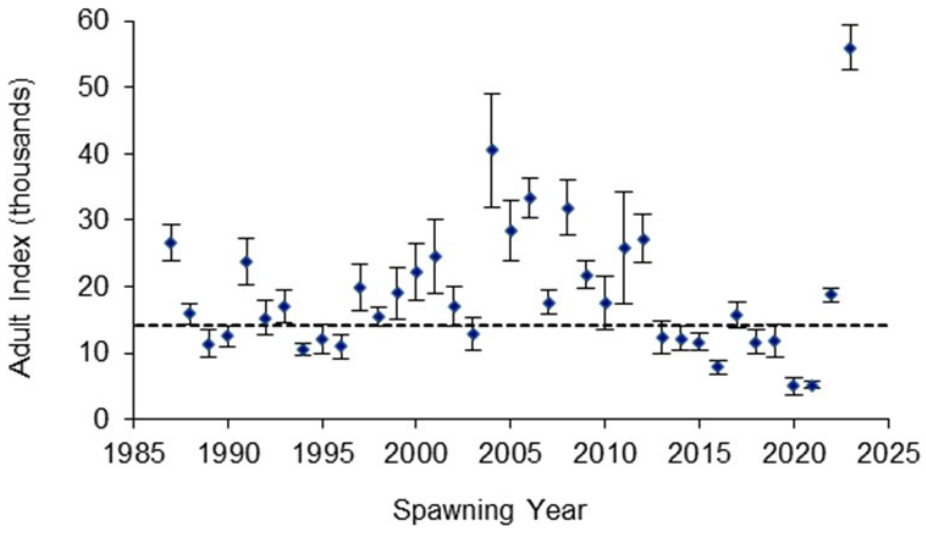


Figure 18. Index estimates with 95% confidence intervals of adult sea lamprey in Lake Ontario. The dotted horizontal line represents the index target of 14,065. The index target was estimated as the mean of indices during a period with acceptable marking rates (1993-1997).

RISK MANAGEMENT AND ENVIRONMENTAL ASSESSMENT

The Risk Management [USFWS (Service) – United States] and Environmental Assessment [DFO (Department) – Canada] teams address environmental and non-target issues related to the implementation of the SLCP in the United States and Canada. This involves coordination with many federal, provincial, and state agencies, tribes, first nations, and others to minimize risk to non-target organisms.

Species at Risk Act (Canada)

Section 73 of the Species at Risk Act (SARA) enables the competent minister to issue permits for activities that may affect threatened and endangered species provided that (a) all alternatives have been considered, (b) all feasible measures have been taken to minimize the impact on the species and its critical habitat, and (c) the activity will not jeopardize the survival or recovery of the species. During 2023, the Department sought and was issued a permit for lampricide applications in 30 waterbodies that overlapped with the known occurrence of the following species at risk:

- Channel Darter (*Percina copelandi*), Lake Erie populations, Endangered
- Eastern Sand Darter (*Ammocrypta pellucida*), Ontario populations, Threatened
- Hickorynut (*Obovaria obovaria*), Endangered
- Lake Chubsucker (*Erimyzon sucetta*), Endangered
- Northern Madtom (*Noturus stigmosus*), Endangered
- Pugnose Shiner (*Notropis anogenus*), Threatened

- Pugnose Minnow (*Opsopoeodus emiliae*), Threatened
- Round Pigtoe (*Pleurobema sintoxia*), Endangered
- Shortnose Cisco (*Coregonus reighardi*), Endangered
- Silver Chub (*Macrhybopsis storeriana*), Great Lakes - Upper St. Lawrence population, Endangered
- Spotted Gar (*Lepisosteus oculatus*), Endangered
- Threehorn Wartyback (*Obliquaria reflexa*), Threatened

Monitoring for sick and dead organisms was conducted during and immediately after each lampricide application. No species at risk were observed.

Endangered Species Act (U.S.)

Section 7 of the Endangered Species Act (ESA) requires that all federal agencies 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 (threatened, endangered, candidate) species or adversely modify designated critical habitat.

Annual Reviews

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

During 2023, the following ES offices reviewed the effect of scheduled lampricide applications to listed species within their jurisdiction. Concurrence with proposed conservation measures and determinations of "no effect" or "not likely to adversely affect" was received by:

- East Lansing Ecological Services Field Office (Michigan)
- Twin Cities Ecological Services Field Office (Wisconsin and Minnesota)

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. To streamline the consultation process and add predictability for project planning, an informal, draft, SLCP-wide (programmatic) Section 7 review was prepared in coordination with the East Lansing Field Office and submitted to the Midwest Region ES Program for consideration during 2007. The programmatic review evaluates all SLCP activities, identifies potential impacts to protected species and critical habitats, and specifies conservation measures to eliminate or minimize disturbance. No further action has been taken on the review due to limited staffing within the ES Program.

State-Listed Species (U.S.)

Annual Reviews

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

During 2023, the following state regulatory offices reviewed listed species within their jurisdiction and issued permits to conduct lampricide applications:

- MIDNR
- WIDNR
- MNDNR

Field Protocols (U.S.)

Field protocols are reviewed and revised annually to protect and avoid disturbance to federal and state listed species located near scheduled SLCP activities. The protocols provide information on each species, their known locations, and detailed conservation measures to be followed:

- Protocol to protect and avoid disturbance to federal- and state-listed endangered, threatened, candidate, proposed, and special concern species, and critical and proposed critical habitats in or near Great Lakes streams scheduled for lampricide treatments in the United States during 2023.

- Protocol to protect and avoid disturbance to federal- and state-listed endangered, threatened, candidate, proposed, and special concern species, and critical and proposed critical habitats in or near Great Lakes streams scheduled for gB assessments in the United States during 2023.

During 2023, 18 federally listed species, 1 candidate species, the federally de-listed bald eagle (*Haliaeetus leucocephalus*) and Kirtland's warbler (*Setophaga kirtlandii*), and 3 critical habitats were identified in the protocols.

National Environmental Policy Act (U.S.)

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 2023, NEPA was required for cooperative agreements for the following actions:

Trapping for adult sea lampreys on the following streams:

- Bad River (Lake Superior)
- Cranberry River (Lake Superior)
- Potato River (Lake Superior)
- Boardman River (Lake Michigan)

- Traverse River (Lake Michigan)
- St. Marys River (Lake Huron)
- Cattaraugus Creek (Lake Erie)

Federal Insecticide, Fungicide and Rodenticide Act (U.S.)

Reports are prepared to comply with the U.S. EPA June 16, 1998 ruling of Section 6(a)(2) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). This section of FIFRA requires pesticide registrants to report unreasonable adverse effects of their products to the EPA. The Service and Department 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 threatened, endangered, or candidate species, and with observed mortalities of ≥50 non-schooling or ≥1,000 schooling fish of any non-target species or taxa during a lampricide application (Table 28).

Table 28. Summary of 6(a)(2) reports submitted for incidents of non-target mortality during 2023 lampricide applications.

Lake	Stream	Species	Number	Comments
Superior	Huron River[1]	Logperch (*Percina caprodes*)	75	Spawning
	Tahquamenon River[1]	Mudpuppy (*Necturus maculosus*)	84	Sensitive
	Gravel River[2]	Round whitefish (*Prosopium cylindraceum*)	80	Spawning
Michigan	Pentwater[1]	Burrowing mayflies (*Hexagenia limbata*)	628	Sensitive
Huron	Chippewa River[1]	Stonecat (*Noturus flavus*)	68	Sensitive

[1] TFM, [2]granular Bayluscide

Studies and Fieldwork (U.S. and Canada)

Non-target Surveys (Treatment)

Manistee River: The Risk Management Team participated in the partner-led effort (Little River Band of Ottawa Indians, Green Bay Fish and Wildlife Conservation Office, Michigan Department of Natural Resources) to collect young-of-the-year (YOY) lake sturgeon (*Acipenser fulvescens*) before and during the Manistee River treatment.

- The following was collected during the 8 survey nights:
  - 186 YOY (110 – 195 mm)
  - 11 yearlings (259 – 384 mm)
- Each LST was weighed, measured, fin clipped for genetics, and pit tagged.
- The fish were release on August 25 at access sites within the stretches of stream where they were collected.

Non-target Surveys (Barriers)

- The Risk Management and Environmental Assessment teams conducted a large-scale field study to assess the impact of existing sea lamprey barriers on fish communities. The study replicated the work described in Dodd et al. (2003; *Low-head sea lamprey barrier*

effects on stream habitat and fish communities in the Great Lakes basin. J. of Great Lakes Res. 29:386 – 402) conducted during 1996/1997. Fish communities were sampled in 24 paired streams across the five Great Lakes. Each pair consisted of one stream with a barrier and one reference stream without a barrier. Sampling was conducted at three sites up- and downstream of the barrier and hypothetical barrier sites. The results will be compared to Dodd et al. (2003) and further the understanding of low-head sea lamprey barrier impacts on fish communities over time. Analysis remains ongoing at the time of annual report compilation.

- The Environmental Assessment Unit sampled two Lake Ontario watersheds in New York (Trout Brook and Grindstone Creek) that are being considered for new low-head sea lamprey barriers. The purpose of this sampling is to determine whether there are threatened, endangered, or vulnerable fish species in the watersheds prior to proceeding with barrier planning. No species at risk were found during 2023. Sampling will continue during 2024.

Toxicity Tests

- The U.S. Geological Survey–Upper Midwest Environmental Sciences Center (UMESC) conducted tests in a streamside bioassay trailer (Cold Creek, Isabella County, Michigan) to determine the toxicity of TFM to logperch (Percina caprodes), the primary host fish for the federally endangered snuffbox mussel. Results demonstrated that the fish are not as sensitive as reported by Boogaard et al. (2015) where handling stress was a suspected contributor to mortality. Based on the results, logperch mortality during a TFM treatment would be about 5 and 23% at 1.0 and 1.5×MLC, respectively, during a 9-hour exposure. Mortality would then increase to about 50% at 2.0×MLC during a 9-hour exposure (Kirkeeng et al., in review).

- UMESC conducted tests to determine the toxicity of TFM to larval (glochidia) and juvenile life stages of hickorynut (Obovaria olivaria) and round hickorynut (Obovaria subrotunda) freshwater mussels. Test results demonstrated that TFM is not acutely toxic to the glochidial and juvenile life stage of either species at concentrations applied during stream treatments (Newton et al., in review).

Garden River First Nation Aquatic Ecosystem Study

In conjunction with the Garden River First Nation (GRFN), the Environmental Assessment Unit continued a multi-year study on Garden, Root, and Echo rivers (northern Lake Huron, Ontario). The purpose of the study is to establish a baseline understanding of these aquatic ecosystems. To accomplish this, data collection and analyses of habitat, physical characteristics of the systems, invertebrate species, water quality (water chemistry, temperature, and levels), sediment transport, biological characteristics (fish assemblage, distribution, and contaminant concentrations), sea lamprey distribution, and fisheries exploitation measures of species that are important to the GRFN will occur.

- During 2023, fyke nets were deployed in the mainstream of the Garden River before, during, and after the August lampricide treatment to collect fish and larval sea lampreys that were drifting downstream. During the treatment, the rate of sea lamprey drift was

dramatically higher. However, the number of fish captured was not higher which suggests low non-target mortality in these areas.

TASK FORCE REPORTS

The Commission has four task forces (Lampricide Control, Barrier, Larval Assessment and Trapping). 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 charged to each task force by the SLCB.

Lampricide Control Task Force

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

2023 Membership
Lori Criger (Chair), Cheryl Kaye, Chris Gagnon, Benson Solomon, Lauren Freitas, Chris Eilers, Aaron Jubar (Service); Bruce Morrison, Shawn Robertson, Al Rowlinson (Department); Jim Luoma, Nick Schloesser, Karen Slaght (USGS); Michael Wilkie (Wilfred Laurier University); Mike Siefkes, Ted Treska, Chris Freiburger (Commission Secretariat).

Progress towards goals described in the Commission 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.

2023 Outcomes:

1. Treatments were completed in 114 streams and 21 lentic areas. Fifteen stream treatments and 2 lentic treatments were deferred until 2024. Forty-seven of the streams and 12 of the lentic areas treated were included in the targeted treatment strategy focused on Lake Superior tributaries.
2. Where applicable, strategies were employed to reduce the number of sea lamprey that survive treatment and increase the effectiveness of individual stream treatments.
    - Backwaters and isolated areas in target streams (Goulais, Garden, Salmon, Ford, Flintsteel, Firesteel, White, Manistee, and Sturgeon rivers) 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 prediction chart levels, particularly in streams that were treated late in the season or under elevated water temperatures.

- Priority streams were scheduled for treatment during the time of year when discharge and water chemistries were optimal for effective treatment. Some exceptions were necessary in streams where sensitive species were present.

3. Service and Department personnel collaborated to effectively treat the Manistee River.
4. Personnel from the larval assessment and alternative control units were deployed to the control units as needed to augment treatment effort on complex, labor-intensive systems including the Flintsteel, Ford, Ontonagon, Chippewa, Pentwater, Manistee, Pere Marquette, and Mississagi rivers.
5. Service and Department personnel worked together to efficiently treat the St. Marys River plots with granular Bayluscide in early July before heavy vegetation reduced treatment efficacy.

2024 Objectives:

1. Treat all streams listed on the 2024 treatment schedule.
2. Review past treatment results and larval assessment data to implement treatment strategies to achieve improved efficacy for streams scheduled for treatment during 2024.
3. Deploy additional personnel from within the program to treat more streams in the spring when larvae are more susceptible and stream discharge and water chemistries are most favorable. Additionally, treatment supervisors will request additional personnel to augment treatment effort on complex, labor-intensive systems scheduled later in the season.
4. To increase treatment effectiveness of St. Marys River granular Bayluscide applications, Service and Department personnel will collaborate to ensure treatments are completed before aquatic vegetation becomes problematic.

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

Additionally, the Lampricide Control Task Force is committed to supporting research and field work that investigates sea lamprey sensitivity and effects on non-target organisms with anticipation that it leads to improved control strategies that increase treatment efficacy while minimizing effects on non-target species.

2023 Outcomes:

1. Lampricide analysis and water chemistry data from streams treated in 2023 was reviewed to identify potential areas that did not receive lethal lampricide concentrations during treatment. Information was provided to larval assessment to help guide treatment evaluation survey effort and recommend re-treatment.
2. Control agents had planned to cooperate with UMESC to conduct a bioassay prior to the first-time treatment of the Tobacco R.; however, the stream was not able to be treated due to fluctuating water levels at the hydrodam.
3. UMESC and Service Risk Management personnel conducted a bioassay to confirm logperch sensitivity to TFM. The bioassay took place in the Coldwater R. (Saginaw R. system) which has similar water chemistries to the Tobacco R. Logperch in the Tobacco R. are of particular concern due to the presence of the listed snuffbox mussel.

4. Continued to support and provide input to UMESC as they work with Battelle to develop a formulation of liquid Bayluscide that would eliminate tubing degradation and clogging and increase applicator safety.
5. Service Risk Management personnel participated in the partner-led effort to collect young-of-the-year lake sturgeon before and during the Manistee R. treatment.
6. Tests were conducted to determine the sensitivity of round hickorynut and hickorynut freshwater mussels to TFM.

2024 Objectives:

1. Review past treatment history and larval assessment information for streams scheduled for treatment in 2024 to identify impediments to effectiveness and develop strategies to increase efficacy.
2. Work with other task forces to measure effectiveness of lampricide applications.
   - Review results of treatment evaluation surveys as they are completed to identify problem areas and improve success of future treatments.
3. Collaborate with UMESC to conduct bioassays on select systems where there is concern that lampricide concentrations may not be effective late in the season due to elevated water temperatures and/or seasonality effects that contribute to sea lamprey survival. Candidate streams for 2024 will be discussed at the 24-01 meeting.
4. Cooperate with UMESC to field test a new formulation of liquid Bayluscide during treatment of the Oconto River lampricide treatment.
5. Identify and address gaps in species-specific lampricide toxicity research by conducting extensive literature reviews and communicating needs to existing internal and external researchers.
6. Service Risk Management personnel will participate in the partner-led effort to conduct non-target surveys in Conneaut Creek (Pennsylvania and Ohio) before and after the lampricide treatment.
7. UMESC will conduct tests to determine the sensitivity of the salamander mussel to TFM.

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

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

2023 Outcomes:

1. Treated all streams and lentic areas included in the targeted treatment strategy focused on tributaries to Lake Superior.
2. Treatment supervisors were diligent about noting the size and densities of larvae observed during treatments to provide anecdotal evidence of the effects from the pandemic or to identify problem streams that contribute to elevated adult index numbers.
3. Assisted the LATF with developing the 2024 rank list. Treatment supervisors reviewed and calculated treatment costs for all streams considered for treatment.
4. Assisted LATF with evaluating the effectiveness of individual treatments in each lake. Treatment supervisors reviewed results of treatment evaluation surveys to identify problem areas and improve success of future treatments.

5. Assisted LATF with determining the most effective approach for applying additional treatment effort.

2024 Objectives:

1. Optimize stream treatment schedules to prioritize problem streams, particularly in Lake Superior where adult index estimates are on the rise, as well as streams that were deferred in 2023.
2. Coordinate with SupCon to consider ways to incorporate alternative control methods with lampricide control to increase efficacy of treatments.

Barrier Task Force

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

2023 Membership
Matt Symbal (Chair), Pete Hrodey, Kevin Mann, Cheryl Kaye, and Jessica Collier (Service); Bruce Morrison, Gale Bravener, Sam Matheson, and Tom Pratt (Department); Kevin Meyer and Carl Platz (USACE); Gary Whelan (MIDNR); David Gonder (OMNRF); Nicholas Johnson and Ted Castro-Santos (USGS); Dan Zielinski (Commission); Rob McLaughlin (University of Guelph); Mike Siefkes, Chris Freiburger, Ted Treska (Commission Secretariat).

Progress towards goals described in the Commission 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.

2023 Outcomes:

1. Planning continued for 35 barrier construction projects to prevent sea lampreys from accessing spawning habitat.
2. The State of Michigan acquired a 35-acre parcel of property adjacent to the Manistique River sea lamprey barrier site location through the tax foreclosure process. The 2 remaining parcels needed for the project are slated to be acquired through the same process in 2024.
3. The Little Manistee sea lamprey barrier project design is 100% complete. Construction award is tentatively scheduled for November 2023 with work to begin on-site during the 2024 construction season. The project is expected to take 2 construction seasons to complete.
4. The sea lamprey barrier feasibility study is ongoing on Conneaut Creek. A tentatively selected plan consisting of an Obermeyer adjustable crest with electric barrier component is the preferred alternative for the Griffey Road location.
5. A sea lamprey barrier feasibility study is ongoing in Beaverdam Brook to determine the best method to block the sea lamprey run while improving guidance of salmon and trout into the NYDEC fish hatchery.

6. Service staff working in coordination with the MDNR replaced stop logs in the 6th Street Dam fishway located on the Grand River. Annual barrier inspections throughout the river are scheduled for completion this fall.
7. Feasibility and design for the Sucker River culvert replacement and sea lamprey barrier construction has continued throughout the summer. Design of the free span bridge has reached 60% design and a location for the barrier has been selected.
8. A condition assessment and feasibility study was done for the Koshkawong River sea lamprey barrier. Consultants evaluated the barrier as being in in fair condition and recommended life extension rehabilitation. The procurement process has been initiated to conduct the repairs at the Koshkawong River barrier addressing badly degraded concrete.
9. Inspection of sea lamprey barriers continues across Great Lake tributaries to assess condition of structures preventing upstream sea lamprey migration. Inspections are also designed to identify any repairs necessary to maintain blockage.
10. Review of 48 fish passage projects was initiated or completed to determine the effect of fish passage and dam or culvert removals to sea lamprey control operations.
11. Routine maintenance at all purpose-built sea lamprey barriers was completed to ensure adult sea lampreys do not have access to spawning habitat. All seasonal sea lamprey barriers were installed.
12. The sea lamprey barrier prioritization list continues to be refined with help from state and private partners. Recently, the GLFC and Service mailed a questionnaire to each of the 350 U.S. barrier owners seeking information on the condition, inspection history, and future plans of each barrier identified on the list.
13. Larval sea lamprey electrofishing surveys were completed above barriers to determine barrier effectiveness were completed on select tributaries. Escapement was documented on the White River (Lake Michigan), as well as the Middle and Sand Rivers (Lake Superior) this year.
14. USACE, GLFC, and Service staff continue to work together to identify future projects that fall into the Great Lakes Fishery and Ecosystem Restoration funding category.
15. Members of the GLFC and task force continue to work with Michigan State University on the Great Lakes Aquatic Habitat Framework to update the sea lamprey barrier map and its functionality.

2024 Objectives:

1. Initiate construction of the Manistique River (Lake Michigan) sea lamprey barrier.
2. Initiate construction of the Little Manistee River (Lake Michigan) sea lamprey barrier.
3. Finalize feasibility study for a sea lamprey barrier on Conneaut Creek.
4. Modify fish hatchery weir on Beaver Dam Brook to block lamprey and improve fish guidance weir at NYDEC fish hatchery.
5. Initiate construction of the Sucker River (Grand Marias, MI) sea lamprey barrier and free span bridge.
6. Initiate repairs for the Koshkawong River sea lamprey barrier.
7. Members remain engaged in the analysis and review of options at the 6th Street Dam on the Grand River (Lake Michigan) to assess risk of adult sea lampreys migrating upstream of the proposed structure that will create a whitewater rapids area in downtown Grand Rapids.

8. Continue working on priority GLFER barrier projects with the U. S. Army Corps of Engineers to limit sea lamprey access to spawning habitat.
9. Investigate use of existing surrogate species and geographic information systems (GIS) data to predict infestation risk upstream of blocking barriers.
10. Deliver barrier program operation and maintenance to limit sea lamprey access to spawning habitat.
11. Continue refining the sea lamprey barrier prioritization list by seeking input from outside agencies.
12. Complete feasibility and design of a sea lamprey barrier for the Trout River (Lake Huron).

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.

2023 Outcomes:

1. Testing of migratory pheromones and pheromone antagonists continued in Carp Lake Outlet. The use of pheromone antagonist is being considered for small scale deployment as a control tool within the SUPCON project.
2. Members of the SLCP and GLFC remain engaged in the Grand River (Michigan) sea lamprey barrier project. The US Army Corp of Engineers' (USACE) development of Environmental Impact Statement for the project remains paused at this time until the GLFC directs work to restart. USACE continues to participate in meetings to remain appraised of project progress and decisions.
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. Trapping was conducted in 2023 in the upper Cheboygan River as a component of the Supplemental Control (SUPCON) Project. Sterilized male sea lampreys (~4,000) were released into Sturgeon, Pigeon, and Maple rivers during the spawning run.
4. Participated in a field experiment in the Black Mallard River to test NEMO as a seasonal barrier to block a natural sea lamprey run with the goal of eliminating the need for lampricide treatment. The electric field was operated in the Black Mallard River, March through August, 2016-2023. Based on trap catches, it blocked >99% of the adults each year. Sterilized male sea lamprey were released into the Black Mallard upstream of the NEMO as insurance in the event fertile sea lampreys had passed. No sea lamprey larvae have been discovered upstream of the NEMO since 2019.
5. Several BTF members and participants are involved with the Supplemental Control Program workgroup. During 2023, the group identified SUPCON deployment strategies and submitted the proposal for Stage 2 of the project. Trapping of adult sea lampreys and larval sea lamprey assessments occurred on 12 streams.

2024 Objectives:

1. Remain involved in barrier research regarding use of chemo-sensory techniques to block or guide sea lampreys to increase capture of adult sea lampreys at barrier/trap complexes.
2. Participate in research trials to further test alarm cue response and its utility in a push-pull scenario to direct lampreys toward a successful barrier/trap complex or effective treatment location.
3. The Cheboygan Work Group (CWG) will continue to assess the upper Cheboygan River population during 2024 to confirm that adult populations upstream of the Cheboygan Lock and Dam complex are small and to document the system response to the Lake Kathleen Dam removal on the Maple River.
4. Continue operation of the NEMO seasonal barrier on the Black Mallard River and Conneaut Creek to prevent the migration of spawning sea lamprey to the upper river.
5. Provide support to the Supplemental Control Program in identifying assessment and control strategies (SMRT, pheromone, alarm cue, NEMO, etc.) for successfully controlling sea lampreys in streams difficult to treat with lampricide.

Larval Assessment Task Force

The task force was established in 2012 and combined some objectives from the LATF and the Larval Assessment Work Group (LAWG).

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

2023 Membership
Aaron Jubar (Chair); Tonia Van Kempen, Lexi Sumner, and Fraser Neave (Department); Lori Criger, Bob Frank, and Becca Philipps (Service); Chris Holbrook (USGS); Travis Brenden and Chris Cahill (Quantitative Fisheries Center, MSU); Mike Siefkes, Ted Treska, and Chris Freiburger (Commission Secretariat).

Progress towards goals described in the Commission 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.

2023 Outcomes:

1. New sea lamprey producing tributaries were detected in Lake Superior (Aguasabon River in the Terrace Bay area, Maki Creek which is a tributary to the Nipigon River, Lester River, and Stewart River), Lake Huron (Shawanga Landing Creek in the Parry Sound area, and Flood Creek on Cockburn Island) and Lake Erie (River Raisin). In Lake Superior, Deer Lake Creek was positive above the lake for the first time. In Lake Ontario, Sage Creek and Skinner Creek were positive for the first time in over 20 years.

2. Larval surveys were conducted in the Grand River (Lake Michigan) above Sixth Street Dam, but no new sea lamprey infested tributaries were detected. Prairie Creek, a tributary to the Grand River, was found to be infested in 2022 and will be treated during 2024.

2024 Objectives:

1. Conduct surveys to detect new infestations of sea lamprey when possible. When new infestations are found, rank streams for treatment based on larval population and size structure information.
2. Prioritize and conduct distribution surveys on all streams scheduled for treatment during 2024, with emphasis on addressing any remaining data gaps stemming from the pandemic.
3. Conduct additional larval and habitat assessments in the Upper Lakes to prepare for the targeted treatment effort planned for 2025.
4. Conduct granular Bayluscide surveys in the St. Clair River on the Canadian side during 2024.

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

2023 Outcomes:

1. Post-treatment assessments were conducted on streams treated during 2022 and early 2023. In Lake Superior, the presence of large residual larvae in the Falls River lentic area and Lowney Creek will lead to re-ranking these systems for possible treatment during 2024.

2024 Objectives:

1. Continue to conduct post-treatment assessments on all treated streams and rank streams when problematic populations of residual sea lampreys are detected.

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.

2023 Outcomes:

1. Multi-station larval habitat identification training was cancelled once again in 2023 due to travel and scheduling difficulties. All larval habitat training for staff was conducted within the respective agent offices in Marquette, Ludington, and Sault Ste. Marie.
2. To address stream selection issues and other items as directed by the LATF, the Larval Assessment Workgroup (LAWG) met in association with the January 2023 Sea Lamprey Biannual Workshop (SLAWS) meeting. Bob Frank (MBS) served as LAWG chairperson but will be stepping down from the position as he has left the program. Lexi Sumner (DFO – Lower Lakes) will serve as LAWG chairperson beginning Fall 2023.

3. Larval Assessment staff continued to work with GLFC Communications staff on the development of a larval lamprey identification guide, which would serve as an important resource for both new and experienced staff at all agent offices. Representative larval specimens from the various lamprey species and morphotypes were collected by all three agent offices over the course of three years (2021-2023). High-resolution photographs of specimens were taken and shared with an illustrator who then drafted drawings of the various species and morphotypes. The draft illustrations and descriptions were reviewed by assessment staff and comments were returned to the illustrator.
4. Larval Assessment staff collected >10,000 larvae to support a variety of GLFC-funded research projects during the spring and summer.

2024 Objectives:

1. Contingent upon the state of the pandemic and any travel-related issues, multi-station larval habitat identification and quantification training will be held during late winter or early spring 2024.
2. Continue to edit larval assessment protocols and operating procedures as necessary.
3. Provide larval assessment support to new and ongoing Commission-funded research projects including, but not limited to: development of eDNA techniques, TFM seasonality, larval lamprey identification, and other larval procurement needs.
4. Work with Commission Communications staff to finalize the larval lamprey identification guide and facilitate distribution to control agents and partner agencies.

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

2023 Outcomes:

1. The targeted treatment strategy focusing on Lake Superior tributaries was implemented during 2023. In a departure from the single basin approach, all Upper Lakes tributaries will be considered as a part of the Targeted Treatment Strategy during 2024.
2. Ranking surveys, distribution surveys, and where required, habitat assessments were conducted for streams identified as candidates for the Targeted Treatment Strategy in 2024 in which the Upper Lakes are focus.
3. Larval assessment staff from Marquette and Sault Ste. Marie assisted with larval and habitat surveys on streams that are a part of the Supplemental Controls (SupCon) research project. Ludington staff provided lamprey identification training for HBBS SupCon crews.

2024 Objectives:

1. Develop the 2024 treatment list using the revised Upper Lakes Targeted Treatment Strategy, which allows for consideration of all tributaries to lakes Superior, Michigan, and Huron.
2. Continue to work with the Trapping Task Force to identify and target streams for trapping out-migrating juveniles for control. Marquette larval staff identified the Middle River, Deer Lake Creek, and Sand River as potential sources of transformers.
3. Continue to work with HBBS and Alternative Control and Evaluation staff to survey and evaluate SupCon project streams.

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.

2023 Membership
Scott Miehls (Chair), Ted Castro-Santos and Carrie Link (USGS), Ryan Booth and Tonia Van Kempen (Department), Sean Lewandoski and Matt Symbal (Service), Weiming Li, Anne Scott, and Michael Wagner (Michigan State University), Heather Dawson (University of Michigan), Rob McLaughlin (University of Guelph), Carrie Baker, Chris Freiburger, Mike Siefkes, and Ted Treska (Commission Secretariat).

Progress towards goals described in the Commission Vision:

Goal 1: Suppress sea lamprey populations to target levels.

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

2023 Outcomes:

1. All 29 index streams were trapped during spring 2023 as well as 10 additional non-index streams. GLFWC conducted trapping operations on the Bad and Marengo rivers and KBIC assisted with SupCon transformer trapping efforts on the Cranberry, Potato (MI), and Traverse during Fall 2022. Mark-recapture population estimates were obtained for 28 of the index streams with model estimates required only for Conneaut Creek (Lake Erie). An index estimate was produced for all lakes. A data analysis protocol is being developed (to complement the trapping protocol).

2024 Objectives:

1. Operate and maintain 39 trap sites throughout the Great Lakes. These include the 29 index streams, for which populations will be estimated using mark-recapture, and another 10 non-index streams.

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

2023 Objectives:

1. Continue trapping transformers for control in newly discovered, or deferred streams to mitigate escapement to the lakes, beginning in October 2023 if warranted.
    - Status: Transformer trapping will occur in 12 of the 13 SupCon streams for assessment (Tawas Lake Outlet, Long Lake Outlet, Black Mallard Creek, Pigeon River, Sturgeon River, Maple River, Furlong Creek, Bills Creek, Cranberry River, Potato River (MI), Traverse River, Bellevue Creek, Root River).

2023 Outcomes:

1. There are several recent and ongoing research projects aimed at improving the capture efficiency of adults and out-migrating juveniles for control purposes: Pheromone, alarm cue, response to hydraulics, and lamprey navigation during upstream movement for adults and response to light and alarm cue for outmigrants. No new methods were deployed in 2023 as part of the control program.
2. Assessment phase of SupCon remains underway. Twelve of 13 streams were trapped and larval assessment complete on all study streams. Adult trapping and larval assessment work occurred in Cranberry River, Traverse River, Bills Creek, Furlong Creek, Bellevue Creek, Root River, Pigeon River, Sturgeon River, Maple River, Black Mallard River, Long Lake Outlet, and Tawas Lake Outlet. Transformer trapping planned in these streams for fall 2023.

2024 Objectives:

1. Continue trapping transformers for control in newly discovered, or deferred streams to mitigate escapement to the lakes, beginning in October 2024 if warranted.
2. Continue monitoring results from recent and ongoing research projects and be prepared to implement effective new technologies and methods into the sea lamprey control field program when they become available.
3. Continue to evaluate trapping for control options, including trapping adults (and transformers) in streams where TFM is less effective.
4. Continue assisting with SupCon by providing suggestions and advice to core group on study design and deployment options for each study stream.

Goal 2: Increase the effectiveness and efficiency of sea lamprey control to further reduce 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.

2023 Outcomes:

1. Milt Pheromones – No further chemical identification or experimentation of milt compounds occurred in 2023. Data analysis in 2023 indicated seminal pheromones provide additional information to female sea lamprey regarding male status. Ovulated females discriminate males based on the presence (versus absence) and concentration of seminal pheromones. Seminal pheromones are potent odorants that induce female attraction independent of gill-released sex pheromones. Pheromone habitat study – We conducted an experiment in the lower Ocqueoc River in 2022 to determine if male nest location modulates ovulated female attraction to the male pheromone. Data analysis in 2023 revealed higher pheromone concentration did not always equate to increased female attraction. The strength of the male pheromone signal (concentration) in addition to the specific nest location within the river both influence female attraction. These results have possible implications for pheromone-enhanced trapping efforts because they underscore the importance of considering trap location prior to implementation. All related data analyses have been completed.

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

2023 Outcomes:

1. (Wagner Lab, MSU): (1) An acoustic telemetry project in the White River, MI revealed that migrating adult sea lamprey track the deep thalweg of large river channels, causing them to pass near the shoreline when the thalweg meanders there. These patterns can be used to target removal efforts (fishing). Data analysis of a subsequent telemetry project using the alarm cue to drive migrants toward the shoreline in concert with their thalweg- tracking movement behavior is underway. (2) New projects were funded to (a) study the use of alarm cue to selectively block migrating sea lamprey from entering fish passage devices, and (b) study the effect of alarm cue in conjunction with light to guide downstream migrating transformers toward traps (being led by Alex Haro, Conte Lab, USGS). (3) A manuscript was published reporting a comprehensive set of lab and field experiments to map the effects of varied alarm cue concentrations on movement tendencies, path selection in rivers, and olfactory sensitivity. A second manuscript is under review that describes the effect of pulsing alarm cue on the prevention of habituation.
2. (Scott Lab, MSU) Pheromone Antagonists – We tested additional candidate 3kPZS antagonists from Phase 3 of the design-test-learn cycle in an effort to discover analogs with increased antagonistic activity through an ongoing collaboration between the Li lab and Dr. Edmund Ellsworth (Department of Pharmacology & Toxicology, MSU). Dr. Ellsworth and the Medicinal Chemistry Core Facility team synthesized new 13 candidate antagonists in 2023 by making structural modifications to the existing 3kPZS antagonists—PZS and 3sPZS. During 2023, the Li lab moved into a new lab space, set up electro-olfactogram equipment, and conducted recordings to determine if the newly synthesized analogs inhibited olfactory detection of 3kPZS. Two analogs reduced the 3kPZS olfactory response by ~50%, 5 additional analogs reduced the 3kPZS olfactory response by 25-15%, and the remaining 6 analogs had minimal influence on 3kPZS olfactory responses (<10%). The analogs did not reduce the EOG response to a positive control odorant, L-arginine, suggesting the analogs are not general suppressants of all olfactory responses but indeed specifically reduced the 3kPZS response. We also determined if the newly synthesized analogs disrupted ovulated female preference for 3kPZS in a two-choice flume assay. Ten of thirteen analogs disrupted female attraction to 3kPZS in a flume, of which one analog averted females from 3kPZS and nine neutralized female preference for 3kPZS. Results from electrophysiology recordings and behavioral experiments from 2021-2023 will serve as the input data for a post hoc assessment to determine which structural features correlate with increased antagonistic activity. These analyses are underway and the results will be made available when completed.

2024 Objectives:

1. (Wagner Lab, MSU): (1) Initiation of a series of experiments to test and refine a prototype selective fish passage device that utilizes alarm cue to selectively guide migrating adult sea lamprey away from fish passage devices and into contact with traps (in partnership with the University of Michigan, the Conte Anadromous Fish Lab, and the Hammond Bay Biological Station). (2) Completion of analyses from two acoustic telemetry studies evaluating how migrating adult sea lamprey respond to alarm cue during entry into rivers from a Great Lake, and in river channels after

selecting a spawning watershed. (3) Submission of a new proposal to continue work to isolate, refine, and identify the chemical constituents of the sea lamprey alarm cue.
2. (Scott Lab, MSU) 2023 is the final year of the medicinal chemistry grant that supported the pheromone antagonist collaboration between Dr. Ellsworth and Li lab. Our 2024 pheromone antagonist objectives will be informed based on the results of ongoing data analyses.

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

2023 Outcomes:

1. Worked with LATF members to identify and target streams for trapping transformers for control.
    - Metamorphosed lamprey were found in Cranberry River (Superior) during 2023 electrofishing surveys. Crews were deployed to conduct extensive electrofishing for removal (174 transformers had been collected at the time of writing) and SupCon teams will trap Cranberry during fall 2023. Additionally, large and metamorphosing larvae were collected from Sand Creek (Superior), Harlow Creek (Superior), and Deer Lake Creek (Superior) during summer and fall surveys. USFWS will conduct emergency treatments and conduct transformer trapping during fall.
2. Evaluated the effects of integrated control strategies that have been implemented (e.g. large-scale treatment strategies) by tracking adult sea lamprey abundance.
    - Adult index estimates were generated for all lakes.
    - SLaMSE modeling was conducted to evaluate targeted treatment strategies.

2024 Objectives:

1. Continue to work with LATF to identify and target streams for trapping transformers for control.
2. Continue to evaluate the effect of integrated control strategies that have been implemented by developing adult sea lamprey abundance estimates.

COMMUNICATIONS AND OUTREACH

The GLFC and its partners, the Service's Ludington and Marquette Biological Stations (LBS, MBS), the Department's Sea Lamprey Control Centre (SLCC), and USGS-Hammond Bay Biological Station (HBBS), conducts a comprehensive education and outreach program. The following is an update about recent activities.

Outreach and Education Events:

As part of the outreach and education program to inform the public about the Commission's programs, the health of the Great Lakes, and the importance of the fisheries to the region, the following is partial list of the shows and events that were attended:

Shows, events, and programs:

Ultimate Fishing Show, Novi, MI—January 12-15 (Commission, Department, LBS)
Chicagoland Fishing, Travel and Outdoor Expo, Schaumburg, IL—January 26-29 (Commission, Department, MBS)
DNR OAC Invasive Species Awareness Day, Detroit, MI—February 11 (Commission)
Duluth Boat, Sports, and Travel Show, Duluth, MN—February 16-19 (Commission, SLCC, MBS)
Greater Niagara Fishing and Outdoor Expo, Niagara, NY—February 16-19 (Commission, LBS, SLCC)
Ultimate Sport Show, Grand Rapids, MI—March 9-12 (Commission, LBS, SLCC)
Toronto Sportsmen's Show, Mississauga, ON—March 16-19 (Commission, SLCC)
Bad River Open House, Bad River, WI—March 30 (MBS)
Pere Marquette Watershed Council Meeting, Baldwin, MI—April 1 (LBS)
KBIC Environmental Fair, Baraga, MI—April 13 (MBS)
Beaverton Community Outreach, Beaverton, MI—April 17 (LBS)
Earth Day Action Expo 2023, Midland, MI—April 22 (Commission, LBS)
Earth Week Expo, Cheboygan, MI—April 22 (Commission, HBBS)
Northern Inland Lakes Citizens Fishery Advisory Committee, Indian River, MI—May 1 (LBS)
EGLE - Wastewater Operators Workshop, Harris, MI—May 9 (MBS)
NMU High School Career Fair, Marquette, MI—May 9 (MBS)
Elk Rapids High School 11th graders, Elk Rapids, MI—May 19 (LBS)
Bay Cliff 7th Grade Science Camp, Big Bay, MI—May 22-26 (MBS)
Blue Water Sturgeon Festival, Port Huron, MI—June 3 (Commission)
Detroit Riverfront Kid's Fishing Day, Detroit, MI—June 11 (Commission)
Fin and Feather Sportsmen's Club, Scottville, MI—June 12 (LBS)
Engineer's Day, Sault. Ste. Marie, MI—June 30 (Commission, MBS)
Brown Trout Festival, Alpena, MI—July 16 (Commission, HBBS)
Lake Superior Day--Maritime Museum, Marquette, MI—July 16 (MBS)
Lumberman's Monument Event, Oscoda, MI—July 25 (Commission, HBBS)
UP State Fair, Escanaba, MI—August 18-20 (Commission, MBS)
Owen Sound Salmon Spectacular, Owen Sound, ON—August 25-September 3 (Commission)
Little River Band of Ottawa Indians Sturgeon Release, Manistee, MI—September 9 (LBS)
Agripalooza, Chatham, MI—September 29 (MBS)
Besser Museum Fall Fest, Alpena, MI—October 7 (Commission, HBBS)

PERMANENT EMPLOYEES OF THE SEA LAMPREY CONTROL PROGRAM

Department of Fisheries and Oceans Canada

Mike Steeves, A/Director, Aquatic Invasive Species and Species at Risk

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

Tonia Van Kempen, A/Program Manager

Control Team Leader: Bruce Morrison

Lampricide Control Biologists:
Shawn Robertson Treatment Supervisor
Alan Rowlinson Treatment Supervisor
Barry Scotland Assistant Supervisor
Joseph Lachowsky Assistant Supervisor

Lampricide Application Coordinators:
Jerome Keen
Paul Kyostia

Lampricide Analysis Technicians:
Stephanie Grand
Melissa Leonard
Richard Middaugh
Sean Morrison
Kathryn O'Donnell

Lampricide Application Technicians:
Sarah Daniher
Melissa Leonard
Agata Kolodziejczyk
Alicia Wellings
Chad Hill
Christopher Sierzputowski
Zachary Allan (On Leave)
Connor Chessman
D'Arcy Campbell
Kevin Sullivan
Ryan Whitaker
Kevin Finlayson
Matthew McAulay
Colin Booth
Justin Colbourne

Barrier Unit:
Vacant Barrier Engineer/Coordinator
Samuel Matheson Project Engineer
Jeff Turcotte Barrier Engineering Technician

A/Assessment Team Leader: Ryan Booth

Assessment Biologists:
Ryan Booth Adult Supervisor
Fraser Neave Larval Supervisor (Upper Lakes)
Kevin Tallon Larval Supervisor (Assignment)
Lexi Sumner Larval Supervisor (Lower Lakes)

Assessment Technicians:
Jeffrey Rantamaki
Clint Wilson
Thomas Voigt
Andrea Phippen
Trevor Plumley
Sean Nickle (A)
Jennifer Syme (Assignment)
Sarah Larden (Assignment)
Brandon Trotter (Leave)
Stephanie Best (Assignment)
W. Armstrong (Assignment)

Administrative Team:
Melanie McCaig Finance and Administrative Officer
Vivianne Messier Administrative Clerk
Kimberly Rose Administrative Clerk

Maintenance:
Brian Greene Maintenance Supervisor

Environmental Unit:
Gale Bravener Environmental Supervisor
Nathan Coombs Technician

United States Fish and Wildlife Service

Amy McGovern, Aquatic Invasive Species Supervisor, Sea Lamprey Program Manager
Jess Barber, Field Supervisor

Ludington Biological Station – Ludington, Michigan

Jenna Tews, Station Supervisor

Administrative Support:
Danya Sanders
Vacant (CS)

Database Management and IT Support:
Daniel McGarry (Fish Biologist)

Lampricide Control Fish Biologists:
Chris Eilers, Treatment Supervisor
Lauren Freitas, Treatment Supervisor
Theresa Benton
Nick Corniuk
Vacant (Fish Biologist)

Lampricide Control Lead Physical Science Technician:
Barry Shier

Lampricide Control Physical Science Technicians:
Paul Seckora
Vacant
Vacant
Vacant

Lampricide Control Biological Science Technicians:
Adam Panek (CS)
Samuel Preston (CS)
Justin Spear (CS)
Hunter Spencer (CS)
Ryan Sprague (CS)
Vacant (CS)
Vacant (CS)

Larval Assessment Fish Biologists:
Aaron Jubar, Larval Assessment Supervisor
Matthew Lipps
Vacant (Fish Biologist)

Larval Assessment Biological Science Technicians:
John Ewalt
Nick Scripps
Timothy Granger (CS)
Nathan Hudak (CS)
Callie Kopp (CS)
Tyler Punke (CS)
Tina Weaver (CS)

Maintenance Worker:
Thomas McVay

(CS) Career Seasonal

Marquette Biological Station – Marquette, Michigan

Administrative Support:
Tracy Matthies, Administrative Officer
Lisa Dennis
Karla Godin
Karen Bowerman

Database Management and IT Support:
Christopher Roberts, Database and IT Supervisor
Lynn Kanieski (Fish Biologist)
Deborah Larson (Data Transcriber)

Risk Management:
Cheryl Kaye, Risk Management Supervisor
Vacant (Fish Biologist)
Chad Andresen (Biological Science Technician)

Chemist:
Benson Solomon

Maintenance Worker:
John Gilkenson

Unit Supervisor (Alternative Control): Pete Hrodey

Alternative Control Fish Biologists:
Matthew Symbal, Barrier and Trapping Supervisor
Samuel Hultberg
Sean Lewandoski
Kevin Mann

Alternative Control Biological Science Technicians:
Kevin Letson
Dennis Smith
Hannah Frye (CS)
Jason Pynnonen (CS)
John Shiflet (CS)

Unit Supervisor (Larval Control): Shawn Nowicki

Lampricide Control Fish Biologists:
Lori Criger, Treatment Supervisor
Christopher Gagnon, Treatment Supervisor
Jesse Haavisto
Sara Ruiter
Vacant (Fish Biologist)

Lampricide Control Lead Physical Science Technician:
Jamie Criger

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

Lampricide Control Biological Science Technicians:
Kevin Hensiak (CS)
Janet McConnell (CS)
Michael Olsen (CS)
Tiffany Opalka-Myers (CS)
Randy Parker (CS)
Cory Racine (CS)
Ben Reith (CS)
Andrew Steffen (CS)
Richelle Terpstra (CS)
Sara Tilton (CS)
Lauren Willman (CS)
Vacant (CS)

Larval Assessment Fish Biologists:
Robert Frank, Larval Assessment Supervisor
Rebecca Philipps
Nikolas Rewald

Larval Assessment Biological Science Technicians:
Jarvis Applekamp
Nicholas Chartier
Mark Bash (CS)
Matt Elya (CS)
Alex Larson (CS)
Vacant (CS)

(CS) Career Seasonal