

Untangling the Mystery: Identifying Factors Potentially Causing
Mismatches in Great Lakes Sea Lamprey Control Program Metrics**Project Lead:** Travis Brenden (QFC faculty)**Contact info:** brenden@msu.edu**QFC Collaborators** L. Ivan (QFC Research Associate)**Other Collaborators** T. Treska (GLFC), J. Adams (USGS), J. Barber (USFWS), C. Goldsworthy (Mn DNR), E. Marsden (U. Vermont), J. Holden (OMNR), J. Markham (NYDEC), M. Siefkes (GLFC), B. Marcy-Quay (USGS), C. Murphy (MSU)**Funding Agency:** Great Lakes Fishery Commission**Start Date/Status Date:** 2020/January 2026*Caption: Photograph of a sea lamprey attacked lake trout. Courtesy of M. Gaden.***Goal:** Explore through simulation how relationships among the primary metrics used to quantify Sea Lamprey Control Program successes (relative abundance of sea lamprey, relative abundance of lake trout, and observed wounding of lake trout) are affected by intrinsic and extrinsic factors**Objectives:**

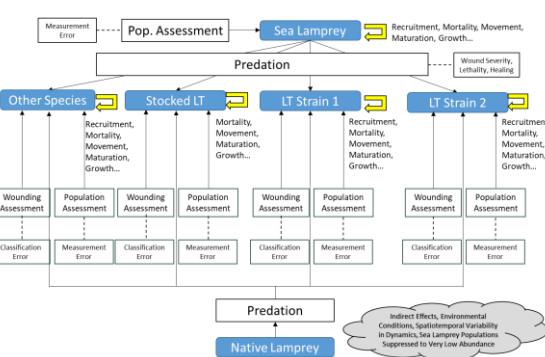
1. Consequences of sea lamprey opportunistic feeding
2. Consequences of the lake trout population consisting of a mixture of different strains, morphotypes, and wild versus hatchery origin with potentially varying demographics and susceptibility to sea lamprey attacks
3. Consequences of spatial structuring of sea lamprey and host species
4. Consequences of inferring damage based on wound patterns of surviving lake trout
5. Consequences of assessment, measurement, and classification errors

Management Implications: The proposed research will help the Sea Lamprey Control Program better interpret lake trout wounding data by identifying when observed wounds reliably indicate true sea lamprey-induced mortality and when they are confounded by ecological complexity or monitoring error. By using simulation models to evaluate control effectiveness and uncertainty, the study provides a decision-support framework to guide adaptive sea lamprey control strategies and prioritize future monitoring and research needs.**Methods:**

- Develop a hybrid simulation model that combines individual-based modeling for parasitic-phase sea lamprey with age-structured population models for host species to capture both individual variability and population-level dynamics
- Using the developed model, simulate sea lamprey-host interactions using functional response and bioenergetic equations to model host attacks, feeding rates, sea lamprey growth, wound formation, healing and resulting lethal and sub-lethal effects
- Incorporate spatial and environmental structures and monitoring and assessment uncertainty for assessing their influence on abundance and wounds

**Prelim. Findings/
Next Steps:**

- Simulation model has been tuned to Lake Huron data at time periods corresponding to high, medium and low time periods of sea lamprey abundance
- Final simulation scenarios are ongoing to complete project requirement

*Caption: Conceptual model developed by the FishLamp working group of the Sea Lamprey Control Board that was tasked with modeling what factors contribute to sea lamprey control program metrics (relative abundances of lake trout & sea lamprey, sea lamprey wounding of lake trout) not necessarily aligning during periods of low or high sea lamprey abundances. Factors identified on the conceptual model for the basis for the simulation scenarios conducted as part of this research project.*

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