

Experience from a Stakeholder-Engaged MSE Process for Walleye Fishery Management in Lake Erie

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The Laurentian Great Lakes, shared by the United States and Canada, include some of the most valuable recreational and freshwater commercial fisheries in the world. Among the most important of these are the walleye and yellow perch fisheries of Lake Erie. Since a substantial recreational fishery for these species developed in the late 1970s, these fisheries have been negatively affected by conflict among recreational and commercial fishery stakeholders, and between stakeholders and managers. From 2005-2009 this conflict reached peak levels, resulting in legal action by the Ontario Commercial Fisheries Association and a near breach of the consensus management process that has been a hallmark of Great Lakes interjurisdictional fisheries management since the 1980s.

In fall 2010 the Lake Erie Committee (LEC), the bi-national management body for these fisheries, established a working group comprising managers, fishery stakeholders, and a team of modeler/facilitators, to develop a transparent process for collaboration on analysis of fishery data and development of harvest policies for both species. The working group is known as the Lake Erie Percid Management Advisory Group (LEPMAG). Prior to this process beginning, harvest control rules (HCR) for walleye and yellow perch were in place, and had been informed by quantitative analysis of stock assessment data, but the process of developing the HCR was opaque to stakeholder groups. As well, no forum had existed for recreational and commercial stakeholders to have a common conversation about management goals and fishery concerns.

Between 2010 and 2014 the LEPMAG met on twelve occasions, using a Structured Decision Making (SDM) approach to guide discussions of future policy for the walleye fishery. Early on, the process focused on developing “rules for engagement”, resulting in a set of Terms of Reference that described the (advisory) relationship between LEPMAG and the actual decision makers (LEC), how participation in the group would be determined, how recommendations would be formulated (including the option for minority opinions to be recorded, etc., and on defining a set management objectives and options to guide the analytical phase of the process. Subsequent meetings provided opportunities for the stakeholders to develop an understanding of and provide feedback on the analysis, which included refinements to the existing stock assessment models and development of a Management Strategy Evaluation simulation model to evaluate alternative HCRs.

Since 1978 the walleye fishery has been assessed using a combination of fishery dependent (recreational and commercial catch and effort data) and fishery independent (trawl and gillnet surveys) data sets. From the 1990s these data have been used to inform a statistical catch-at-age stock synthesis model. During the LEPMAG process this model was refined to improve estimation of fishery and survey catchabilities (random walk model) and selectivities (estimating age-specific selectivities as free parameters). To develop the MSE model, the retrospective assessment results

were used to estimate a stock-recruitment relationship (Ricker model), and the analysis indicated a shift in productivity (Ricker alpha) after Lake Erie was invaded by Dreissenid mussels. Post-Dreissenid productivities were used for the forward simulations.

The MSE focused on comparing the performance of a range of biomass-based HCRs, defined by a target fishing mortality was stock biomass is high and a biomass limit below which fishing mortality rates would be reduced (Figure 1). The HCR accounted for uncertainty in assessed stock status by including a probabilistic component: fishing mortality would be reduced from the target level if the forecasted spawning stock biomass (SSB) after fishing was estimated to be lower than the limit reference point with a probability greater than p^* , where this quantity is a component of the control rule.

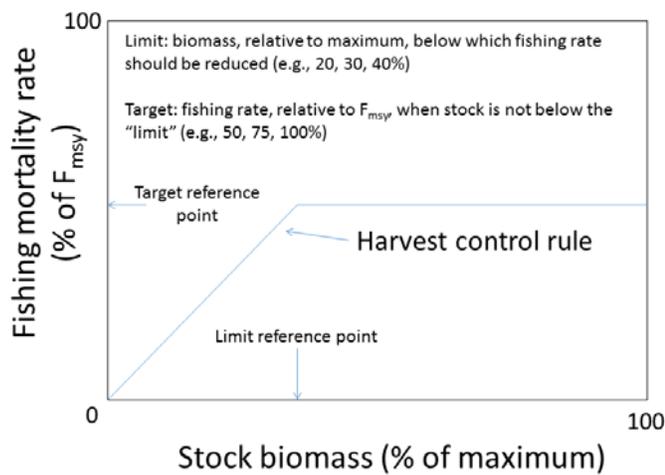


Figure 1. Biomass-based harvest control rule evaluated in the LEPMAG MSE process.

The technical complexity of the MSE analysis presented a communication challenge for our engaged process. Many stakeholders found it difficult to interpret the large volume of graphical output we presented of model results, representing the range of possible outcomes for each candidate HCR, quantified in terms of performance measures linked to management objectives (Figure 2). Despite this challenge, stakeholders maintain a strong level of interest in and support for the process, largely because it was seen as a genuine effort to make transparent the analysis that would ultimately inform policy. In the end, a synthetic trade-off plot (Figure 3) provided a key visualization of MSE results that allowed the group to arrive at a consensus on a management recommendation to the LEC. In January 2014 the LEC announced that it would adopt a new HCR based on the LEPMAG recommendation.

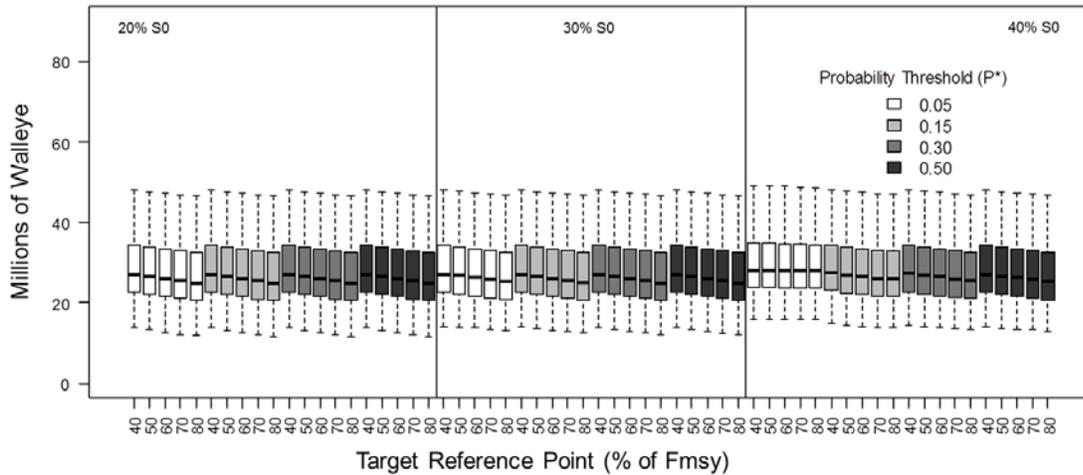


Figure 2. Box plot showing the results of the MSE for mean total abundance. Panels represent different limit reference points (% of unfished spawning stock biomass). Shading of the bars represents different probability thresholds (P^*). Individual bars with the same shading represent a range of F_{targ} values, as indicated on the x-axis

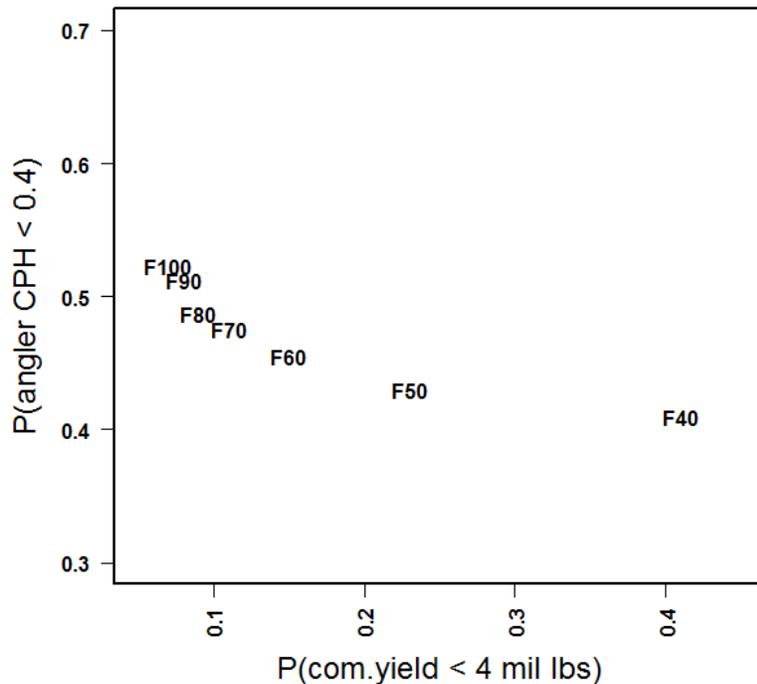


Figure 3. Trade-off analysis of two risk-related performance measures: probability of recreational catch per hour falling below 0.4 (y-axis) and probability of commercial yield falling below four million pounds of walleye (x-axis). Each point represents a different F_{targ} with the number representing the target as a % of F_{MSY} . All HCR results presented here used a P^* of 0.05 and an LRP of 20% B_0 .

We surveyed the LEPMAG at three points during the SDM process to evaluate changes in attitude regarding the fisheries and their management. Our experience and the evidence from the survey suggest that the interspersed analysis and deliberation in the SDM/MSE process has been very successful in increasing stakeholder trust and their views of the transparency of Lake Erie percid management. Since 2014 the process has continued with the objective of developing a similar HCR recommendation for yellow perch fisheries.