

GREAT LAKES FISHERY COMMISSION

2001 Project Completion Report¹

Enhancing stock assessment modeling and management of
Great Lakes fisheries

by:

P. Sullivan², N. Lester³, and J. Bence⁴

²College of Agriculture and Life
Sciences
Cornell University
Fernow Hall
Ithaca, NY 14853-3001

³Ontario Ministry of Natural Resources
Science Development and Transfer
Branch
300 Water Street, P.O. Box 7000
Peterborough, ON K9J 8M5

⁴Department of Fisheries and Wildlife
Michigan State University
13 Natural Resources Building
East Lansing, MI 48824-1222

January 2001

¹Project completion reports of Commission-sponsored research are made available to the Commission's Cooperators in the interest of rapid dissemination of information that may be useful in Great Lakes fishery management, research, or administration. The reader should be aware that project completion reports have not been through a peer review process and that sponsorship of the project by the Commission does not necessarily imply that the findings or conclusions are endorsed by the Commission.

GLFC RESEARCH REPORT
January 1, 2001

PROJECT TITLE:

Enhancing stock assessment modeling and management of Great Lakes fisheries.

PRINCIPAL INVESTIGATORS:

Pat Sullivan, Cornell University
Nigel Lester, Ontario Ministry of Natural Resources
Jim Bence, Michigan State University

PROJECT DATES: September 1999 - January 2001

ABSTRACT:

The management of Great Lakes fisheries relies on models to evaluate the status of fish stocks and to predict the effects of alternative harvest policies. Recent and continuing changes in the Great Lakes environment increase the complexity of models that are needed. Advances in modeling marine and other freshwater fisheries offer a fertile ground for the development of new tools that could be applied on the Great Lakes. The objectives of this project were 1) to identify promising areas for the transfer of this science and 2) to conduct a training session that introduce and develop some new modeling approaches for the analysis of Great Lakes systems. These objectives include (but were not limited to) the evaluation of new software tools for doing catch-at-age analyses that estimate stock abundance.

Two workshops were held: 1) Modeling tools for stock assessment: a cross-fertilization of marine and freshwater approaches; and 2) New approaches and software tools for stock assessment on the Great Lakes. The first workshop, held at the Weber's Inn in Ann Arbor, MI, April 11th and 12th, 2000, brought together fisheries scientists and modelers from marine and freshwater disciplines to identify some new developments and to address issues of concern on the Great Lakes. The second workshop, held at Cornell University in Ithaca, NY, October 10th-12th, 2000 introduced and develop 'state of the art' stock assessment methods in the context of issues relevant to Great Lakes systems. The workshop reviewed new approaches to stock assessment modeling, developed a set of Great Lakes applications, and provide hands on computer sessions to examine the applicability and value of the new modeling tools.

Workshop agendas, presentations, and participants are provided on the website: <http://www.dnr.cornell.edu/afrp/sawk/index.htm>.

Introduction

The management of Great Lakes fisheries depends heavily on the use of models to estimate fish abundance, to determine annual harvest quotas, and to predict the effects of different harvest policies. Recent and continuing changes in the Great Lakes environment increase the complexity of models that are needed. Modeling approaches applied in the past were not designed with rapid environmental changes in mind and concerns have been expressed about our ability to manage effectively in the face of massive ecosystem change. Environmental changes (e.g. nutrients, water transparency)

affect not only parameters that are used to estimate current stock abundance, but also predictions about the future state of stocks. There is a need to incorporate these effects into models that guide decisions about harvest quotas. There is also a need to consider ways of evaluating and conveying uncertainty so that pre-cautionary principles can be better applied in developing long-term management strategies.

Models have had a long and rich history in fisheries science, having been used to characterize populations and communities in the aquatic environment as well as providing quantitative tools for examining management objectives and risk. Similarities exist in models used in marine and freshwater systems, particularly in how they represent the basic biological properties of survivorship, growth, and reproduction. However, differences exist in scale, type and number of trophic interactions, and often in the method of resource utilization (the dominance of recreational vs. commercial fisheries for example). This makes the type of questions asked, the methods employed for addressing those questions, and the data available for deriving answers divergent. In spite of this, the biological and statistical methods applied to marine and freshwater systems have a common heritage, and this commonality can form the basis for communication and sharing of ideas.

It was in this context that this project was conducted in order to facilitate the transfer of science for management of Great Lakes fisheries. Models developed for marine and other freshwater systems offer new approaches and software tools that could be useful on the Great Lakes. Marine scientists have made great strides in characterizing populations using age and size structured methods to assess population levels for quota setting and risk assessment. Uncertainty is better represented now in model parameters and structure, and the handling of large and divergent data sets is not uncommon. In the freshwater environment the focus has been on community and ecosystem dynamics, with special emphasis on ecological interactions, energy flow, and trophic pathways. The effect of urban development and the role that toxicants and introduced non-native exotics have on the ecosystem has been examined in detail. In marine systems there is a stronger tradition of statistical rigour in fitting stock assessment models, but sometimes less attention to changing trophic circumstances and environmental conditions (perhaps because the changes are not as striking) than is the case in the Great Lakes. This contrast enhances the value of the cross-fertilization promoted by this project.

The objectives of this project were:

- identify promising areas for the transfer of new modeling tools to the management of Great Lakes fisheries; and
- conduct a training session that introduces and develops new modeling approaches for the analysis of Great Lakes systems.

We held two workshops, each focusing on one of these objectives. The first workshop, held at the Weber's Inn in Ann Arbor, MI, April 11th and 12th, 2000, and brought together fisheries scientists and modelers from marine and freshwater disciplines to identify some new developments and to address issues of concern on the Great Lakes. The second workshop, held at Cornell University in Ithaca, NY, October 10th-12th, 2000

introduced and developed 'state of the art' stock assessment methods in the context of issues relevant to Great Lakes systems. The workshop reviewed new approaches to stock assessment modeling, developed a set of Great Lakes applications, and provided hands on computer sessions to examine the applicability and value of the new modeling tools.

Workshop agendas, presentations, and participants are provided on the website: <http://www.dnr.cornell.edu/afrp/sawk/index.htm>

This website serves as a technical report of the outcome of each of the two workshops. The lists of workshop participants, however, has also been appended to this document.

Workshop 1 Participants

Name	E-mail Address	Affiliation
Bence, Jim	bence@pilot.msu.edu	Michigan State University
Boomer, Scott	gbs2@cornell.edu	Cornell University
Bowlby, Jim	jim.bowlby@mnr.gov.on.ca	Ontario MNR
Breck, Jim	breckj@state.mi.us	Michigan DNR
Bronte, Charles	charles_bronte@usgs.gov	USGS - Great Lakes Science Center
Christie, Gavin	gavin@glfc.org	Great Lake Fishery Commission
Chudobiak, Darryl	aofrc@cancom.net	Anishnabek Ontario Fisheries Res. Center
Clapp, David	CLAPPD@state.mi.us	Michigan DNR
Clark, Rick	clarkrd@state.mi.us	Michigan DNR
Cook, Andy	andy.cook@mnr.gov.on.ca	Ontario MNR
Costello, Mike	Mike.Costello@dnr.state.oh.us	Ohio DNR
Dettmers, John	dettmers@denr1.igis.uiuc.edu	Illinois Natural History Survey
Ebener, Mark	MEbener@northernway.net	Chippewa/Ottawa Treat Fishery Mgt. Auth.
Einhouse, Don	dweinhou@gw.dec.state.ny.us	New York DEC
Haas, Bob	haasrc@state.mi.us	Michigan DNR
Hansen, Mike	mhansen@uwsp.edu	University of Wisconsin
Henderson, Bryan	bryan.henderson@mnr.gov.on.ca	Ontario MNR
Hill, Tracy	Tracy_hill@fws.gov	USFWS Aplena Fishery Resources Office
Horns, William	hornsw@dnr.state.wi.us	Wisconsin DNR
Hoyle, Jim	jim.hoyle@mnr.gov.on.ca	Ontario MNR
Huber, Rick	huberric@badriver.com	Bad River Tribe
Johnson, Tim	tim.johnson@mnr.gov.on.ca	Ontario MNR
Kayle, Kevin	Kevin.Kayle@dnr.state.oh.us	Ohio DNR
Kenyon, Roger	rbkenyon@erie.net	Pennsylvania Fish - Boat Commission
Knight, Carey	carey.Knight@dnr.state.oh.us	Ohio DNR
Knight, Roger	roger.knight@dnr.state.oh.us	Ohio DNR
Kraft, Cliff	cek7@cornell.edu	Cornell University
Lester, Nigel	nigel.lester@mnr.gov.on.ca	Ontario MNR
Madenjian, Chuck	chuck_madenjian@usgs.gov	USGS - Great Lakes Science Center
Maguire, J.-J	JJ_Maguire@compuserve.com	Halieutikos Inc.
Maraldo, Dave	aofrc@aofrc.org	Anishnabek Ontario Fisheries Res. Center
Mattes, Bill	bmattes@glifwc.org	Great Lakes Indian Fish and Wildlife Com.
Mohr, Lloyd	lloyd.mohr@mnr.gov.on.ca	Ontario MNR
Parma, Ana	parma@cenpat.edu.ar	Centro Nacional Patagonico

Petzold, Mike	mike.petzold@mnr.gov.on.ca	Ontario MNR
Ryan, Phil	phil.ryan@mnr.gov.on.ca	Ontario MNR
Sandstrom, Steve	steve.sandstrom@mnr.gov.on.ca	Ontario MNR
Schaner, Ted	ted.schaner@mnr.gov.on.ca	Ontario MNR
Schneeberger, Philip	schneebp@state.mi.us	Michigan DNR
Schram, Stephen	schras@dnr.state.wi.us	Wisconsin DNR
Schreiner, Don	don.schreiner@dnr.state.mn.us	Minnesota DNR
Sitar, Shawn	sitars@state.mi.us	Michigan DNR
Stewart, Tom	tom.stewart@mnr.gov.on.ca	Ontario MNR
Sullivan, Pat	pjs31@cornell.edu	Cornell University
Sutherland, Bob	bob.sutherland@mnr.gov.on.ca	Ontario MNR
Witzel, Larry	larry.witzel@mnr.gov.on.ca	Ontario MNR
Woldt, Aaron	woldtap@state.mi.us	Michigan DNR
Wright, Greg	gwright@sault.com	COTFMA

Workshop 2 Participants

Name	E-mail Address	Affiliation
Breck, Jim	breckj@state.mi.us	Michigan DNR
Bronte, Charles	charles_bronte@FWS.GO	USGS - Great Lakes Science Center
Chudobiak, Darryl	darryl.chudobiak@mnr.gov.on.ca	Ontario MNR
Clapp, David	clappd@state.mi.us	Michigan DNR
Cook, Andy	andy.cook@mnr.gov.on.ca	Ontario MNR
Eggold, Brad	eggolb@dnr.state.wi.us	Wisconsin DNR
Einhouse, Don	dweinhou@gw.dec.state.ny.us	New York DEC
Haas, Bob	haasrc@state.mi.us	Michigan DNR
Horns, William	hornsw@dnr.state.wi.us	Wisconsin DNR
Hoyle, Jim	jim.hoyle@mnr.gov.on.ca	Ontario MNR
Johnson, Tim	tim.johnson@mnr.gov.on.ca	Ontario MNR
Jonas, Jory	jonasi@state.mi.us	Michigan DNR
Kayle, Kevin	Kevin.Kayle@dnr.state.oh.us	Ohio DNR
Knight, Roger	roger.knight@dnr.state.oh.us	Ohio DNR
Maraldo, Dave	dmaraldo@aofrc.org	Anishnabek Ontario Fisheries Resource Center
Millard, Michael	Mike_Millard@fws.gov	USFWS (Northeast Fishery Center)
Mohr, Lloyd	lloyd.mohr@mnr.gov.on.ca	Ontario MNR

Morrison, Bruce	<u>bruce.morrison@mnr.gov.on.ca</u>	Ontario MNR
Petzold, Mike	<u>mike.petzold@mnr.gov.on.ca</u>	Ontario MNR
Schaner, Ted	<u>ted.schaner@mnr.gov.on.ca</u>	Ontario MNR
Seyer, John	<u>jseyler@aofrc.org</u>	Anishnabek Ontario Fisheries Resource Center
Stewart, Tom	<u>tom.stewart@mnr.gov.on.ca</u>	Ontario MNR
Thomas, Mike	<u>thomasmv@state.mi.us</u>	Michigan DNR
Wilberg, Mike	<u>wilbergm@msu.edu</u>	Michigan State University
Woldt, Aaron	<u>woldtap@state.mi.us</u>	Michigan DNR