GREAT LAKES FISHERY COMMISSION

2004 Project Completion Report[1]

Decision Analysis Implementation for Percid Management on Lake Erie

by:

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ABSTRACT:

The Lake Erie Committee decided to explore the use of Decision Analysis as a tool to guide percid management decision-making on Lake Erie. Following a workshop in September 2002, at which the concepts of Decision Analysis were presented to Lake Erie managers and biologists, a team of Lake Erie biologists has worked with fishery modeling experts at Michigan State University to develop a decision model for Lake Erie walleye. This model, which uses outputs from a statistical catch-at-age-based stock assessment process as inputs to a stochastic forecasting system, is now being used by Lake Erie biologists and managers to evaluate walleye harvest policy alternatives. The model is designed to evaluate the performance of both fixed and state-dependent harvest policies using a range of performance indicators that include measures of expected harvests of stock sizes, and estimates of the risks (e.g., probabilities of persistent low stock sizes) associated with the policies.

INTRODUCTION:

In 2001, the Lake Erie Committee (LEC) decided to explore the development of a Decision Analysis to help evaluate uncertainties and risks associated with the annual harvest allocation of walleye. By following the structured format of Decision Analysis, complex and contentious subject matter can be reduced to more manageable components (Peterman and Anderson, 1999). Explicit LEC management objectives drive the model, reflecting individual agency objectives and the objectives of Lake Erie stakeholder groups. The process requires clear identification of objectives and options which the LEC is striving to achieve as outlined in *A Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC, 1994). The outcome from a Decision Analysis application is an evaluation of the performance of one or more possible exploitation policy alternatives at achieving management objectives. The LEC began to evaluate the Decision Analysis process in the spring of 2002. The first CAP funded workshop was held in September 2002, and since that time significant progress has been made toward the development of LEC objectives and options for the management of Lake Erie percid stocks, particularly walleye. The LEC began to develop a Decision Analysis (DA) model for walleye during the summer and fall of 2003, with the assistance of Dr. Michael Jones, Michigan State University, and the financial support of a previous CAP grant. To aid the LEC in completing the development of the DA model for anticipated implementation in 2005, this grant was provided to support continued interaction with fishery modelers at Michigan State University and a workshop wherein the LEC could review the model and provide guidance for transfer of the model from MSU to agency biologists.

OBJECTIVES:

(1) to refine the Decision Analysis model, with the assistance of Dr. Jones, so that it accurately reflects Walleye Task Group data and provides appropriately ranked options for LEC managers to consider; and
(2) to conduct a workshop for LEC managers to discuss the model output information, to implement the Decision Analysis framework into walleye management deliberations, and to determine specifically how LEC will make use of ranked management options

METHODS AND RESULTS:

Coordination of this project was handled jointly by Elizabeth Wright (OMNR-LEC) and Michael Jones (MSU). We convened several meetings during 2004 to (1) discuss refinements to the DA model (Feb 2004), (2) present progress on the model development to LEC (March 2004, June 2004, Sept 2004), and (3) train agency staff in the use of the DA model (August 2004). Discussions at these meetings as well as frequent communications between the MSU team and the LEC team during intervening periods led to many refinements and improvements to the DA model. We anticipate that interactions between the MSU

and LEC teams will continue after the conclusion of this project, although it is already evident that the LEC team has developed a high level of familiarity with the modeling tool.

The DA model is written in Visual Basic embedded within a Microsoft Excel workbook environment. The model forecasts future abundances of walleye conditional on a harvest policy for both commercial and recreational fisheries and on a set of demographic and fishery parameters about which there is uncertainty. We developed estimates of parameter uncertainty using a Bayesian stock assessment procedure to analyze historical walleye catch and index netting data. Monte Carlo Markov Chain methods were used to sample from the joint posterior probability distribution of the complete set of parameters for the DA model and generate a table of 1000 samples. These samples are used as inputs to sequential runs of the forecasting model, and the model outputs are then summarized across the samples to provide a measure of the distribution of possible outcomes of a particular policy, given the estimated state of parameter uncertainty. The model includes uncertainty about current walleye abundance, fishery parameters (catchability and vulnerability), stock-recruitment parameters, and the relationship between walleye abundance and recreational fishing effort.

In August 2004 we (the MSU team) provided copies of the model (Version 5.0) to the LEC team after they attended a workshop at MSU to explain the use of the model. Since that time the LEC team has been closely examining the performance of the model and analyzing different harvest policies. Ongoing interactions with the MSU team has resulted in a number of additional refinements – as of Dec 2004 the version # is 6.5.

The modeling team met with the LEC in June and September 2004 to present the model and discuss its future use. These workshops also resulted in suggestions for refinements to the model that have subsequently been implemented. More important, they triggered the recent efforts of the LEC team to use the DA model to examine a range of harvest policy options. In anticipation of use of the DA model to support management decisions in 2005 and beyond, further meetings are anticipated early in 2005.

DISCUSSION:

The use of Decision Analysis as a tool for fishery management has become a prominent theme in the fisheries literature in recent years. However, there are relatively few examples of applications of this tool to actual fishery management situations. We believe that this project and its predecessor have enabled a fruitful collaboration between DA experts at Michigan State University and those responsible for management of Lake Erie's percid fisheries. Frequently projects like this are enthusiastically supported by funding and management agencies at the start, but the commitment to implement the results of the project tends to dwindle over time. We are optimistic that this will not be the case for Lake Erie walleye, and look forward to seeing the ongoing use and refinement of this tool for strategic policy analysis by the LEC.

REFERENCES:

GLFC (Great Lakes Fishery Commission). 1994. A Joint Strategic Plan for Management of Great Lakes Fisheries. Ann Arbor, MI. 25 p.

Peterman, R.M. and J.L. Anderson. 1999. Decision Analysis: A Method for Taking Uncertainties into Account in Risk-based Decision Making. Human and Ecological Risk Assessment 5(2): 231-244.

ACKNOWLEDGEMENTS:

Most of the programming for this project was completed by Wenjing Dai. His timely delivery of model revisions on short deadlines was extremely helpful. Jim Bence provided considerable advice on stock assessment and model interpretation issues. Kevin Kayle, Andy Cook, and Megan Belore enthusiastically

embraced the challenge of “taking charge” of the DA model. Tim Johnson, Roger Knight, Roger Kenyon, Don Einhouse, and Bill Culligan also provided valuable guidance during the model development process.

DELIVERABLES:

The principal deliverable for this project is the DA model described above. This model is now in the hands of the LEC. Interested parties should contact Elizabeth Wright (address - see above) for information about the model. A second deliverable for this project was the workshop for LEC managers, held in September 2004, to discuss the model and determine how to make best use of the model outputs in their decision-making process.

PRESS RELEASE:

Fishery management decisions have to be made in spite of great uncertainty about the future of a fishery. The Lake Erie Committee – made up of fishery managers from each of the states and provinces surrounding the lake – has been working with modeling experts from Michigan State University to develop a Decision Analysis to guide future decision making for Lake Erie’s valuable walleye fishery. Decision Analysis is a tool that was developed to assist businesses and investors when faced with risky, uncertain choices, and has recently been applied to several fishery management problems. The Lake Erie walleye decision model enables managers to consider the range of plausible consequences of different management strategies, such as commercial catch quotes and recreational fishing regulations, and thereby rate the performance of these strategies at achieving objectives such as maximizing sustained harvests or minimizing risks of poor future harvests. In this way managers can identify policies that best meet stakeholder objectives in the risky world of fishery exploitation.