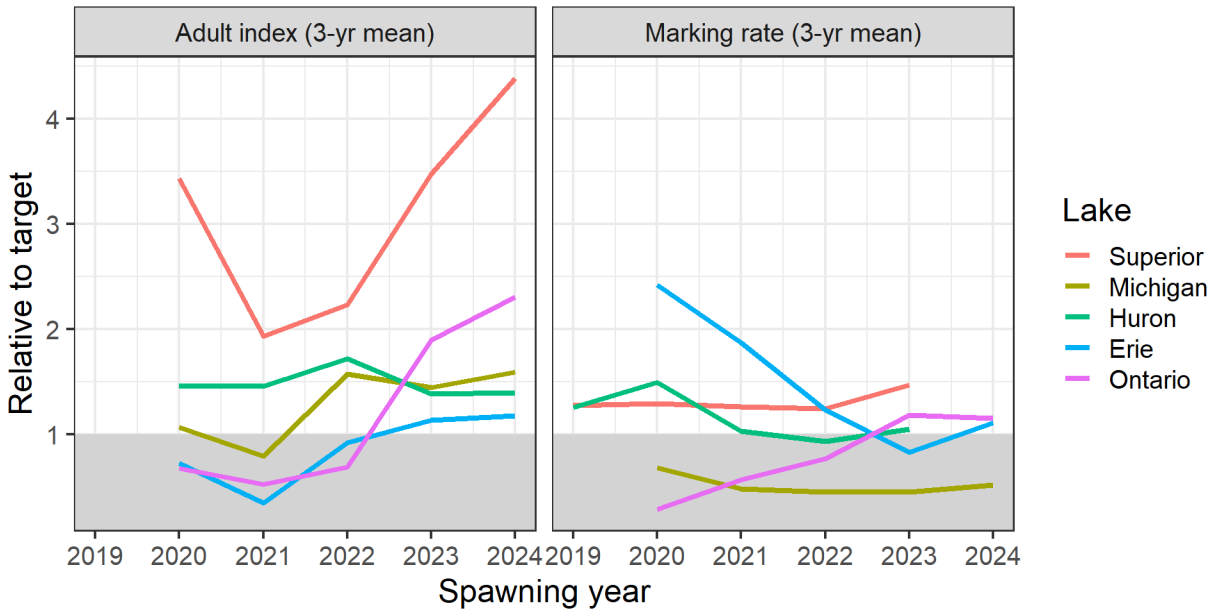
STATUS OF SEA LAMPREY POPULATIONS

Issue: This information item describes the current status of sea lamprey populations in the Great Lakes.

Summary: Sea lamprey control program success is measured by index estimates of adult sea lamprey abundance, sea lamprey marking rates on lake trout, and lake trout relative abundance. The overall status of these metrics in each lake is presented in the table below. The status of sea lamprey abundance and marking rates on lake trout are based on the mean over the last 3 years relative to target and trends are based on the slope over the last 5 years. Lake trout abundance is also reported using a 3-year average and 5-year trend, but there are no targets for lake trout abundance in the context of the sea lamprey control program. Single year point estimates can fluctuate and can have wide error bars, thus the focus on 3-year averages and 5-year trends.

Lake	Sea lamprey	Marks	Lake trout
Superior	Above, Flat	Above, Flat	Flat
Michigan	Above, Flat	Met, Flat	Flat
Huron	Above, Flat	Above, Flat	Flat
Erie	Above, Flat	Above, Flat	Flat
Ontario	Above, Flat	Above, Flat	Flat

Status metrics, relative to target, for each of the Great Lakes are graphed below. For example, for Lake Huron in spawning year 2023, the 3-year average adult sea lamprey index was ~1.5 times the target, and for Lake Superior the 3-year average 2024 marking rate was ~1.5 times the target. Adult assessment operations and lake trout assessment surveys have resumed after being limited due to COVID-19 restrictions and sea lamprey and lake trout estimates were calculated for all lakes during 2024.



Background: Index estimates of adult sea lamprey abundance, sea lamprey marking rates on lake trout, and lake trout relative abundance in each lake are the metrics used to evaluate the success of the sea lamprey control program. The current status of sea lamprey abundance and marking rates on lake trout are based on the mean over the last three years relative to target and recent trend indications are based on the slope over the last five years. Lake trout abundance is also reported using a 3-year average and 5-year trend, but there are no targets for lake trout abundance in the context of the sea lamprey control program. Single year point estimates can fluctuate and can have wide error bars, thus the focus on 3-year averages and 5-year trends. Additionally, maps showing the contribution of individual tributaries to the index estimates and the potential maximum larval production from individual tributaries identify problem areas and guide sea lamprey control activities. Furthermore, several measures of sea lamprey control effort are plotted with index estimates for each lake to help illustrate the success of sea lamprey control. Summaries of these metrics for each lake are presented in Briefing Items 8a – 8e, and Briefing Item 8f graphically summarizes the metrics for all lakes for comparison. The graph components of the status summaries are described below, followed by a summary of the status of sea lamprey control in each of the Great Lakes. The status of sea lamprey control in the St. Marys River is also summarized below and in Briefing Item 8e.

Index Estimates of Adult Sea Lamprey Abundance: Index estimates of adult sea lamprey abundance relative to respective lake targets are the primary performance indicators that the Sea Lamprey Control Board, its task forces, and secretariat use to make recommendations to the Commission to decide on programs, budgets, and strategic direction. Index estimates are calculated by summing population estimates generated using pooled-Petersen mark and recapture methods from a subset of tributaries in a given lake basin. Conversion factors are used to calculate lake-wide adult sea lamprey populations from the indices. During 2004, each of the lake committees established explicit targets for sea lamprey populations that would support their fish community objectives. Except for Lake Huron, the index target for each lake was set at the average level during a 5-year period when sea lamprey marks on lake trout averaged five per 100 fish. Lake Huron is the exceptions because the period when the marking rate was low in Lake Huron did not correspond with low sea lamprey abundance. As a result, the target sea lamprey abundance for Lake Huron was set at 25% of the abundance when the marking rate highest. The target in Lake Michigan was recently re-calculated due to a period of more representative marking, which resulted in a lowering of the index target from approximately 34,000 to just over 20,000. Targets are estimated from historical sea lamprey index estimates and available marking data from comparable assessment surveys. Index estimates for each lake are updated during the early fall of each year after incorporation of the newest trap catch data.

Sources of Sea Lampreys: Maps showing the tributary-specific index estimates of adult sea lampreys, based on the current year's trapping data, alongside the maximum potential larval sea lamprey production from individual tributaries based on data from 1995-2012, providing a useful visualization of sea lamprey abundance. These maps can be used to help identify potential areas of concern and guide the application of sea lamprey control. The adult sea lamprey maps are updated during the early fall of each year. Larval sea lamprey production maps are updated less frequently.

Lake Trout Marking Rates: Analyses of sea lamprey marking rates on lake trout were used to generate adult sea lamprey index targets for all lakes. Average annual A1-A3 marking rates are compared to the 5 marks per 100 fish targets that are used as another performance indicator of the effectiveness of sea lamprey control program on all lakes, except Lake Ontario, where A1 marking rates are the preferred metric. A1 are fresh wounds that have broken the skin of the host fish and A2 and A3 are partially healed stages of A1 marks. The marking rate metric presented in the status summaries is the average number of A1, A2, and A3 marks per 100 lake trout. Lake trout marking rates are estimated from assessment and monitoring operations conducted by fishery management agencies and are updated when new marking data becomes available in the late winter of each year.

Lake Trout Relative Abundance: Lake trout relative abundance estimates are also performance indicators used by the sea lamprey control program. Like sea lamprey abundance, the number of lake trout can influence sea lamprey marking rates on lake trout and should be considered when interpreting marking rates as a performance indicator of the sea lamprey control program. Lake trout relative abundances for each lake are estimated from standardized assessment efforts conducted by fishery management agencies, and are updated when new data from assessment surveys become available in late winter of each year.

Lampricide Control Effort: Lampricide control effort for each lake is reported through the number of field days spent applying lampricides and the amount of lampricide applied during a given year. These metrics are graphed along with sea lamprey abundance, offset slightly to correlate to the year the control efforts would be seen in lamprey numbers. Field days spent applying lampricide, TFM applied, Bayluscide applied, and sea lamprey abundance for each lake are updated during the winter of each year.

Current Status of Sea Lamprey Control in the Great Lakes: In Lake Superior (Briefing Item 8a), the 3-year average adult index is above target and the trend has been holding steady over the past five years (2020 index not available). The 3-year average marking rate on lake trout is above target and the trend has been holding steady over the past five years, although we did see an uptick in the 2024 value. The lake trout abundance trend has been holding steady over the past five years. Mark-recapture estimates of adult lamprey were generated for all seven of the index streams. Lake Superior received a targeted treatment effort in 2016, 2019, and 2023 but COVID-19 severely limited treatments during 2020. The effects of 2016 treatment on the adult index is not evident, but the effects of the 2019 treatment may have been seen in the 2021 and 22 adult indexes. The expected increases in the adult index resulting from treatment limitations during 2020 and increased low water conditions seem to be evident in the increased 2023 index level, possibly delayed due to slower larval growth. Lampricide treatments have returned to pre-pandemic levels, but the adult index is expected to be elevated for a year or two before reversing trend.

In Lake Michigan (Briefing Item 8b), the 3-year average adult index is above target and the trend has been holding steady over the last five years (2020 index not available). Readers may notice that the target value is now lower than it was, leading to the above target trend. This change in target was due to the occurrence of suitable data in recent years which allowed for the recalculation of the target, which is felt to be more appropriate. The 3-year average marking rate on lake trout is meeting target and the trend has been holding steady over the past five years. The lake trout abundance trend has been holding steady over the past five years. Mark-recapture estimates of adult lamprey were generated for all six index streams. Lake Michigan has received a considerable amount of targeted treatment effort since 2012 and likely benefits from treatments in the northern portion of Lake Huron (e.g., St. Marys River); these treatment efforts are evident in the adult index. While the 2022 adult index increased as expected in response to COVID-19 treatment limitations, the 2023 and 2024 indices returned to 2013-21 levels. Lampricide treatments have returned to pre-pandemic levels, and it is hoped that the adult index will remain low.

In Lake Huron (Briefing Item 8c), the 3-year average adult index is above target and the trend has been holding steady over the past five years. The 3-year average marking rate on lake trout is slightly above target and the trend has been holding steady over the past five years. The lake trout abundance trend has been holding steady over the past five years. Mark-recapture estimates of adult lamprey were generated for all six index streams. Lake Huron has received a considerable amount of targeted treatment effort since 2010 (most recently 2018) and likely benefits from treatments in the northern portion of Lake Michigan (e.g., Manistique River). Nevertheless, the 2022 adult index increased as expected in response to COVID-19 treatment limitations, though subsequent indices have returned to recent lower levels. Lampricide treatments have returned to pre-pandemic levels, and it is hoped that the adult index will remain low.

In Lake Erie (Briefing Item 8d), the 3-year average adult index is slightly above target and the trend has been holding steady over the past five years. The 3-year average marking rate on lake trout is slightly above

target and the trend has been steady over the past five years. The lake trout abundance trend has been holding relatively steady over the past five years and natural reproduction has been recently documented. Mark-recapture estimates of adult lamprey were generated for four of the five index streams and one estimate was modeled. Lake Erie has received consistent treatment effort in recent years and near record walleye year classes have created predatory pressure on recently metamorphosed juvenile sea lamprey – both likely contribute to the relatively low adult index value. While the 2022 adult index increased as expected in response to COVID-19 treatment limitations, the 2023 & 2024 index values returned to near target level. Lampricide treatments have returned to pre-pandemic levels, and it is hoped that the adult index will remain low.

In Lake Ontario (Briefing Item 8e), the 3-year adult index is over twice the target and the trend has been steady over the past five years. The 3-year average marking rate on lake trout is above target and the trend has been flat over the past five years. The lake trout abundance trend has been holding steady over the last five years. Mark-recapture estimates of adult lamprey were generated for four of the five index streams, with one being modeled in 2024. Consistent treatment effort on Lake Ontario for nearly three decades has contributed to keeping the 3-year average adult index at or near target. The 2022 adult index increased as expected in response to COVID-19 treatment limitations and the 2023 index increased to be the highest estimate in the time series, though returning to 2022 levels in 2024. Lampricide treatments have returned to pre-pandemic levels, but the adult index is expected to be elevated for a few years before reversing trend.

Briefing Item 8f graphically summarizes the adult sea lamprey index estimates, sea lamprey marking rates on lake trout, lake trout relative abundances, and sea lamprey control efforts for all five of the Great Lakes.

Current Status of Sea Lamprey Control in the St. Marys River: Historically, the St. Marys River was the largest uncontrolled source of sea lampreys in the Great Lakes. During the 1980's and 1990's, sea lamprey populations in Lake Huron became so large, mainly because of production from the St. Marys River, that efforts to rehabilitate lake trout were relaxed. In 1997, the Commission responded by implementing a control strategy in the St. Marys River that attempted to integrate the application of granular Bayluscide, and the release of sterilized-males coupled with trapping; the release of sterilized males was discontinued during 2011 because of low sterile:normal male ratios, an increasing larval sea lamprey population, and uncertainty around the impacts of the sterile male program on larval populations. A decision analysis determined that a program of increased granular Bayluscide treatment (~300 ha annually) provided the most cost-effective control option for the St. Marys River. Therefore, control efforts have consisted of 300+ ha of granular Bayluscide treatments since 2011 with the exception of two large-scale treatments of more 800 ha during 2010 and 2011, which reduced the larval sea lamprey population to the historic low (~300K).

STATUS OF SEA LAMPREY CONTROL IN LAKE SUPERIOR

Adult Sea Lamprey:

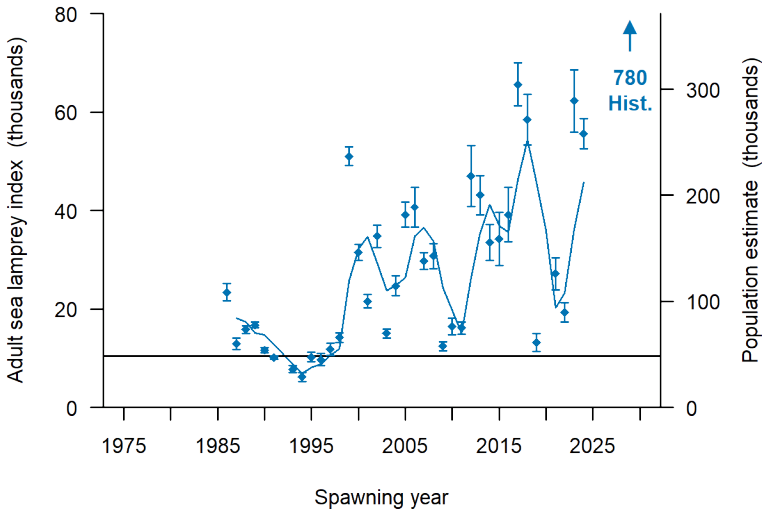


Figure 1. Index estimates with 95% confidence intervals (vertical bars) of adult sea lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 4.64. The adult index in 2024 was 56,000 with 95% confidence interval (52,000-59,000). The three-year (2022-2024) average of 46,000 was above the target of 10,000. The index target was estimated as the mean of indices during a period with acceptable marking rates (1994-1998).

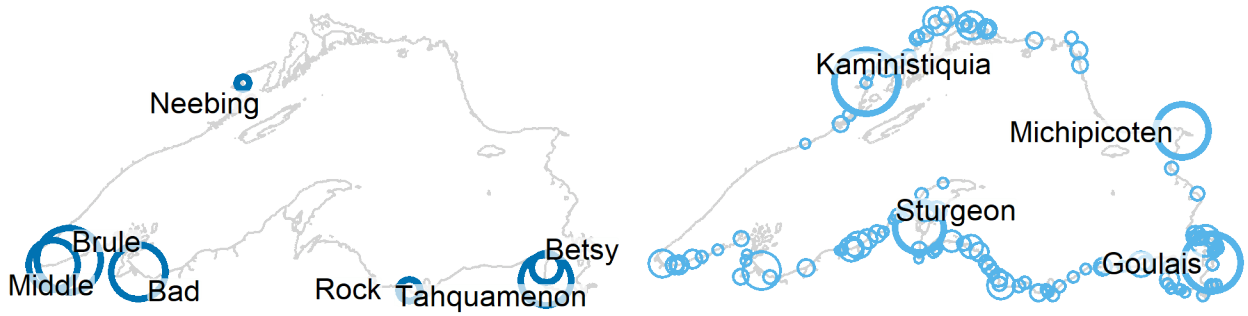


Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2024. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are labelled. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the estimated maximum lake-wide larval population are identified (Kaministiquia 6,600,000; Goulais 5,000,000; Michipicoten 4,100,000; Sturgeon 3,300,000).

- Stream specific estimates for the Brule and Bad Rivers contributed most to the lake-wide index estimate in 2024 (35% and 23% respectively).
- Sea lamprey escapement upstream of barriers has been documented on the Big Carp and Misery Rivers as well as Stokely Creek in 2024.
- Over the past 3 years, Lake Superior has received a higher-than-average number of lampricide treatments. Due to this increased effort, we expect to see a decrease in lake-wide abundance beginning in 2025.

Lake Trout Marking and Relative Abundance:

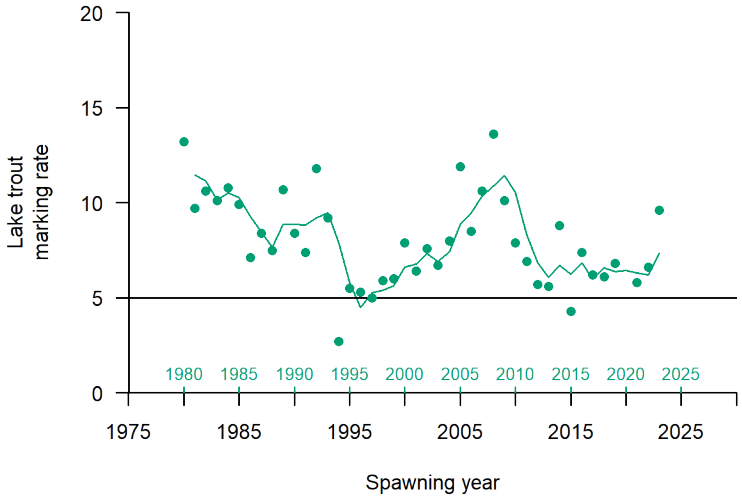


Figure 3. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (spawning years 2021-2023) average marking rate of 7.3 was above the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

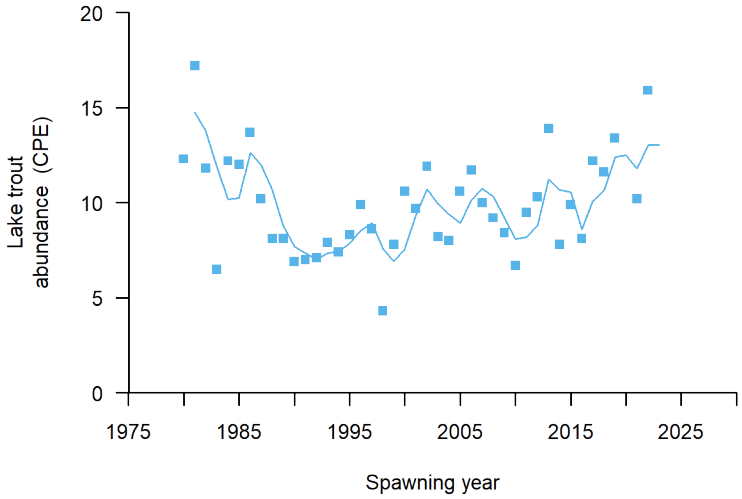


Figure 4. Lake trout relative abundance (May assessments using 4.5 inch gillnets) plotted against sea lamprey spawning year, including the three-year moving average (line). CPE = fish/km/net night of lean lake trout > 532 mm (21") total length.

- Marking rates in Superior increased in 2023, corresponding to the increase we saw in adult index values.
- Lake trout CPE data was not available at the time of report generation.

Lampricide Control - Adults vs. Field Days, TFM, and Bayluscide:

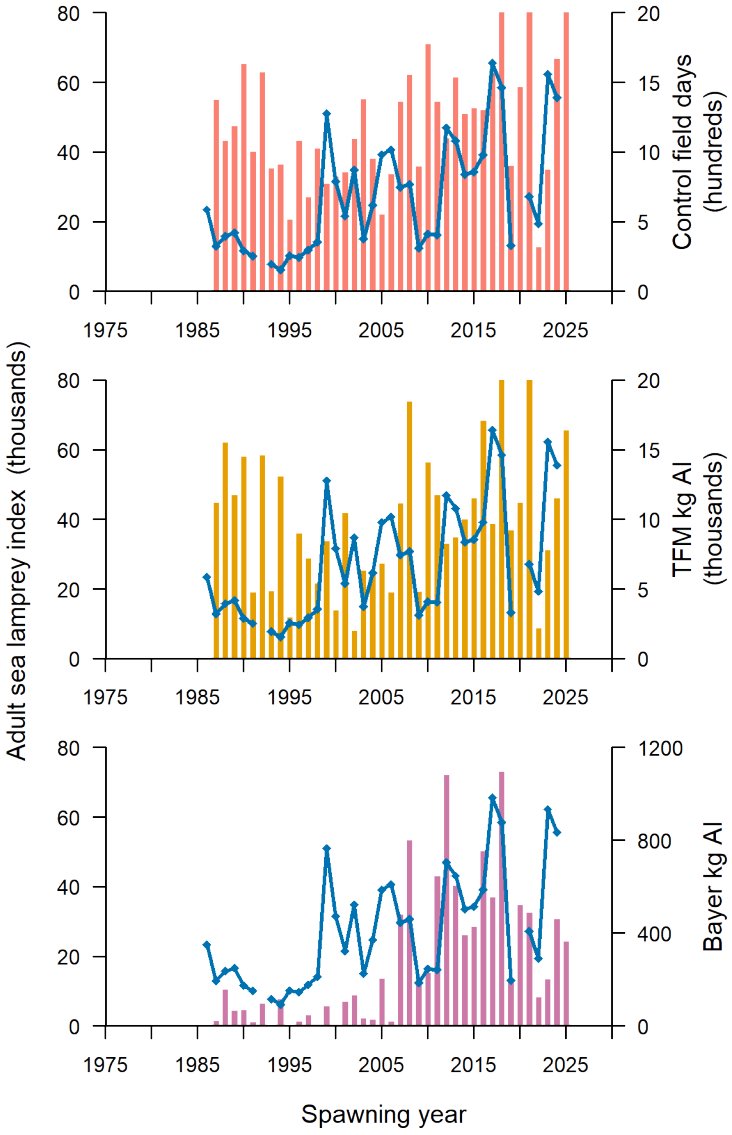


Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (salmon colored bars), TFM used (kg active ingredient; orange bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied during 1985 is plotted on the 1987 spawning year, when the treatment effect would first be observed in adult sea lamprey populations).

STATUS OF SEA LAMPREY CONTROL IN LAKE MICHIGAN

Adult Sea Lamprey:

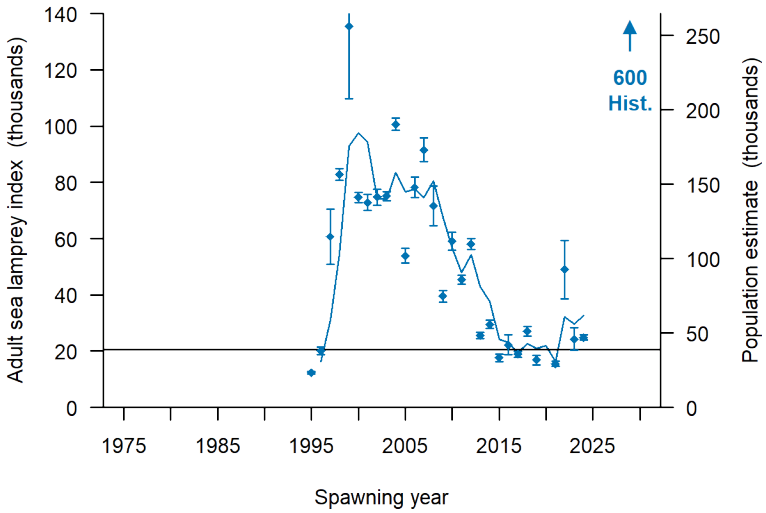


Figure 1. Index estimates with 95% confidence intervals (vertical bars) of adult sea lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 1.89. The adult index in 2024 was 25,000 with 95% confidence interval (24,000-26,000). The three-year (2022-2024) average of 33,000 was above the target of 21,000. The new index target (2024) was estimated as the mean of indices during a period with acceptable marking rates (2015-2019)

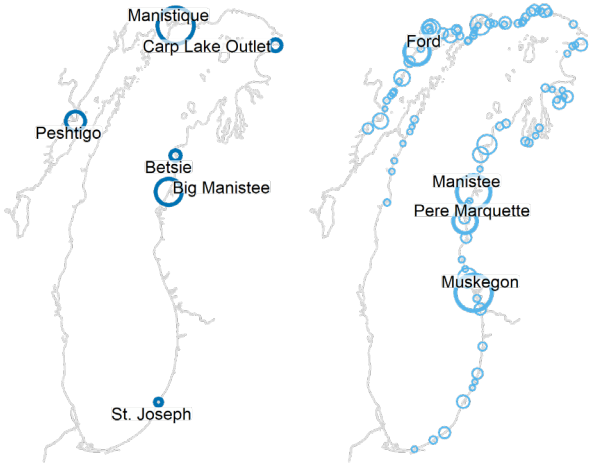


Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2024. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are labelled. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the estimated maximum lake-wide larval population are identified (Muskegon 4,500,000; Manistee 3,600,000; Ford 1,800,000; Pere Marquette 1,400,000).

- The Sea Lamprey Control Program has adjusted the Lake Michigan adult index target from 34,982 to 20,526. This change was made based on the average sea lamprey abundance estimate from 2015-2019, when wounding was near the target of 5 wounds/100 lake trout.
- The stream specific estimates for the Manistique and Big Manistee Rivers contributed most to the lake-wide index estimate in 2024 (45% and 22% respectively).
- Sea lampreys were documented upstream of the sea lamprey barrier on the Kewaunee River.

Lake Trout Marking and Relative Abundance:

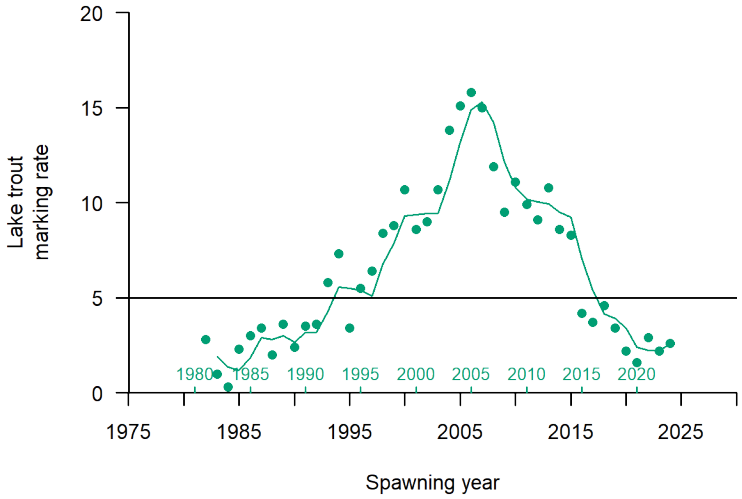


Figure 3. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments during August-November plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (spawning years 2022-2024) average marking rate of 2.6 met the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

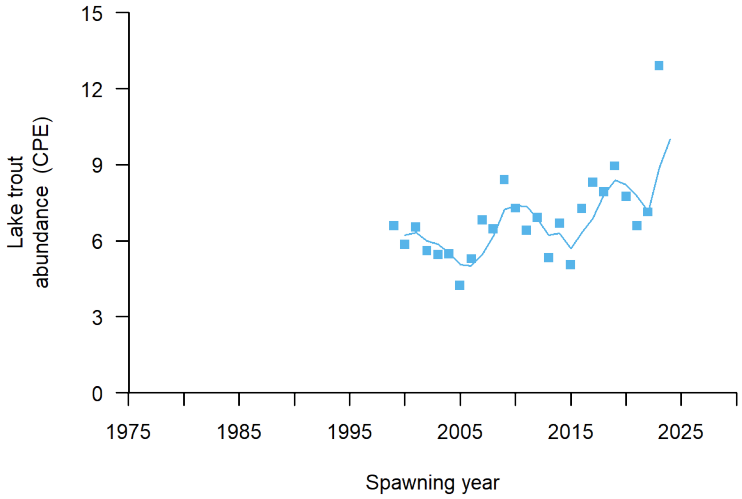


Figure 4. Lake trout relative abundance plotted against sea lamprey spawning year, including the three-year moving average (line). CPE = fish/1000'/net night of lean lake trout > 532 mm (21") total length caught in the Lake Wide Assessment Plan nets (the plan began in the late 1990s).

- Marking rates in Michigan continue to be low.
- Lake trout CPE data was not available at the time of report generation.

Lampricide Control - Adults vs. Field Days, TFM, and Bayluscide:

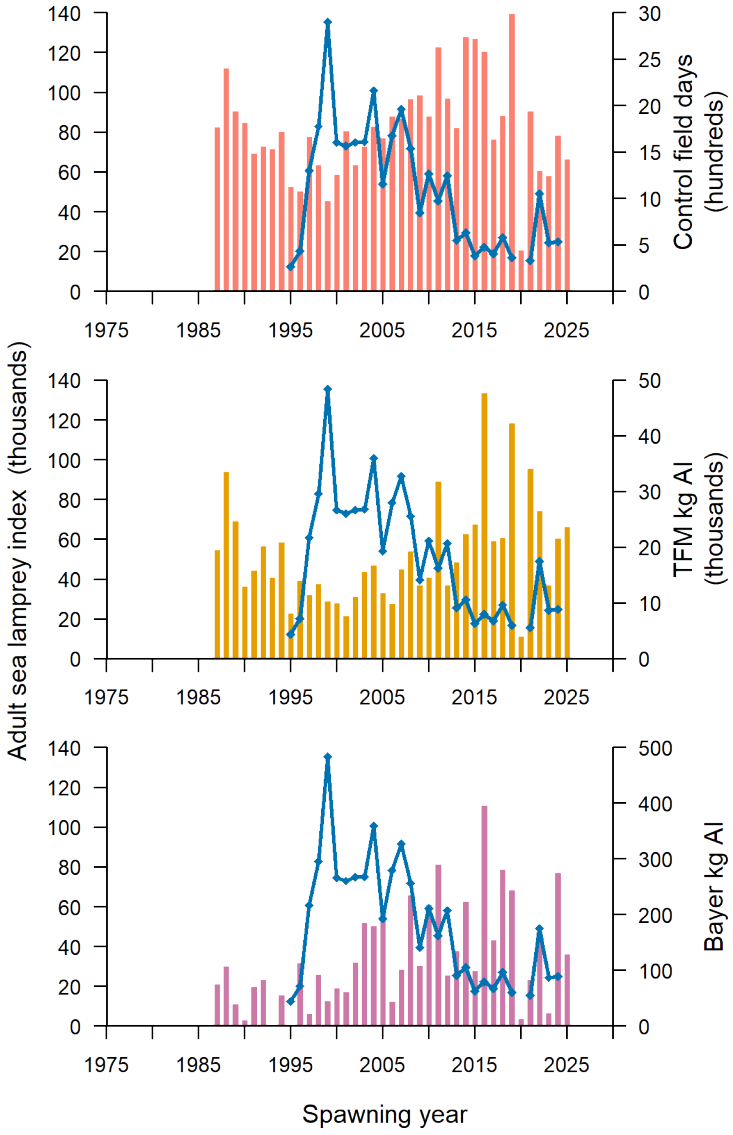


Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (salmon colored bars), TFM used (kg active ingredient; orange bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied during 1985 is plotted on the 1987 spawning year, when the treatment effect would first be observed in adult sea lamprey populations).

STATUS OF SEA LAMPREY CONTROL IN LAKE HURON

Adult Sea Lamprey:

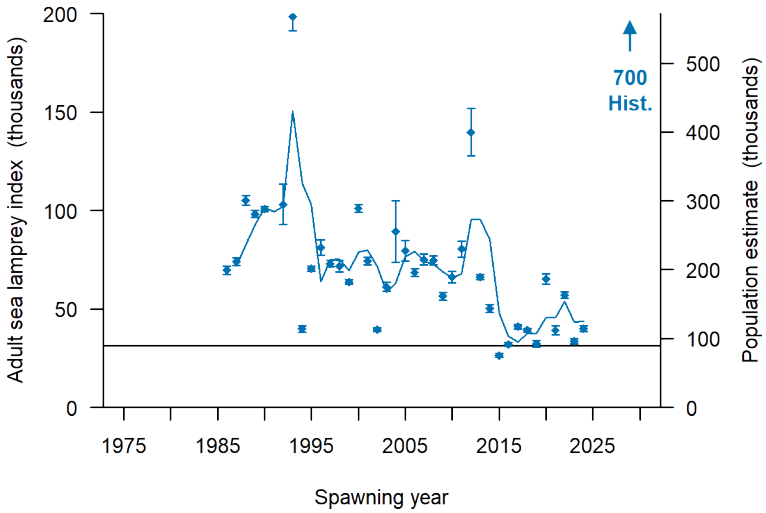


Figure 1. Index estimates with 95% confidence intervals (vertical bars) of adult sea lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 2.86. The adult index in 2024 was 40,000 with 95% confidence interval (38,000-42,000). The three-year (2022-2024) average of 44,000 was above the target of 31,000. The index target was estimated as 0.25 times the mean of indices (1989-1993).

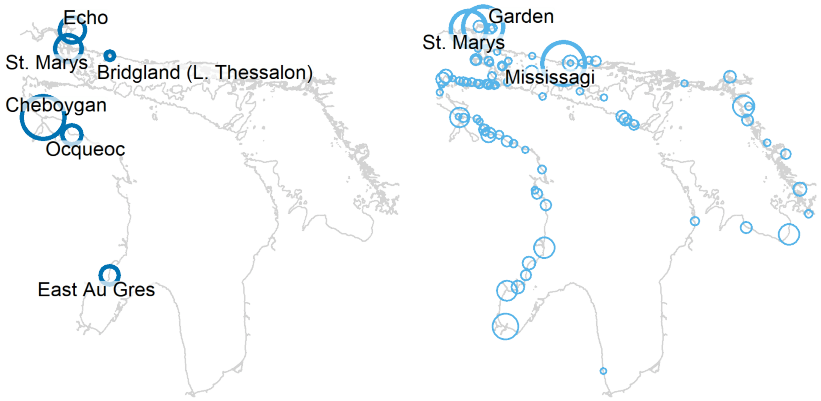


Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2024. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are labelled. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the estimated maximum lake-wide larval population are identified (Mississagi 8,100,000; Garden 7,000,000; St. Marys 5,200,000).

- The stream specific estimate from the Cheboygan River contributed most to the lake-wide index estimate in 2024 (37%).

Lake Trout Marking and Relative Abundance:

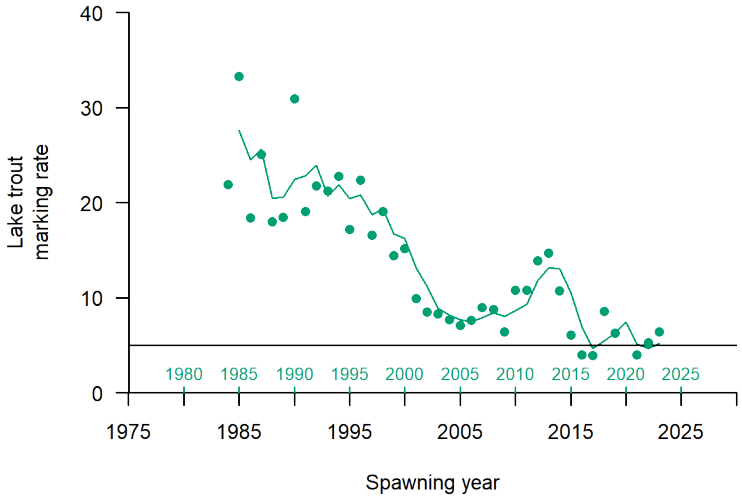


Figure 3. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (spawning years 2021-2023) average marking rate of 5.2 was above the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

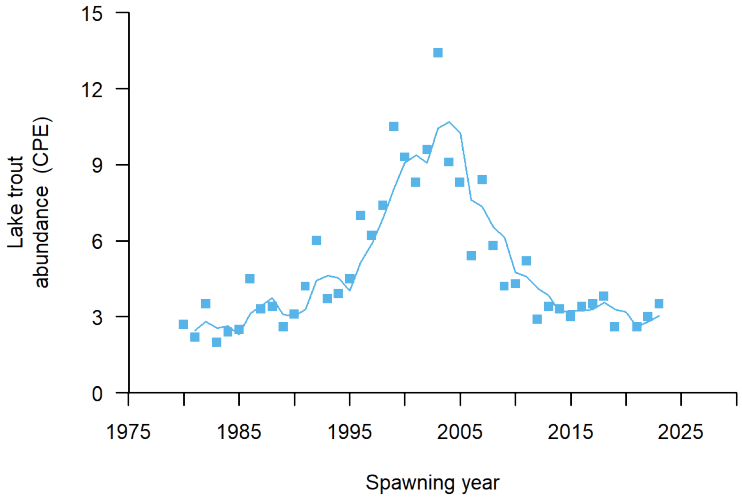


Figure 4. Lake trout relative abundance from standardized surveys (spring 2-6 inch mesh) in U.S. waters of the main basin plotted against sea lamprey spawning year, including the three-year moving average (line). CPE = geometric mean of fish/km/net night of lean lake trout > 532 mm (21") total length.

- Marking rates in Huron are fairly consistent since 2015.
- Lake trout trends are also consistent.

Lampricide Control - Adults vs. Field Days, TFM, and Bayluscide:

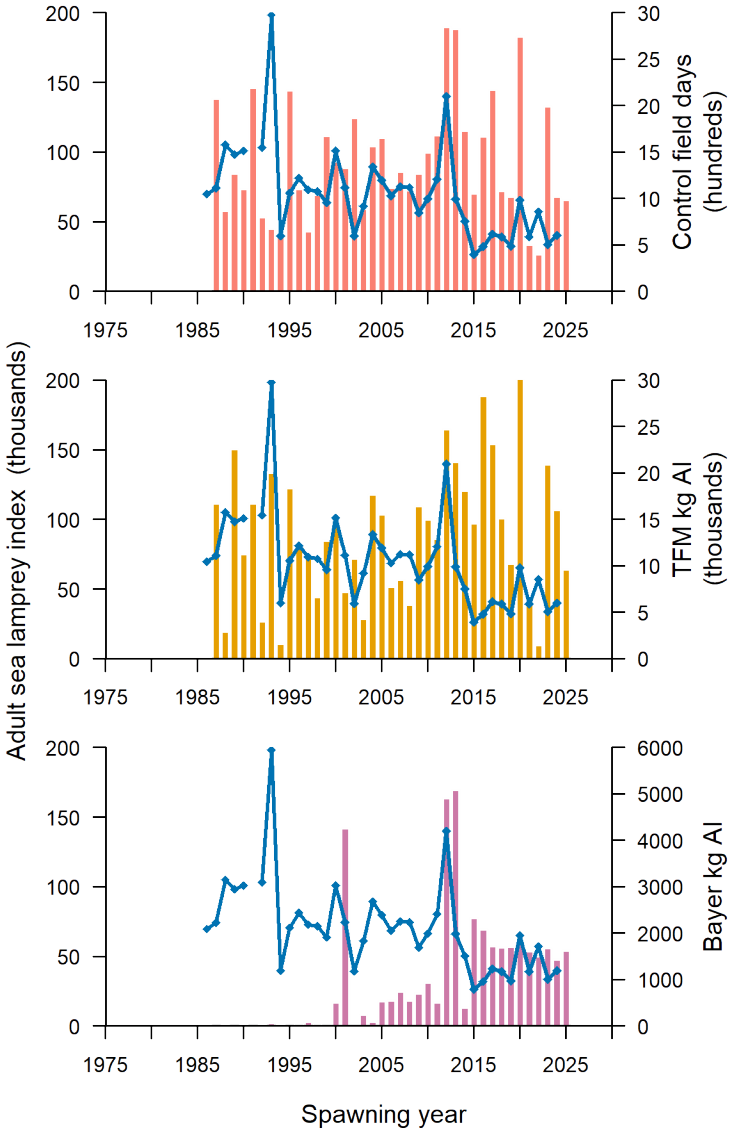


Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (salmon colored bars), TFM used (kg active ingredient; orange bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied during 1985 is plotted on the 1987 spawning year, when the treatment effect would first be observed in adult sea lamprey populations).

STATUS OF SEA LAMPREY CONTROL IN LAKE ERIE

Adult Sea Lamprey:

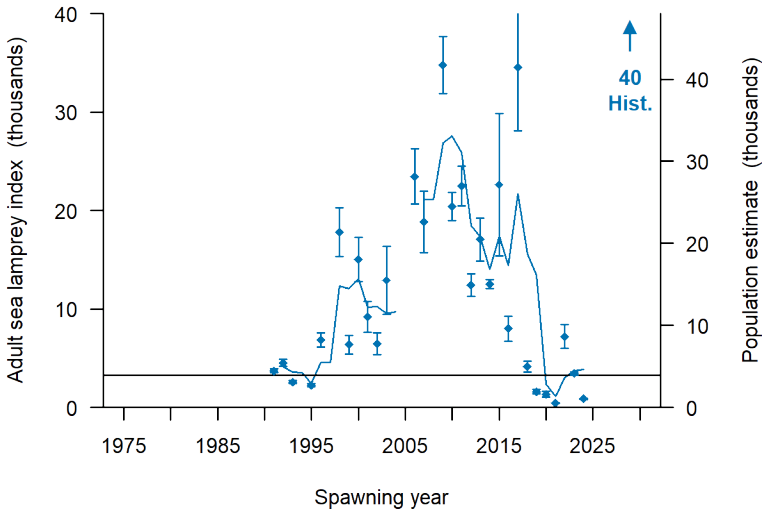


Figure 1. Index estimates with 95% confidence intervals (vertical bars) of adult sea lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 1.2. The adult index in 2024 was 870 with 95% confidence interval (800-940). The three-year (2022-2024) average of 3,800 was above the target of 3,300. The index target was estimated as the mean of indices during a period with acceptable marking rates (1991-1995).

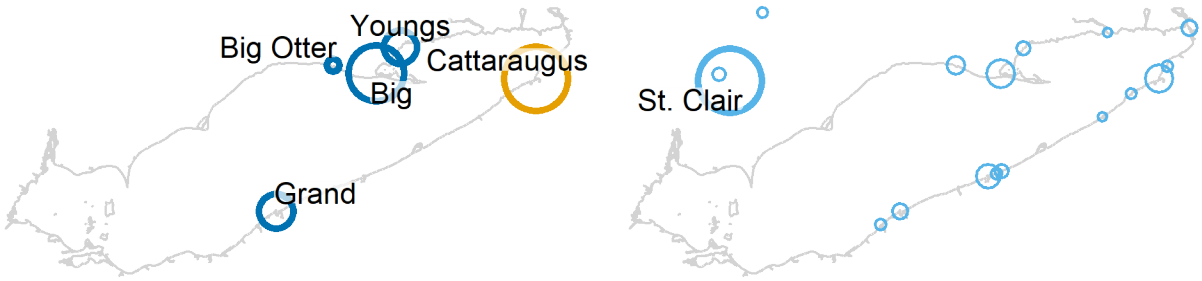


Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2024. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are labelled. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the estimated maximum lake-wide larval population are identified (St. Clair 920,000).

- Stream specific estimates from Cattaraugus (model estimate) and Big Creeks contributed most to the lake-wide index estimate in 2024 (36% and 28% respectively).
- The population estimate for Cattaraugus Creek was modeled due to insufficient recaptures of marked sea lampreys.

Lake Trout Marking and Relative Abundance:

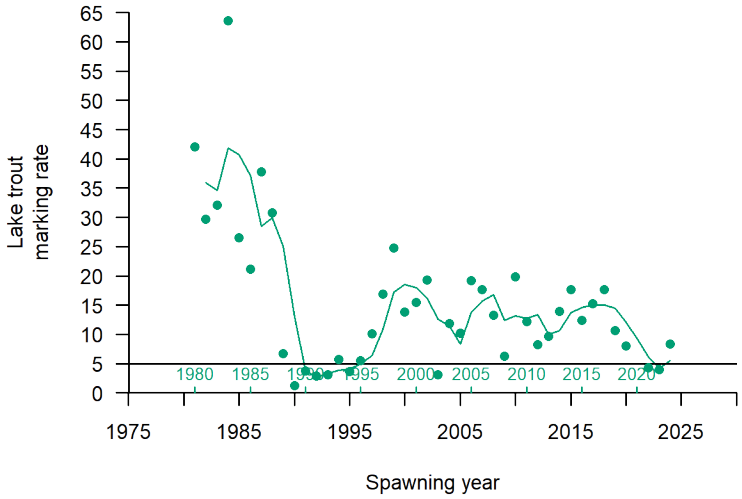


Figure 3. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (spawning years 2022-2024) average marking rate of 5.5 was above the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

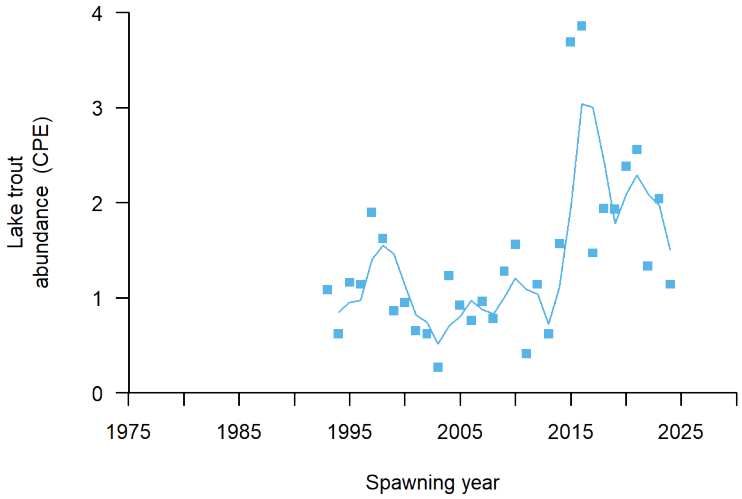


Figure 4. Lake trout relative abundance from standardized spring surveys plotted against sea lamprey spawning year, including the three-year moving average (line). CPE = number per lift of lean lake trout age 5 and older.

- Erie lake trout CPE has been highly variable over the last decade.

Lampricide Control - Adults vs. Field Days, TFM, and Bayluscide:

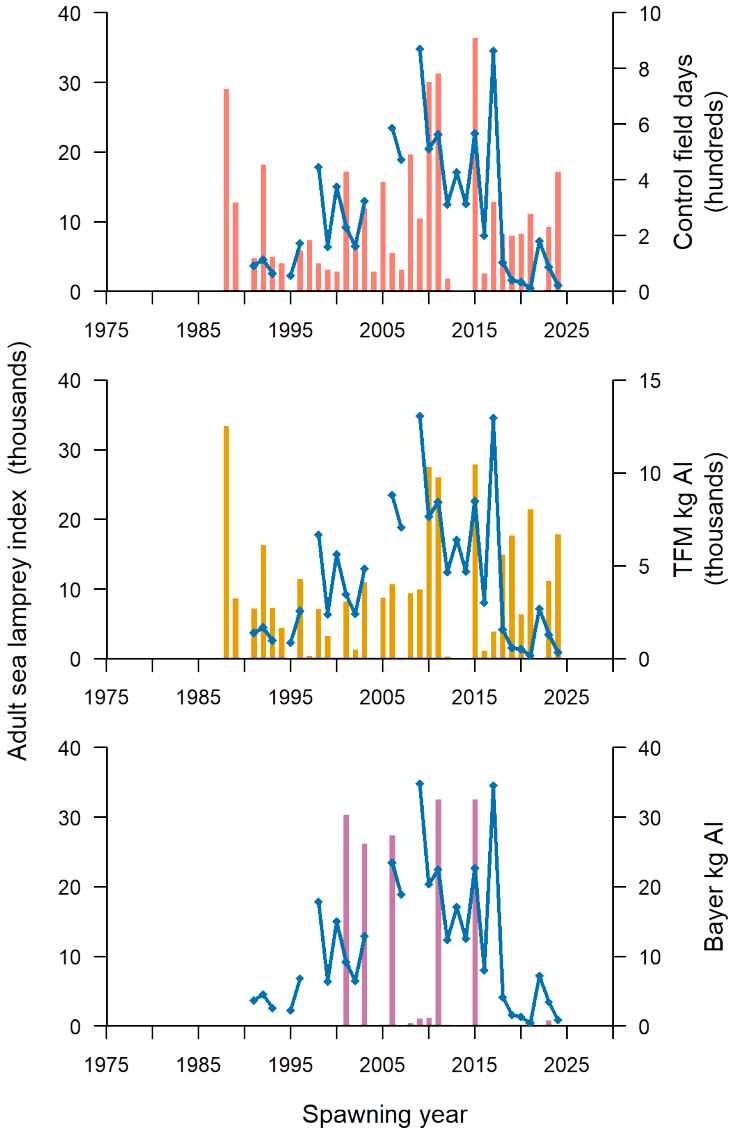


Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (salmon colored bars), TFM used (kg active ingredient; orange bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied during 1985 is plotted on the 1987 spawning year, when the treatment effect would first be observed in adult sea lamprey populations).

STATUS OF SEA LAMPREY CONTROL IN LAKE ONTARIO

Adult Sea Lamprey:

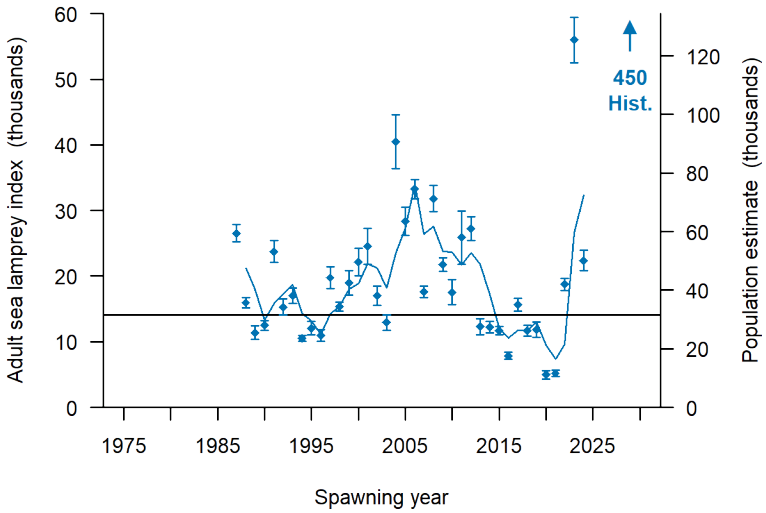


Figure 1. Index estimates with 95% confidence intervals (vertical bars) of adult sea lampreys, including historic pre-control abundance (as a population estimate) and the three-year moving average (line). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 2.24. The adult index in 2024 was 22,000 with 95% confidence interval (21,000-24,000). The three-year (2022-2024) average of 32,000 was above the target of 14,000. The index target was estimated as the mean of indices during a period with acceptable marking rates (1993-1997).

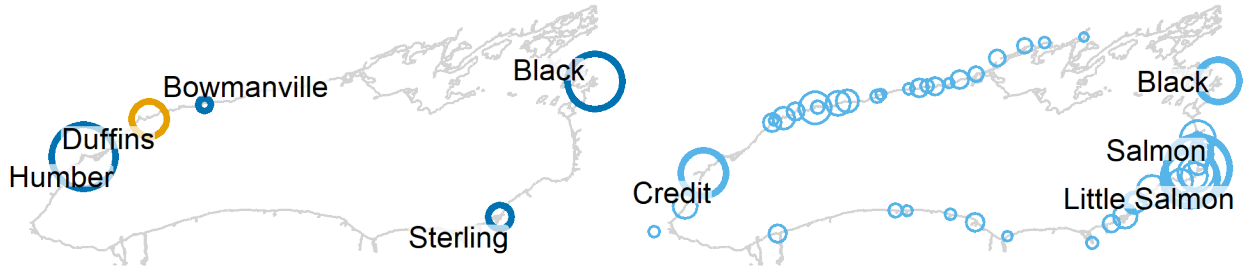


Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2024. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are labelled. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the estimated maximum lake-wide larval population are identified (Salmon 1,400,000; Little Salmon 970,000; Credit 590,000; Black 470,000).

- Stream specific estimates from the Humber and Black Rivers contributed most to the lake-wide index estimate in 2024 (47% and 33% respectively).
- The population estimate for Duffins Creek was modeled due to insufficient recaptures of marked sea lampreys.
- A new producer was discovered near Port Hope, ON (Ganaraska River). This is a large river with a barrier near the mouth. The overall impact to the lake seems to be minimal given the low abundance of larval sea lamprey observed in assessment surveys.
- Sea lampreys were documented upstream of the sea lamprey barrier on Shelter Valley Creek.

Lake Trout Marking and Relative Abundance:

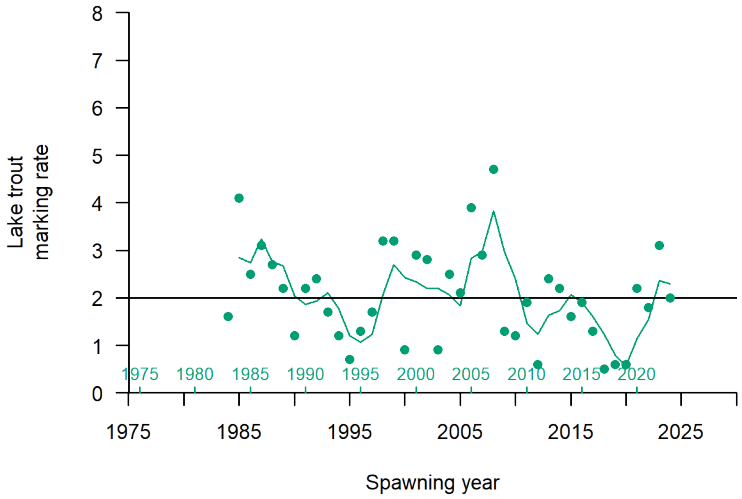


Figure 3. Number of A1 marks per 100 lake trout > 431 mm from standardized assessments plotted against the sea lamprey spawning year, including the three-year moving average (line). The three-year (spawning years 2022-2024) average marking rate of 2.3 was above the target of 2 A1 marks per 100 lake trout > 431 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.

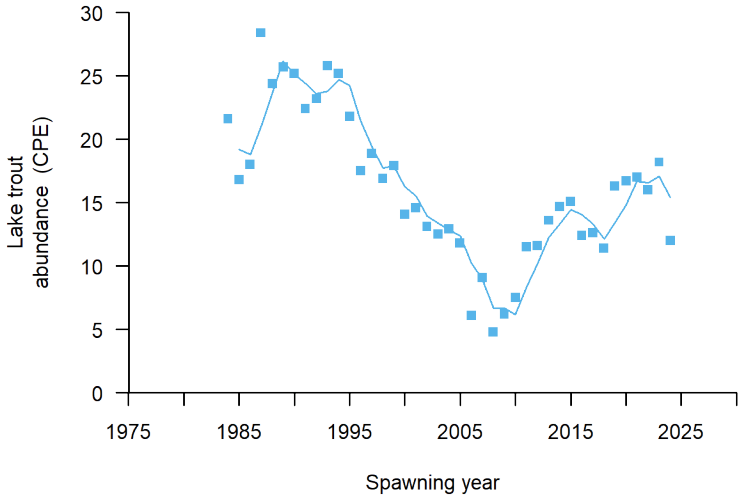


Figure 4. Lake trout relative abundance plotted against sea lamprey spawning year, including the three-year moving average (line) . CPE = fish/km/net night of lean lake trout > 431 mm (17") total length.

- Marking in Ontario returned to recent levels in 2023, and likely will lead to a decreased index in spring of 2024.
- Lake trout CPE has been relatively consistent over the last decade.

Lampricide Control - Adults vs. Field Days, TFM, and Bayluscide:

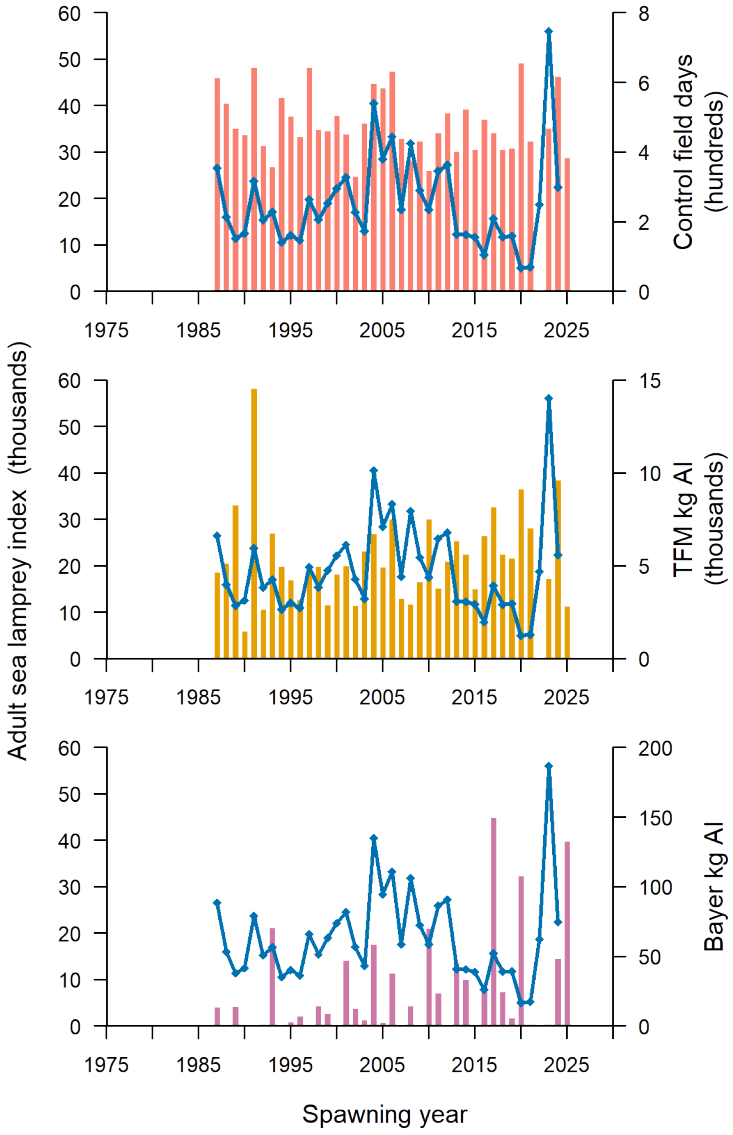


Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (salmon colored bars), TFM used (kg active ingredient; orange bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied during 1985 is plotted on the 1987 spawning year, when the treatment effect would first be observed in adult sea lamprey populations).

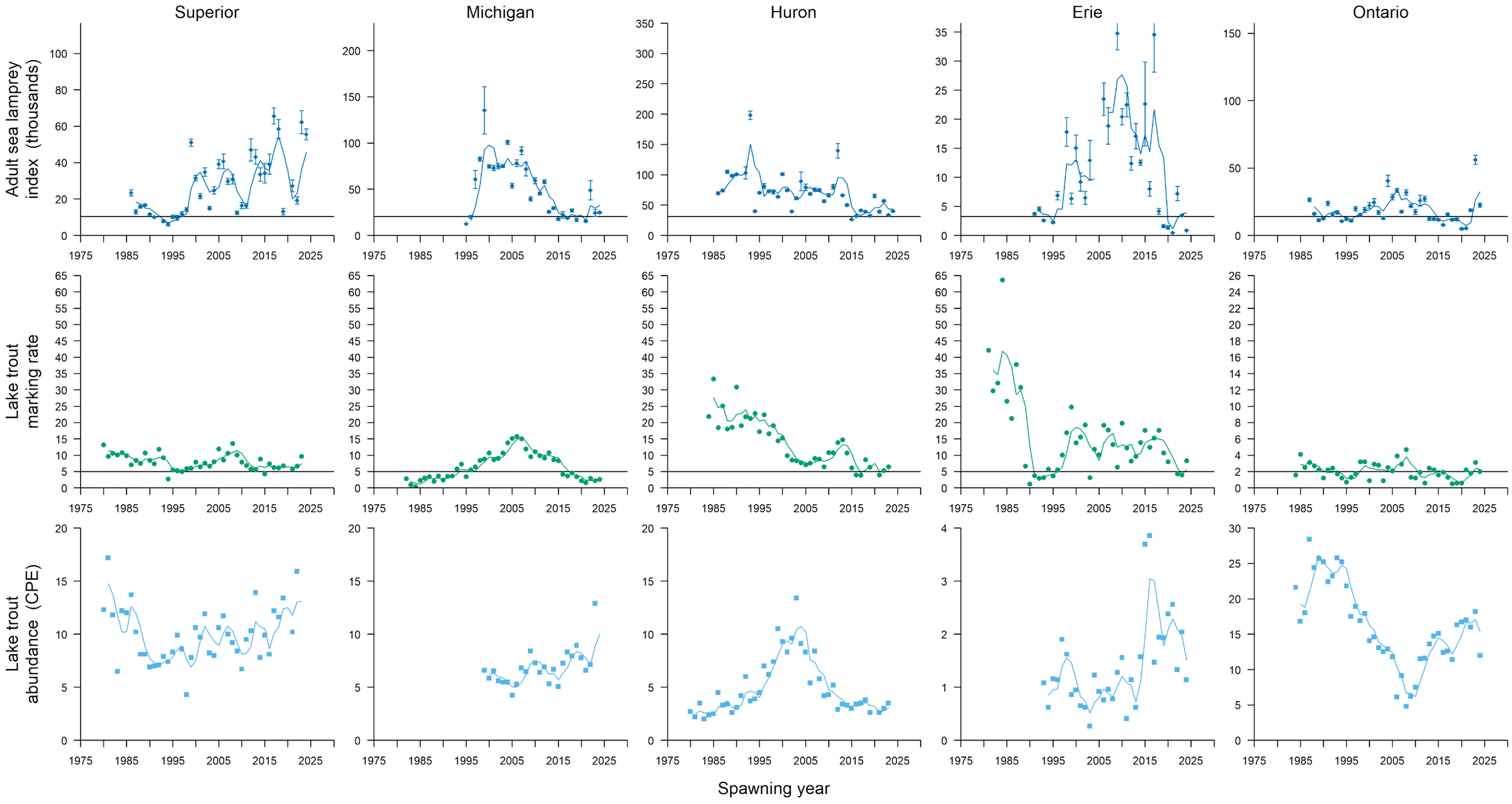


Figure 1. Row 1: Index and 95% confidence interval of adult sea lampreys estimated as the sum of mark-recapture estimates in index streams. The index target was estimated as the mean of indices during a period with acceptable marking rates. Row 2: A1-A3 marking rates on lake trout > 532 mm (for Lake Ontario, A1 only on lake trout > 431 mm). Target marking rate is indicated by the horizontal line. Row 3: Lake trout abundance. For lakes Superior and Huron, CPE is fish/km/net night of lean lake trout > 532 mm total length; for Lake Michigan, CPE is fish/1000'/net night of lean lake trout > 532 mm total length; for Lake Erie, CPE is relative abundance of age 5 and older lake trout sampled in east basin gill nets; and for Lake Ontario, CPE is fish/0.1476 km/net night of lean lake trout > 431 mm total length. All rows: All metrics plotted against the sea lamprey spawning year.

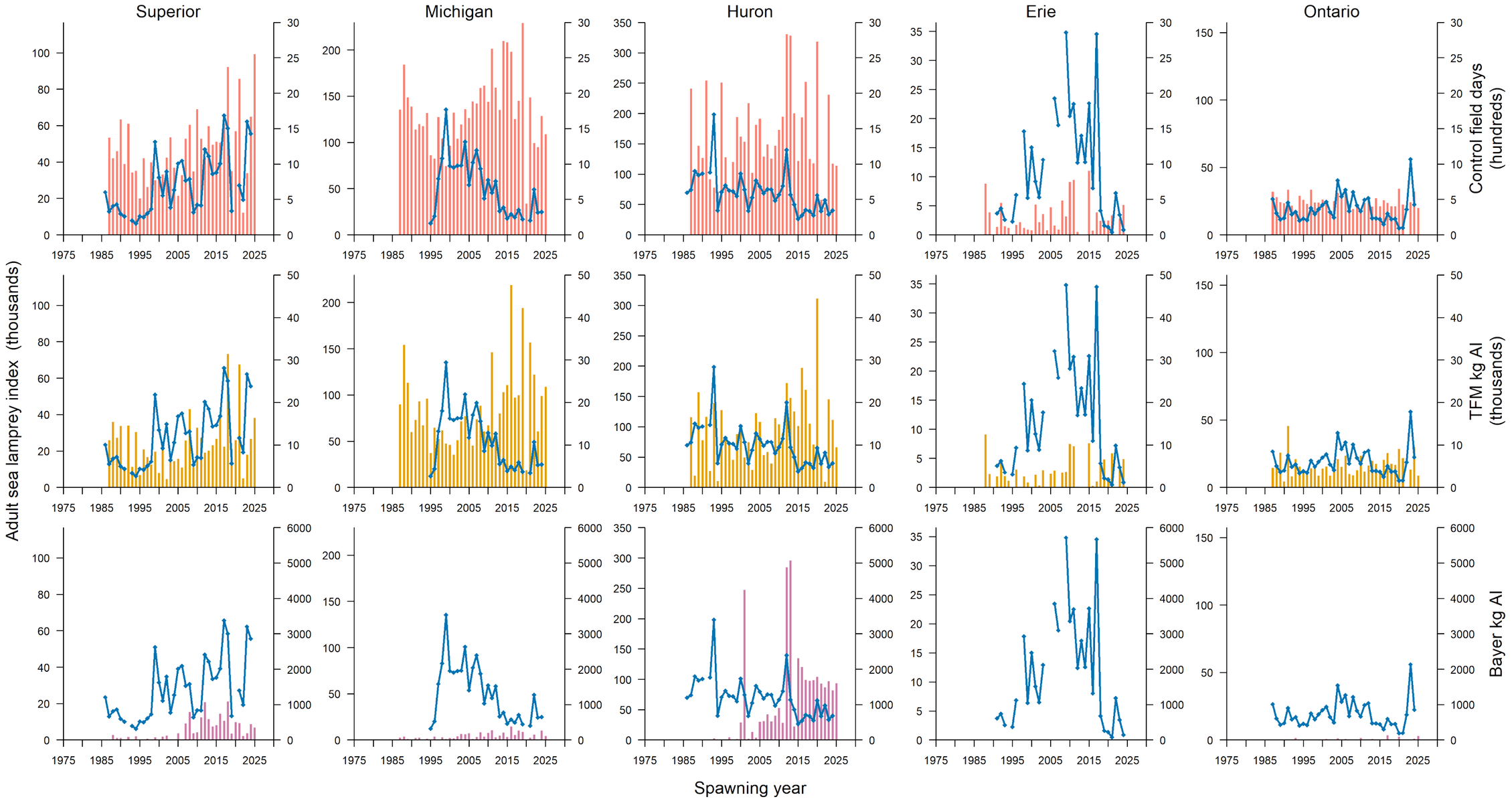


Figure 2. Row 1: Number of control field days (salmon colored bars). Row 2: TFM used (kg active ingredient, orange bars). Row 3: Bayluscide used (kg active ingredient, purple bars). All rows: Index of adult sea lampreys is shown with blue lines. All metrics plotted against the sea lamprey spawning year.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