MICHIGAN STATE UNIVERSITY

Quantitative Fisheries Center (QFC) Completed Project Briefing

Decision Analysis of Integrated Pest Management: A Case Study on Invasive Sea Lamprey in the Great Lakes Basin

Project Lead: Sean Lewandoski (former QFC PhD student)
Contact info: slewandoski@usgs.gov
QFC Collaborators: Kelly Robinson, Travis Brenden
Other Collaborators: R. Booth (DFO), P. Hrodey (USFWS), J. Hume (MSU), T. Pratt (DFO), A. Scott (MSU), M. Symbal (USFWS) , M. Wagner (MSU), N. Johnson (USGS)

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Caption: Mouth (buccal cavity) of a sea lamprey in its parasitic life stage. Photo credit: Ted Lawrence.

Goal: Use decision analysis to develop an adaptive management framework for the selection and use of integrated pest management (IPM) control tactics for reducing sea lamprey densities in the Great Lakes

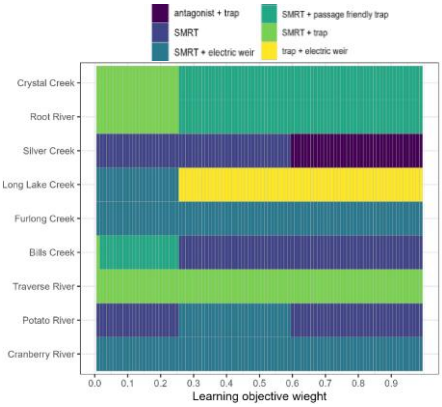
Objectives:

1. Test the hypothesis that adaptive management can reduce long-term standing barriers to implementing IPM by formalizing learning about control-tactic efficacy and understanding tradeoffs into sea lamprey control decisions
2. Evaluate an adaptive, multi-level decision analytic framework for selecting among sea lamprey control tactics at local and regional scales
3. Evaluate how biological, environmental, and social uncertainties affect the selection of optimal control strategies.

Management Implications: IPM has been a foundational aim since initiation of the control program but has been difficult to achieve for various reasons, including heavy reliance on lampricides, complexity and variability across Great Lake tributaries, and uncertain lamprey population dynamics. Reducing impediments to IPM enactment may provide a more adaptive, balanced, and ecologically grounded framework for diversified control actions and improve overall efficiency of sea lamprey control.

Methods:

- Structured decision analysis (PrOACT framework) involving a working group of sea lamprey control agents and decision makers was used to define the management problem, identify objectives, generate alternative control actions, etc in the context of deploying supplemental sea lamprey control tactics (trapping, electronic weirs, sterile male release technique (SMRT)
- Developed a multi-level objective hierarchy that allowed simultaneous evaluation of tributary-scale control decisions and regional coordination needs
- Feasibility analysis was applied to screen thousands of possible tactic-tributary combination to a more manageable set
- Utility-based optimization and sensitivity analysis identified optimal control strategies under all possible objective-weighting schemes



Caption: Optimal sea lamprey control tactic for experimental streams as learning objective weight changes.

Key Findings:

- Adaptive management enabled progress towards IPM by formalizing learning about the efficacy of supplemental sea lamprey control tactics and revealing where assumption about viable strategies should be reconsidered
- Utility-based optimization showed that the best deployment strategies depended on how control agented weighed cost versus learning
- Management decisions about control tactics were highly sensitive to social and technical feasibility assumptions
- The developed framework successfully narrowed thousands of possible management to a reduced ranged of feasible alternative, facilitate evaluations of tradeoffs between minimizing program cost and maximizing learning

Deliverables: Lewandoski, S.A., K.F. Robinson, T.O. Brenden, R. Booth, P. Hrodey, J.B. Hume, T.C. Pratt, A.M. Scott, M. Symbal, C.M. Wagner, and N. S. Johnson. 2025. Decision analysis of integrated pest management: a case study on invasive sea lamprey in the Great Lakes basin. Journal of Environmental Management 373:123666. Download here

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