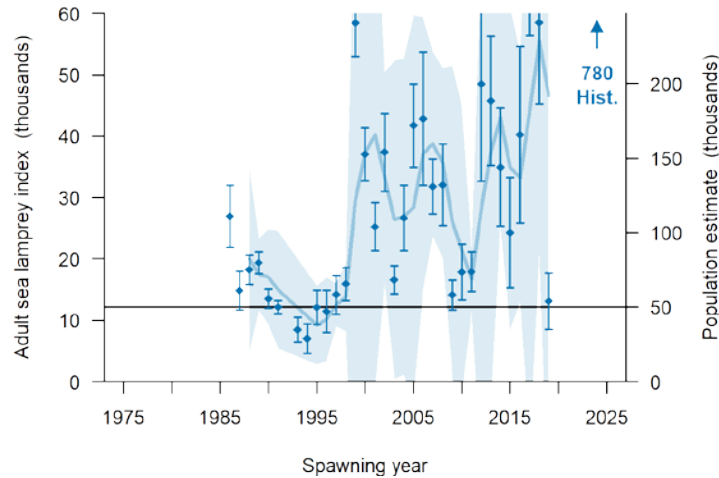# STATUS OF SEA LAMPREY CONTROL IN LAKE SUPERIOR

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) with 95% CIs (shaded area). The population estimate scale (right vertical axis) is based on the index-to-PE conversion factor of 4.12. The adult index in 2019 was 13,000 with 95% confidence interval (8,500-18,000). The three-year average of 47,000 was above the target of 12,000. The index target was estimated as the mean of indices during a period with acceptable marking rates (1994-1998).
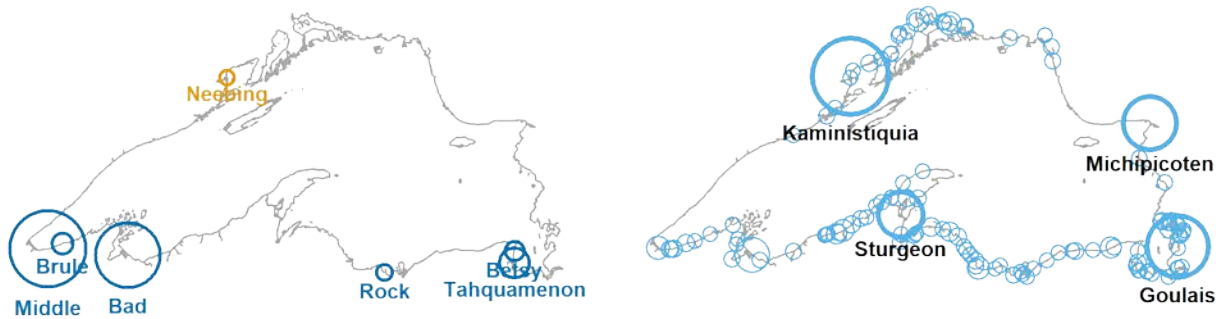

Figure 2. LEFT: Estimated index of adult sea lampreys during the spring spawning migration, 2018. Circle size corresponds to estimated number of adults from mark-recapture studies (blue) and model predictions (orange). All index streams are identified. RIGHT: Maximum estimated number of larval sea lampreys in each stream surveyed during 1995-2012. Tributaries composing over half of the lake-wide larval population estimate are identified (Kaministiquia 6,600,000; Goulais 5,000,000; Michipicoten 4,100,000; Sturgeon 3,300,000).

- The 3-year average adult index estimate is above the target and the adult index has been holding steady over the past 5 years.
- 30 years of adult indices in Lake Superior were highly correlated with environmental factors hypothesized to influence sea lamprey catchability and natural mortality; a prolonged spring and high precipitation events likely contributed to a low adult index during 2019.
- The Black Surgeon River is a concern due to uncertainty about the future of the *de-facto* sea lamprey barrier presently in place on the river; the St. Louis River could become a concern due to habitat restoration and environmental clean up.

Lake Trout Marking and Relative Abundance:
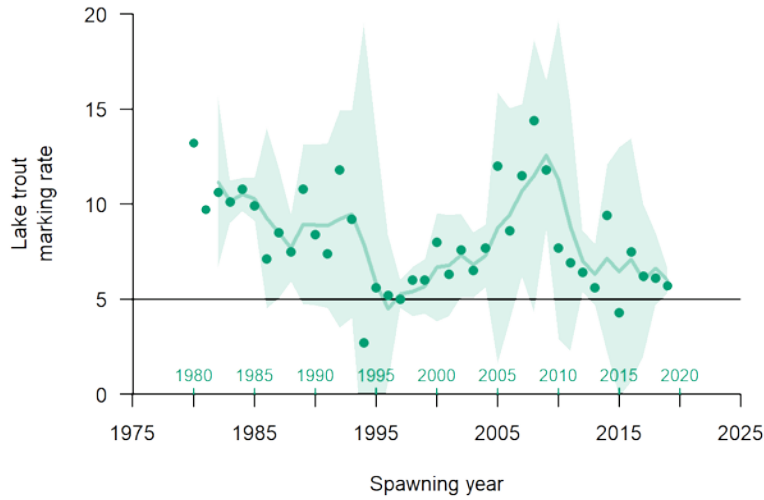
Figure 3. Number of A1-A3 marks per 100 lake trout > 532 mm from standardized assessments plotted against the sea lamprey spawning year, including the three-year moving average (line) with 95% CIs (shaded area). The marking rate of 6 in spawning year 2017-2019 was above the target of 5 A1-A3 marks per 100 lake trout > 532 mm (horizontal line). A second x-axis shows the year the lake trout were surveyed.
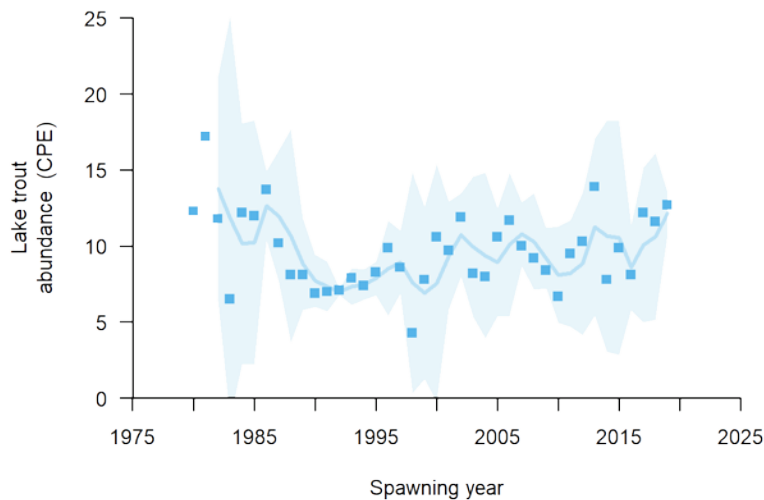
Figure 4. Lake trout relative abundance (May assessments using 4.5 inch gillnets) plotted against sea lamprey spawning year, including the three-year moving average (line) with 95% CIs (shaded area). CPE = fish/km/net night of lean lake trout > 532 mm (21") total length.

- The 3-year average marking rate is above target and marking rates have been holding steady over the past 5 years.
- Marking is currently highest in some of the Michigan portions of the lake, but marking has declined in Minnesota waters during recent years.
- Catch-at-Age modeling in some Michigan waters shows that sea lamprey mortality exceeds the mortality caused by the fishery (fishing mortality is low, however, in Michigan waters).
- Lake trout relative abundance has been holding steady over the past 5 years.
- The Commission, in collaboration with management agencies, maintains lake trout marking and abundance data sets to advance assessment and guidance of the program.
- A workgroup (FishLamp) is working to provide clarity to the often murky relationship between sea lamprey abundance, laket trout abundance, and sea lamprey marking rate on lake trout.

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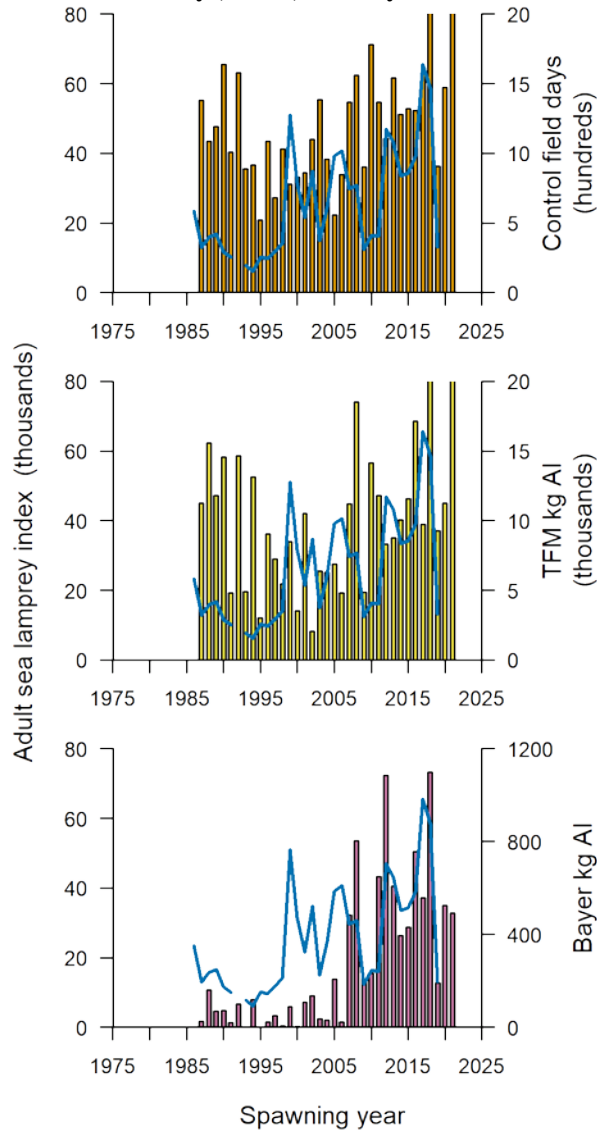
Figure 5. Index of adult sea lampreys (blue lines) and number of control field days (orange bars), TFM used (kg active ingredient; yellow bars), and Bayluscide used (kg active ingredient; purple bars). Field days, TFM, and Bayluscide are offset by 2 years (e.g., field days, TFM, and Bayluscide applied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

- Forty-five tributaries were treated with TFM and 16 lentic areas were treated with granular Bayluscide during 2019 (2021 sea lamprey spawning year).
- Fifty tributaries were treated with TFM during 2016, 23 during 2017, and 40 during 2018 (2018 to 2020 sea lamprey spawning years).
- Twelve lentic areas were treated with granular Bayluscide during 2016, five during 2017, and 13 during 2018 (2018 to 2020 sea lamprey spawning years).
- Targeted treatment efforts focusing on Lake Superior occurred during 2016 and 2019 (2018 and 2021 sea lamprey spawning years).
- In general, the increase in control effort that began in 2000 (2002 sea lamprey spawning year) and then again in 2006 (2008 sea lamprey spawning year) correlates with the marking rate on lake trout, but not the adult sea lamprey index.