

**A Stocking Strategy and Evaluation Objectives for the
Rehabilitation of Lake Trout in Lake Michigan**

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Introduction

Lake trout rehabilitation efforts have been occurring on Lake Michigan since the early 1960s (Holey et al. 1995) and has continued uninterrupted through the present. Since 2011, the rehabilitation effort has been directed by *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan* (Dexter et al. 2011, referred to throughout as the “2011 Strategy”). Success has been elusive for much of the rehabilitation period on Lake Michigan. However, recent observations of increased lake trout abundance and natural recruitment in several regions of the lake provide positive feedback that the implemented management recommendations contained in the 2011 Strategy are contributing to these recent indications of progress toward rehabilitation.

Included in the 2011 Strategy is a recommendation for evaluation of the complete plan by April 15, 2020. This review occurred by the Lake Michigan Technical Committee (LMTC) resulting in a report to the Lake Michigan Committee (LMC; Madenjjan et al. 2020). This current Strategy (2024) is a fusion of recommendations from; 1) *A Guide for the Rehabilitation of Lake Trout in Lake Michigan* (Bronte et al. 2008, referred to as the "Guide"); 2) fishery expectations set forth in the Fish Community Objectives (FCOs) for Lake Michigan (Eshenroder et al. 1995a); 3) management principles of *A Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC 2007); 4) recommendations from the LMTC (Madenjjan et al. 2020); and 5) constituent considerations. As a historically important native species, great emphasis has been placed on rehabilitation of lake trout by all management agencies on Lake Michigan and the federal government. The reader is referred to the Guide and 2011 Strategy for in-depth information on all parts of the lake-wide rehabilitation strategy.

Management agencies are responsible for providing recreational and commercial harvest opportunities while attempting to maintain, protect, and restore the sustainability of the fish community and ecology of Lake Michigan. Within the FCOs, the Salmon and Trout Objective for Lake Michigan is to:

Establish a diverse Salmonine community capable of sustaining an annual harvest of 2.7 to 6.8 million kg (6 to 15 million pounds), of which 20-25% is lake trout. Establish a self-sustaining lake trout population.

Rehabilitation of lake trout in Lake Michigan, while maintaining populations of other species throughout the Great Lakes, will continue to be a challenging undertaking due to direct (e.g., predation) and indirect (e.g., changes in forage) impacts of invasive species and the inherent ecological instability they bring. The successful achievement of lake trout rehabilitation through the strategy set forth in this document is a vital step to achieve the FCOs.

Fisheries Management Goal

Successful management of the multi-species, multi-jurisdictional fishery in Lake Michigan presents decision-makers with many ongoing and complex challenges, including coping with effects of constant ecosystem change; understanding the biology of individual species and fish communities; recognizing users' rights and responsibilities; incorporating economic considerations; and acknowledging the interests of the general public. Consequently, in order to achieve stated management goals and objectives, these challenges must be considered when developing management and regulatory actions such as those described in this Strategy.

The LMC has established the following interim rehabilitation goal:

Reestablish in targeted high-priority areas and refuges of Lake Michigan a diversity of lean lake trout populations predominately supported by natural reproduction that provide sustainable yields to recreational, commercial, and subsistence fisheries.

This interim goal differs from the Guide in that it promotes the stocking of only lean strains, recognizing economic and user-related factors agencies must consider in managing the multi-species fishery of Lake Michigan.

Key Aspects of the Strategy

The following aspects represent groupings of technical recommendations found in the Guide, and the LMC's strategy for implementation.

Stocking - locations

The number and location of stocking sites (Appendix 1) for rehabilitation are pared down from those recommended in the Guide to concentrate hatchery fish in the areas believed to be most conducive for successful lake trout reproduction. First priority stocking areas include the northern refuge, mid-lake refuge, and Julian's Reef. These areas were historically important for lake trout reproduction, and all provide some level of protection from fishing mortality. Stocking sites within or immediately adjacent to first priority areas are more heavily weighted to the rehabilitation effort, but they may also provide fishing opportunities. Second priority sites were chosen to provide local fishing opportunities, as well as supplying fish for the rehabilitation effort. Second priority stocking locations in this Strategy include sites selected from the Guide's second and third priority stocking locations. The LMC will continue to modify stocking locations as necessary to adjust for wild production and achieve rehabilitation goals and FCO targets.

Stocking - strains

Three wild strains will comprise the fish stocked for rehabilitation: Seneca Lake (SLW); Lewis Lake (LLW); and Parry Sound (HPW). These strains were selected based on information gained through strain survival and genetic studies conducted over the past several years (Bronte et al. 2007 and Jonas et al. 2023), and fishers' preference for lean forms of lake trout. The Seneca Lake strain has demonstrated greater resiliency to sea lamprey induced mortality (Madenjian et al. 2004), and they will colonize deep-water habitats. The Lewis Lake strain has an historic genetic link to Lake Michigan and has demonstrated acceptable survival in the lake. The Parry Sound strain, a remnant native Lake Huron lean strain, inhabits shallow waters and has replaced the previously stocked Apostle Island strain that also inhabited shallow water reefs (Jonas et al. 2023). The LMC will consider additional strains when warranted.

Stocking - numbers of lake trout

The maximum number of stocked lake trout is reduced in this Strategy compared to the 1985 plan (6.7 million yearling fish) and 2011 Strategy. This Strategy prescribes 2,285,000 yearlings to meet rehabilitation targets in priority areas, as well as continuing support of fisheries lakewide. As with the 2011 Strategy, the current stocking plan targets nearly 3/4 of all stocked lake trout for rehabilitation efforts with the remainder to support local fishing opportunities and provide rehabilitation opportunities in secondary stocking locations. The judicious use of a limited number of stocked lake trout for fisheries will ensure that significant forward movement toward rehabilitation occurs, while maintaining other naturalized species (salmonids) that are important for achieving management objectives under the FCOs and the Joint Strategic Plan.

Stocking - life stages

The cornerstone of the stocking components of the rehabilitation effort will continue to be yearling lake trout. Fall fingerlings were used primarily to foster sport fisheries and to study survival compared to yearlings in a few shore locations in southern Lake Michigan and were discontinued in 2016. Lake trout fry and egg-stage stocking are not included in this Strategy. The transfer of adults from other Great Lakes populations is not included because of disease and cost concerns.

Sea Lamprey

Continued control of parasitic sea lamprey populations is imperative for the long-term success of lake trout rehabilitation in Lake Michigan. The LMC commends and supports sea lamprey control efforts implemented by the Great Lakes Fishery Commission and their control agents, the U.S. Fish and Wildlife Service and Department of Fisheries and Oceans, Canada. As mentioned earlier, the LMC also supports the use of Seneca strain lake trout to enhance survival of stocked fish through reduced sea lamprey-induced mortality (Elrod et al. 1995, Eshenroder et al. 1995b, Madenjian et al. 2004, Schneider et al. 1996).

Strategy Actions

Stocking

- Stock a maximum of 2,285,000 yearling lake trout annually.
- Continue stocking on first priority rehabilitation sites in MM-3, MM-6, WM-5 (Appendix 2) and at Julian's Reef.
- Continue existing stocking rates at East Beaver and the Charlevoix Group stocking locations using three strains. First priority areas shall receive the full complement of available hatchery fish and the inventory balance will be pro-rated across secondary sites.
 - However, if hatchery inventories are below levels necessary to fully stock first priority areas; proportional reductions will occur first at Sheboygan Reef and Julian's Reef followed by East Beaver and Charlevoix group stocking locations.

Mark all stocked fish and support evaluation of experimental stocking efforts. Support mass marking initiative to allow for distinct marking of all lake trout stocked.

Studies

All studies identified in the 2011 Strategy were completed with details described in Madenjian et al. 2020 with the exception that the spring fry experiment was not, and will not, be conducted.

The LMC recommends the following studies:

- Continue to measure egg thiamine concentrations in lake trout eggs and evaluate the mechanisms that cause periodic fluctuations and regional difference in Lake Michigan.
- Continue evaluating lake trout strains stocked in Lake Michigan, emphasizing which strains contribute most to the growing wild fish component of the population and the contribution of Klondike strain lake trout to surveys and fisheries.
- Review the lake trout spring catch rate indicator due to an apparent disconnect between survey result trends and the benchmark for this indicator.
- Develop criteria for reducing stocking in the event of increased natural reproduction.

Evaluation

Evaluation Objectives

Strictly defined evaluation objectives for lakewide rehabilitation can be found in the Guide. The objectives listed below are established as targets to assess progress toward rehabilitation based on this Strategy and recommendations from the Lake Michigan Lake Trout Working Group and Madenjian et al. 2020. Progress towards each objective were provided by Madenjian et al. 2020 and should be achieved by 2030.

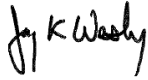
1. Increase the average catch-per-unit-effort (CPUE) to >25 lake trout/1000 feet of graded mesh gill net (2.5-6.0 inch) over-night set during spring stock assessments pursuant to the Lakewide Assessment of Predators protocol (Schneeberger et al. 1998) in MM-3, WM-5, and near Julian's Reef.
2. Increase or maintain the abundance of adults to a minimum catch-per-effort of >50 fish/1000 ft of graded large-mesh (4.5-6.0 inch) gill net fished on spawning reefs in MM-3, WM-5, and at Julian's Reef.
3. Significant progress should be achieved towards attaining spawning populations that are at least 25% females and contain 10 or more age groups older than age-7 in first priority areas stocked prior to 2007. These milestones should be achieved in areas stocked after 2008.
4. Maintain female spawner lake trout biomass density greater than 0.5 kg per hectare of habitat area for MM-123, MM-4, and MM-567.
5. Increase or maintain catch per effort of age-7 lake trout per million fish stocked at 2 fish per 1000 feet of gill net in MM-123, MM-4, and MM-567.
6. Detect eggs with thiamine concentrations of >4 nmol/g in previously stocked first priority areas. This milestone should be achieved in newly stocked areas.
7. Increase the mean number of wild lake trout captured in spring graded-mesh gill net surveys to 19 fish per 1,000 feet of net.

Annual progress reports from the Lake Michigan Lake Trout Working Group will be provided in March of each year. Progress reports will be structured to determine progress toward meeting evaluation objectives, whether the objectives have been met, and provide possible reasons for success or failure, where appropriate. A complete evaluation of the entire Strategy should be completed by the Lake Michigan Technical Committee/Lake Michigan Lake Trout Working Group and reported to the LMC by December 2031.

Strategy Revision

The LMC will conduct a comprehensive review of the Strategy evaluation provided by the Lake Trout Working Group. By April 1, 2032, the LMC shall adopt a new or revised Strategy. Interim (prior to 2031) modifications to the Strategy may be implemented, by consensus of the LMC, if circumstances warrant such modifications. Any modifications to the Strategy will be documented by the LMC.

Approved by the Lake Michigan Committee 10/11/2024

A handwritten signature in black ink that reads "Jay K. Wesley". The signature is written in a cursive style with a large initial "J" and "W".

Jay K. Wesley, Chair

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Appendix 1. Prescribed annual stocking numbers for lake trout yearlings based on 2019 LMC stocking decisions for First and Second Priority areas. LLW = Lewis Lake; SLW = Seneca Lake; HPW = Parry Sound; ANY = Any Strain that is available.

Effective beginning in calendar year 2020

First Priority Areas

Location	STATD	LLW	SLW	HPW	Total
West Beaver (Gull, Trout, Boulder, High Island)	MM3	160,000	160,000	160,000	480,000
East Beaver (Dahlia and S. Fox Trench)	MM3	200,000	200,000	200,000	600,000
Charlevoix (Irishman's, Big, Fishermen's, and Middle)	MM3	120,000	120,000	120,000	360,000
Sheboygan Reef	MM6		70,000		70,000
Sheboygan Reef	WM5		45,000		45,000
Julian's Reef	IL	60,000	60,000		120,000
Subtotal First Priority Areas					1,675,000

Second Priority Areas

Location	STATD	LLW	ANY	Total
Elk Rapids	MM4	50,000		50,000
Torch Lake	MM4	50,000		50,000
Old Mission	MM4	80,000		80,000
GTB Shoal	MM4	60,000		60,000
Ingalls Point	MM4	50,000		50,000
Lee's Reef	MM4	50,000		50,000
Good Harbor	MM5		100,000	100,000
Point Betsie	MM5		100,000	100,000
Portage Lake	MM6		35,000	35,000
Ludington	MM6		35,000	35,000
Subtotal Second Priority Areas				610,000
Lake Michigan Total				2,285,000

Appendix 2. Statistical districts and refuges in Lake Michigan

