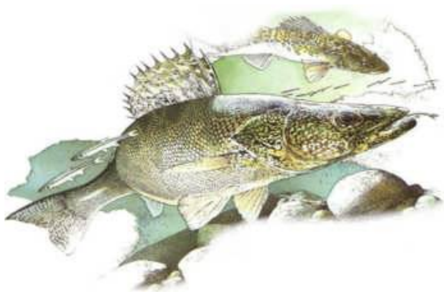
THE LAKE ERIE YELLOW PERCH

COMMERCIAL FISHERY

THE LAKE ERIE WALLEYE

COMMERCIAL FISHERY



PUBLIC COMMENT DRAFT REPORT

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MAY 2015

Client

Ontario Commercial Fisheries Association

Blenheim, Ontario

Contents

Acronyms

AFS	Aboriginal Fisheries Strategy
DFO	Department of Fisheries and Oceans
B_{MSY}	Biomass at Maximum Sustainable Yield
B_o	Unfished biomass
CLC	Council of Lake Committees
COA	Canada-Ontario Agreement
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPMS	Coordinated Percid Management Strategy
CPUE	Catch per Unit Effort
CWTG	Cold Water Task Group
DA	Decision Analysis
DCR	Daily Catch Record
DFO	Department of Fisheries & Oceans
EF	Environment Factors
EO	Environmental Objectives
ETP	Endangered, threatened and protected
FAM	Fishery Assessment Methodology
FAO	Food & Agricultural Organisation
FCO	Fish Community Goals and Objectives
FMP	Fisheries Management Plan
FTG	Forage Task Group
FTR	Fish Mortality Target Reference Point
FWS	Fisheries & Wildlife Service
GLAHF	Great Lakes Aquatic Habitat Framework
GLFC	Great Lakes Fishery Commission
GLIFWC	Great Lakes Indian Fish & Wildlife Commission
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative
GLWQA	Great Lakes Water Quality Agreement
HCR	Harvest Control Rule
HS	Harvest Strategy
HTG	Habitat Task Group
IFC	Intertek Fisheries Certification
IJC	International Joint Commission
ISBF	Introduced Species Based Fisheries
ITQ	individual Transferable Quota
JSP	Joint Strategic Plan
K	Carrying capacity
LADST	Lake bed Alteration Decision Support Tool
LaMP	Lakewide Action and Management Plans
lbs	Pound weight
LEC	Lake Erie Committee
LEMU	Lake Erie Management Unit
LEPC	Lake Erie Program Committee
LEPMAG	Lake Erie Percid Management Advisory Group
LRP	Limit Reference Point

LTL	Lower Trophic level
LTLA	Lower Trophic Level Assessment program
F	Fishing mortality
M	Natural Mortality
MDNR	Michigan Department of Natural Resources
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
mt	Metric tonne
MU	Management Unit
NIS	Non-indigenous species
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
OCFA	Ontario Commercial Fisheries Association
ODNR	Ohio Department of Natural Resources
OMNR	Ontario Ministry of Natural Resources
PCM	Post-capture mortality
PFBC	Pennsylvania Fish and Boat Commission
q	Catchability
QFC	Michigan State University's Quantitative Fisheries Center
QZ	Quota Zone
RAH	Recommended Allowable Harvest
RBF	Risk Based Framework
RP	Reference Point
SARA	*Species at Risk Act*
SCAA	Statistical Catch at Age
SFF	Sustainable Fisheries Framework
SPOF	Strategic Plan for Ontario Fisheries
SSB	Spawning biomass
STC	Standing Technical Committee
TAC	Total Allowable Catch
TL	Trophic level
TRP	Target Reference Point
UoC	Unit(s) of Certification
USGS	US Geological Survey
VMS	Vessel Monitoring System
WMP	Walleye Management Plan
WTG	Walleye Task Group
YOY	Young of Year
YPMP	Yellow Perch Management Plan
YPTG	Yellow Perch Task Group

EXECUTIVE SUMMARY

Note: to differentiate between the two species the report has been formatted; parts that are relevant to both fisheries are in black; those relevant to yellow perch are in red; and parts relevant to walleye are in blue.

Report Objective

Due to the wide range of relevant common information between the two fisheries, this report sets out the results of two separate assessments against the Marine Stewardship Council (MSC) Principles and Criteria for Sustainable Fishing: THE LAKE ERIE YELLOW PERCH COMMERCIAL FISHERY and THE LAKE ERIE WALLEYE COMMERCIAL FISHERY.

The Fishery Proposed for Certification

The MSC Guidelines to Certifiers specify that the unit of certification (UoC) is "The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock) and management framework."

Accordingly, the THE LAKE ERIE YELLOW PERCH COMMERCIAL FISHERY proposed for certification consists of 7 UoC.

Species/Stock	Management	Area	Gear
Yellow perch	DFO/LEC/OMNR	Lake Erie QZ1	Small Mesh Gill net
Yellow perch	DFO/LEC/OMNR	Lake Erie QZ2	Small Mesh Gill net
Yellow perch	DFO/LEC/OMNR	Lake Erie QZ3(E)	Small mesh Gill net
Yellow perch	DFO/LEC/OMNR	Lake Erie QZ3(W)	Small Mesh Gill net
Yellow perch	FWS/LEC/ODNR	Lake Erie MU1	Small Mesh Trap Net
Yellow perch	FWS/LEC/ODNR	Lake Erie MU2	Small Mesh Trap Net
Yellow perch	FWS/LEC/ODNR	Lake Erie MU3	Small Mesh Trap Net

while the THE LAKE ERIE WALLEYE COMMERCIAL FISHERY consists a single UoC:

Species	Management	Area	Gear
Walleye	DFO/LEC/OMNR	Lake Erie	Large Mesh Gill net

Assessment Highlights

The certification process started with the announcement posted on the MSC web site on June 18th, 2013. The client is the Ontario Commercial Fisheries Association.

Of the four original separate assessments, after a preliminary report those for Rainbow smelt / White perch and Lake whitefish / White bass were withdrawn from the process.

A first site visit took place from October 22nd to 24th, 2013 and a second from the 26 th to the 28 th June, 2014. The client draft report was presented in July, 2014. There followed a lengthy exchange of views between the CAB and the client that led to the client providing additional evidence with consequent redrafting and rescoring of parts of the original draft client report.

The report was sent for peer review in February 2015. The audit team reviewed the comments received and redrafted the draft report as considered appropriate in April, 2015. The client agreed with the changes and the Public Comment Draft Report was posted on the MSC web site in May 2015.

The client group for Yellow perch consists licensed gill net fishermen harvesting Ontario waters of Lake Erie together with the Ontario processors members of OCFA that purchase Lake Erie Yellow perch from Ontario gill net fishers and Ohio Yellow perch trap net fishers.

The client group for Walleye is licensed commercial fishermen fishing with large mesh gill net in Ontario waters of Lake Erie together with the Ontario processors members of OCFA that purchase Lake Erie Walleye from Ontario large gill net fishers.

The assessment team was: Bob O'Boyle (Expert Adviser P1), Sara Adlerstein (Expert Advisor P2) and Ian Scott (lead assessor and Expert Adviser P3). The peer reviewers were Andy Hough and Andrew Gill.

Key Strengths & Weaknesses of the Fishery Under Assessment

The overarching character of the Lake Erie fishery can be summed up by: the shared jurisdiction between Canada (Ontario) and the U.S. (Ohio, Michigan, Pennsylvania, and New York); the importance of both commercial and recreational / sport fisheries; the pre-eminence of commercial fishing in Ontario waters; Ohio as the only US state bordering Lake Erie to retain a significant interest in commercial activities; the prohibition on commercial fishing for Walleye in US waters; management coordination through the bi-partite Great Lakes Fishery Commission and its dependencies; the number of invasive species and the recovery of the Lake ecosystem from previous heavy contamination.

The basis of management of the two assessed fisheries is the lakewide quota that is divided between the five jurisdictions that allocate their own shares according to Province / State priorities.

Yellow perch

The Yellow perch stock is assessed according to four management units (MU1 – MU4).

The quota allocated to Ontario is divided into four quota zones QZ1, QZ2, QZ3(W) and QZ3(E) that approximate to the various MUs.

In Ohio, the Yellow perch season is May to November using Yellow perch small mesh trap nets in a limited entry fishery with a low number of licenses. Ohio's quota is in MU1, MU2 and MU3. In most recent years, except for 2010 and 2011, the Ohio MU1 share has only been available to the recreational / sport sector.

In Ontario, the fishery is open year-round with regulations covering gear soak times when ice may be present. The gear used to target Yellow perch is small mesh (i.e. minimum 57 cm) bottom gill nets.

The stock status of Yellow perch meets the MSC standard in all MUs. There are issues however that prevent the fishery meeting the defined MSC standard for reference points (PI 1.1.2) and harvest control rules and tools (PI1.2.2) and this has led to conditions on the certification (see below).

In the directed Yellow perch gill net fishery there are two "main" (i.e. accounting for more than 5% of the total catch, valuable or vulnerable) retained species; White perch is invasive and not considered in scoring while there are no issues for the Walleye by-catch.

In the MU1 Ohio yellow perch trap net fishery there are three main retained species – Channel catfish, Freshwater drum and White perch. There are no issues with the stocks of any of these species. Neither are there issues in MU2 (White perch is the only main species and not taken into consideration) or MU3 where there are no main retained species.

In theory, all non-landed catch in the yellow perch trap net fishery is released live and there is no by-catch. However, due to the lack of information on post capture mortality, there is a condition on PI 2.2.3 for the yellow perch trap net fisheries.

While a large number of species are listed in Canadian (SARA) and U.S. (ESA) legislation as being endangered, threatened or protected, there is limited, to no, interaction of these species with the Yellow perch fisheries.

The soft bottom and the nature and characteristics of the gears contribute to the conclusion that there is limited risk to habitat from the gear.

Due a lack of specific information, the ecosystem component of P2 was assessed using the risk based approach. The limited input from stakeholder workshops on this topic led the assessment team to undertake web based research. The conclusion reached was that the removal of top predators from the ecosystem was the most vulnerable element; consideration of the available evidence led the team to conclude that the fisheries met the MSC standard.

P3 is considered from the perspectives of international (GLFC, LEC) and national (Province / State). No issues are found with any performance indicator, each of which meets the MSC standard. This reflects the amount of work over many years to strengthen all aspects of fisheries management. There is strong stakeholder input that in turn presents an incentive for sustainable fishing, specific fisheries management plans that are reviewed on a regular if not frequent basis, good enforcement and compliance and a good research programme.

Walleye

The major part of the Lake Erie population of Walleye is considered a single stock; a second small stock inhabiting the eastern end of the Lake is not part of this assessment. There is limited entry into the Ontario commercial gill net fishery. Walleye is caught by "large" mesh mid-water gill nets (i.e. minimum mesh size 89 mm). Walleye may also be incidentally caught in the small mesh gear that targets other species; this catch would not be certified to the MSC standard. The Walleye stock meets the MSC standard for all Principle 1 principle indicators.

Main retained species in the large gill net fishery for Walleye are Lake whitefish, White bass and White perch. Due to the precarious nature of the Lake whitefish stock and the lack of a partial strategy to reduce the risk of a negative effect from the large gill net fishery for Walleye, conditions to the certification are raised on PI2.1.1 and PI 2.1.2 (see below).

The main by catch species are Gizzard shad, Lake sturgeon and Lake trout. The first is invasive and not considered in scoring. The assessment team found that the fishery does not threaten the stocks of the other two.

Findings on the remaining Principle 2 performance indicators and Principle 3 are as summarised above.

The Results

Yellow perch

A summary of the overall scores is:

	Gill Net				Trap Net		
Principle	**QZ1**	**QZ2**	**QZ3(E)**	**QZ3(W)**	**MU1**	**MU2**	**MU3**
P 1 – Target Species	81.9	84.4	84.4	84.4	81.9	84.4	84.4
P 2 – Ecosystem	81.7	81.7	81.7	81.7	80.0	81.3	81.7
P 3 – Management System	85.3	85.3	85.3	85.3	85.3	85.3	85.3

This led to the following RECOMMENDED CERTIFICATION DETERMINATION:

- **QZ1, QZ2, QZ3 (E), QZ3 (W), MU1, MU2, MU3**. The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any PIs. It is therefore recommended that THE LAKE ERIE YELLOW PERCH COMMERCIAL FISHERY SHOULD BE CERTIFIED against the Marine Stewardship Council Principles and Criteria for Sustainable Fishing.

The Yellow perch fishery attained a score of below 80 against four PIs. These led to conditions for continuing certification that are applied to improve performance to at least the 80 level within four years of certification

	Condition	PI	UoCs
YP1	By the third annual surveillance audit, the following SG80 SIs must be met: The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	1.1.2	All
YP2	By the fourth annual surveillance audit, the following SG80 SI must be met: Well-defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	1.2.2	All
YP3	By the fourth annual surveillance audit, the following SG80 SIs must be met: - There shall be a partial strategy that is expected to maintain all main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved.	2.1.2	MU1
YP4	By the third annual surveillance audit, the following SG80 SI must be met: Qualitative information and some quantitative information are available on the amount of main by-catch species taken by the fishery.	2.2.3	All MUs

As a standard condition of certification, the client has developed an 'Action Plan' to address the conditions for continued certification.

The assessment team made a number of recommendations that apply to a number of UoCs.

1 To ensure correct information is available to managers, the audit team recommends that OCFA and OMNR work together to design and implement a data system that provides consistently accurate data, and the data on catch, retained catch and by-catch is published and made available to stakeholders on a regular basis.

2 The Canadian distribution of spotted sucker is limited to south western Ontario, where it occurs in the western basin of Lake Erie. Because of its low abundance it is unlikely that the species is caught in the gill net fisheries. Nevertheless, it would not be possible to corroborate this from DCRs as suckers are reported as one group. In the last 10 years, the by-catch of suckers in the fishery was 13,079 lbs. While discards were likely under reported until 2011, since then over 3,000 lbs have been removed annually. Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing. However future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species and it is recommended that data be taken on species composition to allow this to be considered in future annual audits.

3 While the assessment team did not identify main by-catch species in any of the QZs it was noted that DCRs do not identify individual species of the sucker family, some of which could be vulnerable. Further, there are Species of Concern in the area that could be part of the by-catch. It is recommended that to support

the annual surveillance programme, OCFA and OMNR should work to modify the reporting protocol so that sucker species are individually recorded.

4 The annual average catch of lake sturgeon is about 3 lbs over a 10 year period. This is in small quantity and for the moment it is not regarded as a main species; but future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock.

5 Currently, there is no information on size of lake sturgeon; and it is recommended that data should be collected to allow this to be considered in future annual audits.

6 Lake trout is a non-harvest species recorded in the last three years in small quantities (12 lbs in 2013). It is not considered a main species. Future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock. Lake sturgeon was recorded as by-catch in one year (2006). It is not considered a main species.

7 Future annual audits should review the situation to ensure that the by-catch of lake trout has not increased to pose a threat to the recovery of the stock.

Walleye

Summaries of the overall scores are:

Principle	Large Mesh Gill net
P 1 – Target Species	90.0
P 2 – Ecosystem	81.7
P 3 – Management System	85.3

This led to the following CERTIFICATION DRAFT DETERMINATION:

- **Walleye**. The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any PIs. It is therefore recommended that THE LAKE ERIE WALLEYE COMMERCIAL FISHERY SHOULD BE CERTIFIED against the Marine Stewardship Council Principles and Criteria for Sustainable Fishing.

The Walleye fishery attained a score of below 80 against two PIs. These led to conditions for continuing certification that are applied to improve performance to at least the 80 level within a defined period.

	Conditon	PI
WE 1	By the third annual surveillance audit, based on Condition WE2 the partial strategy of demonstrably effective management measures will be in place such that the fishery doe not hinder the recovery and rebuilding of the lake whitefish stock.	
WE 2	By the third annual surveillance audit, there will be a partial strategy in place for amanging the catch of lake whitefish and white bass that is designed to ensure the large mesh fishery does not pose a risk of serious or irreversible harm.	

As a standard condition of certification, the client has developed an 'Action Plan' to address the conditions for continued certification.

The audit team did not make any recommendations.

1 AUTHORS AND PEER REVIEWERS

Expert Adviser P1: Robert O'Boyle. Bob joined Canada's Department of Fisheries and Oceans (DFO) at the Bedford Institute of Oceanography in 1977 as a stock assessment scientist. He was with DFO for over 30 years, before retiring in October 2007. During his DFO career, he was involved in the development of stock assessment approaches. Since 2000, his research interests have focused on the policies and implementation of an Ecosystem Approach to Management. He currently pursues research projects related to resource management and assessment. He also runs Beta Scientific Consulting Inc.; a company which provides a wide range of consulting services related to fisheries and ocean management. He has been an auditor on a number of MSC certifications.

Expert Adviser P2: Sara Adlerstein. Sara was educated in Chile and was awarded a MS degree in Biology. She obtained a MS and PhD in Fisheries at the University of Washington. She is currently Associate Research Scientist at the School of Natural Resources and Environment, University of Michigan. Her current research programme is centred on applied aquatic ecology, with emphasis on population assessments and ecosystem dynamics focussed on the Great Lakes, North Sea and Mediterranean marine ecosystems with the goals of: (i) improving monitoring and increasing the value of available information; (ii) understanding processes that determine distribution and abundance of aquatic organisms; and (iii) quantifying responses of aquatic communities to stressors and management. Major contributions of her research are in applications for management, including diagnostics of environmental quality and advances in concepts related to fish movement and distribution. She has developed a regional, national and international reputation for sophisticated statistical analysis of complex data collection and extensive ecosystem scale data sets. She has experience in various hake fisheries in the Pacific and Mediterranean and also by-catch issues in some Pacific fisheries. She has been an auditor on a number of MSC certifications.

Lead Auditor /Expert Adviser P3: Ian Scott. Ian is a fisheries consultant specialising in fisheries certifications, fisheries policy and fishery management issues with over 30 years of experience in the fishery sector. In recent years he has advised the Governments of Turkey, Montenegro, Serbia, the Dominican Republic and Yemen on fisheries policy, including fisheries management, fleet development, the need for scientific research and fishery related environmental issues. He has co-prepared fisheries management plans for Turkey, Serbia and Montenegro. Ian has completed work as coordinator and P3 specialist on the assessments of the Portuguese sardine fishery, Canadian sablefish, Scotia Fundy haddock, Canadian spiny dogfish, Mexico pole and line fishery for skipjack and yellowfin, Maldives pole and line fishery for skipjack and yellowfin, U.S. dogfish, Newfoundland snow crab, Lake Waterhen walleye and northern pike, and Juan Fernandez lobster. He has completed a large number of MSC pre-assessments. He is a certified auditor for the MSC chain of custody. Ian is trained in the use of the Risk Based Framework (RBF).

1.1 Peer Reviewers

Dr Andrew Gill

Dr Gill is an academic member of staff at Cranfield University, UK, and has over 15 years' experience as an aquatic ecologist with a particular interest in the fish and fisheries ecology and links with human activity. His current duties at Cranfield include: developing research activity (aquatic ecology and anthropogenic impacts); publication, preparation and research grant proposals; development and preparation of contracts and industrial liaison; teaching postgraduate and professional training courses in aquatic ecology, environmental river management, river restoration, coastal and estuarine restoration ecology, fish and fisheries biology, environmental impact assessment and ecological field techniques and surveying of inland aquatic and coastal developments.

From 2002 to 2003 he was a lecturer at the School of Biological Sciences, University of Liverpool where his responsibilities included: developing research profile (aquatic ecology and anthropogenic impacts); and teaching undergraduate and postgraduate modules in fish & fisheries biology, animal diversity, river restoration, lake restoration, experimental methods and design, ecological field techniques.

Between 1988 and 2002 he held various positions: MSc Course Director - Restoration Ecology of Terrestrial & Aquatic Environments School of Biological Sciences, University of Liverpool; Lecturer in Fish and Fisheries Biology, Department of Environmental and Evolutionary Biology, University of Liverpool; Science Coordinator, Coral Cay Conservation (CCC), Headquarters, London; Research and Education Consultant Biologist, Belize; Scientific Officer, CCC, Belize Barrier Reef; and Research Assistant, Department of Zoology, University of Leicester

Dr Andrew Hough

Dr Hough has a PhD in marine ecology from the University of Wales, Bangor (1987-90). He has been involved in marine, coastal and freshwater environmental management since 1991, including management of fishery impacts on ecosystems and marine conservation biology, principally in European inshore waters.

He was manager of Moody Marine operations within Moody International Certification from 1999 to 2011 with particular responsibility for the implementation of MSC Certification procedures and development of MSC methodologies. He was lead assessor on many of Moody Marine MSC pre assessments and main assessments during this time. This work involved stock assessment analysis, evaluation of ecosystem effects and management effectiveness of groundfish, pelagic and shellfish fisheries in various administrations around the world. He now works as a freelance environmental / fishery management consultant and auditor.

1.2 Training in the RBF

Ian Scott has completed the training in the use of Risk Based Framework (RBF) as provided by Intertek Fisheries Certification (IFC). He has used the approach in a number of fisheries.

2 DESCRIPTION OF THE FISHERY

2.1 Eligibility for Certification against the MSC Standard

2.1.1 Yellow perch

The fishery may be assessed within the scope of the Principles and Criteria for Sustainable Fishing as: it is not conducted under a controversial unilateral exemption to an international agreement; fishing operations do not use destructive fishing practices; the fishery is not the subject of controversy and/or dispute; and the fishery has not previously failed an assessment or had a certificate withdrawn.

2.1.2 Walleye

The fishery may be assessed within the scope of the Principles and Criteria for Sustainable Fishing as: it is not conducted under a controversial unilateral exemption to an international agreement; fishing operations do not use destructive fishing practices; the fishery is not the subject of controversy and/or dispute; and the fishery has not previously failed an assessment or had a certificate withdrawn.

2.2 Unit of Certification

The MSC Guidelines to Certifiers specify that the unit of certification (UoC) is "*The fishery or fish stock (=biologically distinct unit) combined with the fishing method/gear and practice (=vessel(s) pursuing the fish of that stock)".*

2.2.1 Yellow perch

Table 1 shows the UoCs for the Yellow perch fishery under assessment.

Table 1: Yellow perch: Units of Certification

Species/Stock	Management	Area	Gear
Yellow perch	OMNR	Lake Erie QZ1	Small Mesh Gill net
Yellow perch	OMNR	Lake Erie QZ2	Small Mesh Gill net
Yellow perch	OMNR	Lake Erie QZ3(E)	Small Mesh Gill net
Yellow perch	OMNR	Lake Erie QZ3(W)	Small Mesh Gill net
Yellow perch	ODNR	Lake Erie MU1	Small Mesh Trap Net
Yellow perch	ODNR	Lake Erie MU2	Small Mesh Trap Net
Yellow perch	ODNR	Lake Erie MU3	Small Mesh Trap Net

2.2.2 Walleye

Table 2 shows the UoC for the Walleye fishery under assessment.

Table 2: Lake Erie Walleye: Units of Certification

Species	Management	Area	Gear
Walleye	LEC/OMNR	Lake Erie	Large Mesh Gill net

2.3 Rationale for Unit of Certification

2.3.1 Yellow perch

The Lake Erie gill net fishery for Yellow perch in Canadian waters is a fishery that targets the species with a specific gear. The area is discreet and the fishermen and fishing gear are well defined. The fishery is managed by the Ontario Ministry of Natural Resources (OMNR).

The Lake Erie trap net fishery for Yellow perch in Ohio waters is a fishery that targets the species with a specific gear. The area is discreet and the fishermen and fishing gear are well defined. The fishery is managed by the Ohio Department of Natural Resources (ODNR).

2.3.2 Walleye

The Lake Erie large mesh gill net fishery captures a number of species including Walleye in Canadian waters. The area is discreet and the fishers and fishing gear are well defined. The fishery is managed by the OMNR.

2.4 Eligible Fishers

2.4.1 Yellow perch

The eligible fishers are those licensed to commercially harvest Yellow perch in the Canadian and Ohio Lake Erie fisheries.

2.4.2 Walleye

The eligible fishers are those licensed to commercially harvest Walleye in the Canadian Lake Erie fishery.

2.5 Scope of Assessment in Relation to Enhanced Fisheries

2.5.1 Yellow perch

The fishery under assessment is not enhanced. The species is native to the geographic region of the fishery. There are natural reproductive components of the stock from which the fishery's catch originates that maintain themselves without having to be restocked every year and stocking is not part of a current rebuilding plan for depleted stocks.

2.5.2 Walleye

The fishery under assessment is not enhanced. The species is native to the geographic region of the fishery. There are natural reproductive components of the stock from which the fishery's catch originates that maintain themselves without having to be restocked every year and stocking is not part of a current rebuilding plan for depleted stocks.

2.6 Scope of Assessment in Relation to Introduced Species Based Fisheries (ISBF)

2.6.1 Yellow perch

The fisheries under assessment are not ISBF.

2.6.2 Walleye

The fisheries under assessment are not ISBF.

2.7 Overview of the fishery

2.7.1 Fishing Area

Lake Erie has a total surface area of 25,700 km^2 and is the shallowest of the Great Lakes with an average depth of 19 m (LaMP, 2012). The lake waters warm rapidly in the spring and summer, and can freeze in winter.

The lake is naturally divided into three distinct basins with different average depths: western (7.4 m), central (18.5 m), and eastern (24.4 m) (GLFC, 2003; Lake Erie LaMP, 2011). Lake Erie's shoreline is 1,402 km long. The Lake Erie basin of 58,800 km^2 that includes parts of Indiana, Michigan, Ohio, Pennsylvania, New York and Ontario is the most densely populated of the five Great Lake basins, with 17 metropolitan areas with populations over 50,000 in a total of 11.6 million.

About 80 % of Lake Erie's total inflow comes from the Detroit River, which conveys flows from the upper lakes of Superior, Michigan and Huron into the lake's shallow western basin. About 11 % of the inflow is from rain and snow, and the balance comes from tributaries, the largest of which is the Maumee River (LaMP, 2011). Other major tributaries are the Sandusky, Cuyahoga, Grand, Raisin and Huron rivers.

The west and central sub-basins of Lake Erie are considered productive, with the west basin considered to be the more productive of the two. The eastern basin is an oligotrophic environment.

Since the 1800s a series of cultural stresses including overfishing but also eutrophication, chemical pollution, habitat loss, introduction of non-indigenous species (NIS), invasive species, and climate change have altered the lake structure and function (Zhu *et al.* 2008).

The waters of Lake Erie are approximately equally divided between Canadian and US jurisdictions. Canadian waters are located entirely in Ontario while four American states border Lake Erie and have jurisdiction in the Lake (New York, Pennsylvania, Ohio and Michigan).

2.7.2 Fishery

Walleye and Yellow perch are two species that are commercially fished in Lake Erie; although in US waters the former is reserved for recreational use.

As stated by Roseman *et al* (2008):

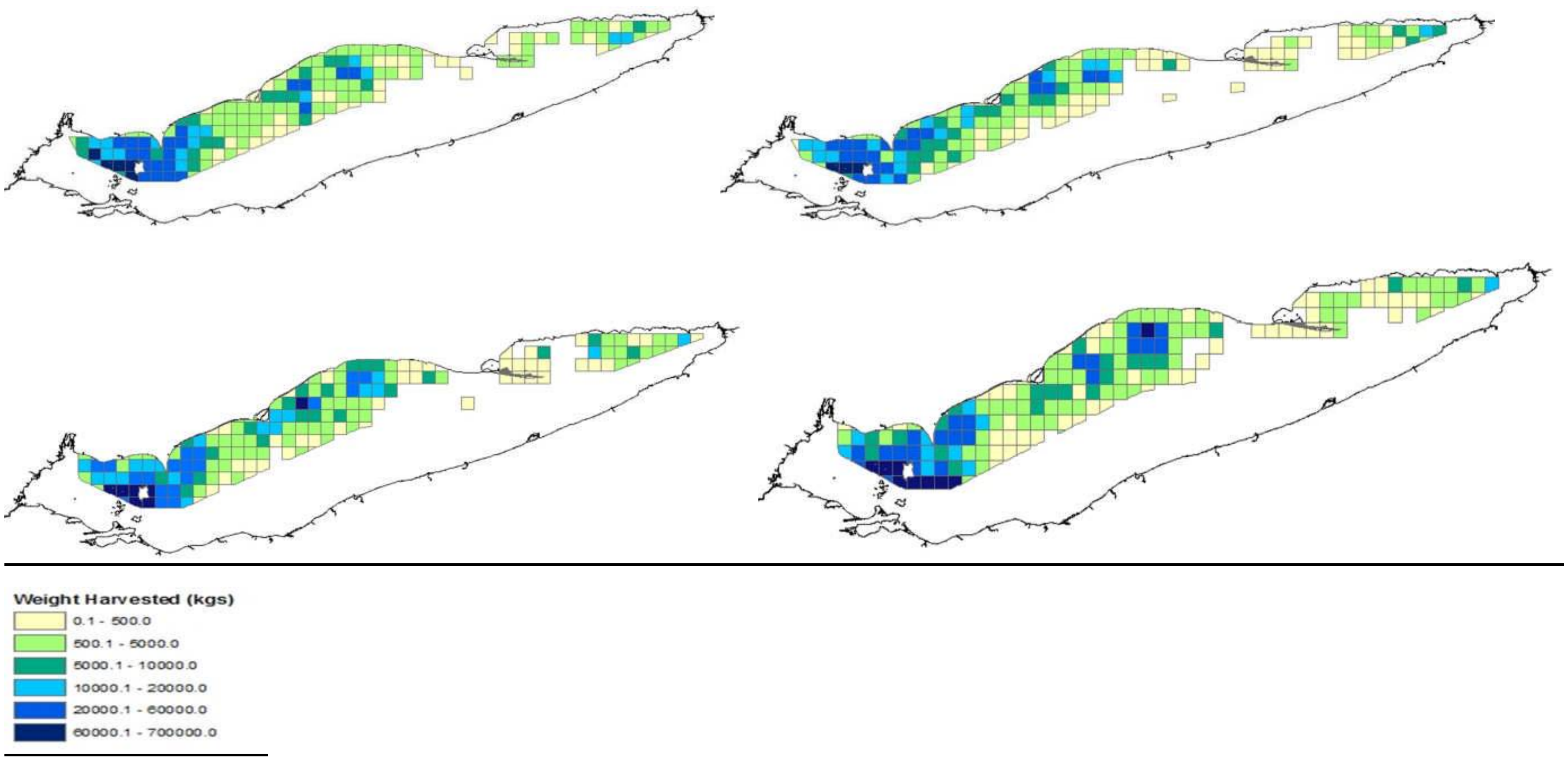
> "*Walleye Sander vitreus and Yellow perch Perca flavescens populations are critical components of Lake Erie's economically and socially valuable commercial and recreational fisheries. These fisheries contribute billions of dollars to the economies of New York, Pennsylvania, Ohio and Michigan and the province of Ontario. Lake Erie percids support commercial and recreational fisheries in both Canada and the United States, with primarily commercial fisheries in Ontario and recreational fisheries dominating in the United States".*

In Lake Erie, there are two Walleye stocks; in the western and the eastern basin. The former is more predominant in the central to western areas of the lake (Fig. 1) which is the fishery subject to assessment.

There are four Yellow perch stocks (MU1, MU2, MU3, MU4).

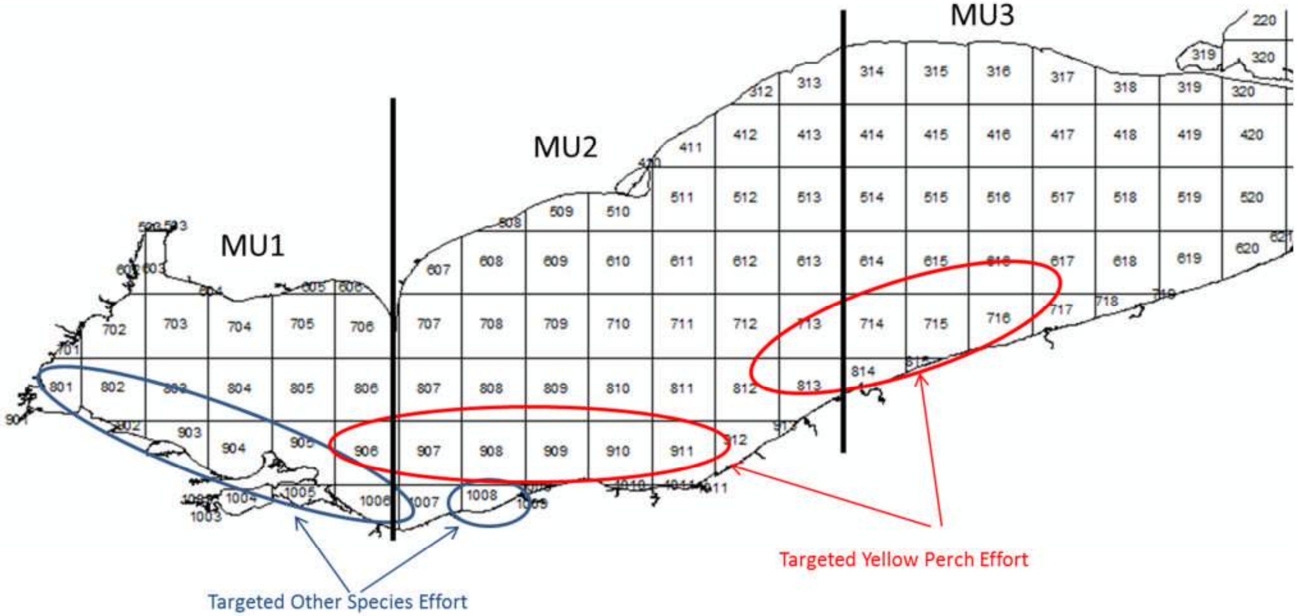
In Ohio waters, yellow perch is fished by "Yellow perch" small mesh trap net (see below) in off-shore waters in depths greater than 7 m (Fig. 2). In contrast, the large mesh trap net is used to fish other species closer inshore (Fig. 3).

Figure 1: Distribution of Walleye Harvest in Ontario waters: clockwise 2009 to 2012



Source: OCFA

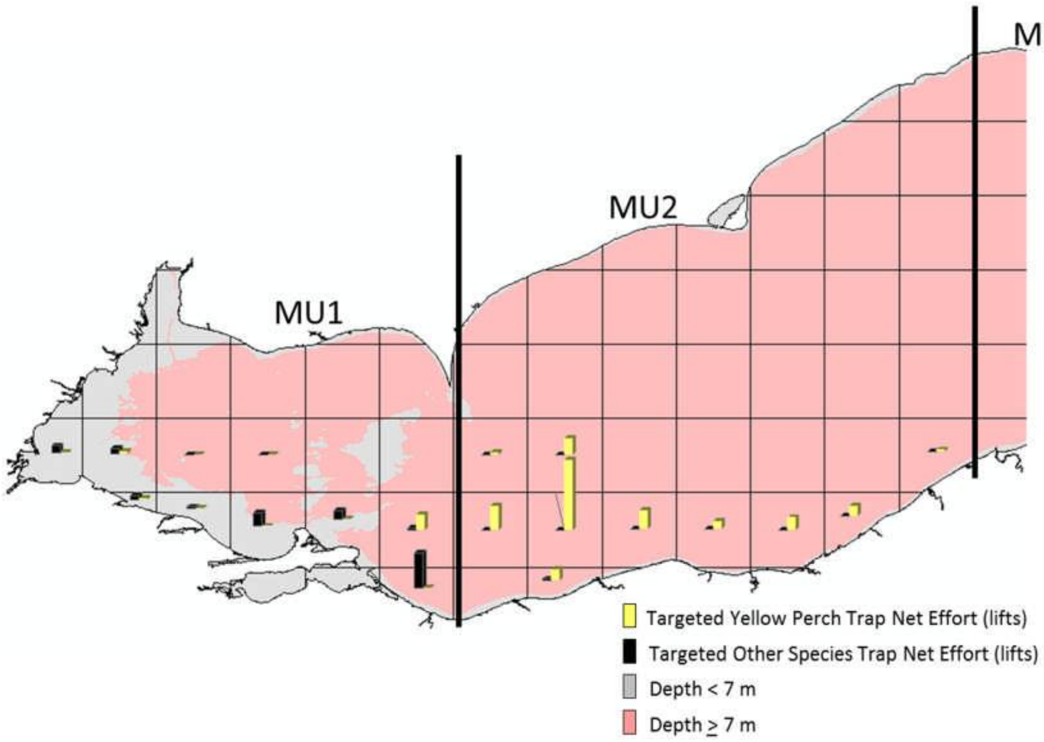
Figure 2: . Primary fishing locations for Yellow Perch (small mesh) and Other Species (large mesh) trap net fisheries in Ohio waters of L ake Erie



Note: targeted effort and harvest are reported at the 10-minute latitude/longitude grid level for the fishery.

Source: ODNR. Information provided to the auditors December 2014.

Figure 3: Targeted small mesh (Yellow Perch) and large mesh (Other Species) trap net effort (number of lifts) 2009-2013 by 10-minute latitude/longitude grid system



Source: ODNR. Information provided to the auditors December 2014.

2.7.3 History of the Fisheries

Management

A summary of the main points of the analysis by Roseman *et al* (2008) is:

- Governance of the Lake Erie Walleye and Yellow perch fisheries is complex, involving multiple jurisdictions, diverse stakeholders, different interests, varying approaches to harvest monitoring and fishery regulation; all combined with highly variable ecological and stock conditions.
- The complexity of the inter-agency fishery management system mirrors the complexity of the environmental and sociological issues on Lake Erie.
- During the early years of the 20th century, disputes over the use and management of Great Lakes waterways led to the formation of the International Waterways Commission in 1905 and, in turn, the 1909 Boundary Waters Treaty and the establishment of the International Joint Commission (IJC).
- IJC consists of six appointed commissioners, three each from the U.S. and Canada. It is tasked with approving new uses and diversions of boundary waters, if these actions affect water levels or flows. Also, it advises the government on matters referred to it for consideration.
- To coordinate the maintenance of Great Lakes fisheries, the Great Lakes Fishery Commission (GLFC) was established in 1955 by the Canadian / U.S. Convention on Great Lakes Fisheries. Movements of Walleye and Yellow perch across jurisdictional boundaries create an ecological basis for inter-jurisdictional fisheries and

habitat management programs. To address these challenges, Great Lakes agency administrators and scientists work together to compile information, solve problems, and set fisheries management goals. In 1980, GLFC adopted a Joint Strategic Plan for the Management of Great Lakes Fisheries (JSP) that outlined the cooperative agreement between state, federal, provincial and tribal agencies to monitor and manage Great Lakes fisheries.

- The GLFC "*plays a pivotal role in the implementation of the JSP through facilitation of the lake committees. Without the GLFC in its facilitation role, it is highly unlikely that inter-jurisdictional fisheries management would occur efficiently, if at all*" (Roseman *et al* 2008).
- GLFC supports and facilitates the five individual lake committees that were identified as the "*major action arms for implementing the strategic plan and developing operational procedures*". The lake committees and the Council of Lake Committees have addressed a wide variety of issues critical to a healthy Great Lakes ecosystem.
- Coordinated management of percids in Lake Erie is accomplished through the Lake Erie Committee (LEC), a bi-national committee of state and provincial agencies, operating under the auspices of the GLFC. The resource agencies of the states of Michigan (MDNR), Ohio (ODW), Pennsylvania (PAFBC), and New York (NYSDEC) and the province of Ontario (OMNR) participate in assessing Walleye and Yellow perch fisheries and populations. The LEC established technical task groups for Walleye (WTG) and Yellow perch (YPTG) to compile harvest data and analyze trends in population abundance. Lake Erie's Standing Technical Committee (STC) annually coordinates an array of assignments to task groups made up of agency biologists.
- The Lake Erie Fish Community Goals and Objectives (FCOs) were developed by LEC to guide the development of strategies and management actions within a framework of sound ecological concepts and basic guiding principles.
- LEC supports the maintenance of mesotrophic conditions across much of Lake Erie, believing that the ecosystem "*will provide optimal environmental conditions for a more balanced, stable, and predictable fish community with maximum potential benefits for fisheries*".
- LEC implemented the Coordinated Percid Management Strategy (CPMS) between March 2001 and March 2005.
- Total allowable catches (TAC) for Lake Erie Walleye and Yellow perch are determined by LEC each spring. As stipulated in the JSP, all decisions are consensus-based and non-binding, but agencies have consistently adhered to TAC decisions. "*For the most part, committee members share a high level of trust between agencies and individuals on the committees, and also have developed a level of respect and trust with their stakeholders*" (Roseman *et al* 2008).
- A surface area sharing formula is used to determine each jurisdiction's share of the TAC, also known as an agency quota, and each agency determines allocation among sport and commercial fisheries. This system has been in place since 1976 for Walleye, and since 1990 for Yellow perch.
- In 1984, OMNR implemented a system of species-specific individual transferable quotas (ITQ) for the Lake Erie commercial fishing industry. These are used to distribute and control the harvest of Walleye, Yellow perch and Lake whitefish. Similarly, ODNR implemented an ITQ system on Yellow perch for commercial trap netters in 1996.
- Prior to 1980, U.S. fisheries on Lake Erie were dominated by commercial fishers, with only minor usage by recreational fishers. Following the lake-wide closure of commercial fisheries in 1970 and the subsequent recovery of percid stocks in the lake, commercial fishing in U.S. waters was vastly reduced and currently sport fisheries dominated fishing activities in the U.S. waters. Furthermore, remaining commercial fishers were restricted to using trap nets after the gillnet ban in the 1980s.
- Regulation of commercial fisheries is also set by the agencies and includes gear restrictions, closed seasons, minimum size limits, quotas, and refuges. Fisheries regulations are enforced by law enforcement personnel in each state and provincial jurisdiction as well as by federal enforcement agencies. At a local level, some townships and municipalities in the Lake Erie basin have undertaken habitat restoration and management initiatives.

Walleye

Gill nets were introduced in the Great Lakes as early as 1834 in Georgian Bay, Lake Huron. New technology introduced between 1870 and 1890 increased fishery efficiency with steam tugs deploying nets and steam-powered net lifters. This allowed fishermen to increase the number of nets set per boat (Berst & Spangler 1973). Gill nets gained popularity in the late 1800s, as they: require less labor and capital investment than pound nets; can be easily moved; and can be fished in deeper waters.

A summary of the main points of the analysis by Roseman *et al* (2008) is:

- Walleye have supported important sport and commercial fisheries in Lake Erie for over 150 years.
- Commercial landings of Walleye varied in the early 1900s and peaked in 1956–1957 at more than 6,000 mt.
- Catches declined dramatically in the late 1950s and early 1960s, when the population diminished due to exploitation, pollution, eutrophication and degraded spawning habitat.
- Following the 1972 adoption of the Great Lakes Water Quality Agreement (GLWQA), basin-wide management strategies focused on reducing organic inputs to the lake in efforts to improve fish habitat and rehabilitate populations.
- The commercial fishery for Walleye was closed in 1970 due to mercury contamination and was opened only to limited harvest after 1972 when mercury levels subsided. The fishery largely remained closed for another three years to allow the stocks to rebuild.
- The western basin Walleye commercial fishery reopened in 1976 with a TAC shared by Ohio, Ontario and Michigan. Each share determined by the proportional area of Walleye habitat present in jurisdictional waters. Ohio and Michigan allocated their shares to the recreational fishery while Ontario allocated the majority of its share to the commercial fishery.
- The harvest of Walleye from the west and central basins increased steadily from 1976 to 1988, ranging between 0.9 and 10.0 million Walleye. During this period, the harvest was primarily by recreational fishers. Following the peak population abundance observed in 1988, the harvest of Walleye fluctuated between 3.6 and 8.2 million fish (1989 to 1999) with the Ontario commercial fishery taking the majority of fish in the mid- to late- 1990s.
- The CPMS, developed in response to increasing concern about declining abundance of Walleye from the late 1980s, had the objective of rebuilding stocks. It established a minimum lake wide abundance target of 19.1 million Walleye and froze lake-wide Walleye harvests at 3.45 million fish from 2001 to 2003. In 2003, WTG reported relatively weak Walleye year classes in 2000 and 2002, suggesting that the number of fishable (2 and older) Walleye would drop below the 19.1 million fish target in 2004.
- Subsequently, WTG recommended a 2003 harvest less than the 3.45 million fish CPMS threshold. As LEC decided that it could not implement this recommendation without severe economic impacts on fisheries, it announced the intention to defer a TAC reduction of about 40–60% below the CPMS threshold until 2004 to give fishers an additional year to prepare for the change.
- The implementation of this decision was contentious with stakeholder groups on both sides of the border lobbying agency personnel to meet their individual objectives. In fall 2003, LEC declared an impasse and sought GLFC assistance to enact the formal dispute resolution process to help reach a consensus on the 2004 TAC. This was only the second time that the JSP dispute resolution process had been invoked (the first time was in 1991, but LEC was able to reach consensus before completing the formal process).
- In early 2004, GLFC assembled a Blue Ribbon Panel of fishery experts to assist LEC and this led to a consensus on the 2004 Walleye TAC. In essence, the impasse resulted from the challenge of decision-making in the face of low Walleye abundance and associated impacts on fisheries.
- By late 2004, a record abundant year-class of Walleye was expected to enter the fishery and jurisdictions

disagreed about whether to maintain low fishing rates to conserve the stocks or to raise fishing rates to take advantage of increased abundance. LEC reached consensus on the 2005 Walleye TAC.

- "*Though rare over the LEC's lengthy history of successful TAC deliberations, clearly there have been episodes that have tested the strength of the JSP as an inter-jurisdictional management tool. With the professional assistance of the GLFC, LEC jurisdictions have re-affirmed their commitments to the JSP on each occasion. It is this commitment to a common goal of having healthy fish community to support a broad distribution of benefits that makes the JSP work for all jurisdictions*" (Roseman *et al* 2008).

Yellow perch

A summary of the main points of the analysis by Roseman *et al* (2008) is:

- Yellow perch have been a historically important commercial and sport fish species in Lake Erie.
- Records dating back to the 1880s show that there were commercial Yellow perch harvests in both U.S. and Canadian waters of the lake. Since the early 1900s, the Yellow perch fishery has enjoyed several peak harvest periods due to strong year classes.
- Wide fluctuations in harvest were seen due to highly variable recruitment patterns, changing lake productivity conditions and high levels of exploitation.
- Lake Erie Yellow perch have shown resilience in the light of several invasions of exotic species, including the proliferation of White perch, and the expansion of dresseinid mussels, spiny water flea (*Bythotrephes longimanus*) and the round goby.
- Yellow perch fisheries are managed under the guidance of the GLFC LEC. The YPTG was formed by LEC in 1980 to determine the status of Yellow perch populations and to assist in quota determination.
- YPTG has changed the Yellow perch exploitation strategy several times since the quota system was implemented in 1984.
- At the time of quota implementation, the commercial fishery agreed to achieve a target fishing effort of 20% of the 1984 fishing effort by 1990.
- In 1985–86, YPTG moved the exploitation strategy from a targeted fishing effort to an approximation of maximum sustainable yield (MSY).
- In the early to mid-1990s, Yellow perch biomass fell to low levels throughout Lake Erie. In 1991, YPTG changed the method used to determing RAH levels moving from MSY to a yield per recruit (Y/R) approach, e.g., F0.1 or Fopt.
- As Yellow perch stocks recovered in the mid- to late-1990s, YPTG changed the methodology used to determine Recommended Allowable Harvest (RAHs) to a more conservative approach by altering details of the F_{age} calculation regarding age and gear-specific selectivity to parallel the technique employed by WTG.
- YPTG also introduced a new harvest strategy that incorporated biological reference points, population simulations and assessment of risk. Working within the harvest recommendations set by LEC, state and provincial agencies use fishery regulations to achieve management objectives.
- A special management plan implemented from 2000 to 2005 instituted reductions in harvest rates in an effort to rebuild stocks (OMNR 2006).

2.7.4 Fishing Vessels, Licenses & Quotas

Ontario commercial fisheries are mixed with specific gears targeting one or two species with a by-catch of other species.

The Ontario commercial gill net fishery is managed through a quota system and restricted fishing season / location. 188 commercial fishing licenses share the Ontario quota and each license is constrained to specific management units (QZ). Some vessels hold more than one license.

65 Ontario gillnet vessels filed at least one Daily Catch Record (DCR) in 2013. A list of these vessels and the number of DCR filings was provided by the client. Detailed information on the characteristics (length, width, depth, tonnage, etc) of each of these vessels is available on the Transport Canada website (http://wwwapps.tc.gc.ca/saf-sec-sur/4/vrqs-srib).

In Ohio, entry is limited to 18 trap net licenses that are held by 12 individuals. The sharing of some licenses between vessels, allows 22 vessels (2014) to be involved in the fishery. To differentiate the yellow perch small mesh trap net fishery from the other species large mesh trap net fishery, it is important to note the following points (ODNR. Information provided to the auditors December 2014.).

- Each individual license has a quantity of Yellow perch quota.
- All licenses do not target Yellow perch, nor do all licenses have Yellow perch quota in every MU. The operators with licenses that do not target Yellow perch transfer their allocation of Yellow perch ITQ to other licensees in the respective MU.
- In 2014, 10 licenses on 10 vessels only targeted Yellow perch.
- In 2014, 6 licenses on 8 vessels targeted: (i) Yellow perch offshore in small mesh (Yellow Perch) nets, and (ii) other species nearshore using large mesh trap nets, throughout the fishing season. These licensees lift offshore small mesh nets and nearshore large mesh nets during the same day, however, catches are separated by grid for reporting purposes as required by the Law. Accordingly reports of offshore grid catches will not be combined with nearshore grid catches).
- In 2014, 2 licenses on 3 vessels only targeted other species in nearshore locations using large mesh nets.
- In 2014, 4 licenses on 4 vessels only fished nets in MU1.
- In 2014, 5 licenses on 4 vessels fished nets in both MU1 and MU2.
- In 2014, 3 licenses on 4 vessels fished nets only in MU2.
- In 2014, 5 licenses on 6 vessels fished nets in MU2 and MU3.

The trap net boat is approximately 30 feet long, has a small cabin at the bow and low sides to facilitate the handling of nets. The wide and flat deck accommodates fish boxes. Steel boats replaced wooden ones about 60 years ago.

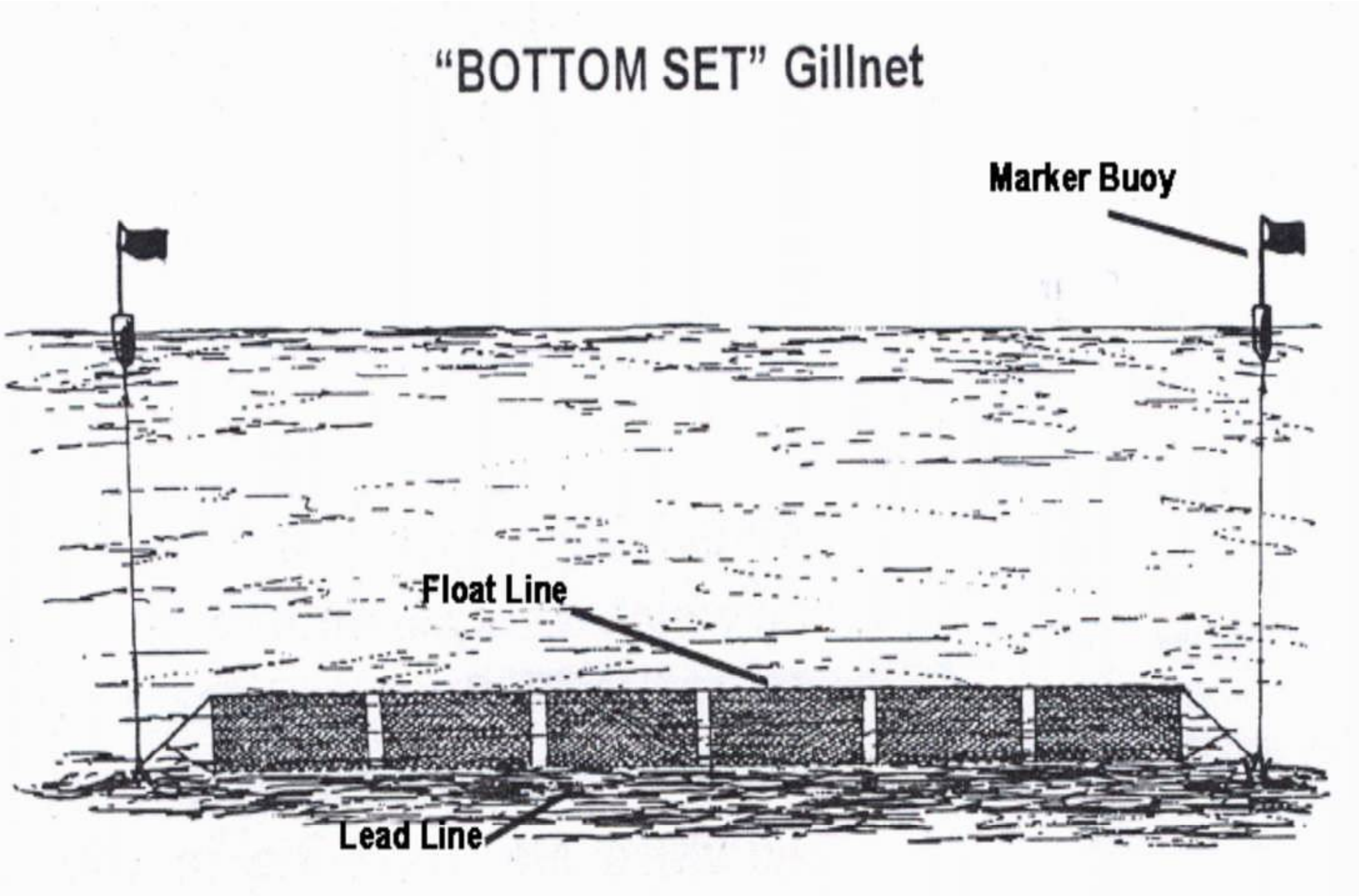
2.7.5 Gear Description

Yellow perch: Gill Net

The Lake Erie commercial gill net fishery targeting Yellow perch uses bottom set gill nets (Fig. 4). Gill nets are mostly of monofilament and are deployed by tugs. They consist of a vertical wall of netting or twine strung between a floated line and a sinker (leaded) line, and are normally set in a straight line and anchored at both ends.

The catch attributed to the Yellow perch fishery is defined by target intentionality as declared by the captain in the DCR. The minimum mesh size for gill nets is 57 mm. The mesh size determines the size of fish targeted, and can be further tuned by seasonal and spatial considerations. When targeting Yellow perch fishers use mostly small mesh 57-89 mm, with approximately 90% of total effort using 57 mm - 67 mm (*Pers. Comm. Kevin Reid*). Large mesh gill nets (> 89 mm) set on the bottom are occasionally used to target Yellow perch. Gill net efficiency is determined by the material used. Selectivity is low when target and non-target species are of similar size.

Figure 4: Bottom set Gillnet



Source: OCFA

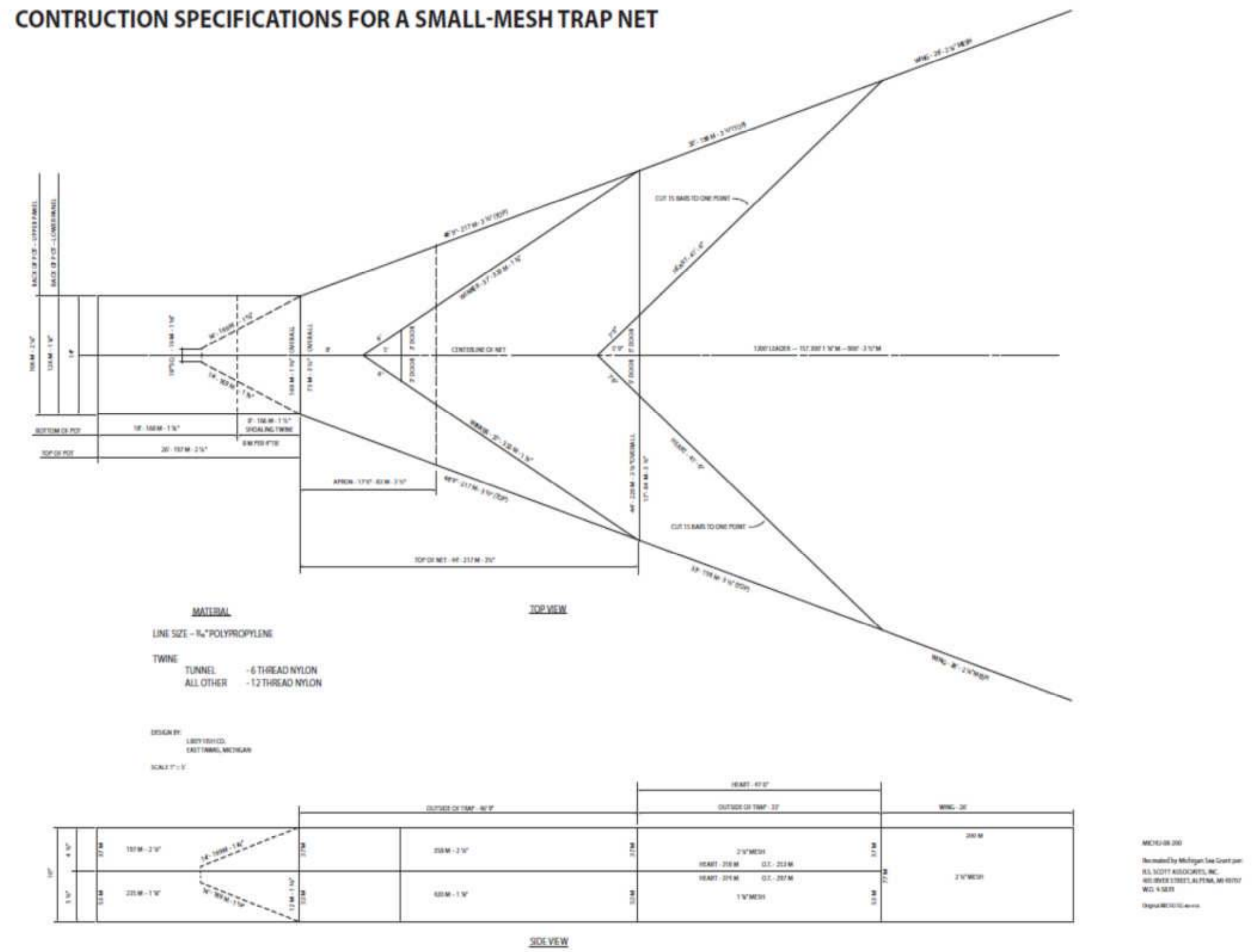
Concerns about the mortality of non-target species in gill net fisheries have emerged as an important issue for fishery management as fish caught in gill nets have high post release mortality (PRM). Gill nets were banned in US waters of the Great Lakes in 1977.

Yellow perch: Small Mesh Trap Net

Trap net boats are any boat used to set, lift, pull, or transport trap nets, or fish using trap nets. Trap nets are custom-made and their design depends on a number of factors. The backs of trap nets used in the Ohio commercial trap net fishery must not measure less than ¼" or more than 4" stretched mesh. The vessels must be fitted with a vessel monitoring system (VMS).

The trap net is designed to sit in the water to catch fish (Fig. 5). When fish encounter the long "lead" they turn into a series of successively smaller boxes that trap them live. The specific characteristics of the net vary according to season, target and personal preferences. Fishing may be close to shore (large mesh gear targeting other species) or further out (small mesh gear targeting Yellow perch). Traps are marked by buoys topped by flags with the fisher's name.

Figure 5: Small mesh Trap nets



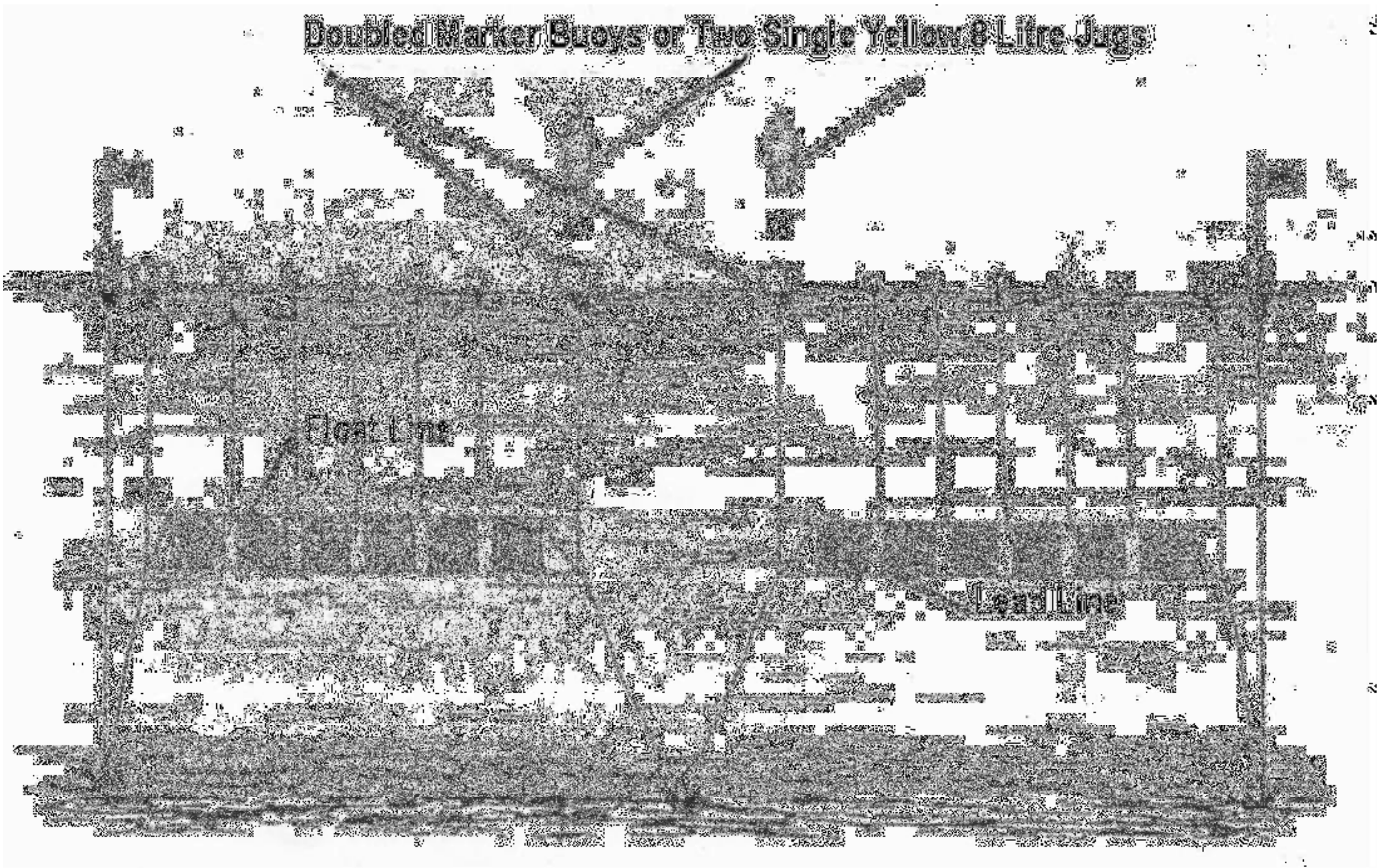
Source: Michigan Sea Grant

The yellow perch directed fishery uses small mesh (Yellow Perch) trap nets, with usually 3” (about 8 cm) mesh leads, leads ofabout 300’ (90 m) in length, and with no “hearts” (Fig.5). The nets are set in waters deeper than 7 m (*Pers. Comm*. Jeff Tyson). Trap nets directed for other species are set near to shore in depths < 7 m. These nets generally have larger mesh leads of 6” (15 cm) or moreand longer leads of about 600’ (180 m), andhave “hearts” to minimize the escape of targeted species such as White Bass, White Perch, and Whitefish.

Trap nets are usually set every two weeks. A typical trap-netting trip begins at 7:00 a.m., can last until 3:00 or 4:00 p.m., and can involve the “pulling” of 12 to 20 nets. Fishers haul the net up next to the side of the boat to unload the fish and the retained catch is placed in ice in a container. Vessels may “pull” small mesh and large mesh trap nets on the same trip. Although these are recorded separately the harvest is not stored separately. This is an issue for traceability if the small mesh catch is to be sold as MSC certified.

Walleye: Large Mesh Gill Net

Figure 6: Canned Gillnet



Source: OCFA

The Lake Erie commercial large mesh gill net fishery uses mostly monofilament "canned" gill nets (i.e. a gill net that is suspended in the water column with large floatation devices that are visible on the surface of the water attached) (Fig. 6). They are set by fishing tugs. Gill nets consist of a vertical panel of netting or twine strung between a floated line and a sinker (leaded) line, and are normally set in a straight line and anchored at both ends. The Walleye fishery uses large mesh gill nets a minimum size of 89 mm stretched mesh (Brenden *et al* 2013).

Walleye catches from smaller meshed gillnets and other gears (e.g. trap/hoop nets, trawl nets) is counted against quota. The efficiency of gill nets is influenced by both technical and biological factors including mesh size, net length, soak time, set and lift time, fish abundance, and fish morphology and behaviors, as well as gear saturation (Hansen *et al*. 1998).

2.7.6 Quotas & Catch

Overview

Since 1997, commercial fishery license holders in Lake Erie complete a DCR that records landed and, since 2011 discarded, species names and weights, gear types and efforts, targeted species, fishing time and locations, landing time and port names, and other fishing status. After each trip, a DCR is submitted to OMNR or ODNR. The vessel captain estimates the weight of the species caught, with the figure updated after dockside weighout. Yellow perch and Walleye are landed whole. Dockside monitoring is not 100% but landings are subject to random checks. There is no observer coverage to verify the information in the DCR.

The discard of quota species including Walleye and Yellow perch is not allowed, so in principle, the DCR should record the total catch. It is prohibited to harvest Walleye commercially in Ohio.

The primary Erie recreational fisheries are for Walleye and Yellow perch.

Yellow perch

Quota

For the purposes of assessment, data collection, population modeling, and quota determination Lake Erie is divided into 4 MUs (Fig. 7). Ohio fisheries are denominated west, central and east, with fishing in MU1 (shared with Michigan), MU2 and MU3 (shared with Pennsylvania). MU4 is shared between Pennsylvania and New York.

While each individual license in Ohio has some Yellow Perch quota in specific MUs, some of the 18 licenses do not target the species, while not all licenses have Yellow Perch quota in every MU. For those licenses that do not target Yellow Perch, the Yellow perch ITQ is transferred to other licensees in the MU that they are allocated.

In Ontario, management is based on QZ. QZ1 is the Ontario portion of MU1; QZ2 is MU2; QZ3(W) is MU3 and QZ3(E) is MU4 (Fig. 8). Canada and the U.S. work through the YPTG to analyze data collected through annual surveys to determine recommended TACs for Yellow perch. Following the advice of the YPTG on the RAH and stakeholder consultations, LEC announces the TAC for each MU.

LEC recommended a 2013 lake wide TAC of 12.2 million pounds of Yellow perch, a 10% decrease from 2012. It was considered that harvestable stocks were lower than the previous year; the TAC for 2013 reflected the importance of relative stability of harvest. The five jurisdictions divided the TAC based on defined formulas for each MU: Ontario received 6.0 million lbs, Ohio 4.9 million lbs, Michigan 0.2 million lbs, New York 0.3 million lbs and Pennsylvania 0.9 million lbs. The 2014 quota was just over 11 million lbs.

Catch

The total catch of Yellow perch in 2013 was 9.6 million lbs. (Table 3).

Figure 7: Yellow perch Management Units

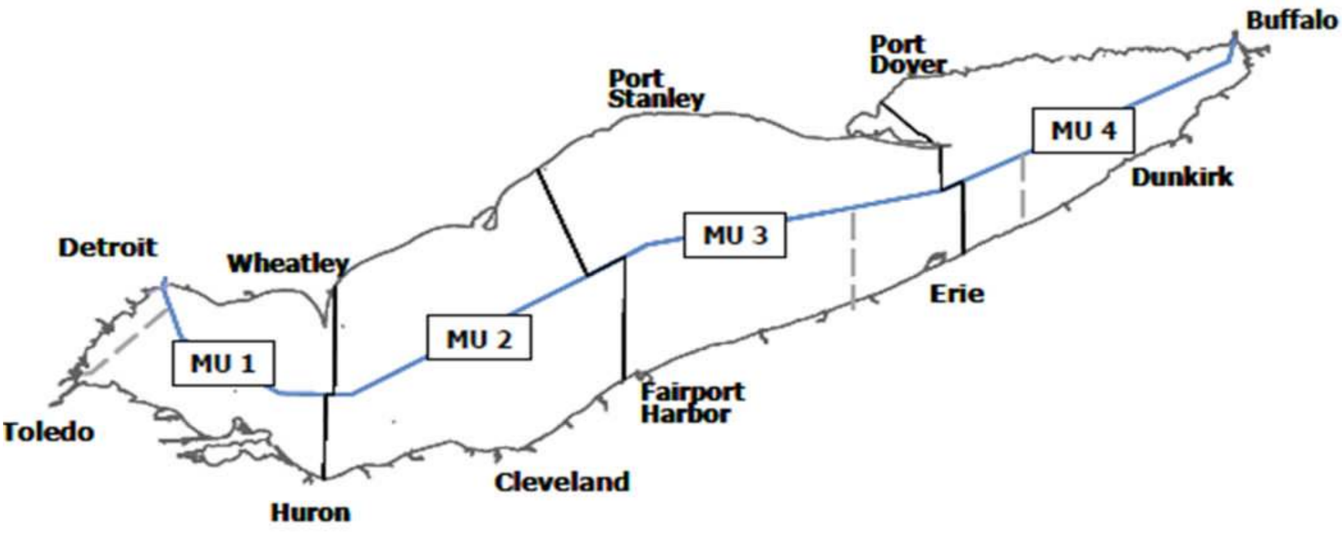


Figure 1. Yellow Perch Management Units (MUs) of Lake Erie.

Figure 8: Ontario QZs

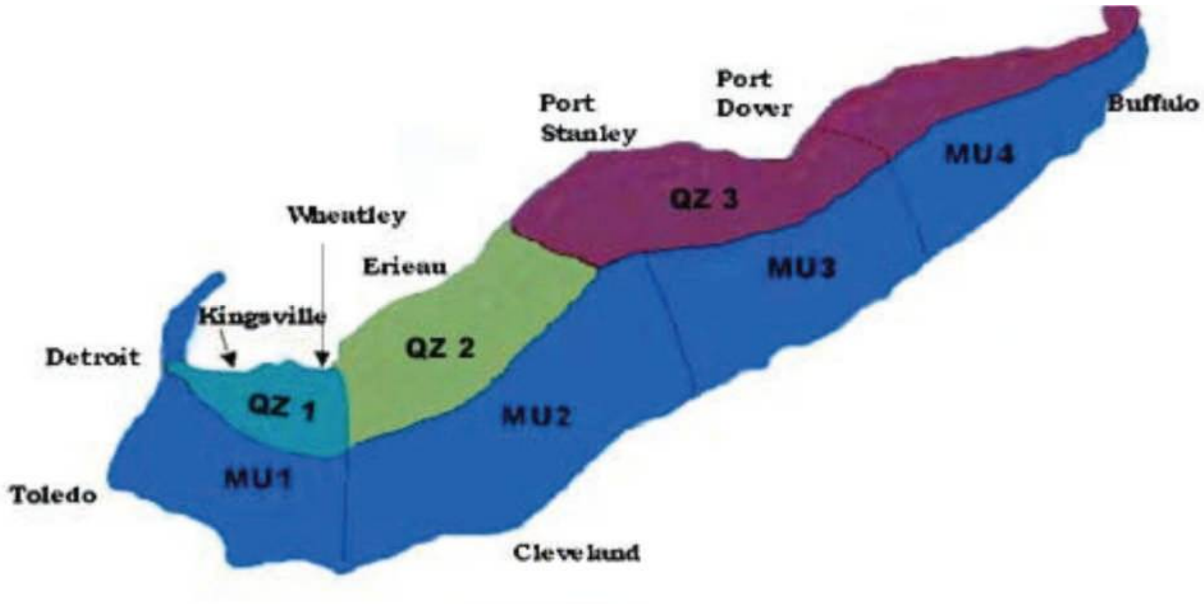


Table 3: Yellow perch Harvest by Jurisdiction & Gear Type. 2013

Table 1. Lake Erie Yellow Perch harvest by jurisdiction and gear type for 2013.

MU	Harvest by jurisdiction (lbs)								Total (lbs)
	Michigan	Ontario	Ohio		Pennsylvania		New York		
	sport	all commercial*	sport	commercial trap net	sport	commercial trap net	sport	commercial trap net	
1	76,994	648,884	750,052	0					1,475,930
2		1,803,684	488,021	1,230,249					3,521,954
3		2,983,539	454,847	300,346	154,403	790			3,893,925
4		496,666			74,277	0	104,055	15,814	690,812
Total	76,994	5,932,773	1,692,920	1,530,595	228,680	790	104,055	15,814	9,582,621

*Small mesh gill net, large mesh gill net, trap net (MU1), and incidental trawl (MUs 2-4) harvest combined.

Commercial trap net corresponds to small mesh trap net targeted effort

Source: LEC 2014 b.

There was limited Yellow perch commercial harvest in NY and PA where sport fishing was more important although the total harvest was not significant. The Michigan sport fishery was small. The Ontario commercial fishery, with 5.9 million lbs. was by far the most important; the Ontario recreational fishery is negligible (*Pers. Comm. B. Locke*). In Ohio, the sport fishery (1.7 million lbs) was slightly more important than the commercial fishery (1.5 million lbs cf. 1.7 million lbs commercial quota).

Yellow perch is the main bycatch species in the gill net fisheries targeting Walleye and White perch, and based on estimates by Li *et al*. (2011), the highest percentage of non-landed Yellow perch bycatch between 1994 and 2007 occurred when targeting White perch and White White bass. It was estimated that 0.79 % of the total Yellow perch catch was released between 1994 and 2007; about half was from the fishery targeting White perch and half from that targeting White bass.

There is a retained catch of Yellow perch in the large mesh trap net fishery (Table 4). For the 5-years ending 2013, in MU1 the total amount of Yellow perch retained was 12,885 lbs while respective figures for MU2 and MU3 were 1,690 lbs and 0 (there is no large mesh trap net fishery in MU3). This catch would not be certified accoding to the MSC standard.

There is a small hoop and seine fishery for Yellow perch in Quota Area 5 (quota=20,000 lbs; catch=7,000 lbs.).

Walleye

Quota

As noted above, for stock assessment and management purposes, Lake Erie is divided into 4 MUs that span the international border and include Ontario and US waters (Fig. 9). In Ontario, the lake is Fishery Management Zone (FMZ) 19. For the purposes of Walleye management, QZ3 includes the east basin rehabilitation zone (QZ3(E) that generally corresponds to MU4) where quotas for Walleye are managed separately from the remainder of QZ3 and are not covered by this certification.

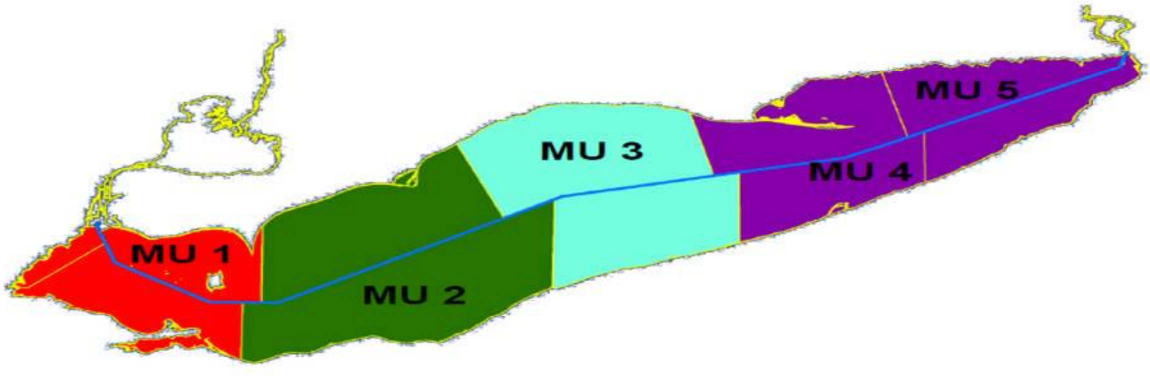
Using an interim harvest policy developed through the Lake Erie Percid Management Advisory Group (LEPMAG process), LEC recommended a 2013 Walleye TAC of 3.356 million fish, compared to 3.487 million in 2012. Due to a series of poor year classes, the population in 2014 was expected to decline, potentially leading to lower TACs in future years as the fish from the strong year classes and the total size of the Walleye stock decreases. The decreased TAC recommendation for 2013 reflected the goal to manage lakewide fish stocks sustainably.

Table 4. Targeted large mesh (Other Species) harvest by Management Unit, 2009-2013.

		Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Main Species	Retained By-catch	Retained By-catch	Retained By-catch		
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	Lifts
1	2009	81,881	3,998	0	36,897	183,494	282,167	565	1,094	143,812	26,926	586,801	535,102	287,273	0	2,170,010	3,360
		3.77%	0.18%	0.00%	1.70%	8.46%	13.00%	0.03%	0.05%	6.63%	1.24%	27.04%	24.66%	13.24%	0.00%	100.00%	
	2010	39,130	2,450	0	18,365	133,437	213,923	688	283	111,197	12,947	316,416	378,576	81,794	8,809	1,318,015	2,678
		2.97%	0.19%	0.00%	1.39%	10.12%	16.23%	0.05%	0.02%	8.44%	0.98%	24.01%	28.72%	6.21%	0.67%	100.00%	
	2011	50,351	3,946	0	31,378	189,132	204,132	10	478	108,958	26,976	333,975	386,399	78,006	4,076	1,417,817	2,687
		3.55%	0.28%	0.00%	2.21%	13.34%	14.40%	0.00%	0.03%	7.68%	1.90%	23.56%	27.25%	5.50%	0.29%	100.00%	
	2012	73,109	955	5	21,348	163,924	273,033	955	175	88,472	16,101	457,036	608,065	118,423	0	1,821,601	2,862
		4.01%	0.05%	0.00%	1.17%	9.00%	14.99%	0.05%	0.01%	4.86%	0.88%	25.09%	33.38%	6.50%	0.00%	100.00%	
	2013	51,033	574	0	25,688	174,205	250,297	659	174	85,763	8,569	473,013	494,091	62,502	0	1,626,568	2,678
		3.14%	0.04%	0.00%	1.58%	10.71%	15.39%	0.04%	0.01%	5.27%	0.53%	29.08%	30.38%	3.84%	0.00%	100.00%	
	Total	295,504	11,923	5	133,676	844,192	1,223,552	2,877	2,204	538,202	91,519	2,167,241	2,402,233	627,998	12,885	8,354,011	
		3.54%	0.14%	0.00%	1.60%	10.11%	14.65%	0.03%	0.03%	6.44%	1.10%	25.94%	28.76%	7.52%	0.15%	100.00%	
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	Lifts
2	2009	25	0	0	133	5,699	9,178	0	0	114	298	3,818	54,983	115	106	74,469	70
		0.03%	0.00%	0.00%	0.18%	7.65%	12.32%	0.00%	0.00%	0.15%	0.40%	5.13%	73.83%	0.15%	0.14%	100.00%	
	2010	0	0	0	11	4,986	905	0	0	0	0	2,636	24,609	106	0	33,253	59
		0.00%	0.00%	0.00%	0.03%	14.99%	2.72%	0.00%	0.00%	0.00%	0.00%	7.93%	74.01%	0.32%	0.00%	100.00%	
	2011	0	0	0	0	6,600	5,091	0	0	561	907	2,656	63,789	66	1,584	81,254	72
		0.00%	0.00%	0.00%	0.00%	8.12%	6.27%	0.00%	0.00%	0.69%	1.12%	3.27%	78.51%	0.08%	1.95%	100.00%	
	2012	16	0	0	354	7,967	8,360	0	0	1,017	506	5,772	55,084	101	0	79,177	99
		0.02%	0.00%	0.00%	0.45%	10.06%	10.56%	0.00%	0.00%	1.28%	0.64%	7.29%	69.57%	0.13%	0.00%	100.00%	
	2013	9	0	0	10	2,142	1,035	0	0	158	0	11,085	40,179	0	0	54,618	47
		0.02%	0.00%	0.00%	0.02%	3.92%	1.89%	0.00%	0.00%	0.29%	0.00%	20.30%	73.56%	0.00%	0.00%	100.00%	
	Total	50	0	0	508	27,394	24,569	0	0	1,850	1,711	25,967	238,644	388	1,690	322,771	
		0.02%	0.00%	0.00%	0.16%	8.49%	7.61%	0.00%	0.00%	0.57%	0.53%	8.05%	73.94%	0.12%	0.52%	100.00%	
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	Lifts
3	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	

Source: ODNR. Information provided to the auditors December 2014.

Figure 9: Lake Erie Management Units for Inter-agency Management of Walleye and other species



Source: WTG, 2013

The Walleye quota is allocated to Ohio, Michigan and Ontario by an area-based sharing formula of Walleye habitat within each jurisdiction in the western and central basins of the lake. The majority of harvest comes from the west end of the Lake Erie and the Walleye fisheries of eastern Lake Erie remain outside the quota management area. Harvest limits in that area are established separately by Ontario, Pennsylvania and New York. The 2014 quota was about 4 million fish.

Catch

Walleye is an important sport fishery and commercial fishing for the species is not permitted in U.S. waters. The highest total catches were in the second half of the 1980s. In 2013, the TAC in quota area waters of the west and central basins was 3.356 million fish (a 4% decrease from 2012) with a harvest of 2.412 million fish (72% of the quota) (Table 5). In the non-TAC area of the eastern basin the catch was 125,476 fish. The sport fishery (1.280 million fish) and commercial fishery (1.260 million fish) harvest levels reported for 2013 were both below the long-term (1975-2012) means (2.374 and 2.063 million fish, respectively) (LEC 2014c). Ontario fished 88% of its quota, which in turn was a 43.06% share of the total quota. In Ohio, about 85% of the participants are individual anglers with the rest being charter boat operators. They fished about three-fifths of their allocated quota in 2013. Limited quantities were taken in the waters of other jurisdictions.

Table 5: Summary of Walleye Catch by Jurisdiction 2013

Table 1. Summary of walleye harvest by jurisdiction in Lake Erie, 2013.

in number	TAC Area (MU-1, MU-2, MU-3)				Non-TAC Area (MU-4 & MU-5)				All Areas
of fish	Michigan	Ohio	Ontario	Total	NY	Penn.	Ontario	Total	Total
TAC	195,655	1,715,252	1,445,094	3,356,000	-	-	-	-	3,356,000
TAC % Share	5.83%	51.11%	43.06%	100.00%	-	-	-	-	100.00%
Harvest	54,167	1,083,395	1,274,945	2,412,507	34,553	60,332	30,591	125,476	2,537,983

Source: LEC 2014 c.

In Ontario, an annual allocation for Walleye of 40,000 lbs is made and assumed to be taken as commercial catch samples for catch at age data which is then used in the assessment model. Reporting requirements are not mandatory for either charter or non-charter recreational licenses.

2.7.7 Fishing Season

The Ohio commercial fishery is open from March 1 to December 10 for all fishing devices but for Yellow perch which should not be taken with any commercial fishing gear except from May 1 - December 10. The commercial catch of walleye is unlawful in Ohio. The gill net fishery in Ontario is open all year.

2.7.8 Management

Authority

Four states (Michigan, Ohio, Pennsylvania and New York) and one Province (Ontario) are involved in the jurisdiction of Lake Erie, within the context of GLFC and LEC. As described below, a structured approach to fishery resource management and administration has evolved that involves State and Provincial authorities working together with stakeholders.

Regulations

Yellow perch

A number of regulations are in place for the Ontario gillnet and Ohio trap net fisheries (Table 6). The former is limited entry, and ITQs has been in place since 1983. Licenses are issued by OMNR and are valid from January 1 to December 31. ITQs cannot be transferred between QZs. The latter has not adopted ITQs but quota transfers out of a defined area are not allowed. In MU1 in 2009, 2012 and 2013, the whole quota was allocated to the sport fishery.

In addition to quotas, there are gear restrictions in both fisheries. There are permanent area closures in Lake Erie, with locations and timing outlined in the conditions of license. Gillnetters operating between January 1 and March 15 are required to have a functioning VMS to monitor gear retrieval.

Walleye

A number of regulations are used in the Ontario gillnet and US sport fisheries (Table 7).

Table 6: Yellow perch: Regulations in the Ontario gillnet and Ohio trap net fisheries

Category	Type	Ontario Gillnet	Ohio Trapnet
Catch	Quota	Quota on yellow perch by MU; quota overage must be covered through transfer from same quota area	Quota on yellow perch by MU; quota overage must be covered through transfer from same quota area
	Bycatch	All dead ETP species must be brought in and all alive ETP species released	Mandatory release of undersized fish
	Handling	Only lake whitefish can be dressed; all others must be	
	Size		Minimum size limits by species
Effort	Time/Season	Season restrictions in licence condition	1 May - 10 Dec season
	Area	Area restrictions in licence condition; no gillnet within 1 km of trap	Area restrictions in licence condition; can't set traps within 1/4 mi of shore;
	Gear Operation	Can't set gillnet more than 8 days	Gillnetting not permitted
	Gear Configuration	Gillnet mesh < 57 mm (2.25 in) not permitted	Trapnet back 6.35 mm(0.25 in) to 102 mm (4.0 in) mesh

Note: ETP species are those defined by Provincial law; not ETP species as defined by MSC.

Source: http://wildlife.ohiodnr.gov/fishing/fishing-regulations/site-specific-regulations

Table 7: Walleye: Regulations for Ontario gillnet and Ohio sport fisheries

Category	Type	Ontario Gillnet	Ohio Sport
Catch	Quota	Quota on walleye; quota overage must be covered through transfer from same quota area	Daily bag limits; scaled dependent upon quota allocation
	Bycatch	All dead ETP species must be brought in and all alive ETP species released	Mandatory release of undersized fish
	Handling	Only lake whitefish can be dressed; all others must be landed round	
	Size		Minimum size of 38.1 cm (15 in)
Effort	Time/Season	Season restrictions in licence condition	Daily bag limits by season (May - Feb & March - April)
	Area	Area restrictions in licence condition; no gillnet within 1 km of trap	
	Gear Operation	Can't set gillnet more than 8 days	
	Gear Configuration	Gillnet mesh < 89 mm (3.5 in) not permitted	Treble hooks prohibited in specific bays & rivers

Note: ETP species are those defined by Provincial law; not ETP species as defined by MSC.

Source: http://wildlife.ohiodnr.gov/fishing/fishing-regulations/site-specific-regulations

The Ontario gillnet fishery is a limited entry fishery; ITQs were introduced in 1983. As the DCR records Walleye weight and the TAC is in numbers, the DCR weight is converted to numbers with a conversion factor set annually by OMNR based on the projected age structure and the age specific selectivity of the gill nets. It ranges from just over 2 lbs/fish (when a large year class is recruiting) to just over 3 lbs/fish. Licenses issued by OMNR are valid from January 1 to December 31. Individual quotas are specific to a quota zone and cannot be transferred between them. The U.S. sport fishery uses daily bag limits (in numbers) by season to manage harvest within its quota allocation.

In addition, there are gear restrictions in both fisheries. The mesh size of the large gill net cannot be less than 89 mm. Area closures and VMS requirements are as above. Sport fishermen must release Walleye under 38.1 cm. Double hook gear is not allowed and treble hooking is only permitted in specific bays and rivers.

3 PRINCIPLE ONE: TARGET SPECIES BACKGROUND

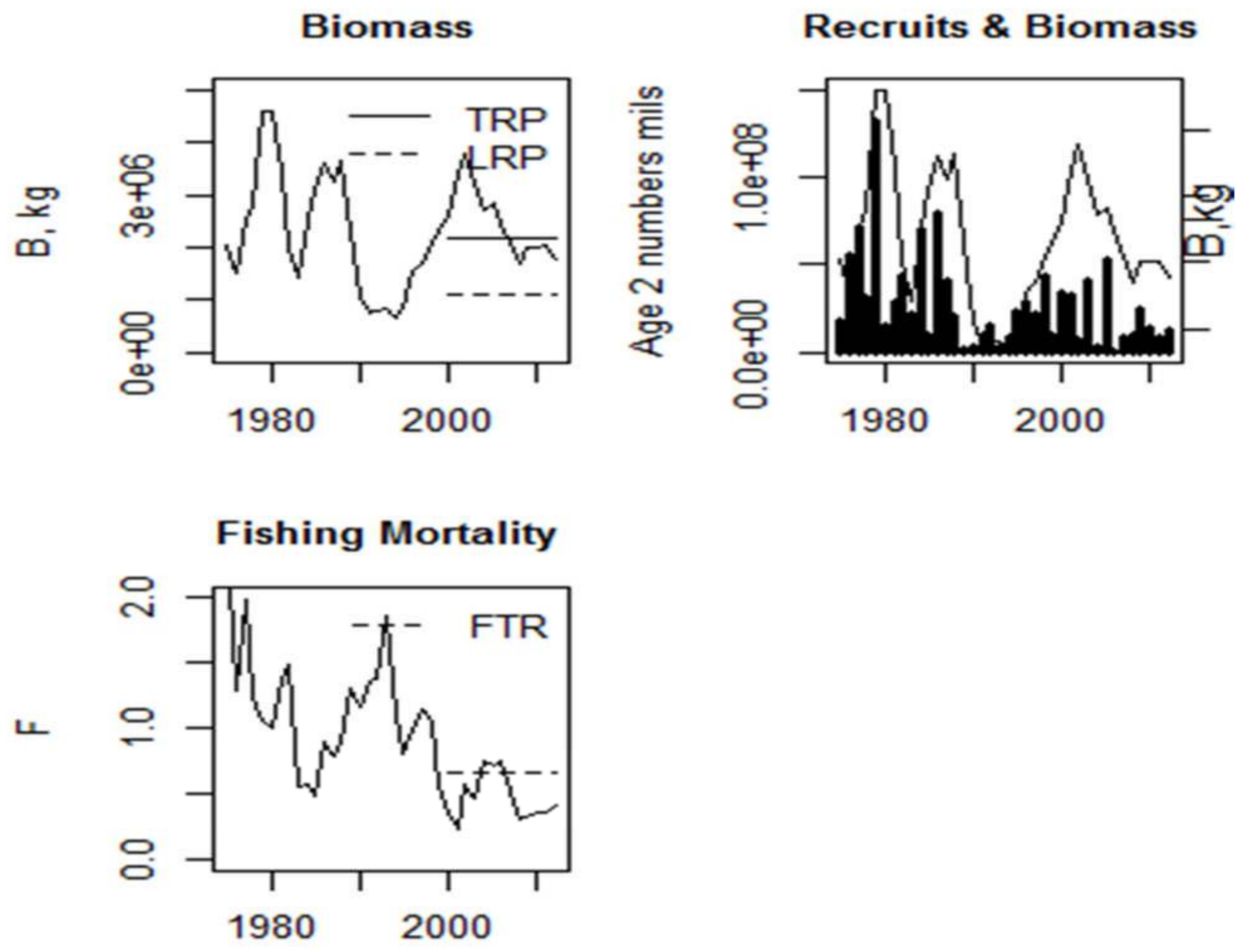
3.1 Yellow perch

3.1.1 Stock Status

MU 1

Spawning biomass (SSB) was above the MSC default target reference point (TRP) of 40% SSB_0 during the late 1990s – early 2000s. It then declined and averaged about 90% of the TRP during 2007-2011 (about one generation or 5.5 years) before dropping to 80% of the default TRP in 2012 (Fig. 10). In comparison to an estimate of SSB_{MSY} from the 2010 YPTG simulation study (see Reference Point section), during 2007 – 2012, SSB averaged about 101% of SSB_{MSY}. The most recent assessment (YPTG, 2015) indicates no change in age 3+ biomass in 2013, a modest decline in 2014 and stability in 2015. Due to recruitment of a strong 2013 year-class, total biomass (age 2+) in 2015 is expected to increase by 27.4%. As this year-class matures at age 3 in 2016, SSB will start to increase.

Figure 10: Yellow perch MU1: Long-term trends in SSB, recruitment & SSB and fishing mortality



Note: TRP, LRP and FTR are the biomass target, biomass limit and fishing mortality target reference points respectively which are assumed to apply to post-2000 stock conditions based upon simulations conducted in 2010

Source: SSB, recruitment and fishing mortality trends from YPTG, 2013

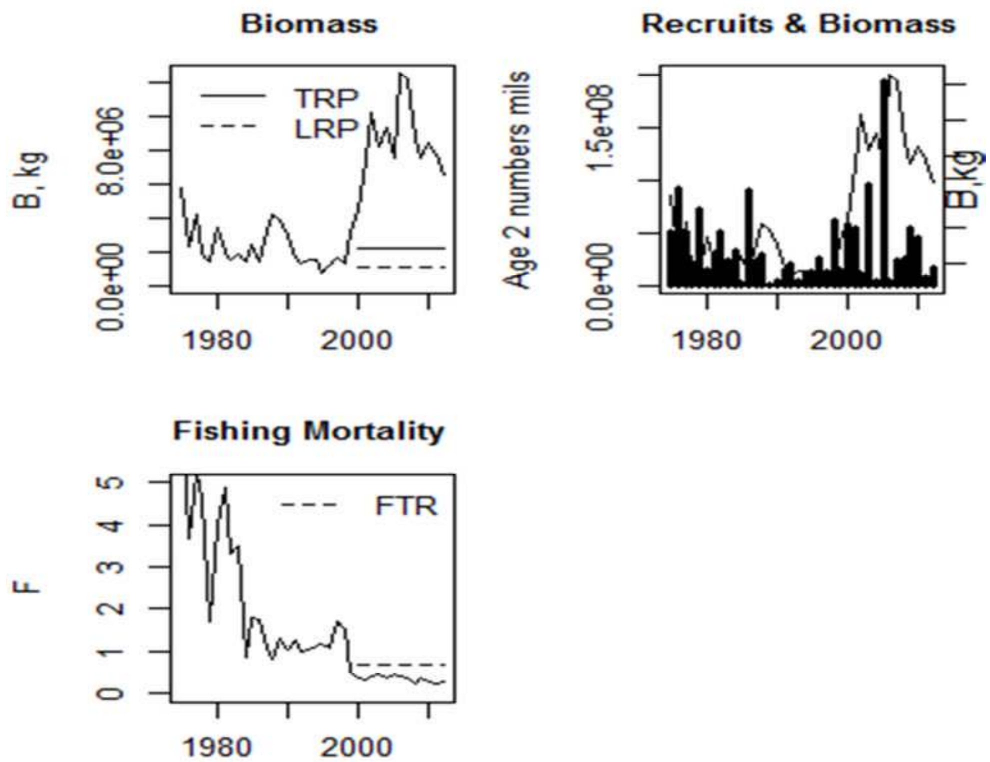
MSC CR 1.3 is not specific about how to interpret recent fluctuations in SSB in relation to a level consistent with SSB_{MSY}. Recent SSB has varied 90% to 101% of the MSC default TRP and an estimate of SSB_{MSY} respectively. SSB is projected to increase with recruitment of a strong 2013 year-class. Further, since 2007, fishing mortality has been significantly below the 50% F_{MSY} target, and certainly well below F_{MSY} since the mid 1990s, implying that SSB should increase in response to a relatively conservative harvest rate. These observations suggest that current SSB is at a level consistent with SSB_{MSY}.

Based upon the assessment model derived annual estimates of uncertainty (Delta method) in the SSB, the probability that SSB was above the MSC default limit reference point (LRP) averaged about 97% during 2007 – 2012. The fluctuations in SSB have been primarily due to pulses of incoming recruitment although there has also been a long-term decline in fishing mortality (F), which has been significantly below the 50% F_{MSY} management target in recent years.

MU 2

SSB was likely at 20% SSB_o until the late 1990s and has been over double the MSC default TRP (40% SSB_o) since then. The fluctuations in SSB have been primarily due to pulses of incoming recruitment although there has also been a long-term decline in F, which is currently below the 50% F_{MSY} management target (Fig. 11).

Figure 11: Yellow perch MU2: Long-term trends in SSB, recruitment & SSB and fishing mortality



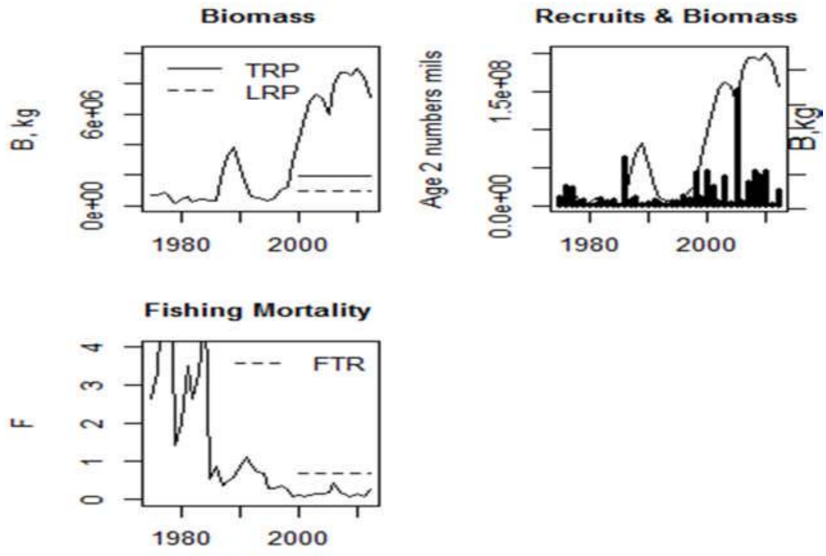
Note: TRP, LRP and FTR are the biomass target, biomass limit and fishing mortality target reference points respectively which are assumed to apply to post-2000 stock conditions based upon simulations conducted in 2010.

Source: SSB, recruitment and fishing mortality trends from YPTG, 2013

MU 3

SSB was likely at 20% SSB_o until the late 1990s and has been over three times the MSC default TRP (40% SSB_o) since then. The long-term decline in F, which is currently below the 50% F_{MSY} management target, appears to be largely responsible for this status (Fig. 12).

Figure 12: Yellow perch MU3: Long-term trends in SSB, recruitment & SSB and fishing mortality



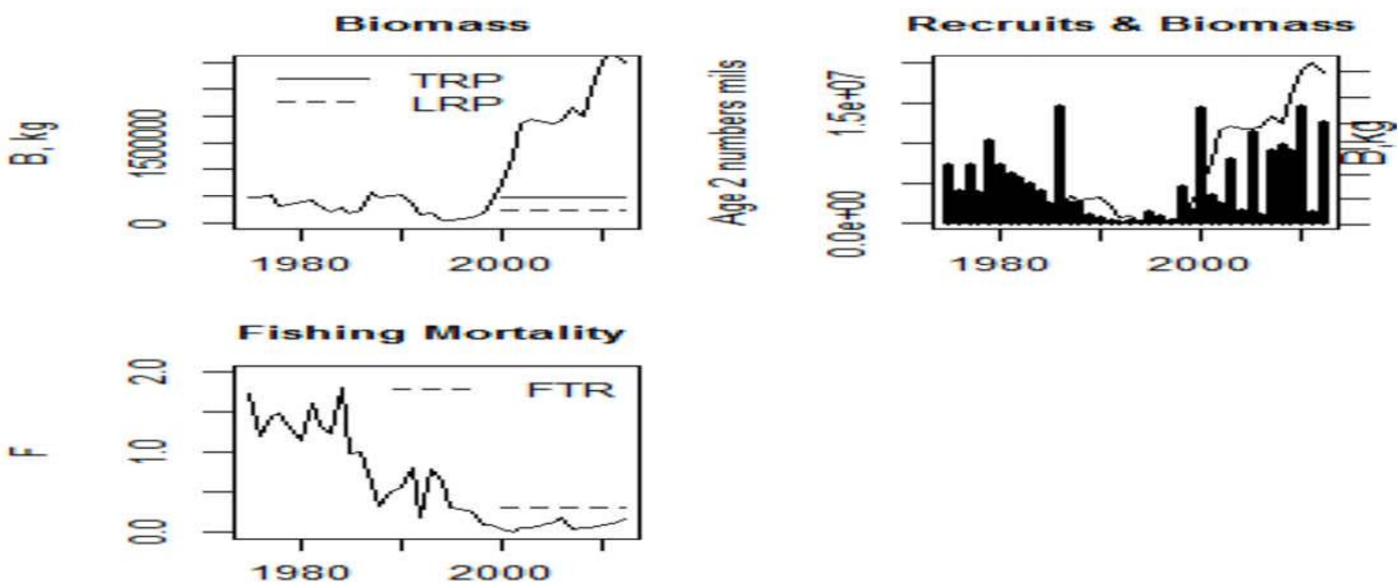
Note: TRP, LRP and FTR are the biomass target, biomass limit and fishing mortality target reference points respectively which are assumed to apply to post-2000 stock conditions based upon simulations conducted in 2010.

Source: SSB, recruitment and fishing mortality trends from YPTG, 2013

MU 4

SSB was below 20% B_0 until the late 1990s and has been well above the MSC default TRP (40% SSB_0) since then. The fluctuations in SSB have been due both to pulses of incoming recruitment and a long-term decline in F, which is currently below the 50% F_{MSY} management target (Fig. 13).

Figure 13: Yellow perch MU4 Long-term trends in SSB, recruitment & SSB and fishing mortality



Note: TRP, LRP and FTR are the biomass target, biomass limit and fishing mortality target reference points respectively which are assumed to apply to post-2000 stock conditions based upon simulations conducted in 2010

Source: SSB, recruitment and fishing mortality trends from YPTG, 2013

3.1.2 Reference Points

Over the years, a number of potential reference points (RP) have been discussed to guide management of the fishery. For instance, YPMP (2007) describes RPs based on Schaefer production models. These models indicated the long-term Yellow perch productivity changes by MU. RPs (e.g. K, F_{MSY}, MSY, r) are reported for these models, although they are not used as the basis for management.

The draft Yellow perch management plan (YPMP, 2013) also describes four management modes (Preservation, Rehabilitation, Conservation, Maintenance) to satisfy defined long-term objectives for each MU, with population and survival thresholds to maintain the sustainability and quality of the Yellow perch populations in each. The draft plan has not been implemented and thus these modes have no status in the current management of the fishery, although they have been used as guides and constraints in simulations (see below) that were used to define the current optimal fishing mortality (F) for the fishery.

The main RP used to inform management decisions during 1992 – 2001 was the target F_{OPT} based on $F_{0.1}$. The YPTG used a simulation to derive $F_{0.1}$ and describe the risk associated with various levels of F. $F_{0.1}$ was based on the ratio of average yield to average recruitment plotted against fishing rates in simulations that assumed a gamma stock-recruitment (S/R) relationship between 1975-2003 stock and recruitment estimates (YPTG, 2003, 2007). The recruitment simulations were influenced by S/R residuals that mimicked combined environmental effects on recruitment (YPTG, 2007). In 2001, an independent review (Myers & Bence 2001) identified issues with the $F_{0.1}$ implementation. For instance, a key part of the process had been the determination of the fishery age-specific selectivity pattern during the current year based on the weighted (by fleet share) average of the assessed selectivity patterns. This resulted in the overall fishery's full selection being less than one which is inconsistent with the assumptions made in the determination of $F_{0.1}$.

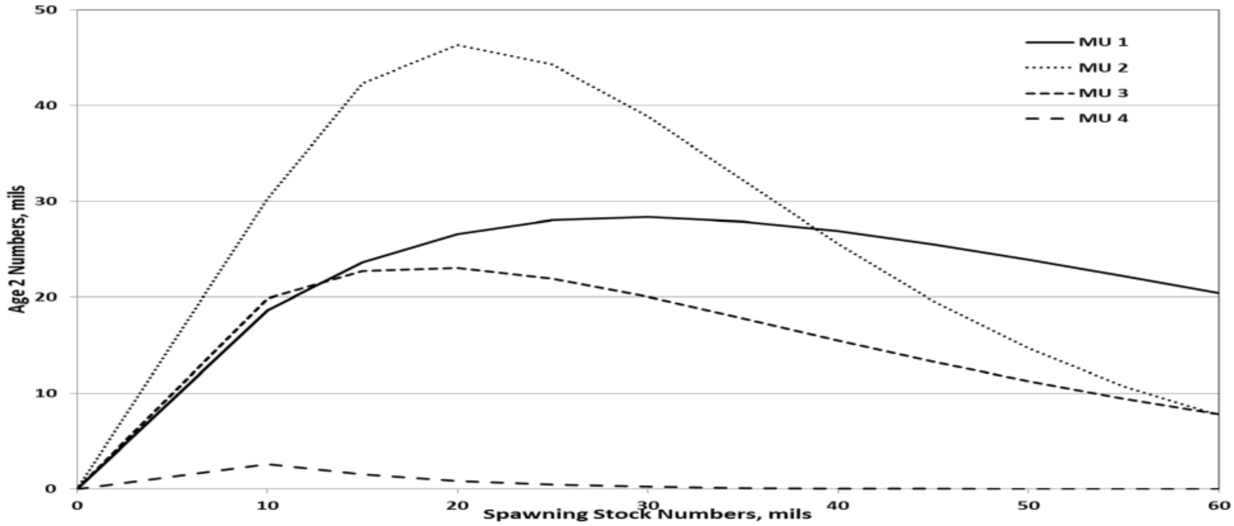
In response, during 2001-2004, YPTG modified the estimation of $F_{0.1}$ and examined several alternative harvest strategies (HS). These included calculating the harvest that would leave a specified percentage of spawner biomass alive compared to the spawner biomass at the beginning of the year. Values of 45%, 40% and 35% of the initial SSB were calculated. The latter was most aggressive since fewer spawners would be left alive. Each year, LEC was presented with a range of harvest options based on these alternative HS. In 2005, LEC directed YPTG to present a single yield strategy for MUs 1 - 3 based on the $F_{0.1}$ spawner-recruit (S/R) (YPTG, 2005). These rates were used to recommend harvest levels to LEC until 2010.

In 2010, YPTG used an updated Yellow perch simulation, which employed a Ricker, rather than the gamma (to reduce the number of model parameters), stock-recruit relationship to evaluate alternative HS involving fishing rates associated with MSY (F_{MSY}) and fractions of F_{MSY} (i.e. 50% F_{MSY}). The derived Ricker stock – recruitment relationships (Fig. 14) indicated strong density dependence of recruitment on stock size in MU 2 and MU 3 and less so in MU1.

The 2010 simulations applied to populations in each MU allowed YPTG to quantify risk associated with various harvest rates, while giving consideration to stock-recruitment patterns and environmental influences experienced by Yellow perch during recent decades. Survival rates, the probability of attaining the above noted management modes and the probability of attaining low levels of abundance comparable to those observed in 1993-94 were included as outputs.

These simulations determined that harvest rates that were 50% of F_{MSY} could support viable sport and commercial fisheries without inviting excessive biological risk. Specifically, exploiting the stocks at 50% F_{MSY} was, over the long term, expected to maintain the four stocks at their Maintenance and above their Preservation modes. Since 2010, these target harvest rates have been applied to the current population estimates and their standard errors used to determine min, mean, and maximum RAH for each MU.

Figure 14: Ricker stock – recruitment relationships for Yellow perch in MUs 1 – 4, based on analyses conducted by the YPTG in 2010



Source: YPTG

The 50% F_{MSY} management targets for MU 1 – 3 (lower in MU 4), along with the previous $F_{0.1}$ estimates are provided in Table 8. The new and old target harvest rates are similar, implying that consistent fishing mortality reference points have been used to support the management objectives since 2005.

The lower harvest rate management targets for MU4 are based upon the perceived need for greater conservation given its likely sub-stock structure (Myers & Bence, 2001).

Table 8: Yellow perch Fishing mortality reference points used by the YPTG to estimate RAH

Management Unit	$F_{0.1}$ (2005-2009)	50% F_{MSY} (2010 - present)
MU 1	0.720	0.67
MU 2	0.661	0.67
MU 3	0.703	0.70
MU 4	0.230	0.30

The HCR does not employ either an explicit target or limit biomass reference point in the annual estimation of RAH by MU. LEC (2007) and YPTG (2010) make reference to the probability of attaining low levels of abundance comparable to those observed during 1993-94, implying that these have been examined as potential estimates of an LRP. These were the observed lowest levels of SSB in the four MUs. However, these have not been formally implemented in management. On the other hand, 50% F_{MSY} is used as the management target harvest rate, implying a target stock biomass of at least B_{MSY} and certainly in excess of this.

CB2.3.3.1 stipulates that where neither B_{MSY} nor B_{LIM} are analytically determined, MSC defaults of TRP = B_{MSY} = 40% B_0 and LRP = B_{LIM} = 20% B_0 can be used. The 2010 YPTG simulations used to determine the 50% F_{MSY} fishing mortality reference point explicitly identify an estimate of the SSB_0 for the four MUs. From these, the MSC defaults of TRP = 40% SSB_0 and LRP = 20% SSB_0 were estimated (Table 9).

Table 9: Yellow perch: MU - Virgin Biomass, target & limit reference point based on MSC default (mil kgs)

MU	SSB_0	TRP	LRP
1	5.485	2.194	1.097
2	8.414	3.366	1.683
3	4.828	1.931	0.966
4	1.197	0.479	0.239

As noted above, explicit estimates of SSB_{MSY} for each MU are not used in the management of the fishery. Nor are they expliclty identified in the 2010 YPTG simulation files provided by the client on behalf of the YPTG. The intent of the MSC is to evaluate whether or not SSB is at or above a target level consistent with SSB_{MSY}. This is implied in the guidance to CR1.3 (GCB2.2.2). Given that recent SSB in MU1 is close to the MSC default TRP (see Stock Status section), it was considered useful to use information provided in the 2010 YPTG simulations to provide an additional estimate of an SSB level which would be consistent with SSB_{MSY}. Using the input assumptions (e.g. natural mortality, recruitment, fishery selectivity, weights at age, etc) present in the files, the simulation for MU1 was run by the IFC assessment team using twice the target management F as an estimate of F_{MSY}. This provided an SSB_{MSY} estimate of 1.908, mil kg for MU 1 which is 34.8 % of SSB_0 compared to the MSC default of 40% SSB_0. The client subsequently confirmed this estimate (K. Reid, pers. com.). This estimate and the MSC default of 40%SSB_0 provide a range of SSB consistent with SSB_{MSY}.

Yellow perch prey upon immature insects, larger invertebrates and the eggs and young of a wide variety of fish. They are in turn preyed upon by a wide variety of warm to cool water top predators, including Walleye, northern pike, bass, sunfishes, crappies, White perch, other Yellow perch and a number of bird species. FishBase provides an estimate of 3.36 for Trophic Level (TL). Adults average 15 – 20 cm in length with a maximum age in excess of 11. Females mature at about age 3 and can lay up to 23,000 eggs in a single spawning event. On balance, Yellow perch does not fit the profile of a lower trophic level (LTL) species outlined in MSC CB2.3.13b.

3.1.3 Stock Recovery

The simulations conducted in 2010 indicated that exploiting the stocks at 50% F_{MSY} is, over the long term, expected to maintain the stocks at the “Maintenance” with 75% probability and above “Preservation” with 99% probability. The simulations used to determine this target harvest rate used hypothetical Yellow perch stocks fished for a 20 year period or about 3.6 generations. This implies that depleted stocks during this period should recover to the “Maintenance” abundance by the end of the simulation period (20 years). By intent, under this HS, rebuilding of depleted Yellow perch stocks should not be required. It is important to note that the implied target biomass is above the MSC default of 40% B_0.

There have been times (e.g. mid-1990s) when stocks were below the MSC default biomass LRP and TRP. In response, LEC introduced more stringent quotas which, along with moderate to strong year-classes, helped rebuild the Yellow perch populations. To lower the risk of this situation recurring, LEC pursued development of a draft FMP that could be implemented to manage Yellow perch populations and to effectively limit the need for drastic management actions with respect to quota management. This FMP built upon lessons learned and models developed during the 2001-2003 CPMS, and development of the 2005 Walleye Management Plan (WMP). Since then, LEPMAG has been developing a new plan to supercede the old plan to which it bears little resemblance (K. Reid, pers comm). This plan outlines more comprehensively the stock recovery initiatives as and when needed.

3.1.4 Harvest Strategy

The HS is composed of linked HCRs, tools (i.e. regulations), monitoring, and assessment method to ensure that management achieves its objectives. RPs, monitoring and assessment are discussed in other sections of the report. Here, attention is placed on the objectives, HCRs and tools and how the components of the HS work together in Yellow perch management.

Objectives

In 2005, YPTG was charged with preparation of a draft Yellow perch Fisheries Management Plan (YPFMP) as a companion document to the WPM. Its completion depended on resolving assessment model issues (catch-age analysis data weighting and definition of lambdas) while establishing population objectives for the YPMP was dependent on final model configurations and risk outcomes using endorsed data weighting approaches (YPTG 2005). In 2009, a technical review of the exploitation strategies and harvest policies by Michigan State University's Quantitative Fisheries Center (QFC) indicated that additional time was required to carry out a thorough review of the HS and thresholds defined in YPMP. Consideration was also given to initiating a Management Strategy Evaluation (MSE) for Walleye.

Since then, the primary objective of the fishery on each stock has been to maintain F at or below a target level. As noted above, during 1992-2001, the target F was based upon $F_{0.1}$. In 2005, LEC directed YPTG to present a single yield strategy for MUs 1 -3 based on the $F_{0.1}$ spawner-recruit (S/R) (YPTG, 2005). These rates were used to recommend harvest levels to LEC until 2010 at which time, based on a simulation study, the 50% F_{MSY} target F is adopted and has been used since.

LEPMAG was formed to increase stakeholder engagement and transparency. It has made significant progress in updating the WFMP and from the documentation received by the IFC assessment team, it was evident that the group was starting to turn its attention to Yellow perch. The lessons learned during the Walleye MSE exercise will no doubt be applicable to Yellow perch.

Harvest Control Rules

HCR are the rules and associated actions that management takes in response to changes in the fishery and the stock. It is the design of the HCR and tools in the control of harvest that are of interest. The intent is to ensure that the stock is kept above the LRP and attempts to maintain the stock at the TRP (MSC GCB2.6).

YPMP (2007) outlines a 'hockey stick' HCR, similar to that discussed for Walleye, which was explored through simulation. It outlines a planned reduction in F as Yellow perch abundance declines, using the management modes. While the YFMP (2007) states that this HCR was to be used from 2008 to set TACs in MUs 1 – 3, this did not happen as the YPMP was never adopted. Notwithstanding this, it is clear that there is a general understanding that F should be reduced as abundance declines.

The current HCR consists of the assessed estimates of stock size at the beginning of the assessment (current) year being projected forward one year under a 50% F_{MSY} ($F_{0.1}$ prior to 2010) target harvest rate assuming a range (plus and minus one standard deviation of the mean) of current year stock sizes (see Assessment section). The product of selectivity estimates (weighted average of fleet-specific estimates) used in assessment models and the target fishing rate determines the age-specific target instantaneous fishing mortality rates used to generate minum, mean and maximum RAH. LEC determines the TAC by consensus.

YPTG (2010) states that although the Yellow perch simulation was used to determine target fishing rates for use since 2010, full examination of Yellow perch exploitation strategies have not been completed for each MU. As indicated in the RP section, the target fishing rates in MUs 1 - 3 are 50% F_{MSY}. They are 0.67, 0.67, and 0.70 for MUs

1–3 respectively. In MU4, a conservative fishing rate of 0.30 was chosen as the target fishing rate. It is expected that these fishing rates will continue to form the basis of the exploitation strategy for each MU and will be the maximum fishing rate used in the exploitation policy. However, explicit and well defined fishing strategies when Yellow perch abundance is below maintenance levels have not been established. YPTG (2010) indicates that there would be further consideration of minimum threshold RPs and fishing strategies at low abundance levels in the near future. Therefore, while YPTG has discussed a range of HS (e.g. YPTG, 2004) and stock limit RPs, it appears that a well defined HCR that would explicitly reduce F as stock abundance declines and approaches the LRP is not in place.

Tools

The primary management tool in the regulation of the Yellow perch fishery in both Ontario and the U.S. is an annual TAC, a portion of which is allocated to each jurisdiction for it to manage by whatever means it feels appropriate. In 1981, YPTG explored the advantages and disadvantages of three potential methods for allocating quotas (STC, 2007): water surface area within each of the four MU by jurisdiction; historical harvest within each of the four MU by jurisdiction; and a “hybrid” allocation scheme that included aspects of both surface area and harvest. While surface area estimates by jurisdiction and sub-area were presented by YPTG, no formal quota allocation strategy was established until 1993. Prior to that year, YPTG annually distributed the RAHs by jurisdiction in each MU based upon relative total surface area and presented harvest and quota allocation for comparison purposes. In 1993, LEC agreed to a formal quota allocation strategy that initially used historical harvest by jurisdiction in each of the MUs for quota allocation and gradually adjusted these to allocations based upon surface area in each MU by jurisdiction over a 12-year period. In 2004, LEC further defined the Lake Erie basin such that MU and quota sharing formulas could be updated using the more definitive technical data then available, as well as documented the history of sharing formula calculation and quota allocation. The results of this analysis indicated that the historical estimates of relative surface area were generally in agreement with the new estimates of relative surface area.

A number of regulations are used in the Ontario gillnet and Ohio trap net fisheries which are summarized in Table 5 above.

Linkage between Components of Harvest Strategy

In evaluating the HS, it is important to assess how closely the harvest recommendations of YPTG are followed by LEC and then how well the catch matches the LEC established TAC.

RAHs are provided by YPTG to LEC each spring. Since 2010, these have included the mean as well as minimum and maximum (plus and minus one standard deviation of the mean) estimates. LEC refers to the advice in setting a TAC that is divided amongst the jurisdictions based on an agreed sharing formula.

Overall, reported catch has been below the LEC TAC while the latter has generally followed the RAHs of YPTG (Table 10). In some years, LEC has set TACs higher than the mean RAH (e.g. 2011 – 2013 in MU1) but never higher than the maximum RAH.

Table 10: Comparison of RAH, LEC Advice and Report Catch of Yellow perch by MU during 2005 – 2013

MU1

	RAH (mil lbs)			LEC Advice	Reported Catch
	Min	Mean	Max		
2005		3.716		3.716	2.529
2006		3.057		3.057	2.444
2007		1.679		1.679	1.773
2008		1.408		1.408	1.038
2009		2.272		2.040	1.404
2010	1.029	2.094	3.158	2.094	1.853
2011	0.803	1.437	2.071	2.071	1.813
2012	0.725	1.364	2.140	1.800	1.729
2013	0.820	1.570	2.391	1.800	1.476

MU2

	RAH (mil lbs)			LEC Advice	Reported Catch
	Min	Mean	Max		
2005		4.387		7.405	4.509
2006		7.026		7.026	4.496
2007		4.206		4.206	4.092
2008		4.227		4.227	3.995
2009		5.313		5.313	4.298
2010	2.134	3.389	4.644	4.000	3.347
2011	1.515	2.526	3.537	3.537	3.065
2012	2.409	3.926	5.646	4.000	3.729
2013	2.275	3.711	5.279	4.000	3.522

MU3

	RAH (mil lbs)			LEC Advice	Reported Catch
	Min	Mean	Max		
2005		3.340		3.340	2.371
2006		6.045		6.045	3.829
2007		5.229		5.229	3.581
2008		3.710		4.200	2.985
2009		3.933		4.200	3.055
2010	3.800	6.251	8.702	6.251	3.965
2011	2.985	4.996	7.006	6.250	4.156
2012	3.362	5.710	8.171	7.000	4.677
2013	2.403	4.053	5.813	5.600	3.894

MU4

	RAH (mil lbs)			LEC Advice	Reported Catch
	Min	Mean	Max		
2005		0.309		0.309	0.291
2006		0.352		0.352	0.335
2007		0.275		0.275	0.238
2008		0.325		0.325	0.312
2009		0.459		0.459	0.381
2010	0.353	0.792	1.231	0.792	0.525
2011	0.399	0.952	1.506	0.792	0.586
2012	0.392	0.837	1.295	0.837	0.651
2013	0.345	0.789	1.248	0.837	0.691

Source: K Reid

3.1.5 Information and Monitoring

Stock Structure

Yellow perch in Lake Erie are managed as four separate stocks, consistent with the four MUs; western (MU 1), central (MU 2 & MU3) and eastern (MU4) basins. Genetic (e.g. Sepulveda-Villet *et al.*, 2009) and morphological studies support these stock boundaries. These studies are documented in YPTG reports since the mid-2000s. While YPTG recognizes that there may be movement between MUs, there is evidence to indicate that there are variations in size at age between the west (MU 1), central (MU 2 and MU 3) and eastern basin (MU 4), and that population density varies between them. While these characteristics provide support for individual management of Yellow perch in each MU, considerable uncertainty remains. Jiao *et al* (2006) report evidence of considerable mixing across MUs and Yu *et al* 2011 report that there may be as few as two stocks, i.e., MU 1-3 and MU4. Based on the research conducted on Yellow perch populations in Lake Erie, there are genetic differences noted between Yellow perch in MU 1 and 4, however there has been little difference identified between Yellow perch in the west and central basin (Tavel, 2009). The issue of stock structure will be addressed during the LEPMAG MSE process for Yellow perch.

MU 4 is notable among Lake Erie's Yellow perch MUs as being the area in which Yellow perch fisheries are more often spatially isolated and Yellow perch habitat remains more clearly partitioned by lake bathymetry (YPTG, 2007). Also, there is evidence of differing recruitment patterns within various parts of the basin. While this is still support for YPTG's ongoing practice of treating the east basin Yellow perch resource as one unit (MU 4) for stock assessment (YTG, 2007), YPTG notes the need to explore assessment approaches capable of detecting, describing and managing discrete stocks.

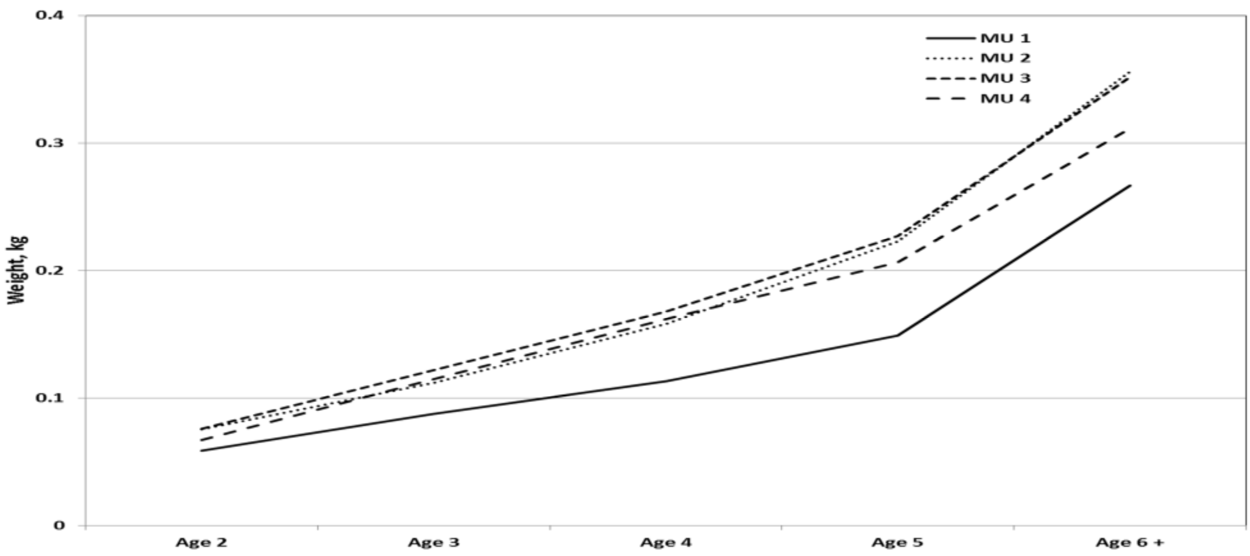
Stock Productivity

Information on Yellow perch growth in each MU is available in the annual survey datasets. Based on these data, Yellow perch in each MU exhibit linear growth for ages 2 to 6+ (Fig. 15). Yellow perch in MU 1 are smaller at age than perch in the other MUs, the latter being generally about the same size at age. Growth trends during 1975 – 2012 vary by MU (Fig. 16). In MU 1, there was an increase in weight at age during the 1990s with a subsequent decline and more recent increase. In MU 2, growth has been variable but without a long-term pattern. In MU 3, there has been a general decline in weight at age since 1975 while in MU 4, the opposite is evident. Overall, however, these trends in growth are not significant. About 50% of Yellow perch in most MUs become sexually mature by about age 3 with most mature by age 4 (Fig. 17). There is a slight tendency for Yellow perch in MU 2 to mature earlier

YPTG has used stock-recruitment (S/R) relationships to establish harvest RPs for each MU (see reference point section). Specifically, until 2009, the S/R relationship was a gamma function with the recognition that environmental factors exert a major influence on recruitment (YPTG, 2004). In 2009, QFC undertook a review of the YPFMP and exploitation strategies and suggested changes. This led to the S/R relationship being changed to a Ricker function that reduced the number of parameters in the model. Environment Factors (EF) were derived from the residuals of the S/R relationship fit to the data from the assessment model (EF = (observed recruitment)/(predicted recruitment). Recruitment for each year was then estimated from the S/R function, and multiplied by an EF selected randomly from the observed distribution of residuals (EFs).

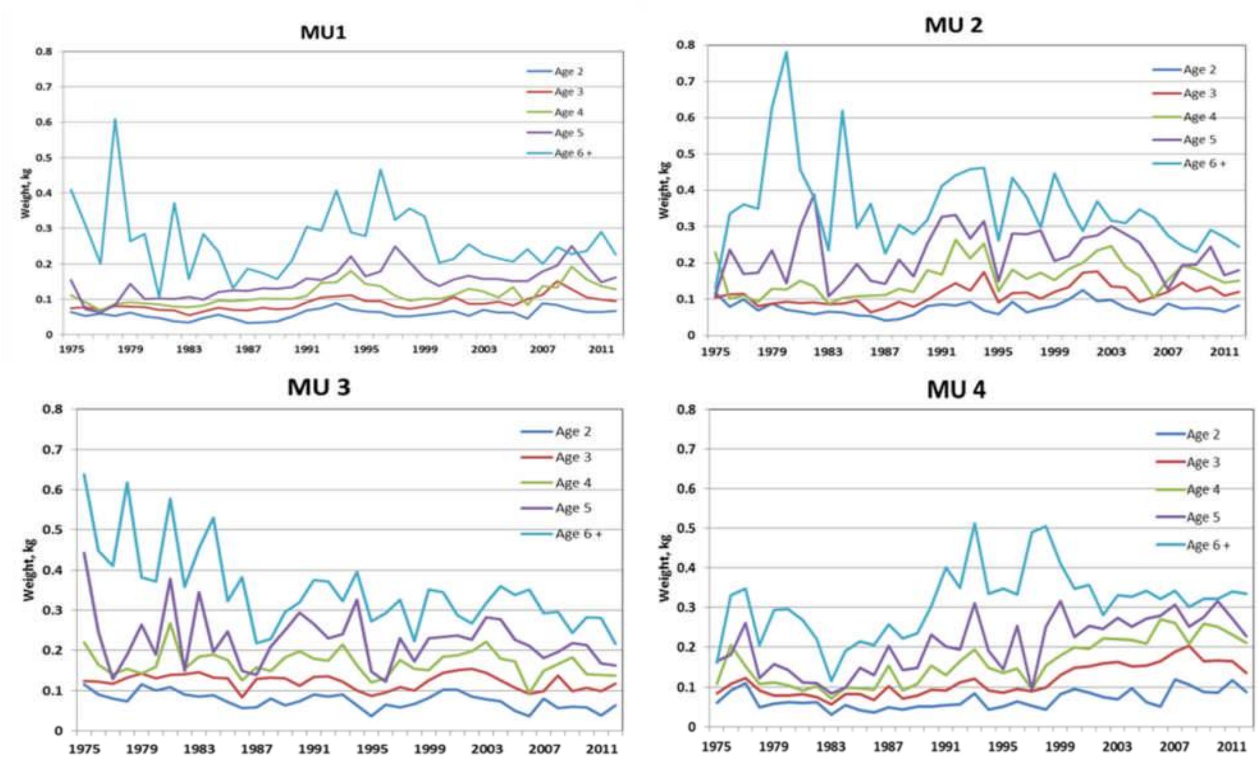
The S/R relationships vary significantly by MU with MUs 2 & 3 exhibiting strong density dependence as spawner numbers increase.

Figure 15: Yellow perch: Average weight (kg) MU1 - MU 4 (1975 – 2012)



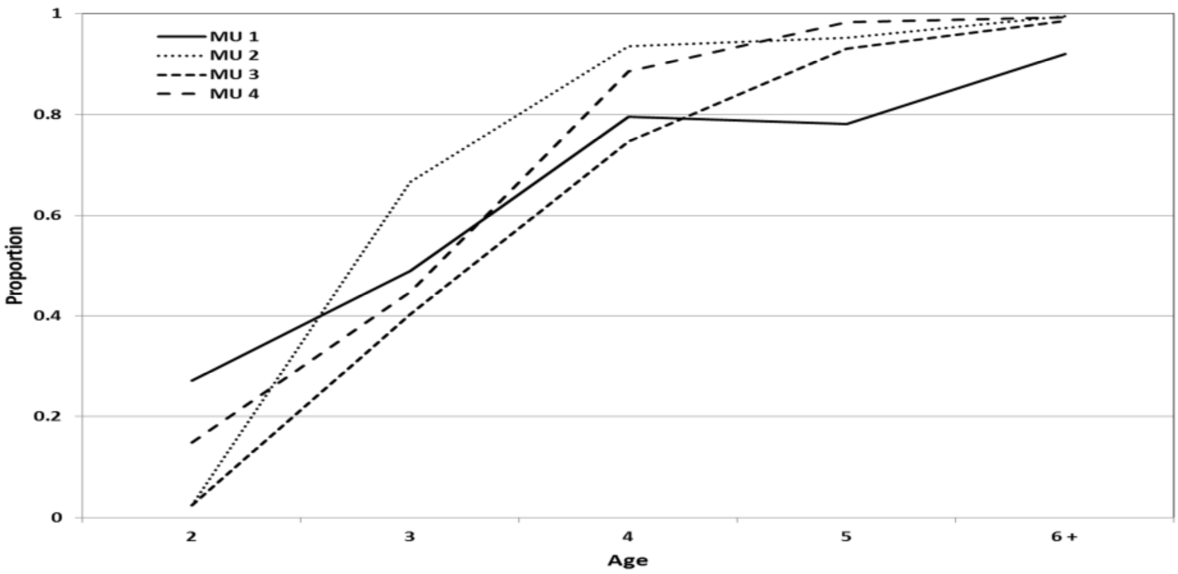
Source: Data from assessment model input files

Figure 16: Yellow perch: Trends in weight at age (kg) by MU (1975 – 2012)



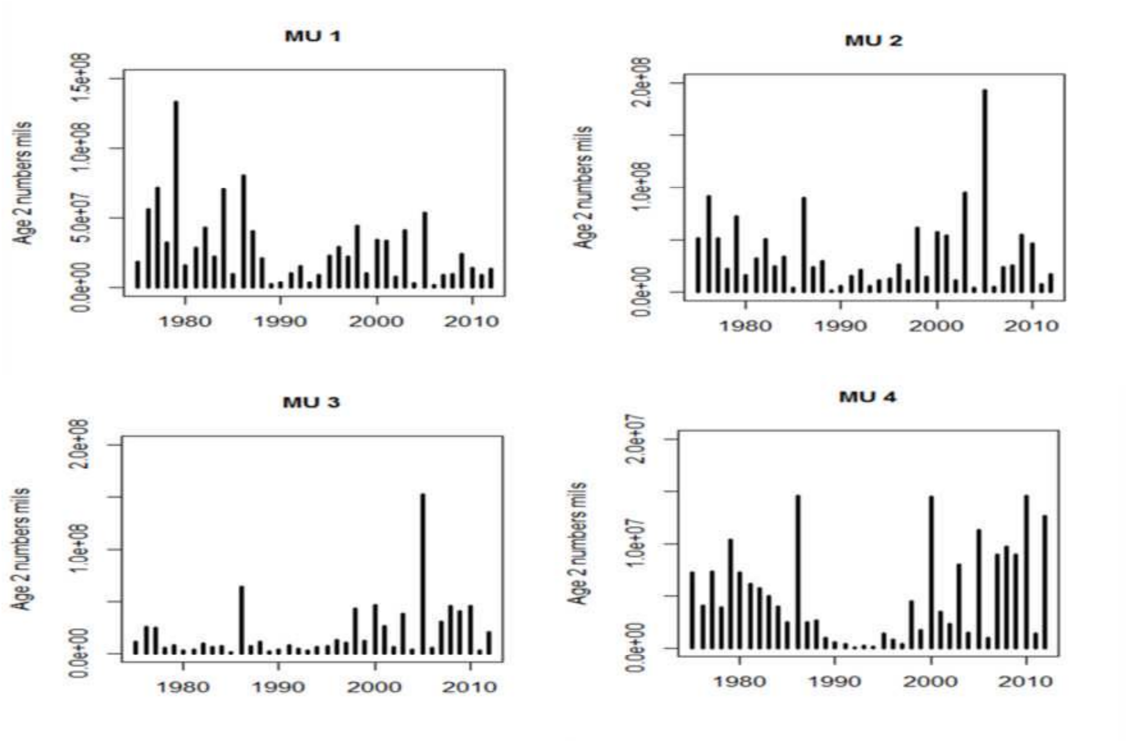
Source: Data from assessment model input files

Figure 17: Yellow perch: Proportion in maturity at age by MU



Source: Data from assessment model input files

Figure 18: Trends in Yellow perch age two numbers (mils) during 1975 – 2012 by MU



Source: Data from Yellow perch task group assessment models

The annual stock assessments by YPTG allow characterization of stock production, including recruitment. Based on this, annual recruitment varies by MU (Fig. 18). In MU 1, there has been a long-term decline in age-2 numbers since 1975. Since the mid-2000s, recruitment, while lower than the long term average, has been relatively stable. The young-of-the-year trawl survey indicates a strong 2014 year-class, comparable in size to those observed in the mid-1990s to early 2000s (K. Reid, pers comm). The overall long-term pattern is somewhat similar in MU2 although strong year-classes in the mid-2000s imply less of a long-term decline. In MU 3, recent recruitment has been higher than historical levels while in MU 4 recruitment declined in the 1990s but has since improved.

The assessment models of the four MUs assumes M=0.4 for all ages and years. This is based upon a review described in YPTG (1997). It is acknowledged that information is limited on M. Assuming the age of 50% maturity is about three, M=0.4 implies a generation time of 5.5 years.

Fleet Composition

There is good information on the composition of both the Ontario gillnet and Ohio trap net fleets.

Detailed information on the characteristics (length, width, depth, tonnage, etc) of each of the vessels engaged in the Ontario gillnet fishery is available on the Transport Canada website (http://wwwapps.tc.gc.ca/saf-sec-sur/4/vrqs-srib). Further, sixty five vessels of the Ontario gillnet fleet filed at least one DCR in 2013. A list of these vessels and the number of DCR filings was provided to the IFC auditors.

There is good information on license holdings and usage in the Ohio Yellow perch trap net fishery (see above). Data are available on the location and characteristics (e.g. size and meshes) of each trap by licensee.

Fishery Removals

While a number of fisheries prosecute Yellow perch, the primary ones are commercial gillnet in Ontario, and commercial Yellow perch trap net in Ohio.

Since 1997, commercial fishery license holders in Ontario have been required to complete a DCR for all fishing activity. This records landed, released and discarded catch (recording of releases and discards has been enforced since 2011), species names and weights, gear types and effort, targeted species on a trip, fishing time and locations, landing time and port names, and other fishing information. The DCR for each fishing trip is submitted to OMNR before fish can be landed on the dock. Comparable data are available on the Ohio Yellow perch trap net fishery from the ODNR. During a trip, the vessel captain estimates the weight of the species caught. This is modified after dockside weigh out. Yellow perch are landed whole.

Monitoring is through dockside verification of landings. In Ontario, this is undertaken by both provincial observers at dockside and OCFA observers within the fish plants; in Ohio, at dockside by state enforcement officers. During 2004 – 2012, the Ontario program monitored greater than 50 % of Yellow perch landings (Table 11).

Dockside monitoring of the Ohio trap fishery is undertaken by ODNR. In 2010 – 2013, an average of 7.7% of the catch reports were checked (T. Hartman, pers. comm).

During the site visit, it was noted that there is no systematic observer coverage to verify the information in the DCR.

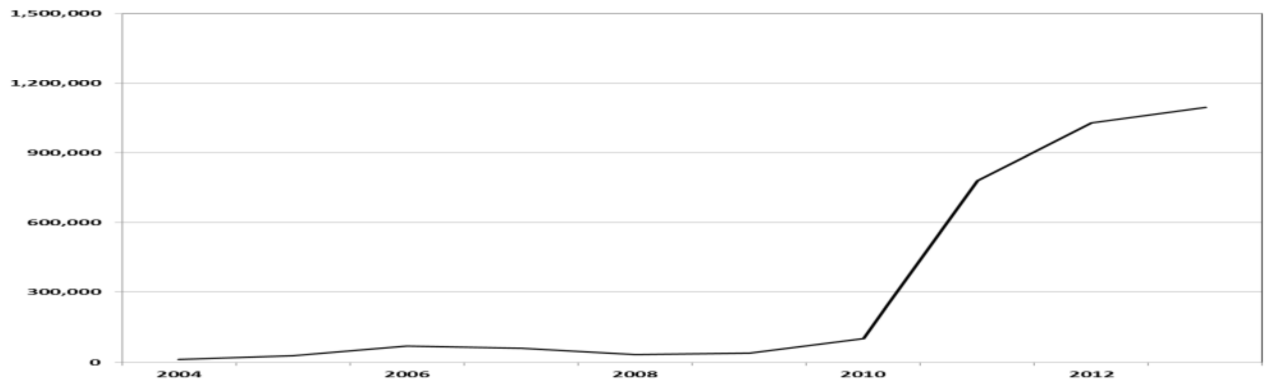
Discarding of quota species (Walleye, Yellow perch, Lake whitefish and rainbow smelt) is not allowed, so in principle, the DCR should, for these species, record the total catch. For discardable non-quota species (White perch, White bass, Freshwater drum, Gizzard shad, etc.), the OMNR discard information prior to 2011 is thought to be less reliable (K. Reid, pers. Comm.) as recording was not an enforced condition of license at that time. After recording became an enforced condition of license in 2011, there was a significant increase in the reported discards (all species combined) in the DCR (Fig. 19).

Table 11: Ontario Fisheries: Dockside and plant monitoring of landing

Year	Walleye	Yellow Perch MU 1	Yellow Perch MU 2	Yellow Perch MU 3	Yellow Perch MU 4	White Bass	Lake Whitefish	Rainbow Smelt	White Perch
2004	39.24%	42.75%	48.52%	43.26%	8.48%	31.16%	30.35%	0.00%	35.75%
2005	37.87%	36.32%	42.27%	41.07%	20.30%	24.18%	22.16%	0.00%	24.53%
2006	52.20%	61.29%	57.54%	48.38%	28.76%	34.61%	48.44%	0.00%	32.70%
2007	61.81%	65.19%	65.58%	56.34%	26.87%	43.18%	47.34%	0.00%	27.22%
2008	68.92%	69.75%	67.19%	72.13%	36.17%	34.98%	53.90%	0.00%	32.40%
2009	70.73%	76.48%	70.89%	75.99%	36.67%	61.11%	63.50%	0.00%	52.25%
2010	50.47%	48.98%	45.76%	47.96%	22.93%	12.37%	36.51%	0.00%	17.04%
2011	56.50%	54.64%	50.88%	43.56%	54.64%	18.81%	52.41%	0.00%	13.78%
2012	58.07%	62.65%	60.50%	57.83%	23.13%	18.97%	59.55%	0.00%	21.88%
Avg	55.09%	57.56%	56.57%	54.06%	28.66%	31.04%	46.02%	0.00%	28.62%

Source: CFHIS as extracted by OCFA

Figure 19: Ontario commercial fisheries: discards (lbs) of all species (2004 – 2013)



Source: OCFA database

Table 12: Ontario commercial fisheries: Proportion of total catch landed (2011 – 2012)

% Landed of Catch	Species Caught					
Target Fishery	Walleye	White Bass	Lake Whitefish	Yellow Perch	Rainbow Smelt	White Perch
Large Mesh(Walleye)	100.0%	99.9%	100.0%	100.0%	0.0%	97.2%
Large Mesh (White Bass)	99.9%	99.2%	100.0%	100.0%	0.8%	98.0%
Large Mesh (Lake Whitefish)	100.0%	100.0%	100.0%	100.0%	52.0%	100.0%
Yellow Perch MU1	99.9%	91.9%	100.0%	100.0%	0.0%	52.6%
Yellow Perch MU2	99.9%	97.7%	91.8%	100.0%	1.7%	67.2%
Yellow Perch MU3	100.0%	98.5%	100.0%	100.0%	14.2%	75.4%
Yellow Perch MU4	100.0%	89.7%	100.0%	100.0%	19.0%	86.5%
Rainbow Smelt	100.0%	99.5%	100.0%	100.0%	100.0%	98.2%
White Perch	99.9%	100.0%	100.0%	100.0%	3.5%	99.3%
% Target of Total Catch	66.2%	89.5%	61.4%	70.5%	100.0%	65.0%

Source: OCFA

Discarding, particularly in the main directed fisheries, appears to be low with landings reporting covering almost all the catch (Table 12). This is despite the fact that the percent catch of the targeted species in each fishery, except the rainbow smelt fishery, averaged about 71%.

The Ohio yellow perch trap fishery mainly catches Yellow perch; larger meshed gear is used to target other species. It is illegal to catch or retain Walleye. While the IFC team accepts that discarding may be low, there is no corroborating evidence through observer coverage, and it is concerned about the high estimate (80%) of post-capture mortality (PCM) from gillnets (see below).

The Ontario and Ohio commercial fishery landings are sampled at dockside to characterize the size, collect scales and, more recently, otoliths, to age the fish, and collect biological information such as the gonad weight, sex, and maturity stage of the fish (LEC, 2013). The IFC team noted that ODNR has standard sampling protocols comparable to that of OMNR. While there was a study of the statistical design of this sampling, it was conducted a number of years ago and the report could not be located (B. Locke, pers. Comm.).

At the request of LEC, in 2004, GLFC assembled a panel of experts (Lester *et al,* 2005) to evaluate the efficacy, precision and accuracy of current techniques (sampling and statistical analysis) used to estimate total percid (i.e. Walleye and Yellow perch) harvest by sport and commercial fisheries in Lake Erie and to recommend improvements. Overall, the panel considered that the procedures to estimate percid harvest were sound but made 12 specific recommendations to address observed deficiencies:

1. Report released fish
2. Estimate latent mortality
3. Measure subordinate fisheries
4. Correct designs for haphazard sampling of biological components
5. Use otoliths for age determination
6. Implement a coordinated approach with neighboring jurisdictions
7. Mandatory reporting for charter fisheries
8. Account for the magnitude of illegal removals
9. Correct designs for unequal probability sampling
10. Address bias introduced from depensatory sampling
11. Test assumptions periodically using independent survey methodology
12. Explore data for re-stratification.

The panel considered that the harvest was likely underestimated, due to the high mortality of released fish and lack of data from all sources of capture (e.g. ice fishing, shore fishing, small access points). Given that there are appropriate procedures to check the accuracy of reporting and vigilant enforcement discourages illegal landings, the panel felt that reported harvest was an accurate measure of commercial landings; of more concern was the mortality of discarded fish. Some problems in implementing "random sampling" protocols for interviews and biological sampling was noted and solutions proposed. The panel noted that most agencies were using otolith-based age assessments to construct the age/length key although one agency was using scale-based ages. It noted that because scales often underestimate the age of older fish, the panel recommended that all agencies adopt an otolith-based approach. Finally, the panel noted that more coordination amongst the agencies in the collection of information on the fisheries would have significant benefits and suggested ways that this could be achieved.

LEC's response to the 12 recommendations is documented in STC (2007b). Where possible, actions were initiated to address the issues raised and where needed, research activities to address some issues (i.e. PCM) over the longer term were identified.

As noted above, the panel recommended that estimates of PCM be included in the catch estimate. No agency had estimated latent mortality of released fish nor accounted for PCM in harvest estimates. STC (2007b) provided estimates of PCM from gillnets, indicating that it could be as high as 80%. However, as noted above, virtually all the Yellow perch caught are landed. There are no PCM estimates from the Ohio trap fishery. Notwithstanding this, given the magnitude of released fish compared to the total catch, PCM does not appear to be a big issue in the Yellow perch fishery.

The catch monitoring data from the DCRs and dockside and/or in-plant weight observers (ON only) are archived in data bases managed respectively by OMNR and OHDNR. In preparing its report, the IFC assessment team interacted with OCFA and ODNR to acquire catch data. In the case of the former, issues were encountered during the extractions which caused the team concern. Specifically, small changes in the queries resulted in large changes in the extracted catch and by-catch data. Checks between OCFA and OMNR extractions were undertaken to identify the source of these changes. Ultimately, most of the causes of these differences were identified (e.g. grids used to identify MUs) although some remained (e.g. captain's estimated weights vs. observed and verified weights). To be consistent, the catch data in this report is based upon the fisher declared weight of the catch, rather than the dockside and/or in-plant observed weights. During the site visit, the IFC team was informed that these weights typically vary by no more than 5% from the dockside weights, most of the difference made up of ice and slime. **The IFC assessment team recommends that OFCA and OMNR ensure that database queries produce accurate, consistent and verifiable catch and by-catch statistics for the Lake Erie fisheries.**

Stock Abundance

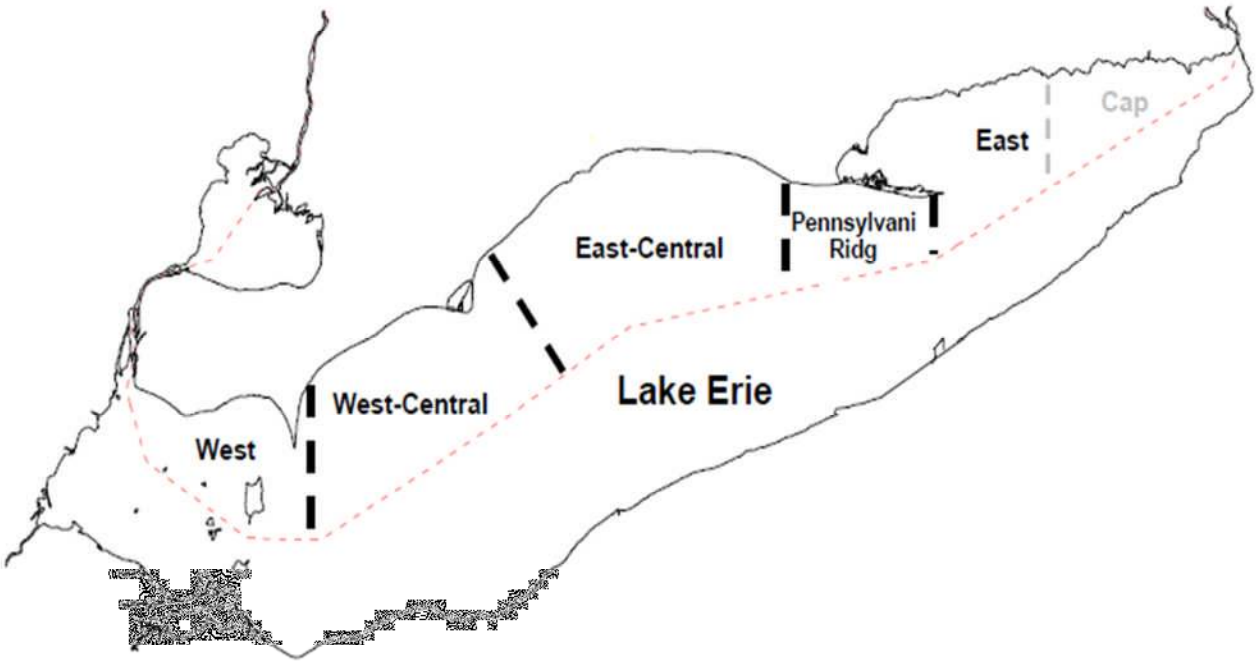
The primary sources of fishery dependent information on stock abundance are the DCRs and logbooks maintained by Ontario and Ohio harvesters, and angler diaries submitted by recreational fishermen. Estimates of fishing effort are derived from these data and used in the assessment models of Yellow perch to derive estimates for F in an analogous approach to the use of commercial catch rate indices to estimate abundance in other assessments. Ontario catch records were used to generate an annual estimate of gillnet effort (km; adjusted for small and large mesh gear since 2001) during 1975 – 2012; those from Ohio were used to generate an annual estimate of trap net effort (number of lifts) for the same period. While catch rate standardization (e.g. GLM analyses) does not appear to have been conducted on the data, there has been a study (Li *et al.,* 2011) of the effects of gillnet saturation on Walleye and Yellow perch catch rates in survey gillnets. This indicated that soak time and fish accumulation can have a significant effect on catch rate and thus nominal effort, particularly in the case of Walleye. While the study was of survey gear, it may be applicable to the Ontario commercial fishery.

In the Ohio and Michigan Yellow perch fishery, recreational harvesters participate in a daily log program. Sport fishers record catch and effort data over the course of the season, on all species. The recreational program has been in place for 24 years, contributing a time series of Ohio and Michigan angler effort (thousands of angler hours) since 1975 to the annual assessment.

Several fishery independent surveys are conducted in Lake Erie and these contribute to the knowledge, understanding and assessment of the Yellow perch stocks. The most important ones are the Ontario partnership index gillnet survey (MUs1 – 4) and the Ontario/US western basin inter-agency trawl survey (MU1 – 3).

The former is a cooperative fisheries assessment program between OCFA and OMNR (OMNR, 2013a). In place since 1989, it monitors abundance, size and species composition throughout the Canadian portion of Lake Erie (Fig. 20).

Figure 20: Study areas of Ontario partnership index fishing; Pennsylvania Ridge and extra Cap area sites excluded in 2013



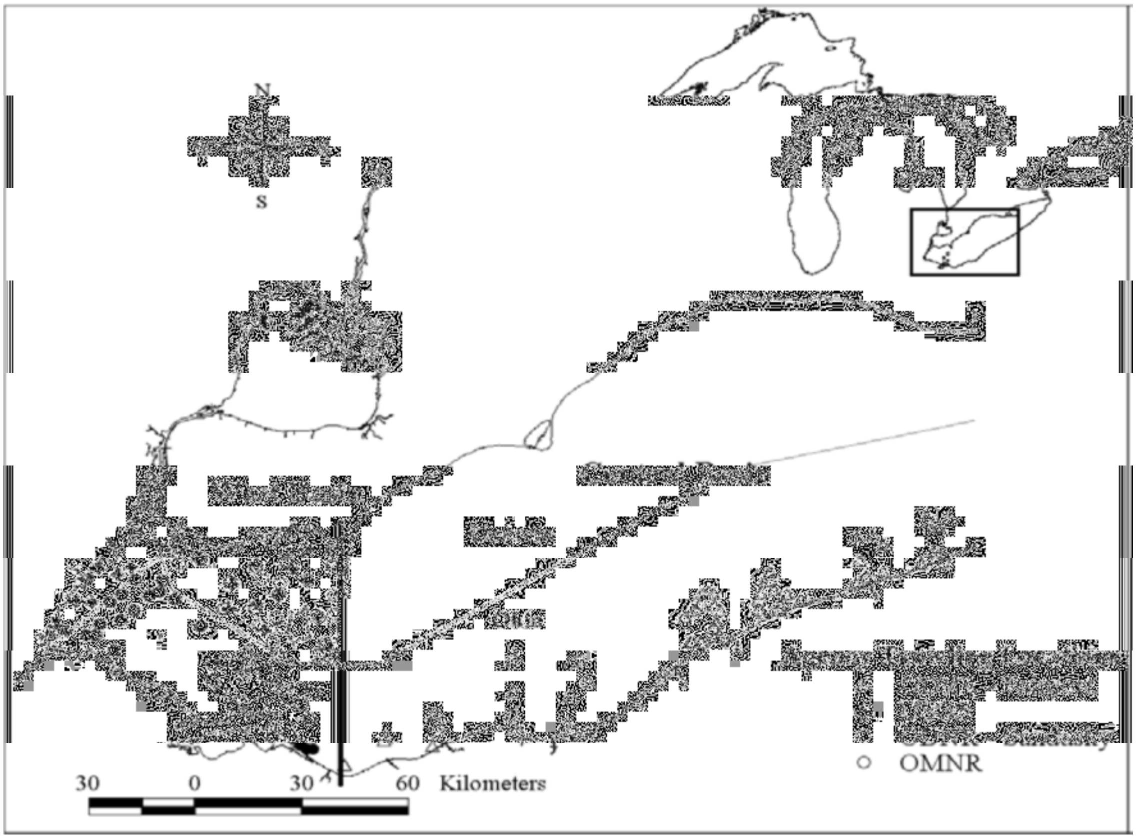
Source: OMNR, 2013a

Each of the basins is split into strata within which stations are randomly allocated, with about 133 sites sampled (2-3 sets per site) per year. Standard gangs of gillnet consisting of fourteen different mesh sizes are fished in two distinct manners: canned and bottom sets. At each site, a bottom gang and a canned gang are set. OMNR (2013a) describes the gear configurations and deployment as well as the sampling protocols. Until 1997, the partnership survey was conducted by volunteer commercial fishers, with onboard OMNR/industry selected technicians undertaking the sampling protocol. However, since 1997, the surveys have been completed using OCFA/OMNR selected technicians deployed on contracted vessels. Also since 1997, partnership surveys are completed over a shorter time frame, which is beneficial when surveying migratory species such as Walleye and Lake Whitefish. In addition, it assures that all sites will be sampled every year. The gillnet index program begins in late August and progresses eastward into eastern Lake Erie, being completed in early November. All fish caught during the partnership survey are identified, counted and weighed "in bulk" by species and mesh size. Biological sampling for selected species includes length, weight, sex, maturity, gonad weigh and the collection of age structures (i.e. otoliths are collected from Yellow perch, Walleye, Burbot and whitefish).

The statistical properties of the partnership survey have been examined. For instance, typically there is a high proportion (75 – 83% during 1989 - 2008) of species-specific zero observations in the partnership survey. Based upon a statistical analysis of the survey data, Li *et al.* (2011) suggested that the AdaBoost algorithm be used to produce more reliable indices of abundance. This approach may be incorporated into future assessments.

Interagency trawl surveys have been conducted in MU 1 since 1987, in MU 2 and MU 3 since 1990, and in MU4, since 1980 (Fig. 21).

Figure 21: Location of sites sampled by interagency trawl surveys in the western and central basins of Lake Erie 1987-2005



Source: ODNR, U.S. Geological Survey and OMNR after Tyson *et al*., 2006

These surveys provide indices of year class strength based on catches of young-of-the-year. In the west basin, OMNR and ODNR sample 36 and 41 stations respectively each August while ODNR samples 75 stations in the central basin. In the east basin, Ontario and New York work cooperatively, to conduct this component of the interagency survey (Tavel, 2009). Sites are selected randomly from three depth strata: 3-6m, 6-9m, > 9m in the western basin of Lake Erie. Adjacent sites are sampled consecutively within each week; each week may be completed in three days depending on conditions. OMNR (2013c) describes sampling and data collection protocols. In Ontario, the gear is a two seam Biloxi bottom trawl (1" codend with ½" codend liner) which is towed for 10 minutes at 1.6 kts (OMNR, 2013c). However, while most interagency trawling surveys have similar and standardized gear and sampling protocols, some differences in gear and vessels exist. To account for differences attributed to catchability in these surveys, an intercalibration experiment was conducted in August 2003 using five survey vessels. Correction factors were estimated for the 10 most commonly collected species by age-group for each vessel during the experiment. Differences in survey catch rate were most evident for vessels using different sampling gears, although differences also existed for vessels using the same gears (Tyson *et al*., 2006). However, most of the correction factors ranged from 0.5 to 2.0, indicating that the systematic bias associated with different vessel-gear combinations was not large.

To complement information derived from the index surveys, juvenile fish are surveyed in Long Point Bay with three independent bottom trawl surveys conducted concurrently during the early fall each year in three areas. Trawls targeting Yellow perch have been conducted annually since 1980 in Inner Long Point Bay (Inner Bay Trawl

Assessment) and the inshore waters of outer Long Point Bay (Nearshore Outer Bay Trawl Assessment). A third trawl survey was initiated in 1984 to estimate rainbow smelt recruitment in the offshore waters of Outer Long Point Bay (Offshore Outer Bay Trawl Assessment). Species composition and age groups are recorded for all catch. Individuals in species groups are classified as either YOY or yearling and older. For yearling and older fish sex, maturity and age is also determined and recorded. The results of these surveys have not yet been formally incorporated into the Yellow perch assessment model for MU 4.

An annual gillnet survey to monitor composition, abundance, and biological characteristics of important sport and commercial fish species communities over time has been conducted since 1986 in the outer waters of Long Point Bay, in depths ranging between 12-30 feet. The Bay is portioned into 3 sampling areas, which is then further subdivided into sampling grids and 2 depth strata. From 1986 to 1993 surveys were conducted from spring to fall, however, since 1994 this has been reduced to June to August. The study has provided trends in abundance, biomass, and growth of Yellow perch from 1986 to recent years in Long Point Bay. Again, the results of these surveys are not formally incorporated into the Yellow perch assessment model for MU 4.

Other Data

Besides the Ontario and U.S. state commercial fisheries, other primary fisheries are sport for Walleye and Yellow perch, the majority taking place in the U.S.

The catch of the Ontario recreational fishery is negligible compared to that of the commercial fishery (B. Locke, pers comm). There is no mandatory reporting requirements for either charter or non-charter recreational licenses. Angler diaries which provide similar data to those of the DCR allow estimation of catch rate indices (CPUE). Creel surveys are not conducted on an annual basis but are conducted from time to time verify the angler diary information. The most recent Ontario surveys were conducted in 2003 (MU 4 – 5), 2004 (MU 2 – 3) and 2008 (MU 1) (WTG, 2013).

In Ohio, about 85% of the participants are individual anglers with the rest being charter boat operators. Creel surveys are used to estimate the catch and CPUE. The sampling design and implementation for the Ohio creel surveys is documented in the state annual reports (e.g. ODNR, 2013). During the site visit, it was noted that the creel surveys for the other states are similar. The data from these creel surveys are considered and reported by YPTG in the annual assessments. The review panel (Lester *et al*., 2005) considered that the creel surveys were generally well-designed to protect against major sources of bias in estimating harvest.

Regarding other fisheries, there is a small hoop and seine fishery in Quota Area 5 in which White perch and Yellow perch are caught. The quota for Yellow perch (20,000 lbs) is typically not caught; about 7,000 lbs are reported annually. There are also small bait fisheries although there are no estimates of their catch. These are small in magnitude compared to the commercial and recreational fisheries.

In 1999, the Forage Task Group (FTG) initiated a Lower Trophic Level Assessment program (LTLA) within Lake Erie and Lake St. Clair. Nine key variables are measured to characterize ecosystem change, including profiles of temperature, dissolved oxygen and light (PAR), water transparency (Secchi), nutrients (total phosphorus), chlorophyll *a*, phytoplankton, zooplankton, and benthos. The protocol calls for each station to be visited every two weeks from May through September, totalling 12 sampling events, with benthos collected on two dates, once in the spring and once in the fall. FTG reports annually on the trends and recent levels of each of these indices.

3.1.6 Stock Assessment

YPTG has used a statistical catch at age (SCAA) model to assess Yellow perch stock status and inform management decisions since the mid-1990s. Separate models have been developed for each of the stocks in MUs1-4. Prior to 2001, the CAGEAN software package was used and since then, the ADMB (http://admb-project.org/) package. While the model has evolved during this period, it has not been as extensive as that of Walleye which has been the focus of work on MSE. During the site visit, it was indicated that the Yellow perch assessment model would be updated in a comparable manner to that of Walleye in the near future. The models which informed 2013 management (YPTG, 2013) are described below.

The SCAA model is divided into three sub-models: the population dynamics sub-model which describes the abundance, mortality and growth functions of the population, the observation sub-model, which links the population characteristics (biomass, numbers of fish at age etc.) to the observations (CPUE, survey index, age and length compositions in surveys and catches) and the statistical sub-model that estimates the likelihood of the observations for a given parameter set, based on the difference between the observations and their expected values. An algorithm is used to search for the set of parameters that maximizes their likelihood. ADMB uses a particularly efficient method to search for the best fit of the model to the data which can cope well with a large number of parameters. Diagnostic tools are used to ensure that the model is fitting the data as well as can be expected and aid in the assessment review process.

An overview of the Yellow perch model components in each MU is provided in Table 13. Regarding the population sub-model, dynamics are modeled since 1975 for ages 2 to 6+. While maturity at age is assumed constant across years, and M (M=0.4) constant across ages and years, weights at age are taken from survey samples and vary by year. These are used to estimate catch and population biomass as required.

Table 13: Yellow perch 2013 SCAA assessment model: Data inputs, parameters & assumptions

MU1

Model Component	Lambdas	Data Input	Parameters (176)
Population		Weight at age, 1975 - 2012; ages 2-6+	Population scaler
		M = 0.4 for all ages & years	Population number: 1975-2012, ages 2-6; 1975-2012, age 1
Fishery	1.0	GN caa: 1975-2012; ages 2-6+; sel: 1990-2012; ages 2-6+	GN sel: 1975-1989; ages 2,3,5,6+; age 4=1
	0.9	Angler caa: 1975-2012; ages 2-6+	Angler sel: 1975-2012; ages 2,3; ages 4-6+=1
	0.7	Trap caa: 1975-2012; ages 2-6+	Trap sel: 1975-2012; ages 2,3; ages 4-6+=1
	0.8	GN effort: 1975-2012 (adjusted for small & large mesh)	GN q: 1975-1983, 1984-1989, 1990-2012 (adjusted added)
	0.7	Angler effort: 1975-2012	Angler q: 1975-1983, 1984-1995, 1996-2012
	0.5	Trap effort: 1975-2012	Trap q: 1975-1983, 1984-1992, 1993-2012
			GN effort dev: 1975-2012
			Angler effort dev: 1975-2012
			Trap effort dev: 1975-2012
Indices	1.0	OH fall trawl: 1990-2012; ages 1-6+	OH fall trawl q: 1990-2012
	1.0	ON GN partnership: 1990-2012; ages 1-6+	ON GN partnership q: 1990-2012

MU2

Model Component	Lambdas	Data Input	Parameters (176)
Population		Weight at age, 1975 - 2012; ages 2-6+	Population scaler
		M = 0.4 for all ages & years	Population number: 1975-2012, ages 2-6; 1975-2012, age 1
Fishery	1.0	GN caa: 1975-2012; ages 2-6+; sel: 1990-2012; ages 2-6+	GN sel: 1975-1989; ages 2,3,4,6+; age 5=1
	0.9	Angler caa: 1975-2012; ages 2-6+	Angler sel: 1975-2012; ages 2,3; ages 4-6+=1
	0.7	Trap caa: 1987-2012; ages 2-6+	Trap sel: 1987-2012; ages 2,3; ages 4-6+=1
	0.8	GN effort: 1975-2012 (adjusted since 2001 for small & large mesh)	GN q: 1975-1983, 1984-1989, 1990-2012 (adjusted added)
	0.8	Angler effort: 1975-2012	Angler q: 1975-1983, 1984-1995, 1996-2012
	0.6	Trap effort: 1987-2012	Trap q: 1987-1992, 1993-2012
			GN effort dev: 1975-2012
			Angler effort dev: 1975-2012
			Trap effort dev: 1987-2012
Indices	0.9	OH fall trawl: 1990-2012; ages 1-6+	OH fall trawl q: 1990-2012
	1.0	ON GN partnership: 1990-2012; ages 1-6+	ON GN partnership q: 1990-2012

MU3

Model Component	Lambdas	Data Input	Parameters (176)
Population		Weight at age, 1975 - 2012; ages 2-6+	Population scaler
		M = 0.4 for all ages & years	Population number: 1975-2012, ages 2-6; 1975-2012, age 1
Fishery	1.0	GN caa: 1975-2012; ages 2-6+; sel: 1990-2012; ages 2-6+	GN sel: 1975-1989; ages 2,3,4,6+; age 5=1
	0.8	Angler caa: 1975-2012; ages 2-6+	Angler sel: 1975-2012; ages 2,3; ages 4-6+=1
	0.6	Trap caa: 1987-2012; ages 2-6+	Trap sel: 1987-2012; ages 2,3; ages 4-6+=1
	0.8	GN effort: 1975-2012 (adjusted since 2001 for small & large mesh)	GN q: 1975-1983, 1984-1988, 1989-2012 (adjusted added)
	0.8	Angler effort: 1975-2012	Angler q: 1975-1983, 1984-1995, 1996-2012
	0.6	Trap effort: 1987-2012	Trap q: 1987-1992, 1993-2012
			GN effort dev: 1975-2012
			Angler effort dev: 1975-2012
			Trap effort dev: 1987-2012
Indices	1.0	OH fall trawl: 1990-2012; ages 1-6+	OH fall trawl q: 1990-2012
	1.0	ON GN partnership: 1989-1995; ages 1-6+	ON GN partnership q: 1989-1995
	1.0	ON GN partnership: 1997-2012; ages 1-6+	ON GN partnership q: 1997-2012

MU4

Model Component	Lambdas	Data Input	Parameters (176)
Population		Weight at age, 1975 - 2012; ages 2-6+	Population scaler
		M = 0.4 for all ages & years	Population number: 1975-2012, ages 2-6; 1975-2012, age 1
Fishery	1.0	GN caa: 1975-2012; ages 2-6+; sel: 1998-2012; ages 2-6+	GN sel: 1975-1997; ages 2,3,4,6+; age 5=1
	0.7	Angler caa: 1989-2012; ages 2-6+	Angler sel: 1989-2012; ages 2,3; ages 4-6+=1
	0.6	Trap caa: 1986-2012; ages 2-6+	Trap sel: 1986-2012; ages 2,3; ages 4-6+=1
	0.8	GN effort: 1975-2012 (adjusted since 1998 for small & large mesh)	GN q: 1975-1987, 1988-1995, 1996-1997, 1998 -2012
	0.7	Angler effort: 1989-2012	Angler q: 1989-1995,1996-2012
	0.6	Trap effort: 1986-2012	Trap q: 1986-1989, 1990-2012
			GN effort dev: 1975-2012
			Angler effort dev: 1975-2012
			Trap effort dev: 1987-2012
Indices	1.0	NY GN survey: 1993-2012; ages 1-6+	NY GN q: 1993-2012
	0.9	ON GN partnership: 1989-1995; ages 1-6+	ON GN partnership q: 1989-1995
	0.9	ON GN partnership: 1998-2012; ages 1-6+	ON GN partnership q: 1998-2012

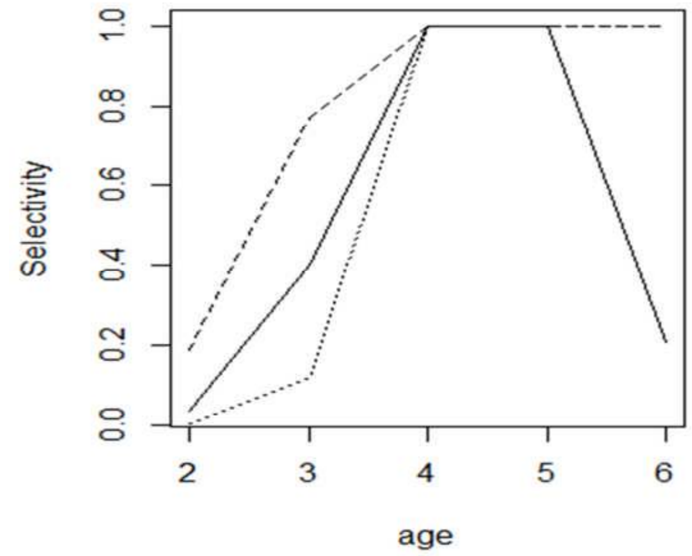
The ON gillnet, OH, and NY angler fisheries are all modeled separately with each employing one age-specific selectivity pattern for their respective time series. These indicate that in MU1, at ages 2 & 3, selection is highest by anglers, followed by gillnets and traps respectively (Fig. 22). Comparable patterns are observed in the other MUs.

Catchability of the two survey indices is assumed to be constant across all ages, which is likely not the case, (Myers & Bence 2001).

F is derived from the time series of effort for each fishery along with its estimated catchability. There are annual patterns in angler, gillnet and trap catchability for MU1 (Fig. 23) that are difficult to interpret. Similar patterns are observed in the fishery catchability trends in the other MUs. The source of these patterns will require examination in upcoming assessments.

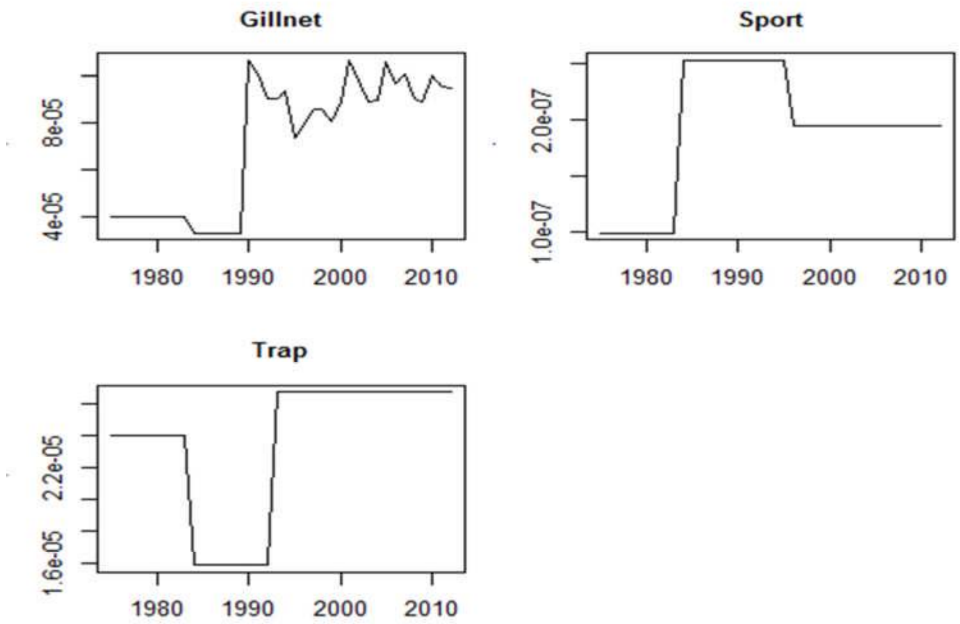
The ON partnership and Ontario / U.S. interagency trawl survey (ages 1–6+) provide the primary indices of abundance at age to calibrate the SCAA models. The catchability (q) on the surveys is assumed to be constant for the entire assessment time period. A concern is the representativeness of the partnership survey of stock trends as it only covers the Canadian portion (roughly 50%) of the stock area. The implicit assumption is that the trends monitored in this survey apply to the unsurveyed area.

Figure 22: Commercial gear selectivity at age of MU1 Yellow perch by angler (dash), gillnet (solid) and trap (dotted) gears respectively



Source: YPTG, 2013

Figure 23: MU1 - Annual trends in angler, gillnet and trap catchability 1975 -2012



Source: YPTG, 2013

The impact of this assumption is mitigated by including the interagency survey which covers the whole stock area. Myers & Bence (2001) noted other issues with the surveys (e.g. changes in survey effort over time) that required further exploration in future assessments.

For the objective function, lognormal errors are assumed in fitting the modeled catch at age, effort and survey at age indices to the observations. Of note is that, contrary to the Walleye assessment, catch and proportions at age are not modeled separately but together. The relative error and thus contribution of the removals and index data to the objective function is governed by an input lambda factor. These lambdas are an estimate of the relative variance in the datasets. In a review of the Walleye assessment (Myers & Bence, 2002), issues with the use and estimation of lambda values up until then were highlighted. This led LEC to convene a workshop (STC, 2007) to review the estimation of the lambda values and recommend appropriate approaches for weighting the assessment input datasets.

YPTG (2013) does not provide diagnostics on model fit. Examination of residual patterns by the IFC team indicated no major issues. There does not appear to have been a retrospective analysis of model behavior.

A report on how YPTG responded to the recommendations of Myers & Bence (2001) is provided in YPTG (2002). Many of the recommendations have been incorporated into the Yellow perch assessment.

The assessment estimates stock status at the beginning of the year during which the assessment is undertaken. For instance, the March 2013 assessment estimated population conditions at the beginning of 2013. For the harvest projection during 2013, the age 2 numbers at age are estimated using, outside the SCAA model, a linear regression of juvenile (age -0) indices against modeled estimates of age 2. Uncertainty in the current year`s (e.g. 2013) stock abundance is expressed as plus (maximum) and minus (minimum) one standard deviation of the mean, these based on the delta method. These three levels of population size at the beginning of 2013 are projected to the beginning of 2014 under a range of harvest options. YPTG estimates a minimum, mean and maximum RAH based upon a harvest policy (50%F_{MSY}) and LEC determines the TAC by consensus.

While there are issues with the Yellow perch assessment, these are not considered major and indeed the model is consistent with formulations used elsewhere. This was also the conclusion of Myers & Bence (2001).

An internal annual review of the assessments is done by YPTG. As indicated above, Myers & Bence (2001) were commissioned to undertake an external review of the assessments for the four MUs. The reviewers made extensive suggestions about how the assessments and management strategies could be improved in the future; they emphasized however, that these should not be interpreted as concluding that the assessments were incorrect. Suggestions for improvements were made rather than imperatives.

3.2 Walleye

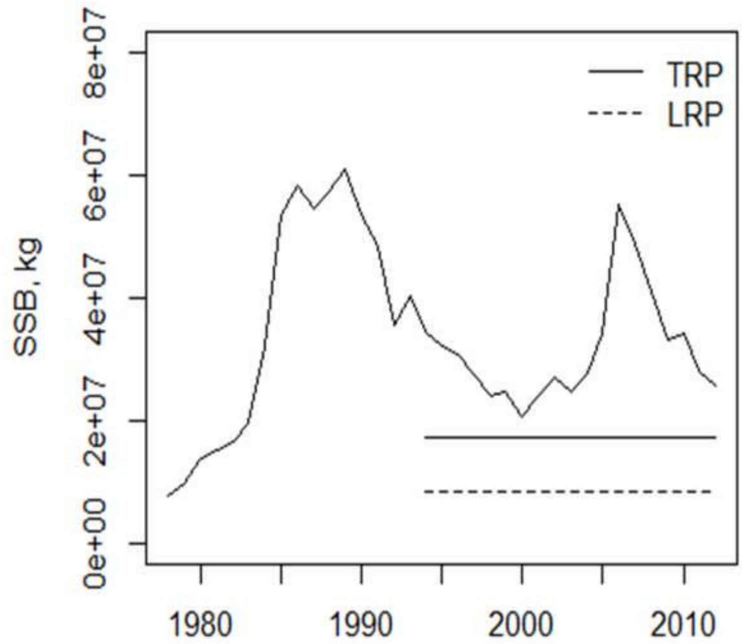
3.2.1 Stock Status

In 1978, Walleye SSB was at an historical low (Fig. 24); it rose dramatically in the 1980s to reach an historical high by 1990 and then declined before recovering until the mid-2000s after which it has declined until the present. Current SSB is well above the MSC default TRP of 40% SSB_0. WTG (2013) determined that the probability of SSB at the beginning of 2014 was below the LRP was 0.011%.

The trends in SSB are primarily driven by trends in recruitment (Fig. 25). While long-term recruitment has averaged about 14.1 million individuals at age 2, large year-classes in 1982, 1986 and 2003 significantly contributed to SSB during the 1980s and 2000s. The decline in recruitment since 2005 is a modest cause for concern that management will need to consider in near future management.

Fully recruited F first declined over the long-term (Fig. 26), being high (relative to M=0.32) at the beginning of the 1980s, fluctuating around 0.32 during the 1990s, and being below 0.2 in the 2000s. In 2013, F was 0.195, which is significantly below F_{MSY} (0.493) and the F_{TR} (0.296).

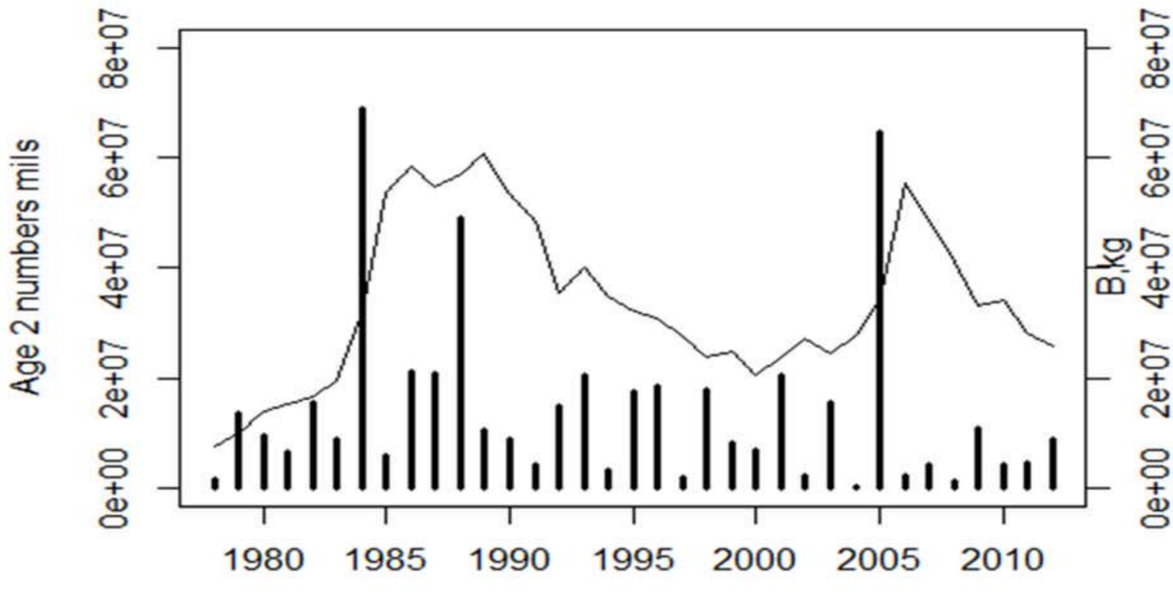
Figure 24: Walleye: Trend in spawning biomass (kg) since 1978



Upper and lower horizontal lines indicate TRP (MSC 40% SSB_0 default) and LRP respectively, which are assumed to apply to post-1994 stock conditions

Source: Data from assessment model of WTG, 2013

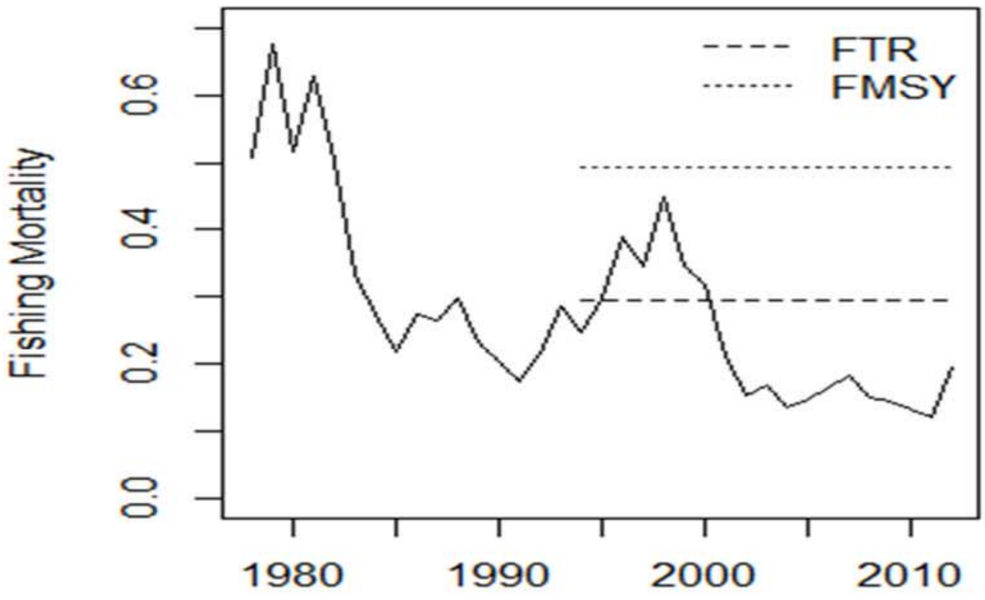
Figure 25: Walleye: Trends in age 2 population numbers



Solid line is SSB and bars are recruitment.

Source: Data from assessment model of WTG, 2013

Figure 26: Walleye: Trend in fully recruited fishing mortality since 1978



Upper horizontal line is F_{MSY} and lower is F_{TR} for 2014, which are assumed to apply to post-1994 stock conditions.

Source: Data from assessment model of WTG, 2013

3.2.2 Reference Points

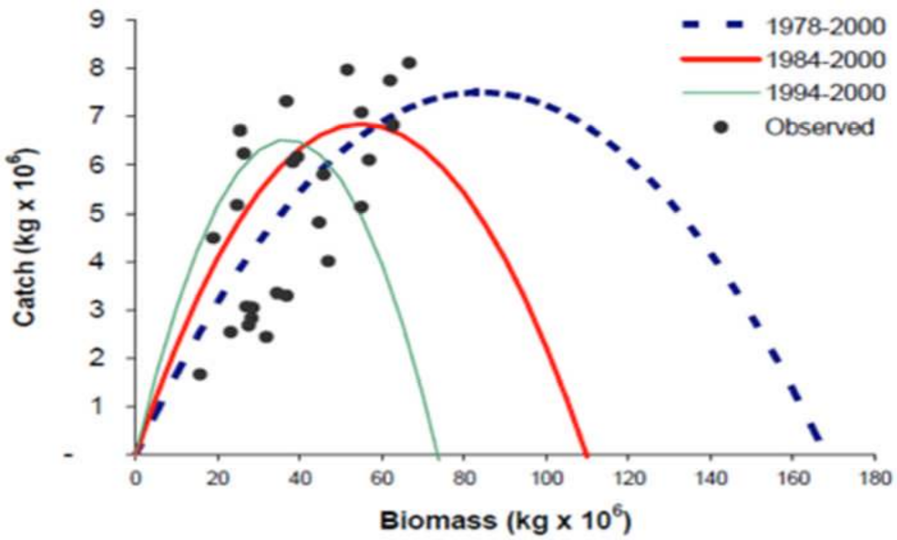
A number of approaches have been used to inform Lake Erie Walleye management. Following the lifting of the 1970 imposed moratorium on fishing in 1976, international quotas were introduced, based on 50% B_0 times M. In 1977 – 78, the Gulland method was used to derive the TAC. In 1984, the target F was made conditional on the level of Walleye abundance:

- <20 million fish in two successive years:
  - For any one year- 15-20 million: F = 0.20
  - 10-15 million: F = 0.15
  - <10 million: F = 0.10
- 40-50 million fish in two successive years: F = 0.285
- >50 million in two successive years: F=0.285+ (Abundance–50 million)

In the 1990s, Beverton & Holt Yield per Recruit analyses were used to establish target harvest rates. For instance, in 1999-2000, based on Yield per Recruit analyses, F_{OPT} was set at 0.326 (LEC, 2005a); this was considered a proxy for F_{MSY}. Yield per recruit analyses continued to be used until recently.

Surplus production models had also been used to provide an overview of the long-term dynamics of the population and provide estimates of carrying capacity. These have indicated that Walleye carrying capacity (K) has changed over time, from about 170 mil kg. in the early 1980's to 75 mil kg in the late 1990's (Fig. 27). LEC (2005a) provides a number of MSY-related reference points associated with these models.

Figure 27: Walleye surplus production model utilizing three different time series 1978-2000, 1984-2000 & 1994-2000



Source: LEC, 2005a

To meet the objectives of the WMP (2005), LEC explored the use of Decision Analysis (DA) to help incorporate uncertainty into decision making, include the knowledge of risks involved in various decision alternatives, and improve the transparency to stakeholders on the decision-making process and the rationale of decisions on Walleye quotas (LEC, 2005a). The first step in the process was to explicitly define operational objectives, a critical component of which is reference points. LEC wished to define a minimum population level from which recovery was not possible within a reasonable time frame. It noted that the relationship between SSB and recruits was weak, with environmental influences masking the effects of stock size on recruitment. LEC therefore considered a population size for sustainability that would lead fisheries to take on negative attributes such as:

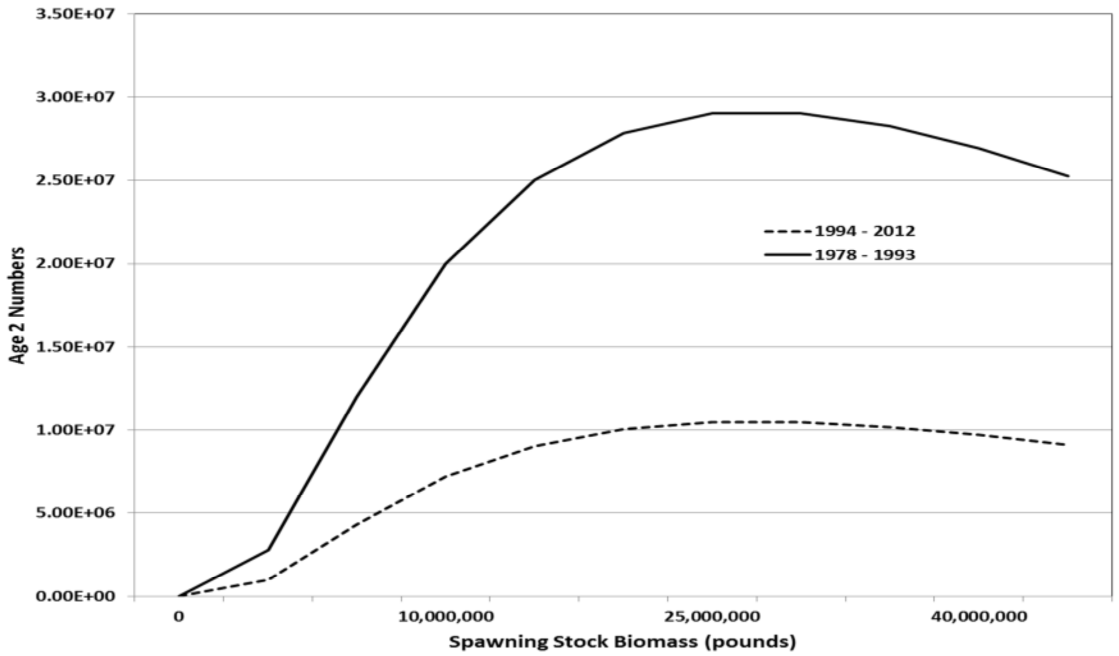
- reduction in catch rates that led to declining angler interest, or make the economics of the commercial fishery problematic;
- reduced number of year classes causing a simple age structure that can lead to low levels of spawner biomass; and
- dependence of fisheries on single year classes, which can cause TACs and harvest to vary wildly on an annual basis (particularly at fixed exploitation rates).

The population abundance of Walleye 1999 – 2000 was considered a level of abundance that created the negative attributes described above. Both commercial and sport fishery catch rates were at 10-year lows, and all jurisdictions had difficulty attaining their portions of the TAC. LEC determined that the population abundance observed in 2000 was a critical minimum for the quality of fisheries, and was problematic for the sustainability of the resource. This critical limit was then combined with other population categories used by LEC and associated with F targets:

- Less than15 million: crisis (F = 0.1)
- 15-19 million: rehabilitation
- 20-25 million: low quality fisheries (F = 0.2)
- 26-40 million: maintenance
- Greater than 40 million: high quality fisheries (F = 0.326)

This was referred to as the 'sliding F' HCR which was used up to 2013. The DA noted above evolved into a full MSE of the Lake Erie Walleye fishery. The MSE was undertaken during fall 2010 – fall 2013 and involved stakeholder engagement over 11 meetings. The MSE explored the 'sliding F' HCR and proposed alternatives. Consensus could not be reached on all aspects of a new HCR and thus an interim policy was announced (LEC, 2013) which outlines the RPs which inform current management. The basis of these reference points were the dynamics described in the 2013 SCAA model (see Assessment section), the key relevant elements being linked stock – recruit and stock per recruit dynamics. These RPs take account of the long-term changes in the stock, as evidenced by the earlier surplus production models, particularly modeling a reduction in productivity since 1994. Specifically, the relationship between stock and recruitment was modeled as a Ricker relationship with residual error modeled as a first – order autoregressive process (Jiao *et al*., 2009) and the change in productivity since 1994 described through the use of an environmental covariate (M. Catalano, pers. comm.). The resulting relationship shows the large decline in productivity since the 1980s (Fig. 28).

Figure 28: Ricker stock – recruitment relationship for Walleye which indicate a reduction in productivity since the 1980s



Source: Data from assessment model of WTG, 2013

SSB and F reference points are used in current manaagment which assume reduced productivity since 1994. LRP is defined as 20% of virgin biomass (SSB_0), estimated as 8.561 mil kg (WTG, 2013) and is consistent with the MSC default; the MSE provided evidence that this is a suitable LRP as it determined that this was the biomass level below which productivity is severely impaired.

The F_{target} (FTR) is set at 60% F_{MSY} (0.296), which is 93% of M. Zhou *et al.* (2012), in an empirical study of F target reference points , noted that targets which are 87% of M provided the best management results. The current F target is consistent with this finding.

The HCR does not explicitly use a biomass target reference point, although fishing at 60% F_{MSY} implies an SSB of 27.889 mil kg which is 65% of SSB_o. CB2.3.4 states that where the LRP is set to 20% SSB_0, the MSC default TRP consistent with SSB_{MSY} may be assumed to be 2xLRP or 40% SSB_0. Thus the implied SSB target of the HCR and fishing at 60% F_{MSY} is significantly more precautionary than fishing towards SSB_{MSY}. The MSC default TRP is used in this assessment.

Walleye is the terminal (top) predator in many near-shore habitats within the Great Lakes. Walleye fry consume primarily small aquatic crustaceans (copepods, cladocerans) and some small fish, while adults feed opportunistically on fish and larger invertebrates. FishBase provides an estimate of 4.31 - 4.46 for Trophic Level. Adults can be 35 – 48 cm in length with a maximum age in the order of 30 years. Females mature at about age 5 and can lay up to 400,000 eggs in a single spawning event. Walleye does not fit the profile of an LTL species outlined in MSC CR 2.3.13b.

3.2.3 Stock Recovery

WMP (2005) outlines the overarching objectives, RPs and HCR to manage Walleye. As noted above, exploiting the stocks at a maximum of 60% F_{MSY} is, over the long term, expected to maintain the stock above B_{MSY}. Thus, by intent, rebuilding a depleted Walleye stock should not be required. Indeed, Walleye in recent years has been well above B_{MSY} and above the implied TRP of the HCR. The MSE evaluated different scenarios in stock rebuilding and a rebuilding plan could be implemented based upon its findings if needed.

3.2.4 Harvest Strategy

As noted for Yellow perch, the HS is composed of the linked HCR, tools (i.e. regulations), monitoring, and assessment method to ensure that management achieves its objectives. These objectives are operationalized through the use of RPs. RPs, monitoring and assessment are discussed in separate sections. Here, attention is placed in the objectives, HCRs and tools and how the components of the HS work together in Walleye management.

Objectives

In the late 1990s, in response to population decline precipitated by a combination of fishing pressure, poor recruitment, and environmental changes (the latter brought about by invasive species such as dreissenid mussels) LEC initiated the Coordinated Percid Management Strategy (CPMS) in which the annual TAC was set at a ceiling of 3.4 mil fish and subsequently at 30% of this due to continued population decline. The CPMS defined two overarching objectives: to reverse declines and rebuild percid stocks to achieve a broad distribution of benefits throughout the lake; and to improve approaches used to estimate percid abundance and determine sustainable harvest levels

To help ensure that the Walleye population would not need such rapid and drastic management action as that taken during the CPMS, LEC determined that it required a new plan (WMP, 2005) to manage Walleye. This plan has guided the fishery since 2005. It establishes fishery sustainability and quality objectives that LEC would employ as a basis for Walleye management. The overarching objectives for the fishery in the WMP are: Secure a balanced, predominantly cool water fish community with Walleye as a key predator in the western basin, central basin, and the near shore waters of the eastern basin; Provide sustainable harvests of Walleye for all areas of the lake; Genetic diversity – maintain and promote genetic diversity by identifying, rehabilitating, conserving, and/or protecting locally adapted stocks; Maintain Walleye catch rates at average or better levels; and Maintain sport and commercial Walleye harvest to average or better levels.

The WMP is being updated. In order to move forward with updating the management plans for Walleye with increased stakeholder engagement and transparency, LEC formed LEPMAG.

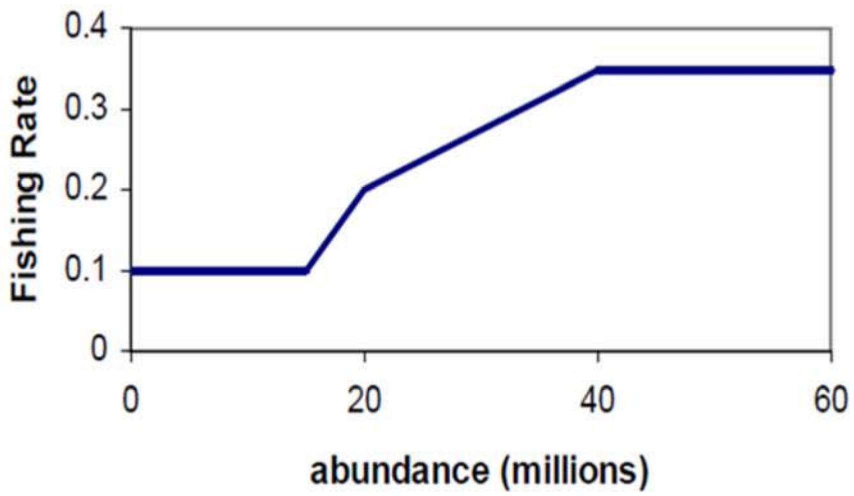
From November, 2010 through February, 2012, LEPMAG members were involved in a series of five facilitated workshops that defined common fisheries objectives for the Lake Erie Walleye population, described the current assessment programs, data sources, stock assessment model and LEC HCR. At the final workshop of the first round of LEPMAG meetings in February 2012, a Technical Review Panel comprised of modeling and fisheries management experts reviewed the SCAA stock assessment model and made recommendations for LEPMAG to consider with respect to potential improvements in the stock assessment model. QFC incorporated these recommendations into a formal Walleye MSE (see below) (WTG, 2013).

Harvest Control Rules

As part of the 2005 management plan review, LEC considered the harvest options of the fishery. Management options (i.e. fixed and feedback) were identified along with key uncertainties in the state of nature. These included catchability, selectivity-at-age, M, current abundance, stock-recruitment relationship, and the relationship between angler effort and abundance. The performance of the management options was evaluated using a set of performance measures (LEC, 2005). Simulations indicated that the Walleye population is influenced more by recruitment than by fishing mortality. As a result, more than one management option could perform well and meet stated management objectives.

LEC proceeded with the sliding F Policy (Fig. 29).

Figure 29: Walleye LEC sliding F HCR for management in Lake Erie



Source: LEC (2005b)

When the population was <15 million Walleye, F was lower (0.1) than rates used during the extant CPMS. At population abundances >40 million, F (0.35) was set at a level consistent with the 1978-2004 mean. At abundance levels from 15 to 40 million, the approach used variable F, or sliding F, that scaled with the population abundance. This option was designed to reduce exploitation when Walleye abundance was low, and safely exploit the resource when abundance is high. It enabled older Walleye to survive and migrate eastward to support central and eastern basin fisheries and create a broad distribution of benefits throughout the lake consistent with the fish community objectives. This is similar to the `hockey stick` HCR used in other fisheries and is considered to be precautionary. The sliding F approach continues to be used.

The discussion and analyses of management options evolved into a full MSE of the Walleye fishery. An MSE is an evaluation of robustness of achievement of management objectives in the face of observational, process and implementation uncertainties (Sainsbury *et al*., 2000) and is generally accepted as a highly effective means to define robust harvest plans. It is inclusive, involving managers, scientists, fishermen and stakeholders and involves: defining clear management objectives; developing performance measures for each objective; identifying candidate management procedures (data collection, stock assessment, harvest strategy); conducting a prospective evaluation of procedures against objectives; and communicating results to decision-makers

The MSE is recent (Nov 2010 – Sept 2013) and full documentation is not yet available. The IFC team had access to all the LEPMAG meeting minutes, presentations and associated reports which indicated that a comprehensive examination of the HCR was undertaken. A sense of this is provided by Berger (2011) who summarizes some of the uncertainties examined (e.g. spatial structure of the population, catchability in fishery and surveys). Other uncertainties (see Assessment section) included changes to catchability (random walk vs. fixed time block), selectivity (estimated within the model across all ages vs. fixed at one age), treatment of catch-at-age data (multinomial distribution vs. lognormal distribution), M (age-specific M vs. M=0.32 for all ages) and estimation of age 2 recruits within the model vs. outside the model as is currently the case in the Yellow perch assessment. The LEPMAG recommendations of SCAA model changes were generally accepted by LEC and implemented to inform 2013 management (WTG, 2013).

LEPMAG developed a range of HCRs and reference points, the performance of which was evaluated through simulation (WTG, 2013). The HCRs included a range of TRPs based on MSY (using $F_{40\%MSY}$, $F_{60\%MSY}$, $F_{80\%MSY}$, $F_{100\%MSY}$ as F_{MSY} proxies) and LRPs based on 20% or 40% SSB_0. LEPMAG also considered a constraint on the amount of inter-annual change (10 – 20%) in the TAC. Lastly, LEPMAG considered implementing a probabilistic control rule (or P*) in a similar manner to US fisheries to account for uncertainty in harvest decisions. This control rule calculates the probability that SSB will go below the 20% SSB_0 threshold based on the TAC option being considered. It was recommended that there be no more than a 5% chance that SSB goes below 20% of SSB_0 for a given harvest option.

WTG (2013) reports that consensus could not be achieved on all aspects of a new HCR. LEC chose to adopt an interim HCR to inform 2013 harvesting. This interim policy employed a TRP of $F_{60\%MSY}$, a LRP of 20% SSB_0, an inter-annual constraint on TAC changes of 20% and a probabilistic control rule (P* of 5%) associated with the LRP. During the preparation of this assessment report, the OCFA reported that this HCR is no longer interim and will be included in the new Walleye management plan soon to be released. It will inform decision-making up until 2018 (K. Reid, pers comm). It should be noted that, consistent with past practice, RAH ranges are still calculated by applying the target fishing rate determined by the HCR to the mean, minimum, and maximum population estimates from the SCAA analysis. However, these may be redundant, due to the P* approach and their continued use on the management may need to be re-considered.

Using results from the 2013 integrated SCAA model, the estimated abundance of 17.736 million age 2 and older Walleye in 2013, and the interim HCR (TRP =$F_{60\%MSY}$; LRP =20% SSB_0), the calculated mean RAH for 2013 is 2.887 million Walleye, with a range from 2.419 (minimum) to 3.356 (maximum) million Walleye (Table 14). The target fishing rate, ($F_{60\%MSY}$ =0.296) in the HCR was applied since the probability that the projected spawner biomass at the beginning of 2014 (17.351 million kg) could fall below the LRP ($SSB_{20\%}$ = 8.561 million kg) after fishing at $F_{60\%MSY}$ in 2013 was less than 5% (P=0.0001). Thus the probabilistic control rule that may reduce the target fishing rate to conserve spawner biomass, was not invoked in 2013.

It is useful to consider whether or not F is reduced as the LRP is approached under the interim HCR. This is a function of the P*. It can be expected that as SSB declines, the probability that it will be below the LRP will increase. This will cause a downward adjustment in the projected quota until the P* test is not triggered. Thus, it can be expected that F will be reduced as the LRP is approached under the HCR.

Table 14: Walleye - Estimated harvest 2013 & population projection for 2014 for fishing scenarios of 60% of F_{MSY}

SSB_0=	42.807	million kilograms
20 % SSB_0=	8.561	million kilograms
F_{msy} =	0.493	

Age	2013 Stock Size (millions of fish) Mean	60% F_{msy} F	sel(age)	Rate Functions (F)	(S)	(u)	2013 RAH (millions of fish) Min.	Mean	Max.	Projected 2014 Stock Size (millions) Mean	
2	3.469		0.235	0.069	0.677	0.058	0.164	0.200	0.235	3.433	
3	6.274		0.779	0.230	0.577	0.177	0.946	1.111	1.277	2.350	
4	2.015		0.813	0.240	0.571	0.184	0.313	0.371	0.429	3.619	
5	1.184		0.789	0.233	0.575	0.179	0.179	0.212	0.246	1.151	
6	2.055		0.837	0.248	0.567	0.189	0.327	0.388	0.450	0.681	
7+	2.739		1.000	0.296	0.540	0.221	0.491	0.605	0.719	2.644	
Total (2+)	17.736	0.296				0.163	2.419	2.887	3.356	13.878	
Total (3+)	14.267						2.256	2.688	3.120	10.444	
SSB	21.700	mil. kgs								17.351	mil. kgs

probability of 2014 spawning stock biomass being less than 20% SSB_0 = 0.011%

Source: WTG, 2013

Tools

The primary management tool in the regulation of the Walleye fishery is an annual TAC (in numbers), a portion of which is allocated to each jurisdiction for allocation according to individual priorities. In 1976, SPC discussed several quota allocation options, including allocation on the basis of division of TAC among jurisdictions based upon the relative surface area of adult Walleye habitat within each jurisdiction, spawning/nursery area within each jurisdiction, or shoreline length within each jurisdiction (STC, 2007). SPC concluded that the simplest and most logical approach was the division by surface area while postponing the other methods pending acquisition of more definitive data. The estimated surface area within the 7-fathom contour of MU1 and 2 was calculated for each jurisdiction (MI, ONT, OH), and quotas were allocated based on these proportions. These surface area proportions were used for allocating harvest quotas by LEC from the inception of quota management through to 1988 at which time the sharing formula was revisited to include MU3. In 2004, LEC further defined the Lake Erie basin such that MUs and quota sharing formulas could be updated using the more definitive technical data available, as well as to document the history of sharing formula calculation and quota allocation. The analysis indicated that the extant estimates of relative surface area, despite being a bit arbitrary (calculated as the mean of the historical and revised estimates) were relatively close to the new estimates which included area within the 7-fathom contour in MU1 to 3. Notwithstanding this, STC recommended that LEC adopt the new sharing formulas for Walleye quota allocation as these estimates were based upon the most current technical data available.

A number of regulations are used in the Ontario gillnet and U.S. sport fisheries (see above).

Linkage between Components of Harvest Strategy

In evaluating the HS, it is important to assess how closely the harvest recommendations of WTG are followed by LEC and then how well the catch is managed in relation to the TAC.

RAHs (in mil fish) are provided by WTG to LEC each spring. Since 2010, these have included the mean as well as minimum and maximum (plus and minus one standard deviation of the mean) estimates. LEC deliberates on the advice and sets a TAC, which is divided amongst the jurisdictions based on an agreed (spatial) sharing formula.

Overall, reported catch has been below the LEC TAC while the latter has generally followed the mean RAHs of the WTG (Table 15).

Table 15: Walleye: Comparison of RAH, LEC Advice & Reported Catch (2005 – 2013)

	Harvest mil no.				
	RAH			LEC TAC	Reported Catch
	Min	Mean	Max		
2005		5.8		5.815	3.581
2006		9.886		9.886	5.669
2007		5.36		5.36	4.486
2008		3.6		3.594	2.778
2009		1.558		2.45	2.157
2010	1.376	2.429	3.597	2.2	1.997
2011	1.832	2.919	4.202	2.919	1.692
2012	2.191	3.487	5.326	3.487	2.364
2013	2.419	2.887	3.356	3.356	

Source: K. Reid

3.2.5 Information

Stock Structure

The WMP (LEC, 2005) focuses primarily on the Walleye stock that spawns on shoals and in tributaries of the western basin, and generally inhabit the west (MU1 & 2) and central basins (MU3) of Lake Erie. These three MUs are considered one stock which is the primary population of interest as it provides most of the benefits to users throughout Lake Erie. Walleye are also found in Presque Isle Bay, East of Long Point, in the eastern basin (MU 4 and 5), which are considered an additional stock. Assessment of this eastern stock remain problematic, but it is clear (LEC, 2005) that it is small relative to the western stock. The eastern basin stock is not part of the assessment.

Genetic and tagging studies examine the basis of stocks by MU; several genetic investigations have covered the stock structure in the Lake Erie Walleye resource both among and within the eastern and western basins of Lake Erie (Stepien & Faber 1998; Strange & Stepien, 2007; Gatt *et al*. 2003; Wilson 2003). Collectively, the western basin Walleye spawning stock remain genetically distinguishable from eastern basin stock (Stepien & Faber 1998), and exhibit markedly different abundance, mortality, and distribution patterns within Lake Erie (Haas *et al.* 2003, Ryan *et al*. 2003, WTG 2004).

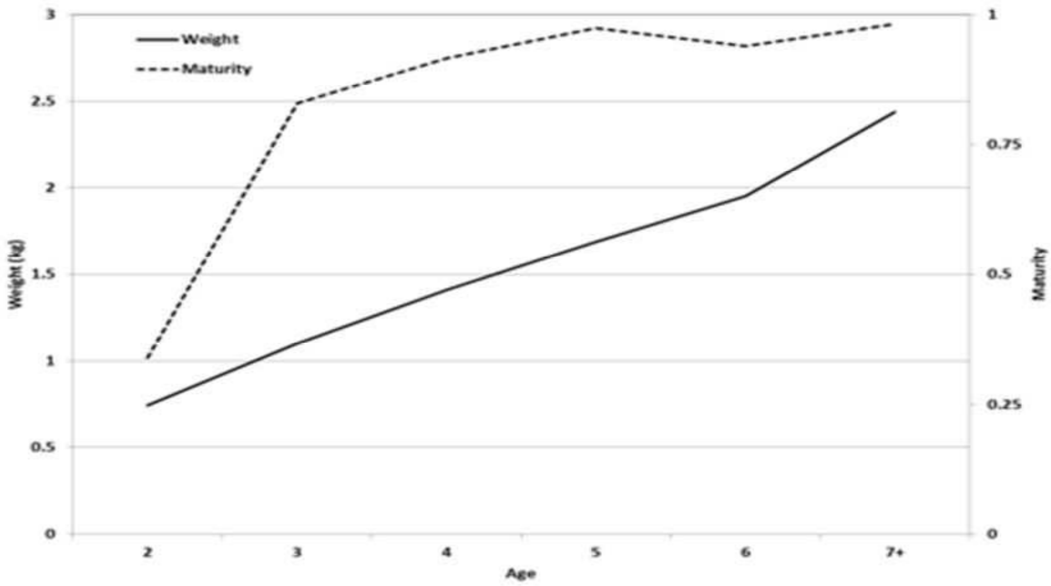
On-going inter-agency Walleye tagging studies carried out by WTG shows that the western basin Walleye stock generates a lakewide distribution of tag recoveries from fisheries, while tag recoveries from eastern basin spawning stock shows this group remains more confined to the eastern half of Lake Erie. These studies indicate that the source of the large Walleye resource exploited in the western and central basins of Lake Erie are part of the western basin spawning stock. In contrast, Walleye in the eastern basin includes fish that originate from both the western and eastern basins (Einhouse & MacDougall 2010). In a recent study, Zhao *et al.* (2011) used a mark-recapture analysis to quantify the contribution of both sources. They estimated that, on average, about 90% of Walleye harvested in the east basin were seasonal migrants from the west basin. However, there is a large amount of uncertainty and variation associated with the annual age and size structure of the Walleye stock migrating from the west basin. Further, it is unlikely that this migration occurs in a consistent way by exactly the same segment of the stock each year. The study suggests that catch-at-age information cannot track the same cohort of Walleye from year to year in the east basin and the core assumption of tracking cohorts in a cohort-based model is likely violated (WTG, 2013). There is also migration in and out of Lake Erie via the Erie – Lake St. Clair - Huron corridor.

Stock Productivity

Based on survey samples, Walleye exhibit almost linear growth in weight during ages 2 – 7 (Fig. 30).

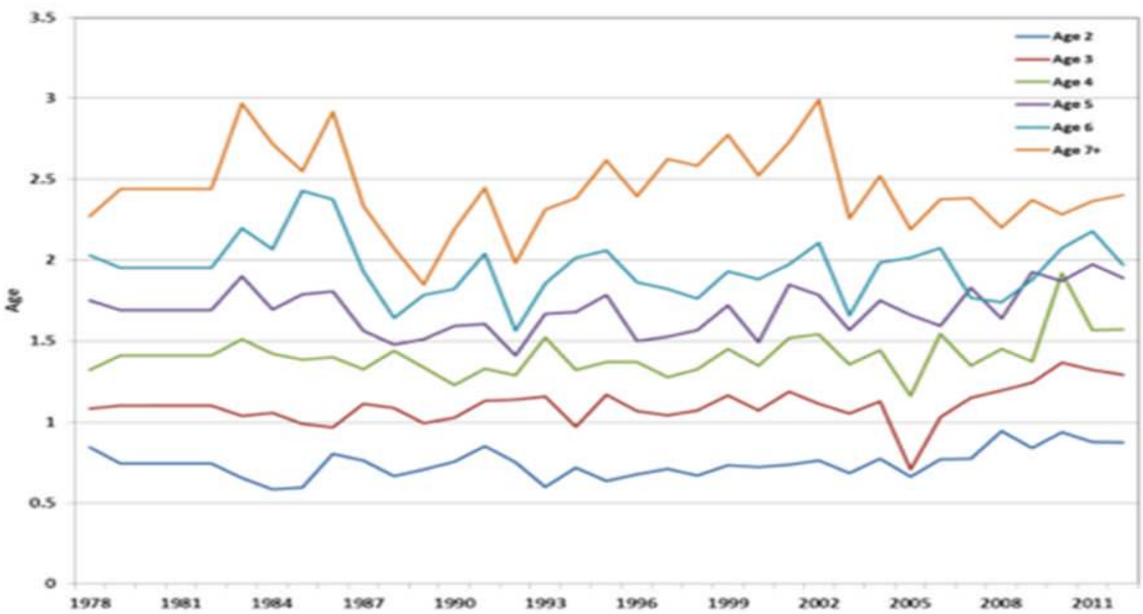
Walleye are about 50% mature between age 2 – 3 with full maturity occurring by about age 5. The assessment employs an age 7+ group in the catch at age; Walleye over 20 are common (K. Reid, pers comm) and the oldest Walleye on record was age 29 (Seafood, 2008). Weights at age from survey sampling does not indicate any long-term changes in growth (Fig. 31).

Figure 30: Walleye: Trends in weight (kg) and fraction mature by age



Source: Data from 2012 assessment input

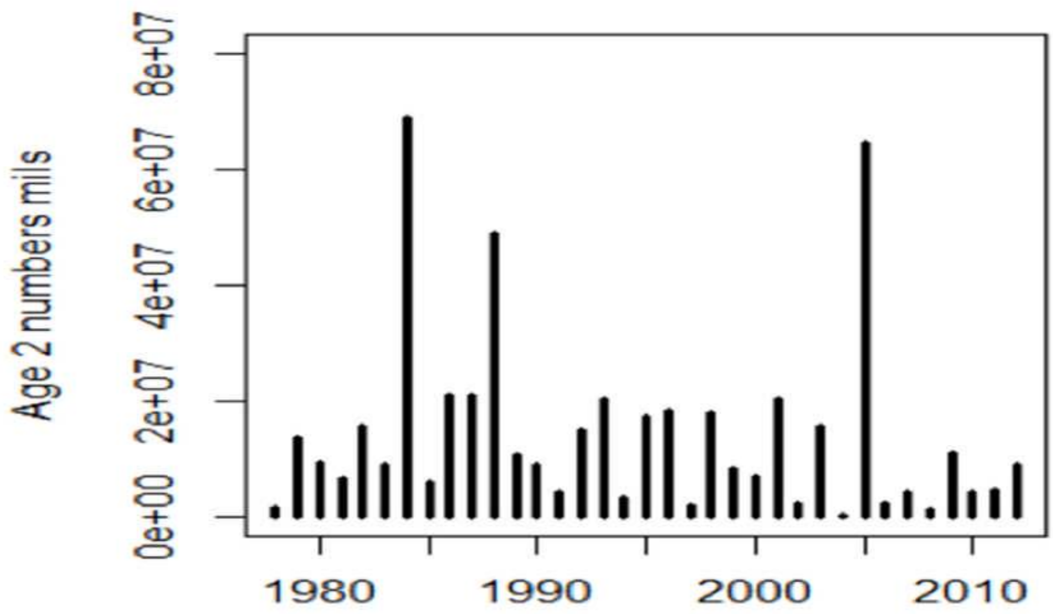
Figure 31: Walleye weights at age (kg) for ages 2 – 7+ from Ontario & Ohio surveys 1978 – 2012.



Source: Data from 2012 assessment inputs

One of the primary indices of year-class strength used in the assessment model is of age zero numbers caught in the fall trawl survey. This indicates that recruitment, while variable, has declined since the 1990s. This long-term decline in recruitment is reflected in the age two numbers estimated by the most recent stock assessment (Fig. 32). The assessment also indicates a strong 2003 year-class. This correspondence is to be expected as the assessment uses the trawl survey data for an index of recruitment.

Figure 32: Walleye: Trend in Age-2 number (millions) estimated by 2013 stock assessment



Source: Data from assessment model of WTG, 2013

The recent MSE on Walleye explored the robustness of a range of harvest control rules to stock uncertainties. As noted in the Reference Point section, the simulations employed a Ricker stock – recruitment relationship with environmental covariates to describe a decrease in Walleye stock's productivity since 1994. This relationship was used to estimate the SSB and RPs currently in use.

In the 2012 assessment, based upon historical tagging results, which did not recognize the effects of tag loss and variable non-reporting rates across fisheries and years, natural mortality was assumed to be 0.32. A recently completed interagency tagging study on Lake Erie (WTG, 2013), that used different tagging methodologies, indicated that the historical tagging studies used to estimate instantaneous M may be improved by recognizing tag loss and variable non-reporting rates across fisheries.

The more recent tagging results, which demonstrated that tag loss and variable non-reporting rates occur, suggested that an exploration of methods to estimate M incorporating this information is more accurate. These analyses suggested that allowing M to vary by age fit the data much better. LEPMAG agreed that while it is unrealistic that M is constant across ages and through time, additional analyses were necessary to determine how to capture information on tag loss and variable non-reporting rates in the stock assessment model. Assuming an M of 0.32 and 50% maturity at age 2.5, generation time would be (2.5+1/M) 5.63 years.

Fleet Composition

See Yellow perch section.

Fishery Removals

The monitoring of Walleye removals is the same as for Yellow perch (see above). There are, however, some differences. Unlike Yellow perch, there is not a commercial fishery for Walleye in U.S. waters. There is, however, a large US recreational fishery, primarily in Ohio. Monitoring of these fisheries is described in the Yellow perch section. In the recreational fishery, otolith samples and other biological data from harvested Walleye are collected at sport fishery cleaning stations at selected locations as an independent sampling effort, as it remains impractical for creel clerks to extract otoliths during standard interviews.

No studies of hooking PCM in the recreational fishery have been conducted on Lake Erie percids, however, several investigators have quantified Walleye hooking mortality in other management systems. STC (2007b) noted that Walleye hooking mortality rates have ranged from 0-16% with an average of approximately 3%. Using current estimates and the best available information, STC (2007b) estimated that if 400,000 Walleye were released about 12,000 would die i.e. a small fraction. Given that virtually all captured Walleye in the Ontario gillnet fishery are retained, PCM does not appear to be an issue. In the Ohio trapnet fishery, all Walleye under 15" must be released.

The review panel on harvest estimation (Lester *et al*., 2005) recommended that agencies use otoliths for assigning ages to fish sampled in the fishery because scale-based ages typically underestimated the ages of older fish. In fact, most agencies had already converted from scales to otoliths in the mid-2000s. STC (2007b) noted that for Walleye, all agencies had implemented otoliths as the primary ageing structure. A study had been undertaken to compare the ages determined from scales and otoliths of Walleyes collected from various MUs in Lake Erie to decide whether or not the OMNR commercial catch sampling program require Walleye to be aged using otoliths or if it should continue to age Walleye using scales (Locke, 2013). Scale age and otolith age agreed with each other up until age 8 or a total length of approximately 450 mm, with more disagreement over fish greater than 550 mm. Notwithstanding this, the switch to otolith reading was made. Note that the stock assessment employs an age 7+ group so that historical issues in the aging of Walleye after age eight would not impact the assessment.

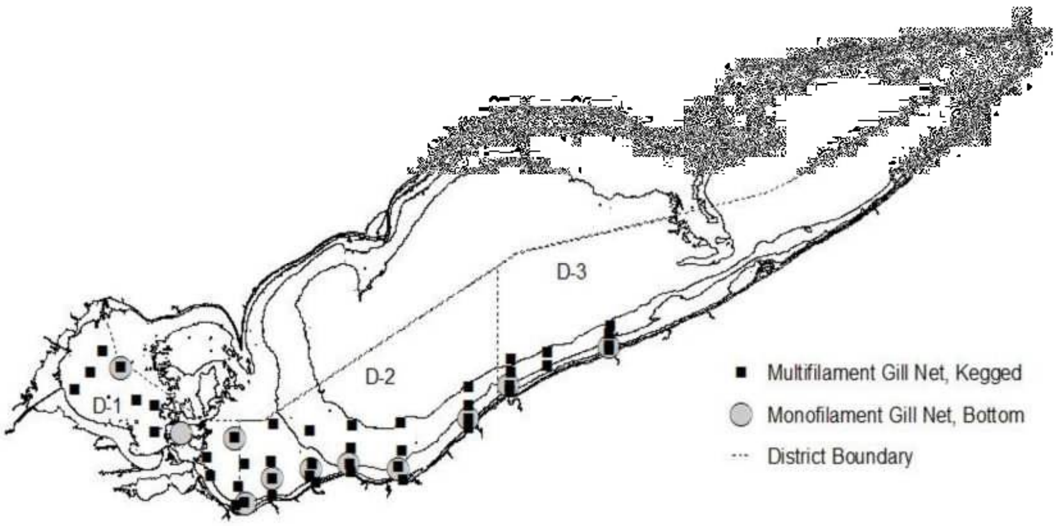
Stock Abundance

The primary sources of fishery dependent information are, as with Yellow perch, the DCRs and logbooks maintained by Ontario harvesters, and angler diaries submitted by recreational fishermen. Estimates of fishing effort are derived from these data and used in the assessment model of Walleye to provide estimates of F in an analogous approach to the use of commercial catch rate indices to estimate abundance in other assessments. While catch rate standardization (e.g. GLM analyses) do not appear to have been conducted on these data, there has been a study (Li *et al.,* 2011) of the effects of gillnet saturation on Walleye catch rates in survey gillnets which indicated that soak time and fish accumulation can have a significant effect on catch rate and thus nominal effort. While the study was of survey gear, it may have applicability to the Ontario commercial fishery.

Several fishery independent surveys conducted in Lake Erie contribute to the knowledge, understanding and assessment of the Walleye population. The most important of these are the Ontario partnership gillnet survey (MUs1–4), the Ontario/US western basin interagency trawl survey (MU1– 3) and the Ohio/Michigan gillnet survey. The first two are described above. The Ohio/Michigan fall gill net survey, designed to assess adult abundance of Walleye and White bass in Lake Erie, was initiated in 1978. The survey design has changed through the years, in terms of effort expended, but has maintained the same sampling gear (ODW, 2012). While the initial survey focused on the western basin, in 1983, the survey was expanded to include the central basin due to the migratory nature of Walleye and to get broader spatial coverage of Walleye habitat.

An example of survey coverage (2012) is indicated in Fig. 33.

Figure 33: Stations sampled during OH and MI gillnet survey during the fall of 2012



Eleven sites fished with both standard kegged 1,300-ft multifilament nets and 600-ft monofilament bottom nets; auxiliary sites were sampled with standard canned 1,300-ft multifilament nets only

Source: ODW, 2013

A total of 44 gillnet sites, including historical sampling sites, are sampled from Toledo to Conneaut. Sites are selected by 5-m depth strata (< 5, 5-10, 10-15, 15-20 and >20 m) from transects that correspond with the trawl survey. Overnight sets of nylon multifilament gill nets are fished (kegged) 1.8 m below the surface at each station. Each net consists of a gang of 13 randomly-ordered panels, each 30.5 m (length) by 1.8 m (height) and ranging from 51-127 mm stretched mesh in 6-mm increments.

In addition, bottom gill nets are fished at six sites using modified interagency community monofilament gill nets. These nets consist of a gang of 12 randomly ordered sections, each 15.2 m (length) by 1.8 m (height), ranging from 32-76 mm stretched mesh by 6-mm increments and from 76-127 mm by 12-mm increments. For each gill net type, effort is expressed as number of nets set. Relative abundance indices of age-1 and older Walleye and White bass are calculated from fall gill net catches as the arithmetic mean of the catch per gill net set. Catch rates are reported as the number of fish, by species and age, caught in each district, by the number of nets, and by type and set.

Other Data

See Yellow perch section for a description of other data available which is also relevant to Walleye.

3.2.6 Stock Assessment

Since 1990, WTG has used a SCAA model to assess Walleye stock status and inform management decisions. Prior to 2001, the CAGEAN software package was used and subsequently the ADMB software (http://admb-project.org/). The model has evolved significantly during this period. Significantly, as part of the LEPMAG MSE (June 2012 – January 2013) workshops with stakeholders provided comment on model assumptions and error structure which resulted in a number of enhancements.

The SCAA model used to inform the 2013 management (WTG, 2013) is divided into three sub-models: the population dynamics sub-model which describes the abundance, mortality and growth functions of the population; the observation sub-model, which links the population characteristics (biomass, numbers of fish at age etc.) to the observations (CPUE, survey index, age and length compositions in surveys and catches); and the statistical sub-model that estimates the likelihood of the observations for a given parameter set, based on the difference between the observations and their expected values. An algorithm is used to search for the set of parameters that maximizes their likelihood. ADMB uses a particularly efficient method to search for the best fit of the model to the data which can cope well with a large number of parameters. Diagnostic tools are used to ensure the model is fitting the data as well as can be expected and aid in the assessment review process.

An overview of the Walleye model inputs, parameter and assumptions are provided in Table 16.

Table 16: Data inputs, parameters and assumptions of Walleye 2013 SCAA assessment model

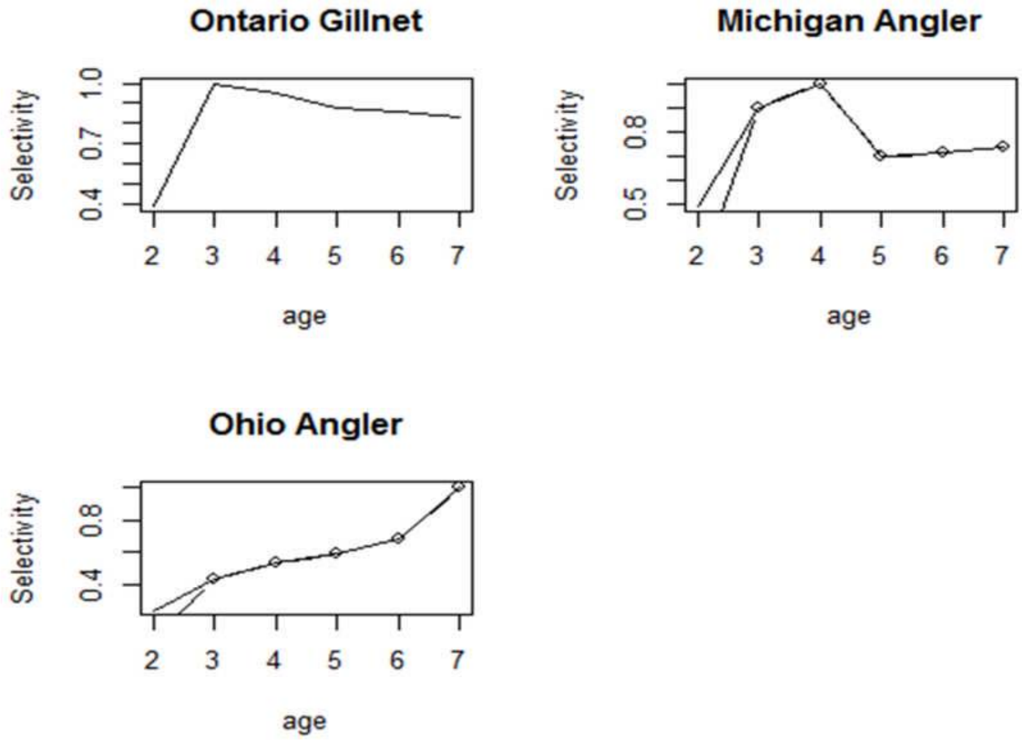
Model Component	Lambdas	Data Input	Parameters (230)
Population		Weight at age, 1978 - 2012; ages 2-7+	Population scaler
		Maturity at age, ages 2 - 7+	Population number: 1978-2012, ages 2-7+
		M = 0.32 for all ages & years	SD on ON caa which is used to scale SD of all datasets
Fishery	0.91	ON GN catch: 1978-2012	ON GN sel: 1978-2012 (ages 3,5,6,7+; age 4=1)
	ESS	ON GN prop at age: 1978-2012; ages 2-7+	
	0.85	OH Angler catch: 1978-2012	OH Angler sel: age 2 (1978-2003 & 2004-2012); 1978-2012 (ages 3,5,6,7+; age 4=1)
	ESS	OH Angler prop at age: 1978-2012; ages 2-7+	
	0.76	MI Angler catch: 1986-2012	MI Angler sel: age 2 (1978-2003 & 2004-2012); 1978-2012 (ages 3,5,6,7+; age 4=1)
	ESS	MI Angler prop at age: 1986-2012; ages 2-7+	
	0.89	ON GN effort: 1978-2012	ON GN q: 1978; 1979-2012 (random walk)
	0.86	OH Angler effort: 1978-2012	OH Angler q: 1978; 1979-2012 (random walk)
	0.80	MI Angler effort: 1986-2012	MI Angler q: 1986; 1987-2012 (random walk)
Indices	1.00	ON & OH fall trawl: 1988-2012; age 0	ON & OH fall trawl q & power
	0.86	OH & MI GN survey: 1978-2012; ages 2-7+	OH & MI GN survey q: 1978; 1979-2012 (random walk); sel: 1978-2012; ages 2,3,5,6,7+; age 4=1
	1.00	ON GN partnership: 1989-2012; ages 2-7+	ON GN partnership q: 1989; 1990-2012 (random walk); sel: 1978-2012; ages 2,3,5,6,7+; age 4=1
	2.00		OH & MI GN survey: 1978-2012; ages 2-7+ devs
	2.00		ON GN partnership: 1989-2012; ages 2-7+ devs

Regarding the population submodel, dynamics are modeled forward from 1978 for ages 2 to 7+. While maturity at age is constant across years, and M (M=0.32) constant across ages and years, weights at age are taken from survey samples and vary by year. These are used to estimate catch and population biomass as required. During the MSE workshops, there was discussion on the need to allow M to vary by age and possibly over time (i.e., non-stationary M), although it was agreed that more analyses were required before implementing such changes.

The ON gillnet, OH angler and MI angler fisheries are all modeled separately with each employing age-specific selectivity patterns. The latter two are estimated in annual time blocks to address a reduction in selectivity age two. This is to model a 15 in. minimum size regulation that was instituted in these fisheries in 2005 (Chris Vandergoot, pers. comm.). The age-specific trends in these fisheries are provided in Fig. 34.

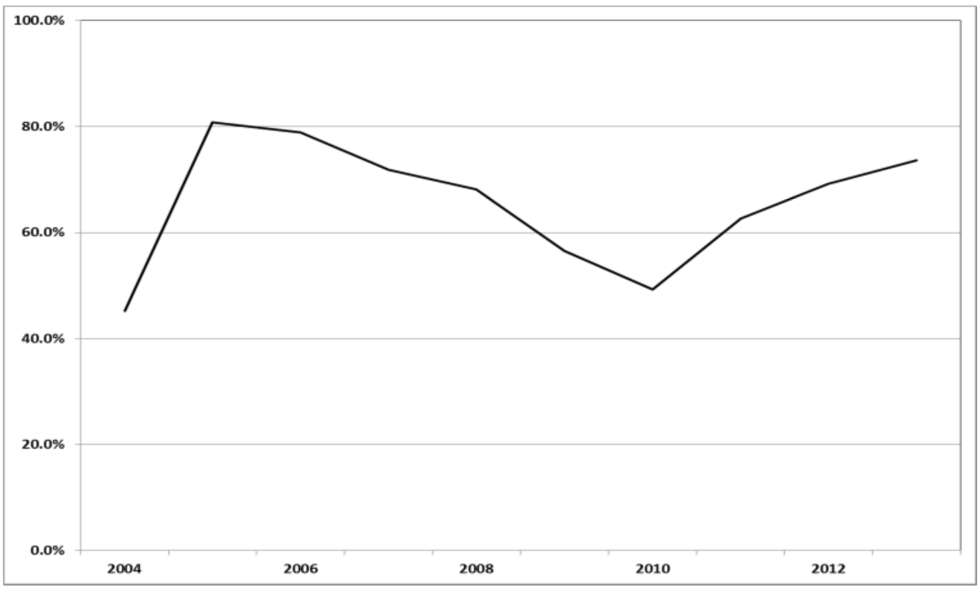
The selectivity pattern in the Ontario gillnet fishery describes a composite of two fishing patterns within that fishery as the gillnet mesh size for targeted Walleye sets must not be less than 89 mm while the gillnet mesh size for all other targeted species must not be less than 57 mm. Temporal changes in gillnet selectivity are not modeled and thus variation in the percent targeting for Walleye on an annual basis would cause variation in the residuals around the proportions at age observations. A greater concern would be a long term trend, as opposed to variation, in the percent targeting for Walleye. This does not appear to be the case, at least since 2004, with there being annual variability without significant trend in the percent contribution of the targeted fishery to the overall Walleye landings (Fig. 35).

Figure 34: Age-specific selectivity of the Ontario gillnet and Ohio and Michigan angler fisheries during 1978 – 2012; reduction in age two selectivity since 2004 indicated in the two angler fisheries



Source: Data from assessment model of WTG, 2013

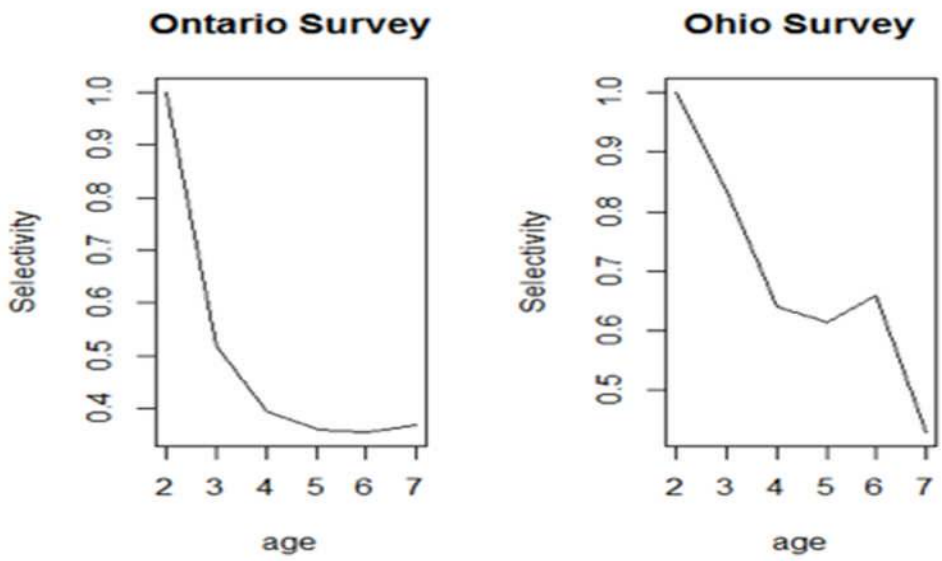
Figure 35: Walleye in targeted fishery of total Walleye landings (%)



Source: CFHIS as extracted by OCFA

The Ontario and Ohio gillnet surveys are treated in the same manner but without employing time blocks. It was agreed during the MSE workshops to allow selectivity to vary without the assumption that selectivity at certain ages (i.e. age 4 = 1) is known. In comparison to the fisheries, there is a large reduction in survey selectivity with age (Fig. 36).

Figure 36: Age-specific selectivity of the Ontario and Ohio gillnet surveys 1978 – 2012



Source: WTG, 2013

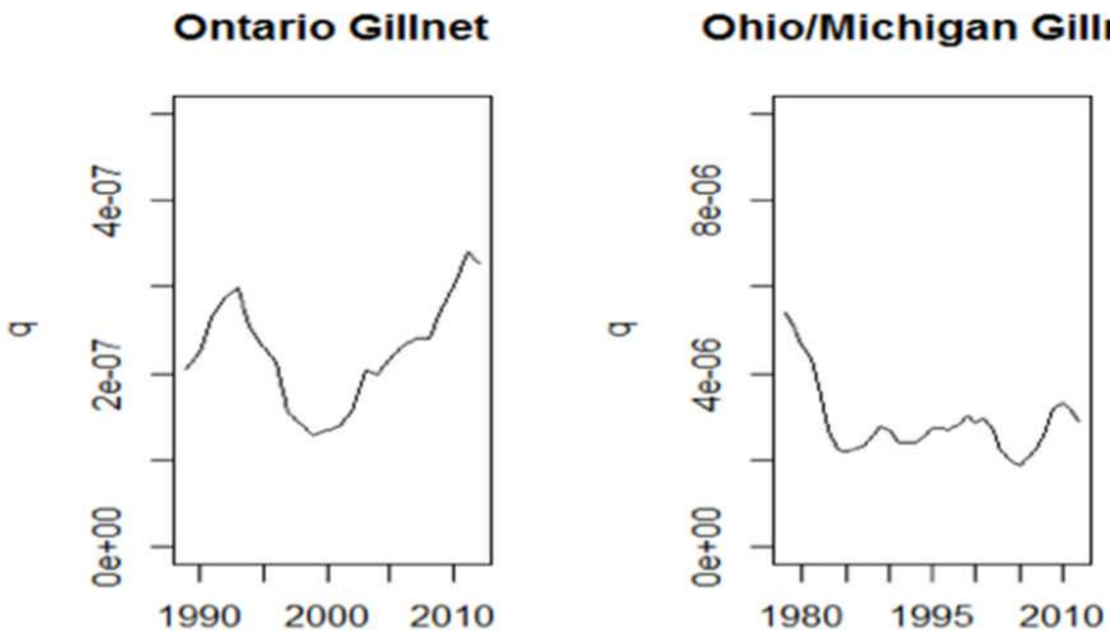
F is derived from a time series of effort for each fishery along with its estimated catchability. The latter was modeled as a random walk over years to describe gear efficiency changes. The implementation of a random walk of fleet catchability was recommended during the MSE workshops.

The Ontario partnership, Ohio and Michigan gillnet and Ontario/US interagency trawl survey (age 0 only) provide overall indices of abundance as well as proportions at age to calibrate the model. Age 2 recruitment is estimated as a power function of age 0 abundance in the interagency trawl survey. Outside the SCAA model, recruitment is modeled as a Ricker function of spawning biomass. This is to estimate reference points rather than to inform the model fit (see above).

The catchability (q) on the two gillnet surveys is estimated as a random walk to describe temporal changes in q which are particularly evident in the Ontario survey, over time (Fig. 37).

A concern is how representative the two (Ontario gillnet and Ohio/Michigan gillnet) surveys are of stock trends. Both surveys cover a portion (opposite and roughly 50%) of the stock area. The implicit assumption is that the trends monitored in each survey apply to the unsurveyed area. The impact of this assumption is mitigated by including the interagency survey which covers the whole stock area.

Figure 37: Annual trend in Ontario gillnet (left panel) and Ohio/Michigan gillnet (right panel) survey catchability



Source: data from assessment model of WTG, 2013

For the objective function, lognormal errors are assumed in fitting the modeled catch, effort and survey indices to the observations while multinomial errors are assumed in fitting the modeled fishery and survey proportions at age to the observations. The relative error and thus contribution of the removals and index data to the objective function were considered in a workshop (TC, 2007) which was a response to an external review of the assessment model by Myers & Bence (2002). Specifically, previous models had used a data weighting term (lambda) to govern how much influence a dataset would have in the optimization. Myers & Bence (2002) recommended that the basis of the lambda terms (ratio of variance method) be re-examined. In order to estimate data-specific lambdas, the approach was to first consider the error in one dataset (Ontario catch data) as a standard to which the error in the others would be compared. Next, an initial lambda for each dataset was estimated as a ratio $(CV_{standard})^2/CV_{other})^2$. Then, the SCAA model was run iteratively, scaling the catch and survey lambdas so that the derived error in the fit between the modeled and observed Ontario catch at age corresponded to the prior estimate. The details of this process are provided in TC (2007). In the current model, one overall value of the error (SD) associated with the input datasets is estimated, which is then scaled by the dataset-specific lambda. For the error in the proportions at age, the input effective sample sizes (ESS) are derived iteratively, consistent with the recommendation of Francis (2011).

WTG (2013) does not provide diagnostics of model fit. However, examination of residual patterns by the assessment team indicated no major issues. During the MSE (see Management Strategy), retrospective analyses were undertaken to explore the SCAA model's behavior with no major patterns observed.

The assessment estimates stock status at the beginning of the year during which the assessment is undertaken. In other words, the March 2013 assessment estimated population conditions at the beginning of 2013. Based upon a Ricker stock-recruit relationship (noted above), the age 2 numbers at age are estimated for the beginning of 2014. Based on a RAH and an interim harvest policy ($F_{60\%MSY}$) during the projection year, the probability that the projected SSB at the beginning of 2014 is below 20% virgin biomass is estimated. If this probability is greater than 5%, the harvest rate is reduced and the RAHs re-estimated. While estimates of uncertainty for the historical stock conditions are not available in WTG (2013), it is evident that the assessment produces probabilistic statements of projected SSB to inform management.

TC (2007) notes the need to consider mixing of Walleye between the assessed stock (MUs1–3) and Walleye in the east basin (MU4). It recognized that the migration and uncertainty about dynamics that affect Walleye movements increase the complexity of conducting a viable independent stock assessment of the east basin. Additionally, population parameters may be affected, such as M. As a result, the eastern basin has not yet been formally incorporated into LEC harvest decisions. LEPMAG recognized the importance of pursuing a more integrated approach to assessment and management of Walleye lake-wide, and recommended exploration of eastern basin Walleye datasets to achieve a broader based approach to Walleye assessment and management in the east basin.

Overall, the Walleye SCAA model is consistent with formulations used elsewhere with no major issues evident.

Scrutiny of the assessments is undertaken each year by the WTG, which would be classified as internal. During the MSE, it has been particularly extensive, with input from a range of experts both within the WTG and outside. Further, Myers & Bence (2002) were commissioned to undertake an external review of the assessment, concluding that wide range of changes was required to address issues that they identified. They emphasized however, that these should not be interpreted as concluding that the assessment was incorrect. This resulted in the shift to the current modeling approach. Thus, the assessment has also been subjected to external review.

4 PRINCIPLE TWO: ECOSYSTEM BACKGROUND

4.1 Introduction

Principle 2 comprises five components that consider the potential interactions of the fishery with the ecosystem. Three components address potential species interaction: retained by-catch, discarded by-catch and endangered, threatened and protected (ETP) species. Two components address the potential impacts of the fishery on the habitat and the ecosystem.

Analysis in this section covers the aquatic ecosystem, its status and any particularly sensitive areas, habitats or ecosystem features influencing or affected by the fishery; the status and relevant management history of the retained, by-catch and ETP species including specific constraints; and details of any critical environments or sources of concern and actions required to address them.

In Lake Erie, some of the dominant species in the aquatic community are non-native, exotics to the lake. Species invasions have impacted biodiversity of historical fish, benthic and plankton communities and affected survival of native populations. For example; smelt, Alewife, and the round goby have become main prey in Lake Erie (Lake Erie LaMP Management Committee, 2008).

4.2 Retained Species

4.2.1 Introduction

Component 2.1 evaluates the status, management and information for retained species caught in the targeted fisheries. At SG80, main retained species are taken into account while at SG100 all species are considered. Main species are those that: (i) constitute over 5% of the total catch in a specific fishing activity (e.g. the total catch when gill nets are targeting Yellow perch); (ii) are of high commercial value; or (iii) are vulnerable. A caveat is that when the catch of a specific species in a UoC is high and even < 5% represents a significant quantity.

4.2.2 Retained Species Background

Ontario

The Lake Erie commercial gill net fisheries targeting Yellow perch and Walleye in Ontario are part of a multi-species fishery that also targets Lake whitefish, White perch and White bass. The fishery uses bottom set and "canned" gill nets with the catch attributed to each fishery defined by target intentionality as declared in the DCRs. The minimum permitted size for gill net mesh is 57 mm. The directed Yellow perch fishery uses small mesh of 57- 89 mm, with approximately 90% being less than 67 mm (Kevin Reid personal communication). Larger meshes are occasionally used to target Yellow perch and these are set on bottom. Currently the Lake Erie commercial Walleye fishery mostly uses monofilament "canned" gill nets with a regulated mesh size of > 89 mm stretched mesh.

OMNR requires fishers to declare all fishes caught on a DCR (including retained catch, and discarded, released and surrendered catch).

Appendix C of the Conditions of Ontario Commercial Fishing Licence specifies allowances for the four quota species (Walleye, Yellow perch, Lake whitefish, and smelt), and lists 11 species with unlimited catch (Channelcatfish, White bass, Longnose gar, Bowfin, Alewife, Gizzard shad, Burbot, White perch, Rock bass, Freshwater drum, and crappie) as well as four unlimited catch species groups (suckers excluding black and Bigmouth buffalo, Mooneye/Goldeye, carp >56 cm and smaller bullheads, sunfish excluding Warmouth). All other species are defined as "*No harvest permitted*". Conditions specify that all fish named on Appendix "C" and all no harvest permitted species must be reported and landed. This would imply that discarding is illegal and in principle all catch should be retained.

Nevertheless, fishers declare catch on their DCR which includes data entries for landed catch, as well as for weight of discarded and released fish by targeted effort. The target species entered in the DCR is defined at the moment of setting the gear (i.e. by intentionality) and the gill net mesh size should be appropriate for the target. Data from up to three lifts may be entered in a single DCR.

Gillnet mesh size determines the size of fish targeted, and selectivity can be further tuned by seasonal and spatial considerations, but selectivity is similar for target and non-target species of similar size. Gillnets can kill via suffocation or damage to gills, and there is a high mortality of fish that is caught.

Ohio

The Lake Erie commercial trap net fishery in Ohio waters is part of a multi-species fishery: small mesh is used to target Yellow perch while large mesh is used for other species. The yellow perch trap net fishery operates from May 1 to November 1. In contrast, the large mesh fishery is open from March 1 to December 10.

Fishers are required to declare all fishes retained on a DCR. The retention of some species (Sauger, Sturgeon, Mooneye and Cisco, Brook, Brown, Rainbow and Lake trout; and Coho, Chinook and Pink salmon) is not allowed. There are minimum landing sizes for some species. The operation of the fishing gear allows for the selection and release of regulated and non-commercial species.

ODNR provided the assessment team with summarised data from DCRs 2009 – 13.

Outcome

Yellow perch

Gill Net

Overall: Outcome status of retained catch based on DCR data in this assessment is evaluated separately by QZ. Reported landings from the Yellow perch commercial gill net fishery dating back to 2004 were provided by OCFA. Data were sorted and provided by the OCFA and include those records in the gill net fishery for which Yellow perch was the declared target species. These data include catches from small and large mesh gill nets.

Historically, discards were not always reported leading to the total harvest being underestimated in DCRs for 2004 to 2010. Since 2011, reporting of discards is mandatory. The conditions of licence require the recording of all species listed on the licence (quota and unlimited harvest species) and ‘no-harvest’ permitted species. Thus, while landing data provided reliable information on retained species in the candidate fishery there are issues about discard and total harvest figures prior to 2011.

Based on commercial gill net DCR data for the fishery targeting Yellow perch, from 2004 to 2013 there were two main retained species in each QZ (Table 17).

Table 17: Ontario Yellow perch Gill Net Fishery: Summary Main Retained Species

QZ1	QZ2	QZ3 (W)	QZ3 (E)
Walleye White Perch	Walleye White Perch	Walleye White Perch	Walleye White Perch

QZ1. The total harvest 2004 – 13 (landed, released, discarded, and surrendered) in the Yellow perch gill net fishery in MU1 (2004 – 2013) ranged between 0.59 million lbs in 2008 and 1.86 million lbs in 2004. Around 90% of the harvest was retained and about over 80% of the retained catch was Yellow perch target. There were 13 retained species in QZ1 besides the target and two species groups including suckers and Pomoxis (Table 18).

Table 18: QZ1 - Retained Species in the Yellow perch Gill Net Fishery (lbs)[1] (2004 – 2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Black Crappie	1	0	0	0	0	0	0	1	0	0
B. Bullhead	0	0	0	0	164	0	0	0	0	0
Burbot	0	0	15	0	0	0	0	0	0	0
C. Catfish	138	420	276	427	225	346	193	394	388	1,206
C. Carp	58	12	18	11	1	52	0	47	0	16
FW Drum	358	376	375	0	0	0	4	19	1	91
Gz Shad	56	0	0	0	0	0	0	0	0	0
L. Whitefish*	50	120	774	103	155	124	156	37	184	7
Pomoxis	0	0	0	2	0	0	0	0	3	0
Quillback	346	28	2	239	1,543	55	0	0	0	0
R. Smelt*	3	0	0	0	0	0	10	0	0	0
Rock Bass	1	3	1	12	205	3	14	4	14	10
Suckers	32	178	0	0	0	0	0	6	0	37
Walleye*	97,390	158,133	117,063	11,687	11,186	51,614	51,419	32,768	41,143	87,284
White Bass	9,321	10,105	17,604	10,646	6,965	2,362	11,237	4,787	6,761	40,564
White Perch	288,017	243,542	222,945	69,372	69,951	78,942	73,530	63,765	48,541	101,630
Y. Perch*	1,459,615	1,315,537	1,184,437	630,565	500,418	694,461	761,415	747,666	679,123	566,384
Total Landed	1,855,386	1,728,454	1,543,533	723,064	590,813	827,959	897,978	849,494	776,158	797,229
Total Catch	1,855,638	1,742,217	1,552,986	728,065	591,488	828,690	903,072	931,856	877,781	899,760

Note: * quota species Source: CFHIS as extracted by OCF

The most significant species retained were Walleye (1.6 to 9.7%) White bass (0.3 to 4.5%), and White perch (5.5 to 15.5%). Walleye and White perch both constituted > 5% of total annual harvest and are considered main retained species. Reports do not indicate what species were included in the species groups, and could include vulnerable species. In the last 10 years, the retained catch of suckers in the fishery, excluding Quillback which is reported separately, totalled only 253 lbs. and are not considered as a main retained species. Over the same period, the total retained Pomoxis (sunfishes) catch was 5 lbs in the last 10 years; hence neither is Pomoxis considered as a main retained species.

QZ2. The total annual harvest 2004 – 13 (landed, released, discarded, and surrendered) was higher than in QZ1 ranging between 1.4 million lbs in 2010 and 3.4 million lbs in 2006. Over 95% of the catch was retained. The share of the Yellow perch target was also higher than in QZ1. There were 14 retained species in QZ2 besides the Yellow perch target and three species groups including Lepomis, Pomoxis and suckers, which could include vulnerable species (Table 19).

Table 19: QZ2- Retained Species in the Yellow perch Gill Net Fishery (lbs) (2004 – 2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
B.Bullhead	0	0	0	0	106	0	0	0	0	0
Burbot	0	0	0	0	0	0	0	0	3	0
C. Catfish	22	141	387	117	324	187	406	878	335	491
C. Carp	0	0	0	0	3	0	0	0	3	0
FW Drum	24	39	97	0	0	0	0	181	106	183
Gz Shad	0	117	58	0	0	0	0	40	24	0
L.W'fish*	367	4,661	1,652	169	48	47	64	79	88	47
Lepomis	0	0	0	0	0	1	0	0	0	0

[1] Unless otherwise stated pounds (lbs) are round weight.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pomoxis	0	0	3	7	9	2	0	0	5	19
Quillback	0	0	0	0	0	0	0	3	0	5
R. Smelt*	30	18	191	31	3	0	0	3	0	24
Rock Bass	0	2	0	1	1	2	0	0	1	0
Suckers	81	13	0	0	0	0	0	69	1,621	233
Walleye*	52,449	57,106	35,874	13,718	3,958	7,102	6,796	5,413	18,752	19,118
W. Bass	3,597	9,789	31,203	15,814	65,865	17,858	2,360	41,774	17,186	45,078
W. Perch	157,277	495,141	560,966	54,555	73,735	116,476	116,055	126,517	166,802	215,055
Y. Perch*	1,748,874	2,239,436	2,766,675	1,427,803	1,517,791	1,849,191	1,268,609	1,177,438	1,455,616	1,489,306
Landings	1,962,776	2,807,445	3,397,127	1,512,215	1,661,843	1,990,943	1,394,290	1,352,395	1,660,542	1,769,559
Catch	1,963,500	2,809,351	3,405,393	1,513,913	1,662,643	1,991,752	1,398,172	1,447,965	1,805,245	1,911,799

Note: * quota species Source: CFHIS as extracted by OCFA

The most significant retained species were Walleye (0.4 to 2.7%), White bass (0.2-4%), and White perch (3.6 to 17.6%). Although the proportion of Walleye in the catch was under 5%, removals were comparable to QZ1 and as the species is the most valuable in the Lake Erie gillnet fishery, along with White perch it is considered main. The limited retained catch of suckers (2,017 lbs), Lepomis (1 lb) and Pomoxis (36 lbs) in the last 10 years means these are not considered as main retained species.

QZ3 (W). The total annual harvest 2004 - 13 (landed, released, discarded, and surrendered) ranged between 1.46 million lbs in 2004 and 3.7 million lbs in 2006. Over 98% of the catch was retained. The share of Yellow perch across years was above 88%. There were 15 retained species in QZ3W besides the target and two species groups including Pomoxis and suckers (Table 20). The most significant retained species were Walleye (0.1 to 2.1 %), White bass (0.1 to 1.6 %), and White perch (1.1 to 9.8%). Although the proportion of Walleye in the catch was under 5%, removals were comparable to QZ1 and as the species is the most valuable in the Lake Erie gillnet fishery, along with White perch it is considered main. The species were similar to QZ1 and QZ2 except that Brown bullhead, and Quillback were not reported and Alewife, black crappie, cisco, round goby and White suckers were landed. The retained catch of suckers, excluding White sucker reported separately (231 lbs), and of Pomoxis (2 lbs) in the last 10 years are small and they are not considered as main retained species.

Table 20: QZ3W - Retained Species in the Yellow perch Gill Net Fishery (lbs) (2004 – 2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Alewife	0	0	0	0	0	0	0	0	2	0
B. Crappie	0	0	1	0	0	0	0	0	0	0
Burbot	39	184	187	755	63	64	40	42	0	11
C. Catfish	165	389	592	246	16	60	68	126	803	298
Cisco	0	0	0	0	0	0	0	0	1	0
C. Carp	0	0	28	0	0	0	0	0	0	0
FW Drum	164	5	393	0	0	0	1	68	0	1
Gz Shad	0	0	0	0	0	0	0	0	126	0
L. W'fish*	121	3,015	3,603	500	561	178	1,794	33	34	68
Pomoxis	0	0	0	0	0	2	0	0	0	0
R. Smelt*	212	32	164	192	103	23	25	43	65	29
Rock Bass	0	0	0	0	0	1	0	3	0	0
R. Goby	0	0	0	0	2	0	0	0	0	0
Suckers	0	0	171	2	0	0	0	24	30	4
Walleye*	24,271	39,828	37,628	7,354	1,604	16,508	8,775	6,423	51,188	36,546
White Bass	3,424	2,752	22,039	14,887	929	3,278	1,275	16,375	11709	49,128
W. Perch	44,693	172,671	367,106	79,301	17,632	33,545	67,809	142,700	37,011	164,380
W. Sucker	0	0	0	0	0	0	0	2	0	0
Y. Perch*	1,385,497	1,680,532	3,279,585	2,803,590	2,078,283	2,066,475	2,996,771	2,963,671	3,414,442	2,721,687
Landings	1,458,586	1,899,408	3,711,497	2,906,827	2,099,193	2,120,134	3,076,558	3,129,510	3,515,411	2,972,152
Catch	1,460,843	1,899,898	3,714,540	2,906,836	2,099,195	2,122,263	3,079,357	3,161,851	3,605,155	3,031,212

Note: * quota species, Source: CFHIS as extracted by OCFA

QZ3(E). The total annual harvest 2004 – 13 (landed, released, discarded, and surrendered) ranged between 95 thousand lbs in 2004 and 513 thousand lbs in 2013. Over 98% of the catch was retaine consisting 11 retained species in QZ3E and the target (Table 21).

Table 21: QZ3E: Retained Species in the Yellow perch Gill Net Fishery (lbs): 2004 – 2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
B. B'head**	0	1	0	0	0	0	0	0	0	0
Burbot	15	99	266	208	85	0	43	0	0	15
C. Catfish	0	71	0	0	20	40	44	59	60	21
FW Drum	10	353	0	0	0	0	0	0	0	0
L. S'rgeon**	2	0	0	0	0	0	0	0	0	0
L. Wh'fish*	4	85	260	94	135	45	88	171	19	183
R. Smelt*	2	0	1	29	12	85	103	29	48	156
Rock Bass	1	0	0	0	1	6	0	0	0	1
Walleye*	595	8,230	4,410	326	3,976	473	553	4,392	6,394	3,553
White Bass	56	164	603	117	27	22	56	451	2,155	3,334
White Perch	734	1,397	4,466	947	754	920	403	8,252	12,712	37,153
Y. Perch*	93,587	151,055	185,374	138,507	179,253	248,484	442,716	435,787	472,601	458,334
Landed	95,006	161,455	195,447	140,228	184,263	250,075	444,006	449,141	493,989	502,754
Catch	95,480	161,693	195,984	140,228	184,263	250,104	444,008	453,913	503,880	513,225

Note: * quota species, ** No take species. Source: CFHIS as extracted by OCFA

The proportion of the Yellow perch target across years was above 89%. Similar to QZ1, QZ2 and QZ3W the most significant other species were Walleye (0.1 to 5.1%), White perch (0.1 to 7.2%) and White bass (0.1 to 0.7%). Walleye and White perch, species with proportions >5%, were considered main retained species for QZ3E.

Walleye

See Principle 1 for outcome status.

White Perch

Biology. White perch, an anadromous estuarine species native to the northeast Atlantic coast of North America introduced into the Great Lakes in the 1950s entered Lake Erie via the Welland Canal in 1953. The species proliferated in the mid-1970s, and became abundant in the western Lake Erie in 1982. There are no genetic, morphological or tagging studies of stock structure. Given the short time since the species has become established in the Great Lakes, it is too early to assess the natural population structure in Lake Erie but most probably it is a single population. Schaeffer (1983) and Schaeffer & Margraf (1986) studied seasonal distribution, population characteristics and food habits of White perch in Sandusky Bay and the region near the Bass Islands.

Invasion of the Great Lakes brought White perch into sympatric distribution with White bass, a closely related but previously allopatric species, allowing hybridization to occur. White perch x White bass hybrids have been reported in western Lake Erie, in Ohio and Michigan, and from the Detroit and St. Clair Rivers in Michigan (Todd 1986). Hybrids were first noted in western Lake Erie in the early 1980s, as White perch were increasing in this region. Because these hybrids are capable of backcrossing with the parental species, and possibly producing of F2 hybrids by crossing amongst themselves (Todd 1986), they dilute the gene pool of each parent species.

White perch mature at a younger age in Lake Erie than in other areas. Age at maturity determined from 1984 samples by Bur (1986) showed some males and females reached maturity at age 1; and all males age 2 and females of age 3 were mature. Examination of 50 gravid females revealed egg numbers ranging from 64,482 at age 2 (176 mm) to 388,736 at age 4 (244 mm); the mean fecundity was 174,945 (SE ± 10,198). FishBase indicates that fecundity is in the order of 250,000 eggs per female and that the average maximum size is about 49.5 cm. The ovaries of White perch from Lake Erie contained eggs of two size groups, with mean diameters of 0.3 to 0.6 mm. Although there were two size groups of eggs, there appeared to be only one spawning event. White perch spawning is May through June in a variety of habitats (vegetated, non-vegetated) under a broad range of conditions (slow or fast currents) (Sutton *et al*. 1996).

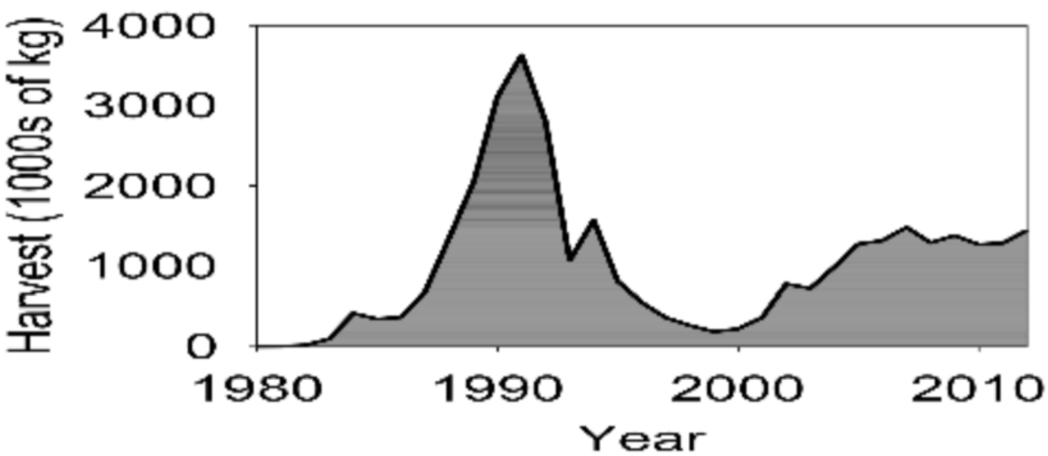
Stomach content data from USGS collected in 2010 summarized by Guzzo *et al*. (2013) indicate that during spring zooplankton and benthic invertebrates were the most common diet items, and that fish and fish eggs were the least common. Dreissenids were also found to be an important diet item and were present in 22.3–56.3 % of fish analyzed. Benthic invertebrates remained an important diet item during the fall season (41.6–100 %) and the presence of fishes also increased in the diets (0–42.9 %). FishBase indicates that trophic level is in the order of 3.14.

White perch average eight to 10 inches long and less than a pound in weight. They have a long lifespan, and 12 years old fish are not uncommon.

White perch has a high environmental impact in the Lake Erie. Fish eggs are an important component of their diet, especially in spring; mainly Walleye, White bass (Schaeffer & Margraf 1987). Walleye and White bass eggs can make up 100% of White perch diet depending on which fish is spawning. Schaeffer & Margraf (1987) found this diet to be unique in that eggs were eaten for a comparatively long time; they were the only significant food item eaten by adults during two of the three years; large volumes were eaten per individual; and most fish were feeding. Madenjian *et al.* (2000) hypothesized that egg predation by White perch was the most significant contributor to the large decline in White bass recruitment in Lake Erie in the 1980s. Parrish & Margraf (1990) hypothesized that White perch compete with native Yellow perch for zooplankton as their growth rates had declined since the invasion of White perch, especially in the western basin. They also determined that the two species had considerable diet overlap. It has been speculated that competition between White perch and forage fishes is complex and may be responsible for their decline and possibly affecting Walleye. On the positive side, a disproportionately large amount of White perch diet consisted of the invasive *Bythotrephes cederstroemi* (Bur & Klarer 1991).

Harvest. The stock has been fished in large numbers since 1981, as part of a multi-species fishery. Harvest reached its highest levels between 1988 and 1992, sharply declined and picked up in 2005 to achieve stable levels around 1,500 mt. (Fig. 38).

Figure 38: White perch harvest in Lake Erie

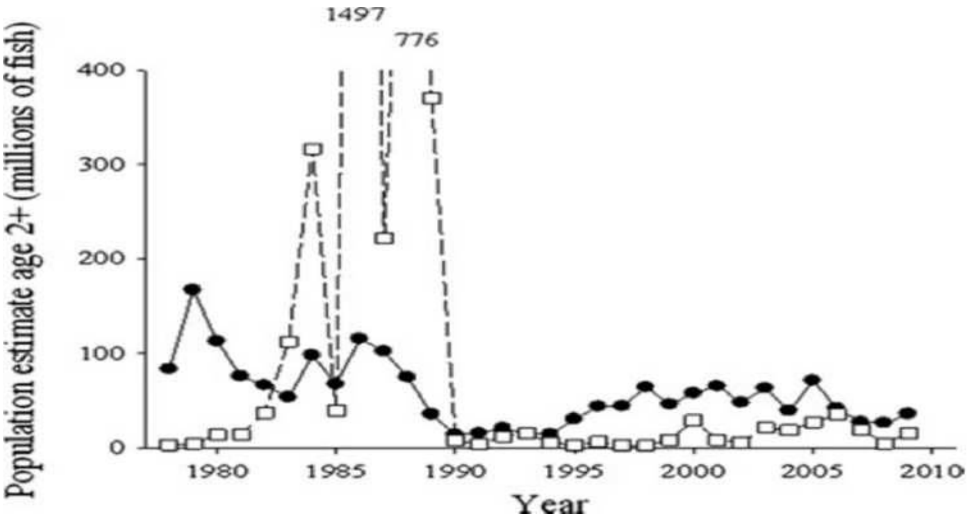


Source: Site visit presentation by A. Debertin.

A number of fisheries harvest White perch. The primary fisheries are the commercial gillnet based in Ontario, the commercial trap net based in the US states (Ohio, Pennsylvania and New York), and the sport fishery based primarily in the US although there is some recreational fishing based in Ontario.

Outcome Status. Based on analysis conducted by the YPTG (2011) and consistent with the dynamics of invasive species, after becoming abundant in Lake Erie in the early 1980s, the White perch population continued to grow exponentially through 1986 when it peaked at 1.5 billion (Fig. 39). These estimates might be too high given assumptions about catchability and biomass (Pers. Comm. OCFA comments on the draft report). The adult White perch population decreased between 1986 and 1990 and has remained relatively low.

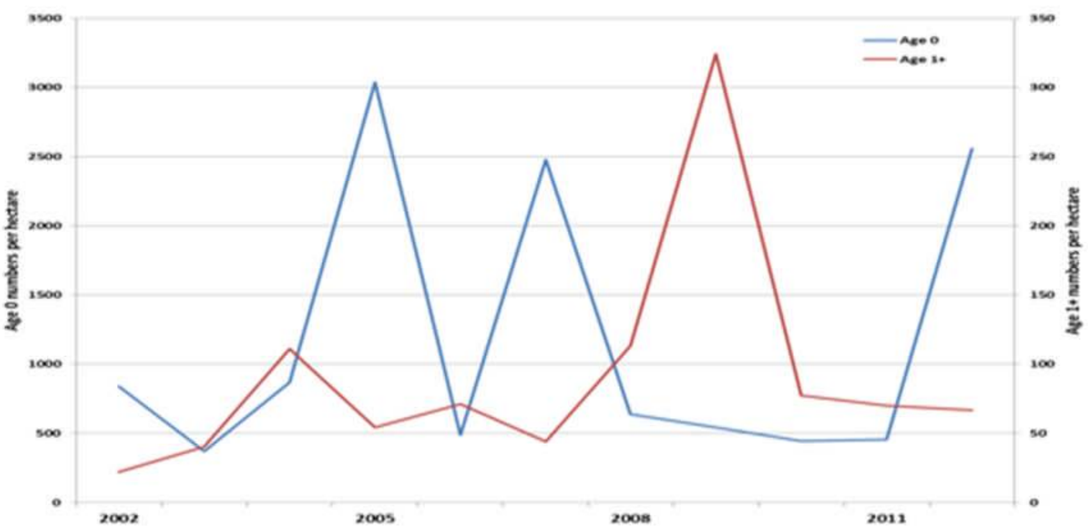
Figure 39: Population Estimates of Adult (age2+) White Perch (squares) in the Western Basin of Lake Erie.



Source: YPTG 2011 Guzzo *et al* 2013.

Overall, age 0 and 1+ indices in the central basin have been highly variable without a general trend since 2002 (Fig. 40). More recently, in 2012 age-0 indices were strong in all areas of the central basin. Age-0 indices were the highest in the time series in Pennsylvania and western Ohio and third highest in eastern Ohio.

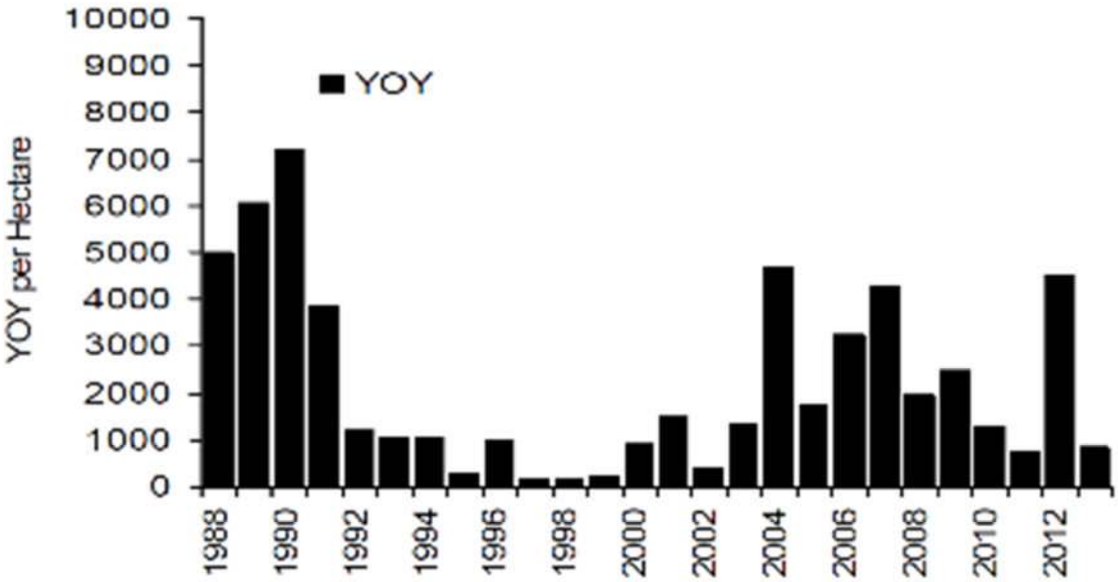
Figure 40: White Perch Age 0 and 1+ Abundance Survey Indices, Central Basin 2002-2012



Source: FTG 2013

Longer time series in the western basin from the Ontario and Ohio August Interagency Trawl Survey indicate age-0 White perch trends similar to population indices, with a peak in 1990 followed by sharp decline, low numbers over the 1990's and a later recovery to fluctuating levels in 2004 (Fig. 41). A recent peak of 4,838 fish/ha was experienced in 2012.

Figure 41: YOY White Perch Interagency Trawling, West Basin ON.



Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013.

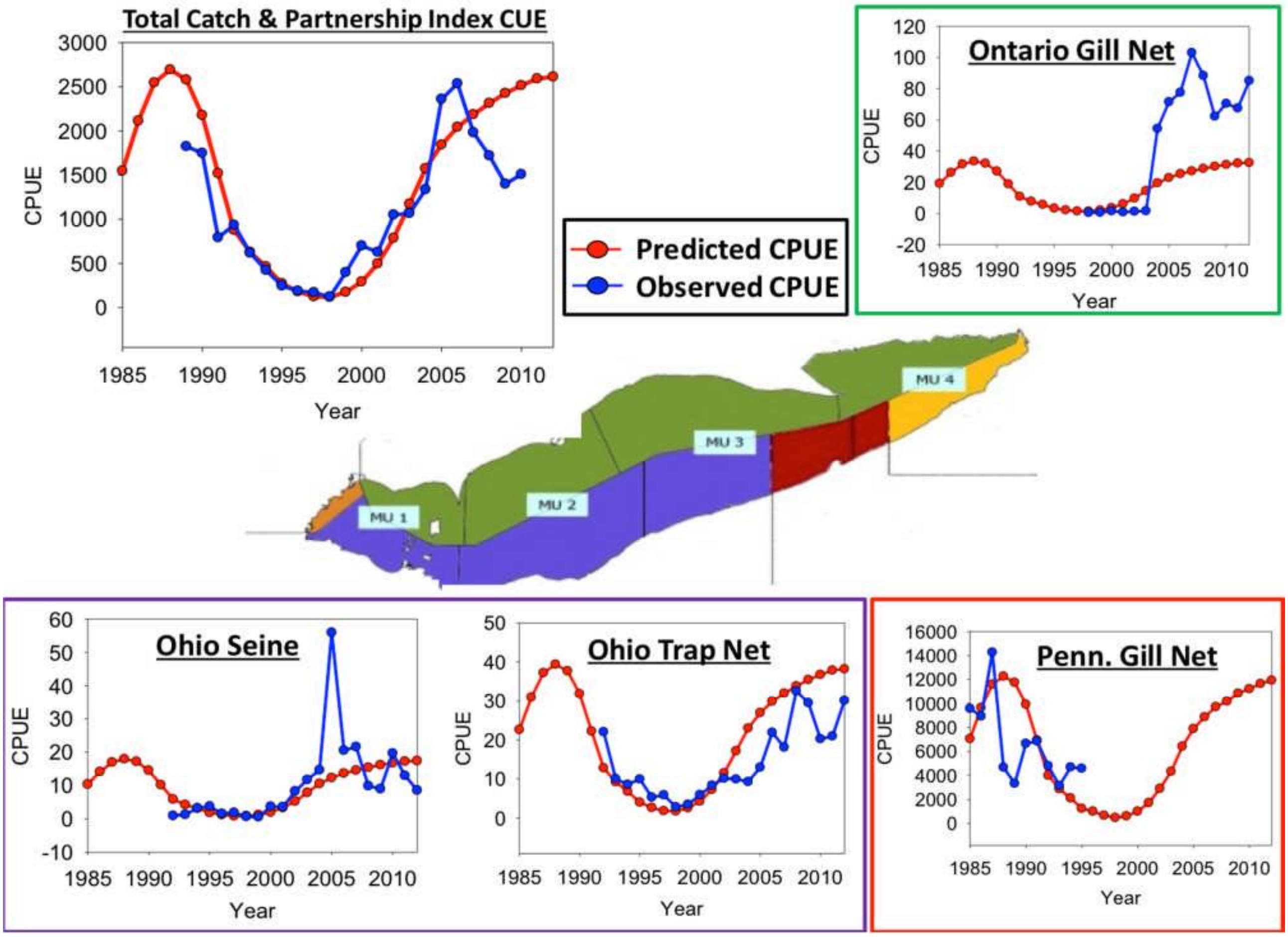
A preliminary analysis of the White perch stock status was presented during the site visit by researchers at the University of Guelph (Pers. Com. A. Debertin). Observed CPUE data and model predicted CPUE proposed as Indices of population abundance for Lake Erie show same fluctuations described above with an initial peak and a decline in 1990, followed by years of low abundance and a later recovery (Fig. 42). Trends were consistent among five surveys used in the analysis including the Partnership Gill Net survey, the Ontario Gill Net survey, the Ohio Seine survey, the Ohio Trap Net survey and the Pennsilvania Gill Net surveys.

Results from an Observation error/Time-Series fitting method to a Surplus Production Model that incorporates covariates were presented by University of Guelph Ph.D. candidate Allan Debertin at the site visit (Fig. 43). This unpublished analysis provided estimates of biomass and status of the stock relative to reference points. Results indicate that F/Fmsy was >1, B/Bmsy was <1 in the 1990's and that the opposite is true since 1999 (Fig. 44). Results of the analysis are preliminary and do not have management implications.

Management. There is not an explicit HS for White perch; the assessment team was informed that the fishery is market driven. As White perch is an invasive species and management is not concerned about sustainability, HCRs are not in place to reduce the risk of damaging recruitment and limiting effort when the stock is reducing. White perch is an unlimited catch species, thus retained catch is only regulated by the Yellow perch catch quota. Appendix "B" License Conditions establishes a series on conditions that apply to White perch as a retained species such as that fish must be reported and landed. Also, in targeting Yellow perch, gill nets shall not be set or lifted with a mesh less than 57 mm in extension measure. In general, methods to manage retained catch and reduce discarded by-catch in the commercial fisheries in the Great Lakes have been employed. Initiatives include reducing effort, modifying fishing gear, and establishing area and time closures system.

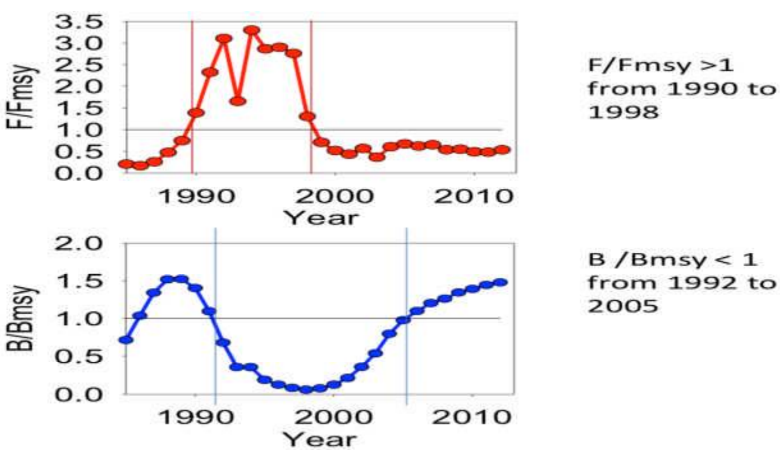
In Ohio waters, there are no specific regulations for White perch.

Figure 42: Abundance Indices for White Perch in Lake Erie Surveys



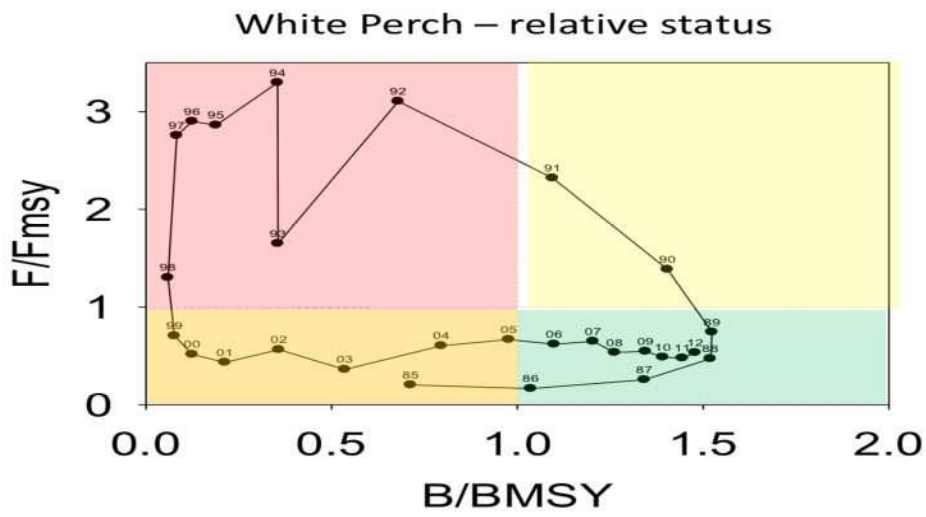
Source: A. Debertin (unpublished analysis)

Figure 43. Results ASPIC from Surplus Production Model for the White Perch Lake Erie Stock ASPIC



Source: A. Debertin (unpublished analysis)

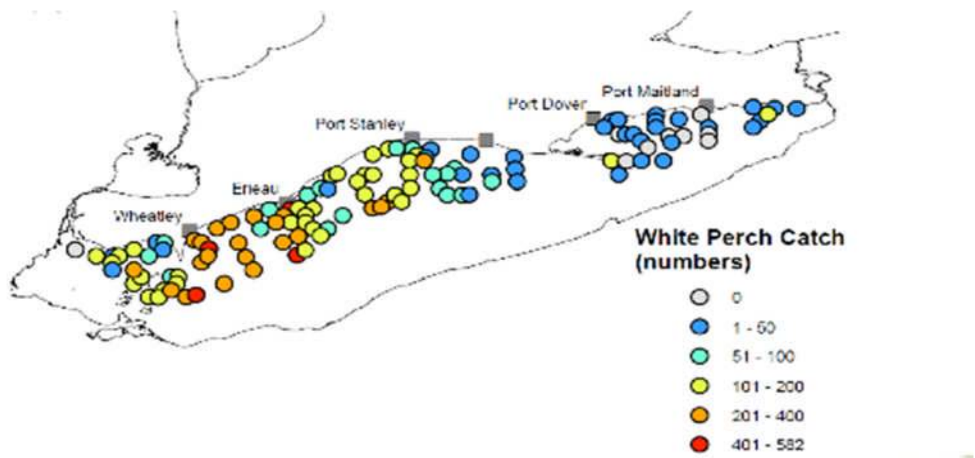
Figure 44: Summary White Perch Relative Status in Lake Erie



Source: A. Debertin (unpublished analysis)

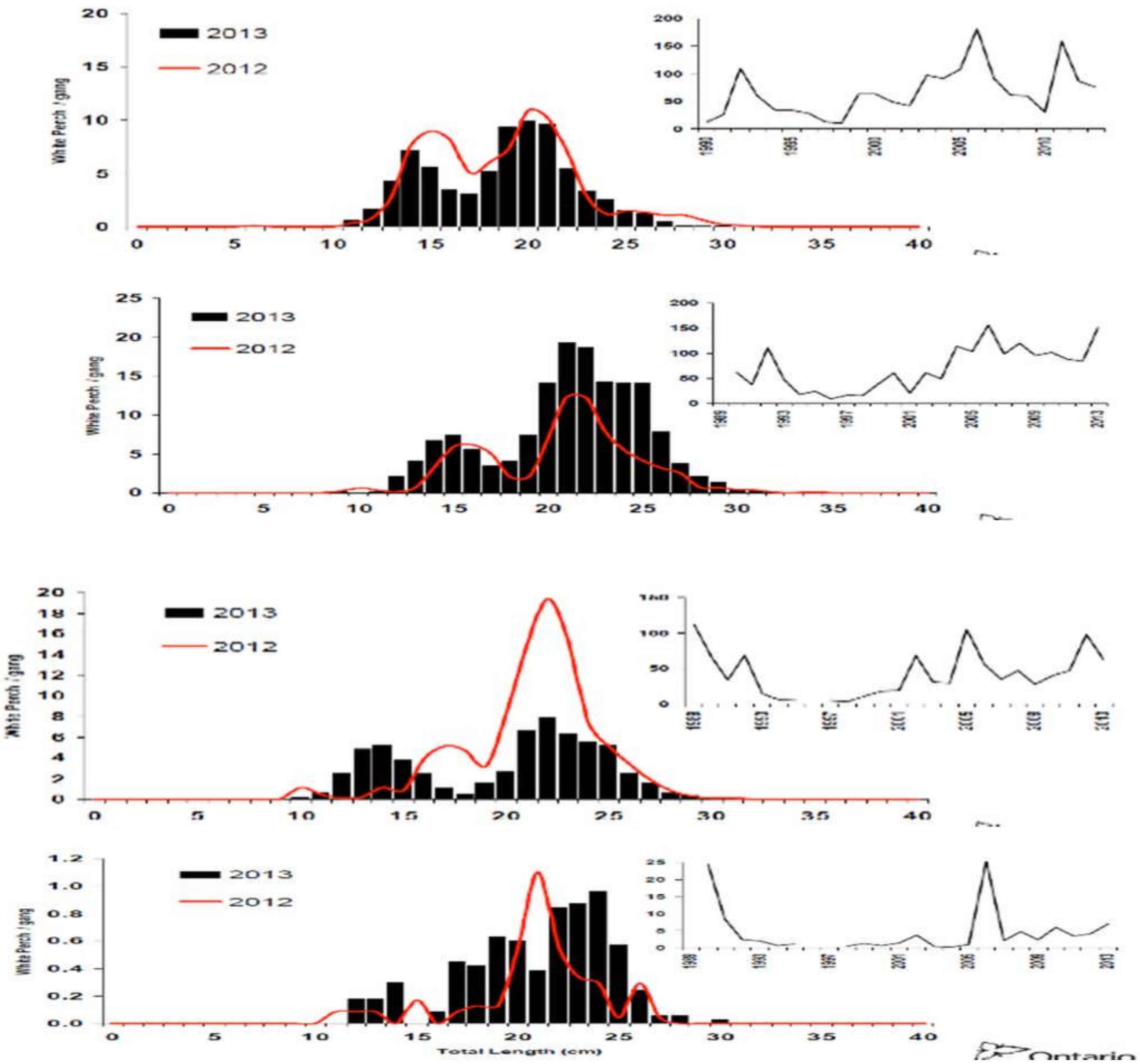
Monitoring / Information. Landings from Ontario gill net fishery are reported in DCRs and available from a database maintained by the OMNR. Conditions of licence for the Ontario fisheries state that all species listed on the licence (quota and unlimited harvest species) and 'no-harvest' permitted species are to be recorded. In the past, while landings data provide information on retained species, discards were underreported and this may have been significant for White perch that is discarded in several fisheries. The reporting of discards has been mandatory since 2011. Removals from the Ohio trap net fishery are reported in DCRs and available from a database maintained by ODNR-ODW. For White perch, the primary indices used to monitor stock trends by the FTG are the Ontario/Ohio (ON/OH) interagency trawl survey and trawl surveys by New York and Pennsylvania. These bottom trawl surveys have provided trends on 0-group White perch abundance in the central basins since 2003 (FTG, 2013). In the western basin, the Ontario and Ohio August interagency trawl survey also provides monitoring of White perch abundance. The partnership gill net survey also provides White perch indices (Figs. 45, 46).

Figure 45: White Perch Catch in Standard Gear Partnership Gillnet Index 2013



Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013

Figure 46: White Perch Catch Rates (numbers/gang) and Size Composition in Partnership Gillnet Surveys



Top to bottom: West Basin, West Central Basin, East Central Basin, and East Basin.

Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013.

Trap Net

Overall.

In overall terms, the Lake Erie commercial trap net fishery in Ohio waters is a multi-species fishery that catches a significant number of fish including Yellow perch. However, Yellow perch is targeted by small mesh trap nets, while large mesh trap nets are used to target other species with some Yellow perch taken as retained catch.

Regulations, seasonal variations, migration patterns and market considerations contribute to the decision on where and how to set the trap net. Trap nets targeting Yellow perch are set in water depths greater than 7 m, while those looking to harvest other species are set in shallower waters closer inshore.

The Yellow perch trap net fishery under assessment comprises the populations distributed in MU1 to MU3. Data made available from 2009 to 2013 identify 10 retained species across MUs besides the target species (Table 23).

Table 22: Targeted small mesh (Yellow Perch) trap net harvest by Management Unit, 2009-2013

		Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Retained By-catch	Main Species		Lifts
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	
1	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2010	152	1	0	1,019	48,079	20,305	154	6	2,826	30	2,754	42,462	318	186,865	304,971	1,600
		0.05%	0.00%	0.00%	0.33%	15.77%	6.66%	0.05%	0.00%	0.93%	0.01%	0.90%	13.92%	0.10%	61.27%	100.00%	
	2011	455	5	0	947	26,933	11,764	7	6	2,767	168	919	42,815	1,110	152,062	239,958	1,998
		0.19%	0.00%	0.00%	0.39%	11.22%	4.90%	0.00%	0.00%	1.15%	0.07%	0.38%	17.84%	0.46%	63.37%	100.00%	
	2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	
	Total	607	6	0	1,966	75,012	32,069	161	12	5,593	198	3,673	85,277	1,428	338,927	544,929	
		0.11%	0.00%	0.00%	0.36%	13.77%	5.88%	0.03%	0.00%	1.03%	0.04%	0.67%	15.65%	0.26%	62.20%	100.00%	
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	Lifts
2	2009	0	0	0	108	55,812	18,387	79	0	633	3,657	489	80,545	869	1,338,510	1,499,089	6,397
		0.00%	0.00%	0.00%	0.01%	3.72%	1.23%	0.01%	0.00%	0.04%	0.24%	0.03%	5.37%	0.06%	89.29%	100.00%	
	2010	7	0	0	123	73,253	11,422	0	0	1,663	4,078	855	92,614	800	935,616	1,120,431	6,740
		0.00%	0.00%	0.00%	0.01%	6.54%	1.02%	0.00%	0.00%	0.15%	0.36%	0.08%	8.27%	0.07%	83.51%	100.00%	
	2011	10	5	0	65	57,349	13,995	0	0	931	0	1,001	39,894	2,659	1,069,233	1,185,142	5,697
		0.00%	0.00%	0.00%	0.01%	4.84%	1.18%	0.00%	0.00%	0.08%	0.00%	0.08%	3.37%	0.22%	90.22%	100.00%	
	2012	0	1	5	52	21,465	672	0	0	126	218	2,290	126,651	345	1,285,336	1,437,161	6,920
		0.00%	0.00%	0.00%	0.00%	1.49%	0.05%	0.00%	0.00%	0.01%	0.02%	0.16%	8.81%	0.02%	89.44%	100.00%	
	2013	0	0	82	75	18,570	1,349	0	0	7	39	1,931	71,610	926	1,230,249	1,324,838	5,851
		0.00%	0.00%	0.01%	0.01%	1.40%	0.10%	0.00%	0.00%	0.00%	0.00%	0.15%	5.41%	0.07%	92.86%	100.00%	
	Total	17	6	87	423	226,449	45,825	79	0	3,360	7,992	6,566	411,314	5,599	5,858,944	6,566,661	
		0.00%	0.00%	0.00%	0.01%	3.45%	0.70%	0.00%	0.00%	0.05%	0.12%	0.10%	6.26%	0.09%	89.22%	100.00%	
MU	year	Buffalo	Bullhead	Burbot	Common Carp	Channel Catfish	Freshwater Drum	Gizzard Shad	Goldfish	Quillback	Suckers	White Bass	White Perch	Whitefish	Yellow Perch	Total	Lifts
3	2009	0	0	0	0	0	0	0	0	0	0	0	0	37	112,030	112,067	482
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	99.97%	100.00%	
	2010	0	0	0	0	828	0	0	0	0	0	0	0	285	153,097	154,210	972
		0.00%	0.00%	0.00%	0.00%	0.54%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%	99.28%	100.00%	
	2011	0	0	0	0	9,181	0	0	0	51	0	0	1,558	964	327,871	339,625	1,108
		0.00%	0.00%	0.00%	0.00%	2.70%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.46%	0.28%	96.54%	100.00%	
	2012	0	0	143	0	5,933	0	0	0	0	0	150	3,228	1,018	469,401	479,873	2,082
		0.00%	0.00%	0.03%	0.00%	1.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.67%	0.21%	97.82%	100.00%	
	2013	0	0	0	0	0	0	0	0	0	0	260	0	512	300,346	301,118	1,014
		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.09%	0.00%	0.17%	99.74%	100.00%	
	Total	0	0	143	0	15,942	0	0	0	51	0	410	4,786	2,816	1,362,745	1,386,893	
		0.00%	0.00%	0.01%	0.00%	1.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.35%	0.20%	98.26%	100.00%	

Source: ODNR. Information provided to the auditors December 2014.

The catch of Buffalo (607 lbs in MU1 and 17 lbs in MU2) is mostly Bigmouth buffalo (Pers. Comm. T. Hartman). While COSEWIC considered this species to be of Special Concern in April 1989, the limited catch means it is not considered as a main species for this assessment.

There were three main retained species (>5% of the catch) in all MUs (Table 23).

Table 23: Summary Main Retained Species in the Ohio Yellow perch Trap Net Fishery

MU1	MU2	MU3
Channel catfish Freshwater drum White perch	White perch	

MU1. In the five years beginning 2009, a commercial fishery for Yellow perch was only allowed in MU1 in 2010 and 2011. In those two years, 12 species were retained apart from Yellow perch (Table 23) in the total catch of 544,929 lbs. Yellow perch accounted for 62.2% of this total. Main retained species were Channel catfish (13.77 %), Freshwater drum (5.88%), and White perch (15.65 %). While Lake whitefish may be considered a vulnerable species, due to the low proportion of its total catch in the Yellow perch trap net fishery (0.26 %) it is not considered as a main retained species.

MU2. In the five years beginning 2009, there were 12 retained species in MU2 besides yellow perch (Table 23). The total annual catch ranged from 1.1 million lbs in 2010 to 1.5 million lbs in 2009, with Yellow perch accounting for the highest proportion of the annual catch (83.5% to 92.9%). The only main retained species in MU2 is White perch (1.9% to 14.9% per year).

MU3. In the five years beginning 2009, there were 6 retained species in MU3 besides the yellow perch (Table 23). Annually, yellow perch accounted for 96.54% to 99.97 % of the total catch that varied between 112,067 lbs and 479,873 lbs. There were no main retained species in MU3. Channel catfish catch was the only species that constituted over 1%.

Channel Catfish

Biology. The Channel catfish is a member of the Ictaluridae family and prefers cool, deep, clean water with sand or gravel bottom. The species is found in all the Great Lakes except Lake Superior. In late spring or early summer, the male builds a nest in underwater holes, logs or among submerged rocks. Sexual maturity comes at 5-8 years of age, and they can live as long as 25 years. Eggs hatch in 5-10 days following spawning, and the juveniles grow quite rapidly. Fishbase reports a 36 cm length at maturity, maximum length of 132 cm, common length of 57 cm, maximum published weight of 26.3 kg and age of 24 years.

The length weight relationship for the species based on trawl samples from Ohio surveys in 2006 (ODWR 2013) is log W= -5.8121+3.3346 log TL. Many Channelcatfish 'monsters' exceed 9 kg. In reservoirs, many of these are the result of the successful state stocking program. Typically 68 reservoirs are stocked each year. In the Great Lakes, older fish can reach 14 kg.

Members of the catfish family are all more or less omnivorous, feeding on all sorts of plant and animal matter. They are also mostly nocturnal, and use their barbels to locate food in the dark recesses of deep water. Young catfish eat mostly insect, crayfish, other fish and even tree seeds. They take a large part of their food from the bottom, but they also feed at the surface. In turn, small catfish are eaten by many other fish. Adults feed on small fish, crustaceans, calms and snails, aquatic insects and even small mammals (Fishbase). At large size, adults probably have no predators except man.

Harvest. Channel catfish are harvested by sport and commercial fisheries. Their impressive size and high quality flesh make them popular as a sport fish. They are also of significant commercial value, especially in Lake Erie. Harvest of catfish, including Channelcatfish and brown bullhead, in commercial fisheries recorded over 2,000 mt in the 1990s (Baldwin *et al*., 2002). Seine is the main fishing gear.

Outcome Status. Catch declined from the mid-1990s, suggesting either a decline in market demand, fishery interest or abundance. More recently, interagency surveys have documented strong increases in abundance. The trend in abundance occurred primarily in the western basin and in the warmer waters of the central basin (ODNR 2004; OMNR 2004). Harvest rates in trap nets and seine fisheries reported by ODNR that are taken as indicators of abundance show increases in Channel catfish since 2007 (Table 24). Nevertheless, the species may have recently experienced increased M due to outbreaks of disease (Channelcatfish viral disease and type *E botulism*). There are no other stock assessments to evaluate the status of Channelcatfish in Lake Erie.

Table 24: Channel catfish harvest rate in Ohio (lbs/ trap net lift; lbs/1,000 feet of seine haul)

	Trap	Seine
2003	35.4	210.1
2004	17.9	249.9
2005	28.1	276.9
2006	36.5	182.6
2007	49.1	275.4
2008	93.7	299.2

Source: ODNR Report 2013

Management. There is a minimum landing size of 14½” in the Ohio commercial fishery. There are general regulations for all retained species covering season, area closures and gear configuration. There are no regulations in Ontario except for general mesh size regulations for target fisheries; it is an unlimited harvest species. Channel catfish are harvested by jurisdictions without an interagency management protocol, a change that likely should be made (State of Lake Erie, 2009).

Information / Monitoring. The species is sampled in Lake Erie partnership surveys and a number of state surveys. Survey data are available from databases such as the Lake Erie interagency trawl database. Harvest data are available from CDR both from Ohio and Ontario fisheries.

Freshwater Drum

Biology. Freshwater drum is the only North American freshwater representative of the Sciaenidae Family. It is found in Central North America from Canada to Central America. Apparently it has the greatest latitudinal range of any North American freshwater fish (Fremling 1980). The distribution of the species is associated with turbid to clear lakes and rivers, but does occur in a wide variety of habitats. They are found in benthic habitats of large, shallow bodies of water. Individuals have been observed to become distressed when water temperatures exceed 25.6° C. and when dissolved oxygen concentrations remain low over an extended period.

The species is known to attain up to 70 cm. Rypel (2007) reported males up to 21 years and females up to 32 years. Females are significantly larger and have significantly higher growth rates than males after age 4. The length weight relationship for the species in Ohio from 2006 is log W= -5.8973+3.3750 log TL.

Freshwater drum mature at ages 3 to 6, with males measuring at least 20 cm and females 22 cm. The spawning season extends from May to June, usually at water temperatures between 18 - 26°c (Fremling 1980). The number of vitellogenic oocytes range from 34,000 to 66,500, in 6-9 year-old fish measuring from 31-39 cm. Fecundity reaches 600,000 eggs for large females of 3.5 kg. Spawning occurs in open waters. The Freshwater drum reproductive strategy consist of non-guarders; open substratum spawners; and pelagophils – characterized by numerous buoyant eggs. Eggs and sperm are released in the water column; eggs are buoyant, larvae are planktonic (Daiber 1953). The species is primarily a benthic feeder, consuming insect larvae, crustaceans, fish, clams, and snails; molar-like pharyngeal teeth aid in masticating molluscs (Fremling 1980).

Harvest. (Table 25). In Ontario, the species is part of the retained and discarded gill net by-catch.

Table 25: Freshwater Drum Harvest in Ohio Waters of Lake Erie by Commercial and Sport Fisheries (2012)

		Sport Harvest			Commercial Harvest			
Species	District	Private Boat	Charter Boat	Sport Total	Trap Net	Seine & Trotline	Commercial Total	Grand Total
Freshwater Drum	1	16,863	163	17,026	273,033	232,245	505,278	522,304
	2	3,879	19	3,898	9,032	0	9,032	12,930
	3	835	154	989	0	0	0	989
	Total	21,577	336	21,913	282,065	232,245	514,310	536,223

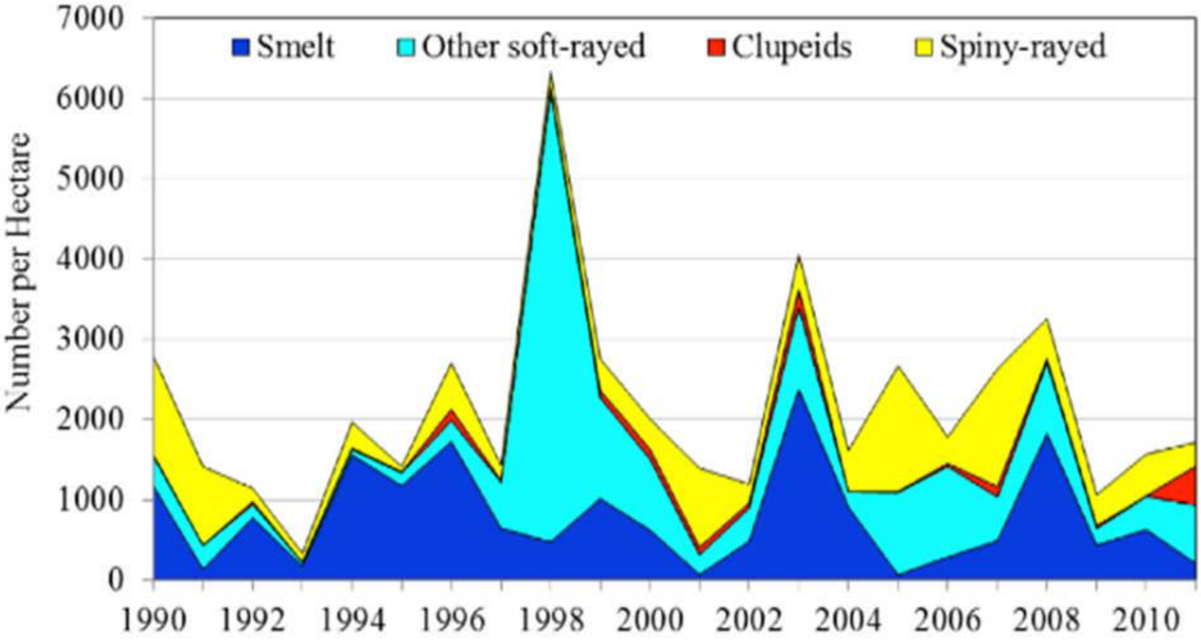
Source OWD 2013

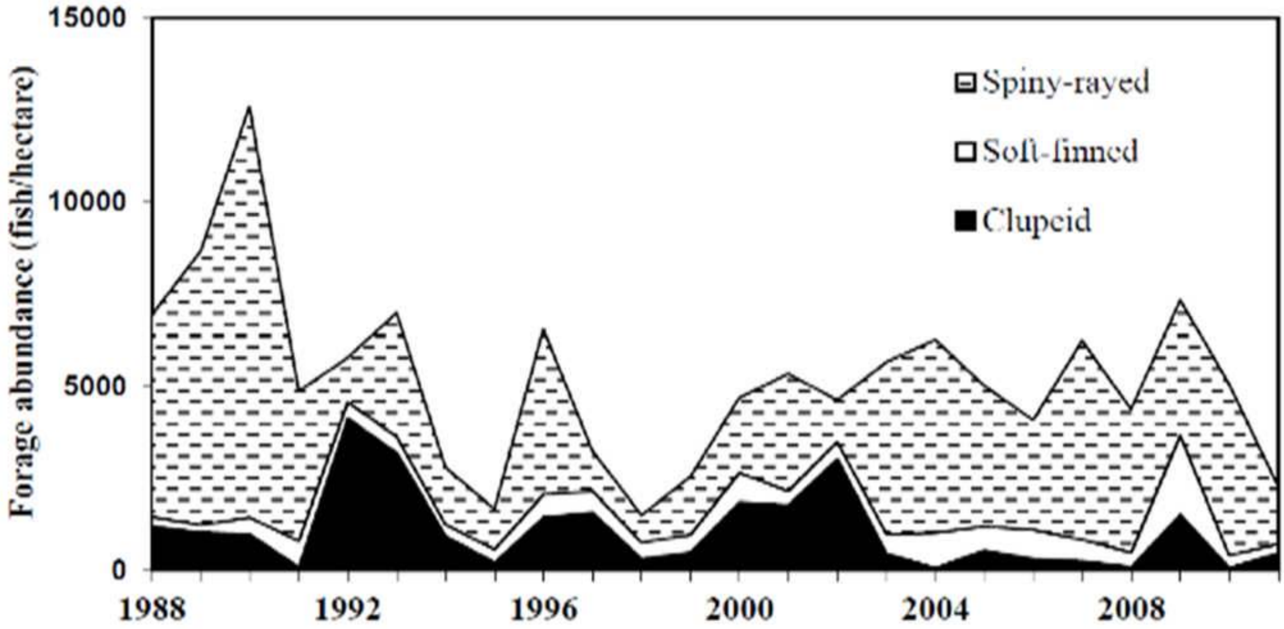
Status Outcome. There are no stock assessments of Freshwater drum in Lake Erie. The species, as well as Channelcatfish and common carp, is associated with warm-water habitat and as such they are defined as a group in state survey reporting. The State of Lake Erie report (2009) indicated that these three species were sought primarily in commercial fisheries, with a reduced catch since the mid-1990s suggesting a decline in market demand, fishery interest, or abundance. Annual trends for the group are reported by the forage fish assessments of the FTG, with Freshwater drum classified as spiny-rayed species in terms of functional groups within the context of forage fish assessments (Fig. 47). These assessments are to evaluate the prey basis in Lake Erie but provide no information on Freshwater drum status. Interagency fishery independent surveys tend to indicate that harvest declines are independent of abundance for which they have documented a slight increase; primarily in the western basin and in the warmer waters of the central basin (ODNR 2004; OMNR 2004). The species may have experienced increased M due to outbreaks of disease. Abundance indices of YOY Freshwater drum from USGS bottom trawl surveys indicate a recovery since 2006 (Fig. 48).

Management Strategy. Commercial species of any size that may be sold and possessed in Ohio are: Alewife, American eel, Bowfin, carp, sheepshead, gar, Gizzard shad, lamprey, Quillback, smelt, goldfish, suckers, buffalo, Burbot and White perch (Fishing Law). Although this list does not include Freshwater drum, no specific regulations were found for the species. General regulations for all retained species such as season and area closures, as well as gear configuration, apply to Freshwater drum. In Ontario, Freshwater drum is an unlimited catch species.

Information/Monitoring. Hydro-acoustic and trawl surveys in the central basin monitor the stock as well as gill net partnership surveys (Fig. 49, Table 26), and assessments of the nearshore community with electrofishing and trap nets (Fig. 50).

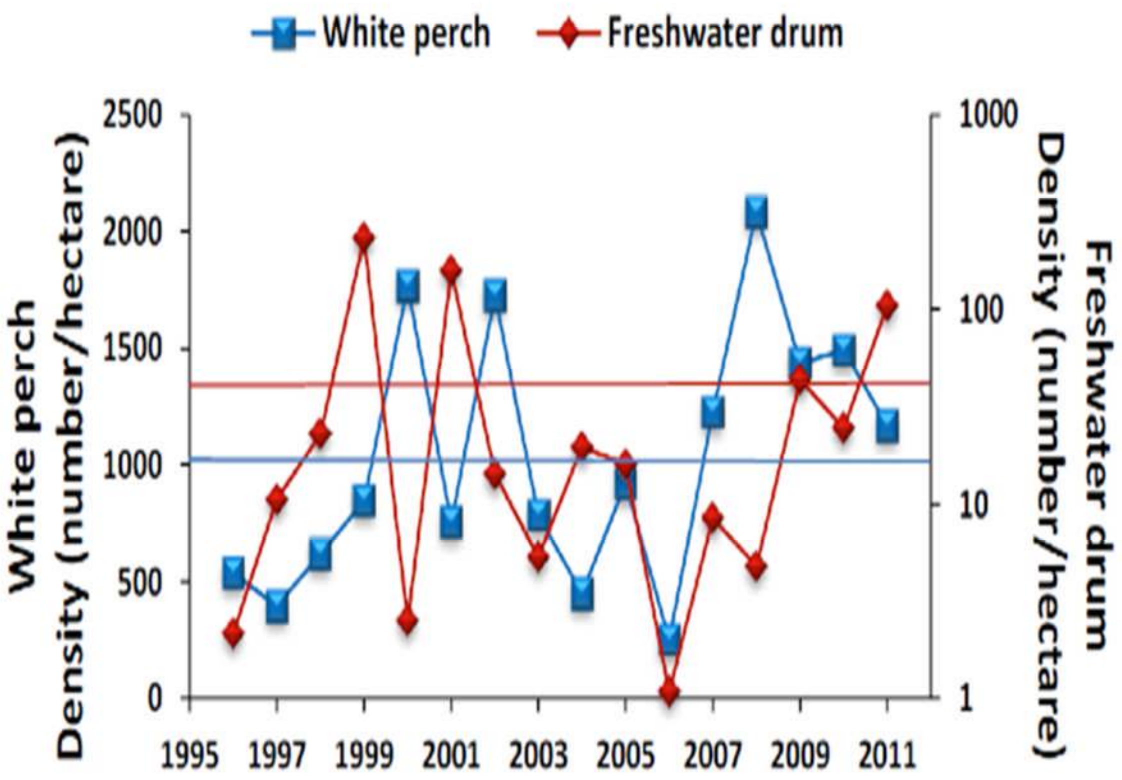
Figure 47: Mean Density of Prey fish (# / ha) by Functional Group in Ohio Waters of the (top) Central and (bottom) Western Basins of Lake Erie





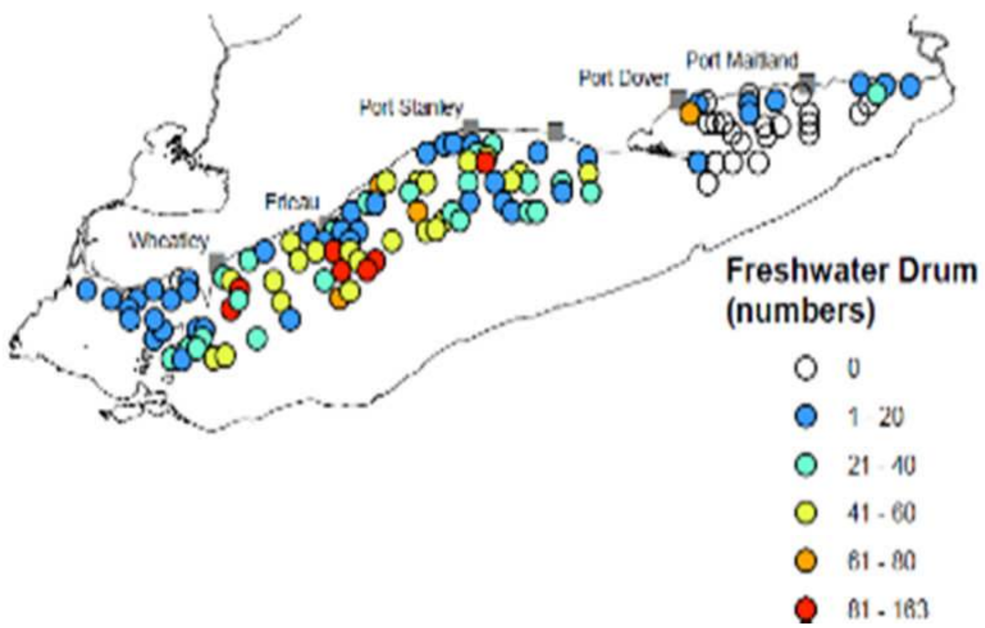
Source : LEC FTG 2012

Figure 48: Abundance Index of YOY Freshwater Drum from Bottom Trawl USGS Surveys in Western Lake Erie



Source : Fisheries Research & Monitoring Activities of the Lake Erie Biological Station 2011, USGS. Reported to the GLFC for LEC Meeting 2012.

Figure 49: Freshwater Drum Catch in Standard Gear in Partnership Gillnet Index 2013



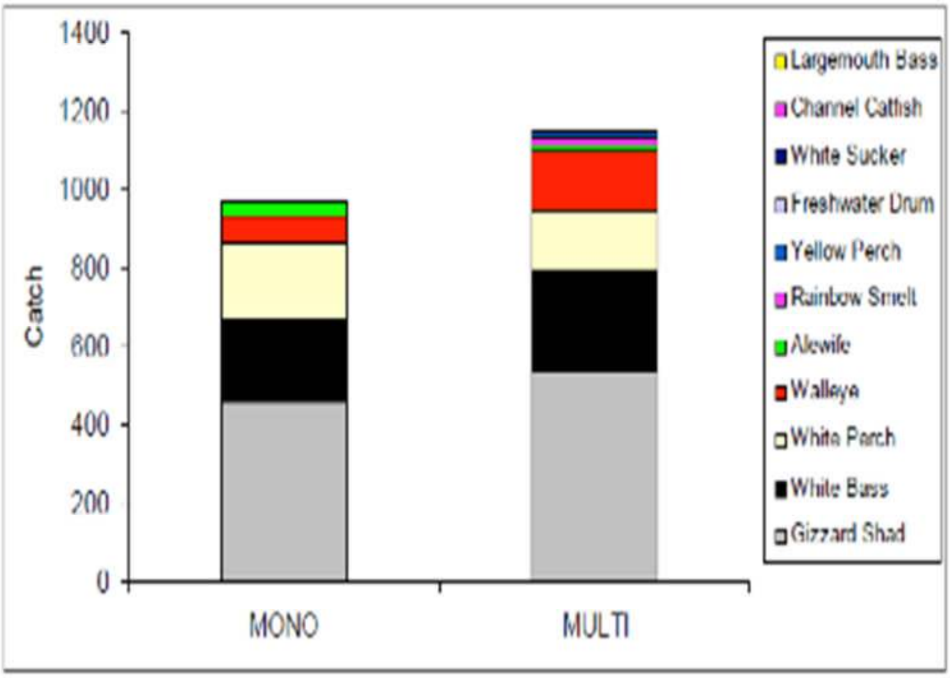
Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch 2013.

Table 26: 2013 Partnership Index Lake-Wide Catch by Species

SPECIES	STANDARD INDEX	CB 1 FA INDEX	50 MESH 4 3/4"	All	%
Lake Sturgeon	4	-	-	4	0%
Longnose Gar	2	-	-	2	0%
Alewife	8,681	2,022	42	10,745	19%
Gizzard Shad	4,166	617	675	5,458	10%
Coho Salmon	1	-	-	1	0%
Rainbow Trout	20	-	4	24	0%
Brown Trout	1	-	1	2	0%
Lake Trout	45	-	-	45	0%
Lake Whitefish	1	1	1	3	0%
Rainbow Smelt	1,659	265	99	2,023	4%
Quillback	8	-	-	8	0%
White Sucker	199	-	2	201	0%
Shorthead Redhorse	29	-	1	30	0%
Common Carp	4	-	-	4	0%
Silver Chub	6	-	-	6	0%
Emerald Shiner	1	-	-	1	0%
Brown Bullhead	1	-	-	1	0%
Channel Catfish	292	2	14	308	1%
Burbot	7	-	-	7	0%
White Perch	15,071	56	8	15,135	26%
White Bass	3,325	666	102	4,093	7%
Rock Bass	10	-	-	10	0%
Smallmouth Bass	106	-	3	109	0%
Black Crappie	1	-	-	1	0%
Yellow Perch	14,164	2	-	14,166	25%
Walleye	1,014	188	369	1,571	3%
Round Goby	45	-	-	45	0%
Freshwater Drum	3,237	3	45	3,285	6%
Carp-Goldfish Hybrid	3	-	2	5	0%
All	52,103	3,822	1,368	57,293	100%

Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch 2013.

Figure 50: 2012 Catch Numbers by Species in Monofilaments & Multifilament Index Nets



Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildlife Services Branch 2013.

The Ohio DNR-Wildlife Division presents results from these surveys in annual reports. Harvest information is collected in DCRs. The USGS-LEBS has conducted annual bottom trawl surveys near East Harbor State Park, Ohio in each spring (1961 – 2008) and in autumn beginning in 2009. The objectives of the surveys have been to estimate relative abundance and growth of YOY of common fish species. Abundance indices and growth data from these surveys provide an index of recruitment for species including Freshwater drum, which are presented to LEC. In Ontario, information on harvest is available from DCRs as the species is retained and discarded in gill net fisheries.

White Perch

See above.

Walleye

Ontario Gill Net Retained Species

The commercial Lake Erie Walleye gill net fishery is part of a multi-species fishery that also targets Lake whitefish and White bass: regulations require the use of large mesh gill nets > 89 mm. Landing reports are available for the commercial large mesh gill net fishery since 2004. While conditions of licence for the Ontario fisheries require recording of all fish caught on the DCR), reporting of discards was only enforced in 2011; previously reporting of releases and discards was less reliable (Li *et al.* 2011).

Based on the commercial gill net data in the large mesh fishery targeting Walleye from DCRs in MU1 to MU3 and from 2004 to 2013, there were three main retained species (Table 27)

Table 27: Summary Main Retained Species in Ontario Walleye Gill Net Fishery

MU1 - MU3
Lake whitefish, White bass, White perch

Table 28: Walleye Gillnet Fishery Retained Catch (lbs) all MUs: 2004- 2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Alewife	0	87	0	0	0	0	0	0	0	0
Black Crappie	11	13	46	0	0	0	0	4	0	0
Bowfin	10	6	20	0	0	19	14	9	40	0
Brown Bullhead	575	597	578	51	18	38	0	0	122	0
Burbot	3,014	6,260	1,384	1,863	856	3,315	1,408	2,050	102	32
Channel Catfish	5,631	7,450	13,006	8,197	7,170	24,947	9,161	12,577	2,4175	16,601
Common Carp	7,196	8,336	12,279	3,234	4,240	3,544	2,096	2,520	1494	707
Freshwater Drum	58,103	128,333	112,773	28,340	39,878	135,250	109,122	178,717	59,342	56,112
Gizzard Shad	271	65,283	6,243	252	1,863	7,376	27,690	7,231	23,496	3,638
Lake Trout	0	0	0	72	0	0	0	0	0	0
Lake Whitefish	583,896	293,815	296,682	789,112	884,046	753,027	568,755	503,449	202,478	88,951
*Lepomis	0	12	3	1	2	0	0	0	0	0
Longnose Gar	13	5	0	0	0	29	0	0	0	0
*Moxostoma	0	0	0	0	416	0	8	44	0	104
*Pomoxis	14	21	15	11	26	5	10	5	19	11
Quillback	71,625	70,479	53,014	22,838	33,017	42,780	14,733	16,064	22,234	9,427
Rainbow Smelt	449	31	48	321	293	695	646	74	17	173
Rock Bass	29	197	36	25	27	47	49	23	33	12
*Suckers	1414	6,583	4,062	335	1,318	6,802	2,460	5,142	7,717	7,256
Walleye	2,343,017	5,779,686	7,305,150	5,226,663	4,480,530	3,069,032	2,877,206	3,961,467	4,588,677	4,155,640
White Bass	3,129,500	2,373,073	1,957,529	2,703,944	3,850,498	2,809,540	3,279,197	1,508,042	3,064,428	4,850,721
White Perch	360,448	402,005	396,246	656,806	527,055	398,216	396,742	329,463	341,119	379,369
Yellow Perch	58,488	92,644	84,271	59,576	46,561	64,987	75,951	90,869	52,105	49,816
Total Catch	6,743,329	9,332,069	10,318,460	9,522,210	9,906,388	7,379,621	7,417,454	7,156,223	9,117,176	10,453,472

* Species groups

Source: CFHIS as extracted by OCFA,

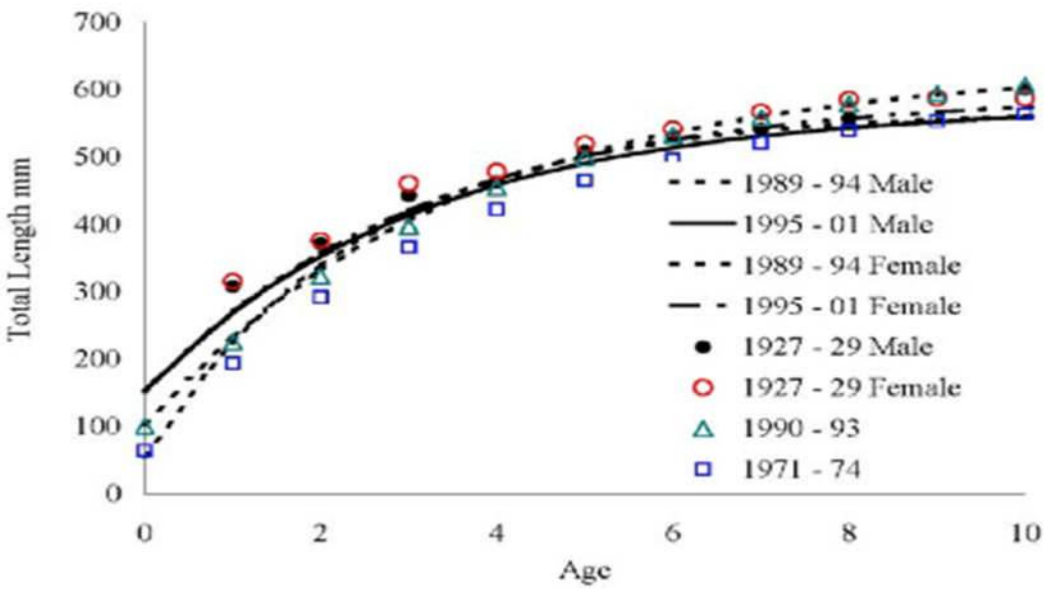
Total harvest including retained, released, discarded, and surrendered catch ranged between 6.7 million lbs in 2004 and 10.3 million lbs in 2006 (Table 28). Between 2004 and 2013, data shows that, in addition to the target, 18 retained species and four species groups *Lepomis, Moxostoma*, *Pomoxis* and suckers. Most of the catch was retained. The proportion of Walleye in the catch was 35 to 71% and other retained species with significant contributions were White bass (19-50%), Lake whitefish (1-10%), and White perch (4-7%). The species included in the groups are not known but could include vulnerable species. The small retained catch of Lepomis (12 lbs), Moxostoma (520 lbs), Pomoxis (14 lbs) over the period leads them to not being considered main. While the catch of suckers is higher (14,251 lbs), the by-catch is more and the species is addressed as a by-catch.

Lake Whitefish

Biology. Lake whitefish is an epibenthic, coldwater species broadly distributed throughout the northern United States and Canada, and is now the dominant deepwater epibenthic fish in the Great Lakes (Seafood, 2008). Lake Whitefish prefer temperatures between 11°c and 17°c. They school in deep waters (> 12m) and can move to depths greater than 60 m in the summer in search of colder water. Lake Erie is the southern extent of their range (Cook *et al*., 2005) which might be expected to influence productivity.

Lake whitefish generally live longer than 20 years, with a maximum reported age of 50 years. Total adult length is typically 45 – 64 cm and weight ranges from 0.7 to 2.3 kg. FishBase indicates that the average maximum size is about 100 cm. Lake whitefish have been known to reach 9 kg and the largest recorded was 19.1 kg (Lake Superior in 1918 (Seafood, 2008)). In Lake Erie, growth rates ranged from 0.318 to 0.401 for males and 0.280 to 0.310 for females, with Von Bertalanffy growth parameters for 1989-1994 for males as L∞= 569 mm, K= 0.401, to= – 0.2552, and for females L∞= 634 mm, K= 0.280, to=– 0.638, and for 1995-2001 for males as L∞= 576 mm, K = 0.318, to=– 0.973, and for females L∞= 593 mm, K= 0.310, to=– 0.956 (Figure 51).

Figure 51: Lake Whitefish Length (mm) at Age in Lake Erie



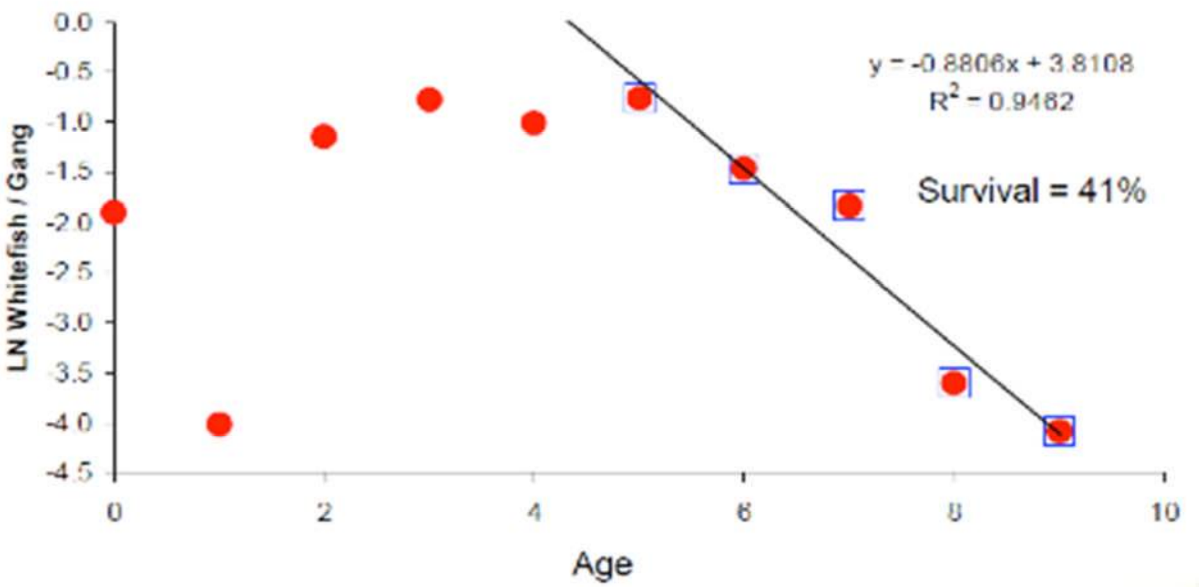
Source: Cook *et al*. 2005

Lake whitefish begin to mature between 30 and 45 cm in total length at ages 2–8 years, and complete maturity is typically achieved between 37 and 55 cm at ages 4 to 12, with males reaching maturity sooner than females. No data were found on average age at maturity in Lake Erie, but in Lake Ontario it increased from 4 years in 1992 to 7 years in 2002 and the mean fork length declined. Fecundity is correlated with female size and average clutch size ranges from 8,000 to 24,000 eggs. Lake whitefish spawn from late October into December. Spawning sites are typically near shore in less than 5 m of depth along exposed windward shorelines or reefs (Ebener *et al.* 2008). They spawn over small to moderate-sized cobble substrates and on sand. Populations intermingle during summer and exhibit homing behavior separating into distinct spawning stocks that return to their shallow nursery habitats to reproduce. After hatching in early summer, juvenile whitefish leave the spawning grounds moving into deeper, cooler waters.

Most Lake whitefish stocks inhabit areas within 50 km of the spawning site, and some are very migratory; thus spatial distribution of discrete stocks overlap during the non-spawning season and fisheries can harvest multiple stocks. The degree to which stocks mix in Lake Erie is currently unknown (Brenden *et al.,* 2010). Most notably, there is a very poor understanding of the distribution and habitat utilization during non-spawning periods.

CWTG reported an estimate of M of 0.38 (CWTG 2013). Statistical catch at age models of lake whitefish in Lake Superior, Lake Huron and Lake Michigan, estimate M to range between 0.15 – 0.38 (Ebener *et al.* 2005). Survival of 41% was estimated for adult Lake Erie whitefish using survey catch rates (Figure 52).

Figure 52: Lake Whitefish Survival Estimates From 2013 Partnership Index Central+ East Surveys



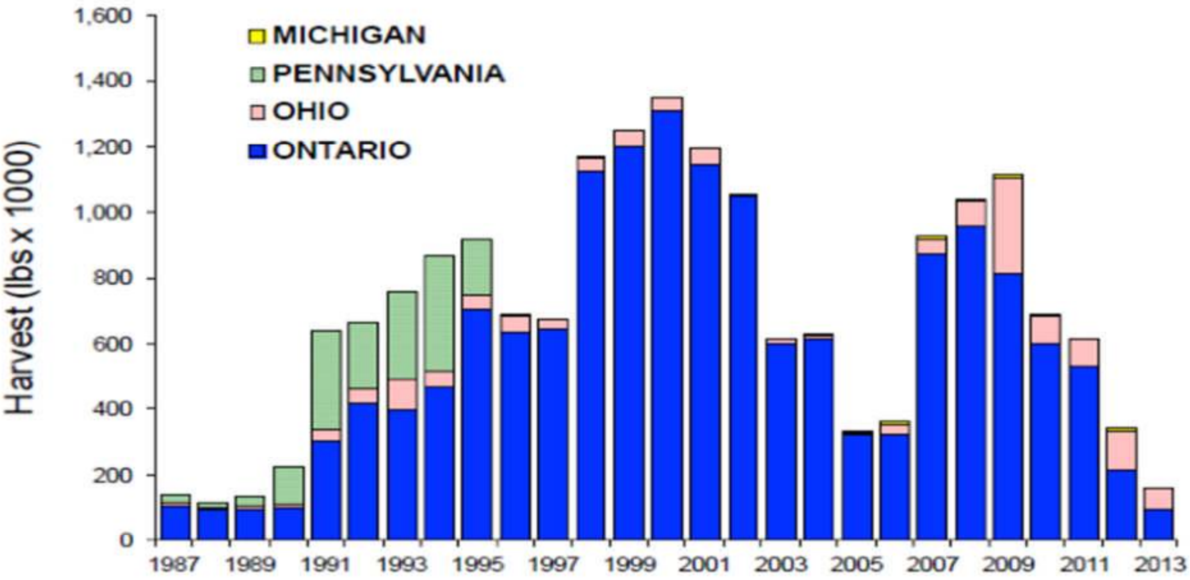
Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013.

Adults typically feed on benthic invertebrates (particularly amphipods) and insect larvae, and may become increasingly planktivorous if benthic prey is scarce. Diporeia, an amphipod that once formed the basis of much of the benthic biomass of deeper Great Lakes, was the primary prey of Lake whitefish in Lake Erie. After the invasion of dreissenids, Diporeia abundance sharply declined and the species is now disappeared in Lake Erie. Lake whitefish was able to incorporate the mussels in their diet. Diet studies from Ohio waters of the Central Basin in 2002 indicated that age 1 whitefish consumed mainly chironomids (36%), isopods (21%), Bythotrephes cederstroemi (12%), Leptodora sp. (7%), Dreissena sp. (6%), and Sphaeriidae (5%). Age 2 and older whitefish consumed mainly on Dreissena sp. (33%), followed by Isopoda (17%), Hirudinea (14%), chironomids (10%), Sphaeriidae (10%) and B. cederstroemi (3%)(CWGT 2003).

The trophic level of lake whitefish is about 3.43 (FishBase).

Harvest. Lake Erie lake whitefish has been harvested since at least the middle of the 1800s (Figure 53). The primary fisheries are those of commercial gillnet based in Ontario, the commercial trap net based in the US (Ohio, Pennsylvania and New York), and the sport fishery based primarily in the US although there is some recreational fishing based in Ontario. Lake whitefish harvest in 2013 was 157,919 lbs, distributed exclusively between Ontario (60%) and Ohio (40%). The harvest in 2013 was comparable to low levels observed during the 1980s before recovery.

Figure 53: Lake Whitefish Harvest in Lake Erie

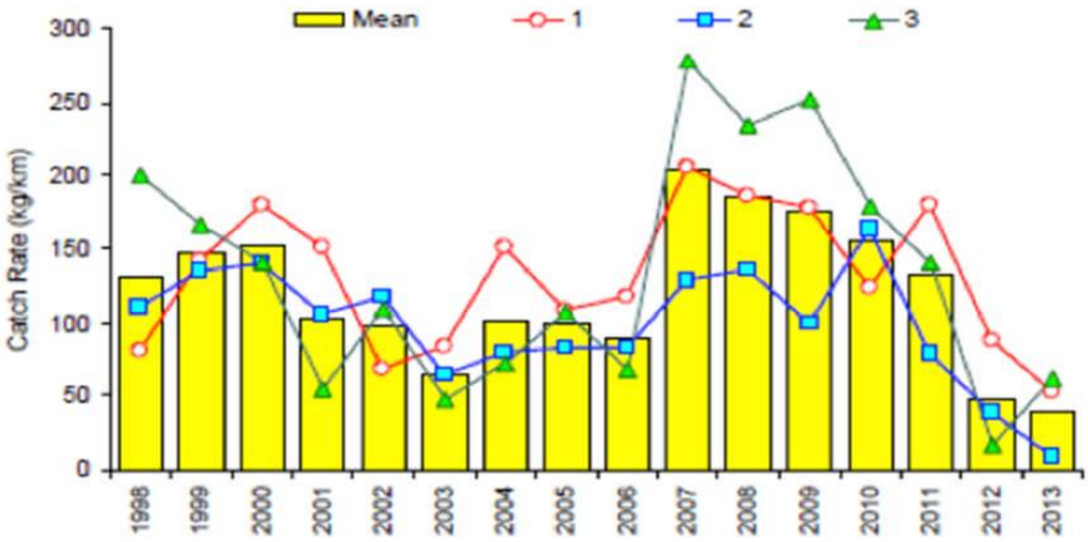


Source: CWTG 2014

Outcome Status. Populations declined precipitously in 1959 due to the cumulative effects of exploitation, watershed degradation, eutrophication, and exotic species (Cook *et al*. 2005). A recovery began in the mid-1980s and was abetted by reduced nutrient loading. Whitefish recruitment was favourable during much of the 1990s (CWTG, 2001), as in the mid-1980s abundance of rainbow smelt (which prey on larval lake whitefish) was reduced by increased walleye predation and intensification of the smelt trawl fishery. The CWTG annually considers the abundance indicators in commercial catch rates (ON gillnet, OH and PA trapnet) as well as surveys (ON gillnet, OH gillnet and trawl, USGS gillnet, NY gillnet and PA gillnet) of whitefish in Lake Erie to assess stock status. Trends are reported in relation to historical conditions with statements qualifying upcoming harvests based upon incoming recruitment. There appear to be no references to desirable stock states other than in general terms. CWTG (2003) provided a rough estimate of spawning abundance based on a catch curve analysis. The latter suggested an annual exploitation rate at that time of 22%. There are no updates of this analysis. Population dynamic models have been developed of Lake whitefish in Lake Superior, Lake Huron and Lake Michigan (Ebener *et al*., 2005) but not of Lake Erie.

Reports on more recent stock conditions in 2013 indicate that the 2003 year class comprised the largest fraction of Lake whitefish observed in fisheries and assessment surveys (CWTG 2014). Lake whitefish sampled in fisheries and surveys ranged from ages 3 to 26, while young-of-the-year and yearling lake whitefish were present as by-catch in commercial trawls that seek rainbow smelt. The decline in Lake Erie's lake whitefish population is evident from both fishery and survey indicators (CWTG 2014). The 2014 CWTG report stated that continued poor recruitment elevates the need for reduced fishing mortality and habitat improvement. Some indicators suggest that mean condition factors have dropped below historic averages. Further, Ontario annual commercial catch rates dropped precipitously from 2011 to 2013 (Figure 54).

Figure 54: Catch Rates in Ontario Large Mesh Gill Net Targeting Lake Whitefish by Quota Zone, 1998 – 2013;: 1= west basin, 2 =eastward to the middle of the central basin, 3= eastern portion remaining.



Source: CWTG 2014.

It is foreseeable that in the Ontario whitefish gill net fisheries, most of quota allocation will be to by-catch in other fisheries (Pers. Comm. K. Reid). The population is in a state of decline, because in recent years recruitment was exceeded by mortality.

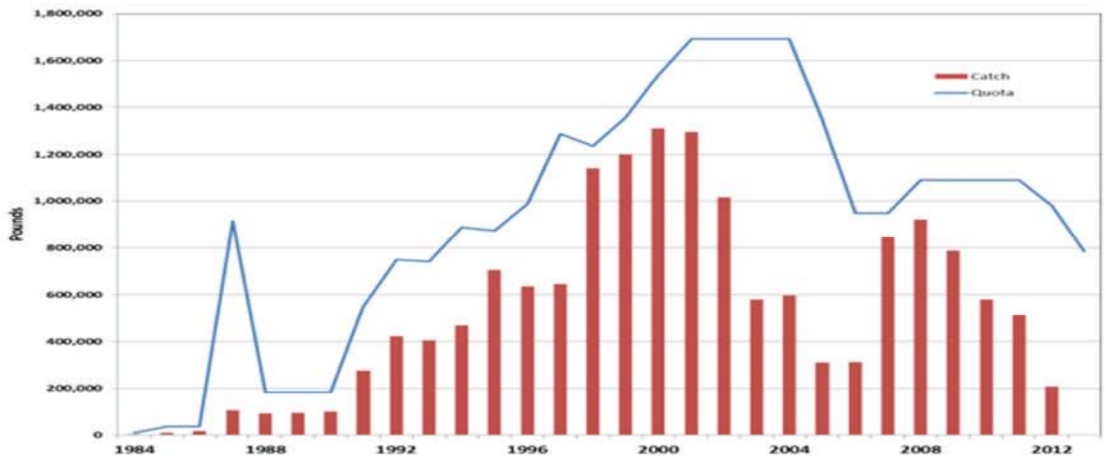
Management. Lake whitefish is managed as two stocks – one in the west and central basins and the other in the east basin, with the general intent of management to limit the harvest of spawners. It is not evident how the annual discussion by the CWTG is translated into management action.

In Ontario, Lake whitefish is a quota species and the retained lake whitefish catch in the walleye fishery is counted against the quota. However, this quota does not appear to be related to stock status. During the site visit it was mentioned that the quota would be reduced if there was a need, but the quota has not been caught since at least 1984 (Figure 55). During the site visit, it was also indicated that there are not any HCRs to guide management; this was confirmed by a review of CWTG reports since 2001.

Appendix "B" of the Ontario License Conditions establishes a series on conditions that apply to whitefish as a target and as retained species such as that fish must be reported and landed. Fishing is not allowed within designated lake trout refuges. The walleye gill net minimum mesh size is 98 mm. The commercial fishery targeting Lake whitefish in Ontario uses larger mesh (10.16 - 30.48 cm stretched mesh) gill nets (Brenden 2013). More commercial fisheries use large-mesh gill nets of 114 mm stretch mesh and larger than any other gear to harvest lake whitefish (Ebener 2008). Thus, the retained catch in the walleye fishery is of smaller sizes than fish in the targeted fishery. The walleye fishery could take the whitefish quota as retained catch.

The Ohio trap net fishery has a minimum size for Lake whitefish of 17" and it is not a quota species. There is no interagency coordination on the management of the species.

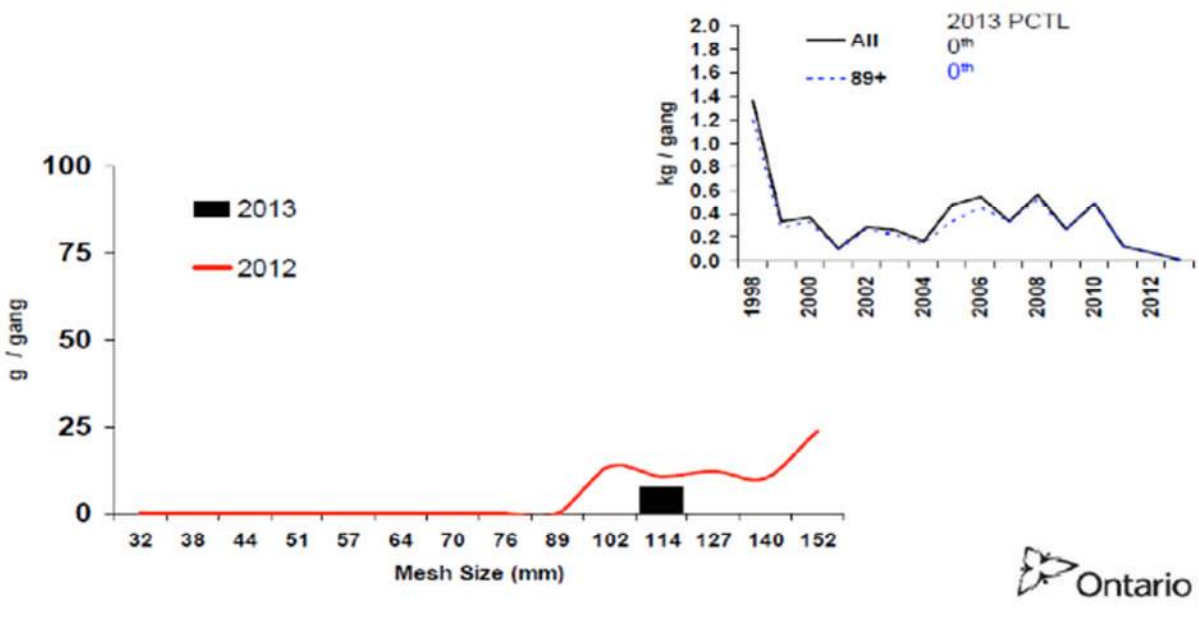
Figure 55: Trend in Ontario catch and allocation since 1984



Source CWTG 2013

Information / Monitoring. The primary indices used to monitor Lake whitefish stock trends by CWTG are the Ontario partnership gillnet, and the New York and Pennsylvania gillnet surveys. These surveys are described above; they are designed to monitor several commercial species. CWTG annually reports on lake-wide stock conditions based on a number of commercial and survey indices. It provides an indication of what the status will be in the short term based upon the strength of recruiting year-classes. CWTG provides a rough estimate of Lake whitefish spawning abundance based on a catch curve analysis. The latter suggested an annual exploitation rate of 22%. The Partnership Gillnet Survey assesses the population in Central and East Lake Erie and reports annual indices (Figure 56).

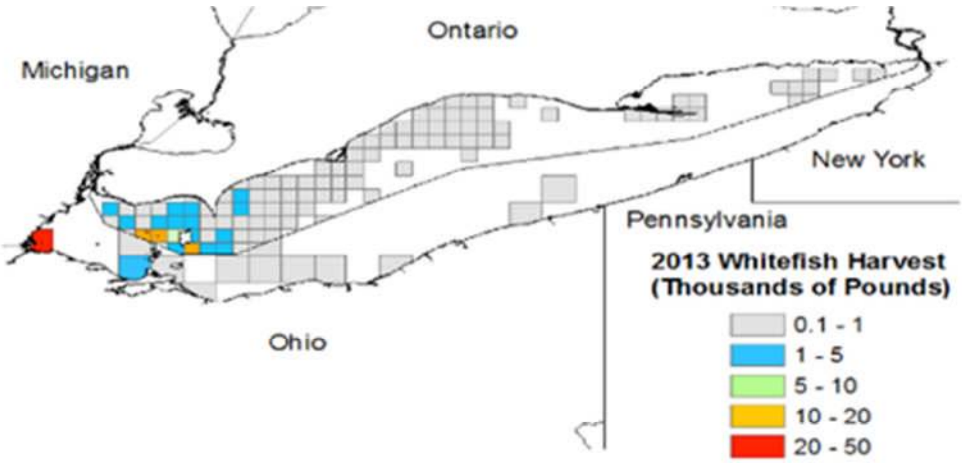
Figure 56: Lake Whitefish Catch Rate (Biomass $_{mesh/gang}$) in Central + East Lake Erie Partnership Gillnet Survey Index



Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013.

Catch information is recorded in DCRs in both Ontario and Ohio (Figure 57). Lake whitefish are dressed on the lake, for which an 18% correction factor is applied to the DCR to estimate harvest. Dockside monitoring is not 100% but is subject to random checks. There is no on-board monitoring. The commercial fisheries are subject to sampling at dock side to characterize the size and, through the collection of scales and otoliths, the age of fish caught. This sampling also collects biological information such as the gonad weight, sex, and maturity stage of the fish (LEC, 2013). Ohio has standard sampling protocols comparable to those of LEC (2013) (see above).

Figure 57: Commercial Catch of Lake Whitefish by 5-min (Ontario) and 10-min (Ohio) grids (2013)



Source: CWTG 2014.

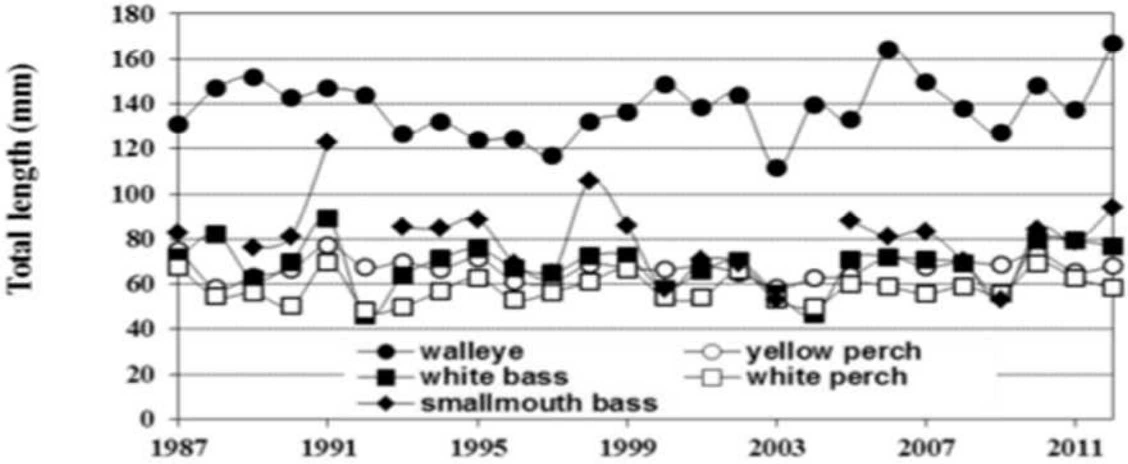
White Bass

Biology. White bass is native to Lake Erie and the species is a freshwater member of the Moronidae family. It belongs to same genus as the non-native white perch and hybrids have been found in the lake. White bass were ranked the 7th most numerically important species over 55 species identified among the Lake Erie western basin fish community based on interagency index trawl program conducted by OMNR and ODNR (Zhu *et al*., 2008). The species occurs as well in Lakes Ontario, Huron and St. Clair.

Throughout its natural range, the species frequents clear, cool water of moderate depth over rock reefs, sand bars and submerged rock jetties. It shows some preference for running water, below dams, locks, and the mouths of tributary streams. White bass live usually within 6 m of the surface and form schools. White bass appear to be great wanderers often traveling around 10 km per day. Schools move into shoals in the lake to spawn in spring and shoals are often sex segregated prior to spawning. Spawning takes place near shore, in water three to six feet deep, on gravel, sand, rubble or rock bottom. Investigation of the natal origins of young of the year white bass that compose the Lake Erie Central Basin population conducted in 2011 indicated that >80% of the successful recruits were produced by the Sandusky River spawning-stock (Davis, 2013). Surviving individuals from this stock were retained in nursery habitats to significantly larger sizes before emigration to the Central Basin than individuals from the Maumee spawning-stock.

White bass adult average 350 - 700 g and seldom live longer than seven years. Changes in growth since the 1980s can be inferred by weight and size trends of age-0 white bass in the annual Ontario, Ohio and Pennsylvania bottom trawl surveys. In the central basin, white bass size-at-age remains high and is generally at or above average for all year-classes in both the east and west areas of Ohio. In the western basin, there have been no obvious trends in growth since 1987 (Figure 58). FishBase indicates that the average maximum size is about 45 cm.

Figure 58: Mean length (mm) of age-0 White Bass, in Western Lake Erie in August Bottom Trawl Surveys (1987 – 2012)



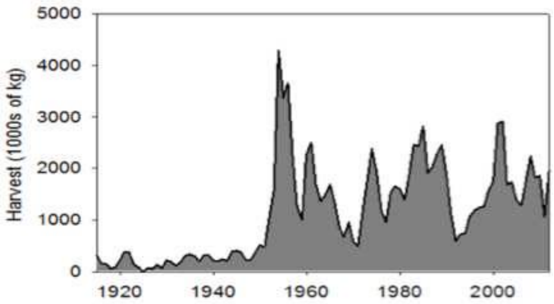
Source: FTG 2013

The majority of white bass mature by age 3; males at 24 cm and females by 30 cm. White bass are extremely fecund (128,897 to 1,049,207 eggs/female) (Madenjian *et al.*, 2010). Eggs hatch in two days and average diameter is around 0.8 mm. The spawning period may last five to ten days and the incubation period a few days. The eggs and sperm are scattered simultaneously over the spawning grounds near the surface or in mid-water where fertilization takes place as the eggs sink and finally adhere to rocks on the bottom. After spawning, white bass return to deeper water. Information on M is limited. A maximum age of 7 suggests of high M. The application of the relationship of $5.075/T_{MAX}$ (Then & Hoenig 2013) provides an M estimate of 0.73. Accordingly, generation time (T_{GEN}) is almost four years.

White bass have a diverse diet. The young grow rapidly consuming insects and insect larva, crustaceans, and small fish. As they grow they eat fish, especially yellow perch, emerald shiner in the spring and gizzard shad in the fall. Other prey items include bluegill, crappie, black bullhead, plankton and crayfish. White bass feed by visual orientation. Diet information from 2012 surveys from showed that 68% of white bass age1 and older had empty stomachs (OHDNR, 2013). The trophic level of white bass is about 4.04 (FishBase).

Harvest. Until the 1980s, white bass was only caught as incidental catch in the gill net fishery. It is currently targeted during certain times of the year and in particular locations. Estimated harvest reached a peak over 4,000 t. in the 1950s and has fluctuated between about 800 and 3,000 t. (Figure 59).

Figure 59: White Bass Harvest in Multi-species Commercial Fisheries in Lake Erie



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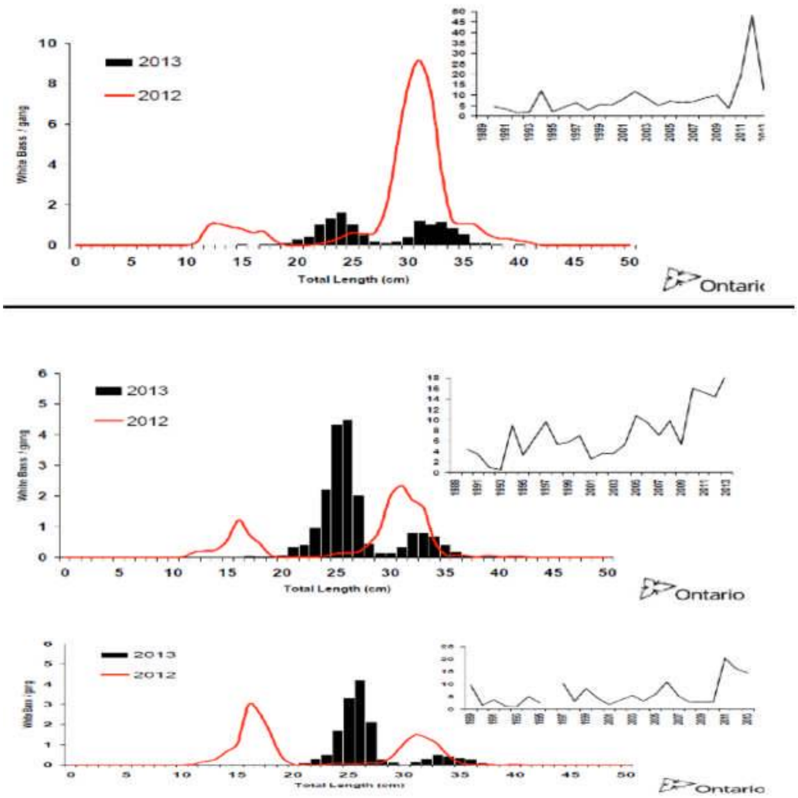
Source: Allan Debertin

Outcome Status. For management purposes white bass in Erie is considered as one stock. However, reports on status (e.g. ODNR, 2013) are generally by small areas of the lake in state and provincial waters. There are limited studies on the stock structure of white bass in Lake Erie. White bass recruitment in Erie sharply declined during the early 1980s. Abundance of age-0 white bass between 1982 and 1997 was significantly lower than between 1969 and 1981 (Madenjian *et al.* 2010). Also CPUE in commercial trap nets between 1987 and 1997 was significantly lower than before 1987. Madenjian *et al.* (2010) proposed that reduced survival was due to an increase in walleye abundance during the 1970s and 1980s. Trends in white bass CPUE from surveys and commercial catch tend to indicate a recovery of the stock since the 1990s (Figure 60).

Figure 60: White Bass Catch Rates (numbers/gang) and Size Composition in Partnership Gillnet Survey

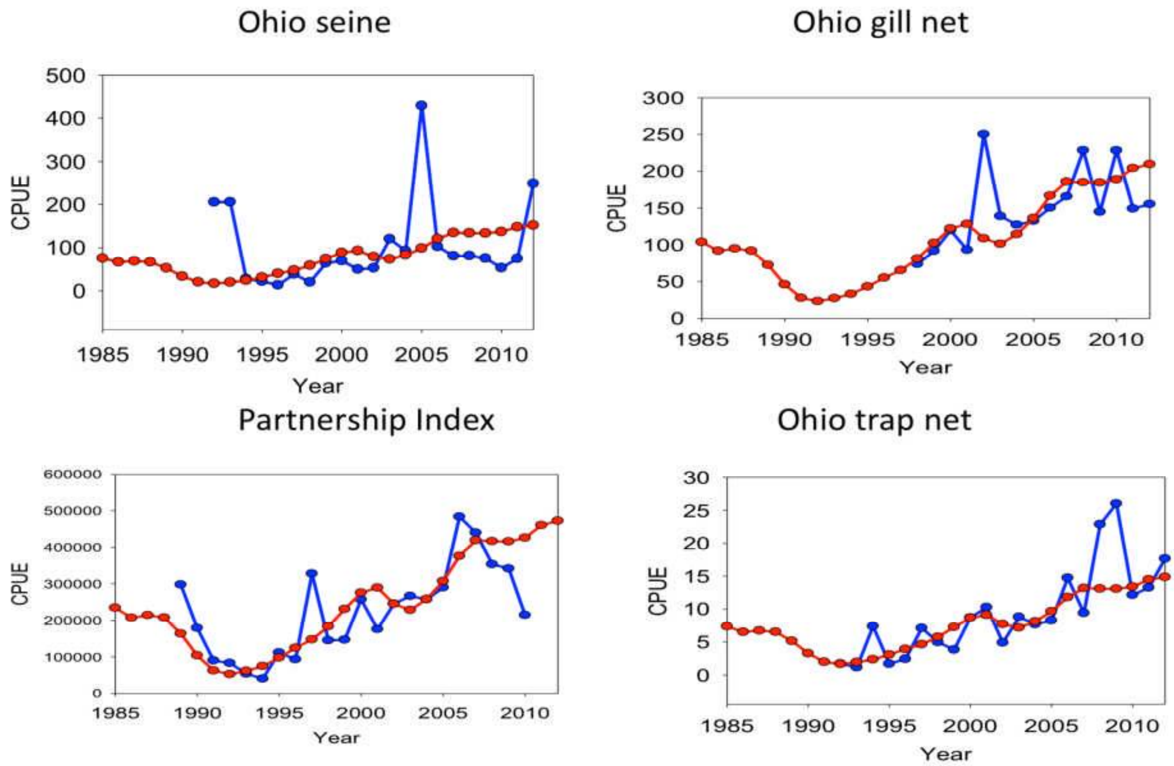


Top= West Basin, Middle=West Central Basin, Bottom=East Central Basins.

Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013

CPUE in surveys conducted by the ODNR and ODW indicate a consistent increasing trend during recent years (ODNR 2013) (Fig 61). Surveys indicate that sub-adult and adult white bass abundance has been high since 2011. Also, growth of juvenile white bass exceeded the recent 20-year average. Length-at-age for ages sampled in the 2013 Ohio DNR fall assessment surveys was generally at, or above, long-term means. Aging with otoliths has shown a greater contribution of older fish (ages 6+) in the samples since 2003. It is unclear whether higher abundance of older fish is due to reduced exploitation, improved aging techniques, or large cohorts. Indices for age-1+ white bass in gill net surveys in Ohio waters of Lake Erie have been well above the historic mean.

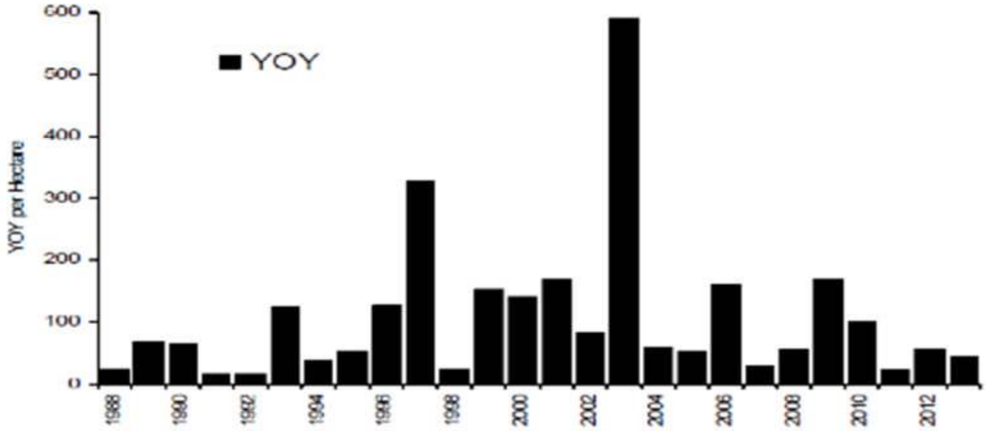
Figure 61: Abundance Indices (CPUE) for White Bass



Blue circles = observed CPUE, red circles = model predictions.
Source: Allan Debertin

Bottom trawl surveys in Ohio waters (Central & Western basins) used to evaluate age-0 white bass in 2012 reported relatively high numbers, with survey in District 3 (May- October, thus before, during, and after lake stratification) reporting some of the largest catches in the 20-year time series (ODW 2013). Nevertheless, relative abundance in District 3 is low compared to other districts. On the other hand, the trawl survey in Ontario waters in the west basin reported CPUE for YOY in the last three years below the running mean (Figure 62). Highest numbers in the surveys in Western basin in Ontario were in 2003 and in Ohio in 2001 and 2003, and in the Central Basin in Ohio waters in 2001.

Figure 62: YOY White Bass from Interagency Trawling in Lake Erie West Basin, ON

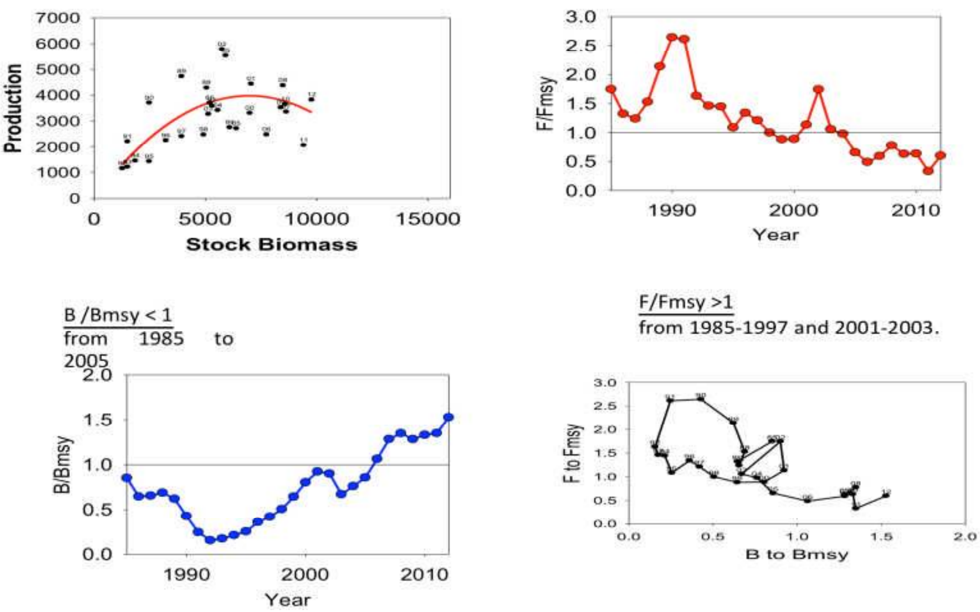


Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013

Other estimates for white bass indicate that the sport harvest in the Ohio 2012 open lake fishery increased 68% over 2011 while targeted effort decreased by 11% (ODMR 2013). Further, in 2012 the reported commercial harvest of white bass in Ohio waters increased 27% relative to 2011, and was above long-term average. Catch rates in trap nets in 2012 (47.4 kg/lift) was higher than in 2011, while the seine catch rate dropped to 21.1 kg/ 350 m. Younger white bass (ages 3 and below) contributed more to the fisheries in 2012. Because reported figures are limited to 2011 and 2012 they do not provide information to evaluate stock trends.

A Stock–Production Model Incorporating Covariates (ASPIC) was developed for white bass to obtain biomass estimates (Debertin). Preliminary results indicate the stock is currently not being overfished (Figure 63).

Figure 63: White Bass Production Curve (1000s of kg) ASPIC : F/Fmsy, B/Bmsy & stock status



Source: Allan Debertin

Management. In the Ontario fishery, white bass is a non quota species with unlimited catch. The retained catch in the commercial fisheries is determined by the quota of the targeted species. Appendix "B" License Conditions establishes a series on conditions that apply to white bass as a target and retained species such as that fish must be reported and landed. Also, in targeting walleye and white bass, gill nets must have a minimum size of 89 mm. Ontario does not have a management plan for the stock in Ontario. Although there is monitoring of the stock through annual trawl surveys which is considered by FTG, there is no official assessment of the degree to which harvesting is impacting the stock. Thus, there is limited response of management to changes in the fishery and stock conditions. The Stock–Production Model ASPIC results from student research and is not taken into consideration by in management. There is not a formal HCR to ensure that fishing does not increase the risk above an acceptable level and which reduces susceptibility when the fish stock is declining.

The Ohio trap net fishery has an 11" minimum size of capture. Other regulations such as season and area closures, and gear characteristics apply to white bass. There is no interagency coordination on the management of the species.

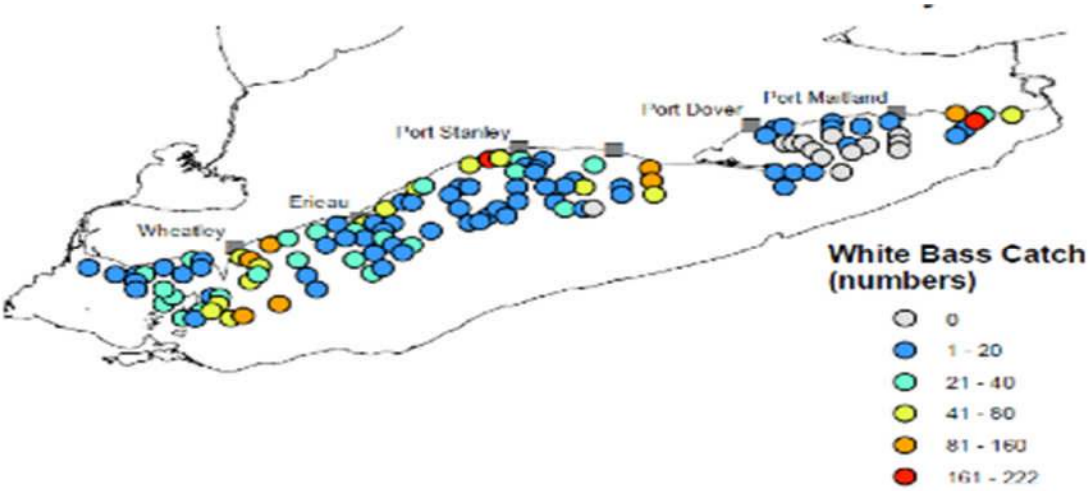
Information and Monitoring. Several sources of information are available to assess the white bass stock (Table 29) but data sources are not specifically for the species. Among the surveys only the Lake Erie Partnership Gill net survey is lake wide and fishery independent. Some of these data sources were used in the ASPIC model described above.

Table 29: Sources of Information for White Bass from Fishery Dependent and Independent Monitoring

Jurisdiction	Database	Description	Time-Series
Ontario	Lake Erie Partnership Gill Net Survey CUE	**Fishery-independent**	1989-2010
Ontario	Gill Net Harvest and Effort	Fishery-dependent	1985-2013
Michigan	Seine & Trap Net Harvest	Fishery-dependent	1985-2013
Michigan	Angling Harvest	Recreational fishery-dependent	1986-1996 & 1999-2013
Ohio	Seine Harvest and Effort	Fishery-dependent	1985-2013
Ohio	Trap-Net Harvest and Effort	Fishery-dependent	1985-2013
Ohio	Angling Harvest	Recreational fishery-dependent	1994-2013
Ohio	Western and Central Basin Bottom trawl surveys	Fishery-independent	1990-2013
Ohio	Fall Western and Central Basin Gill net survey	Fishery-independent	1978-2013
Pennsylvania	Gill Net Effort and Harvest	Fishery-dependent	1985-1995
Pennsylvania	Trap Net Effort and Harvest	Fishery-dependent	1996-2007
Pennsylvania	Angling Harvest	Recreational fishery-dependent	2004-2007

For white bass, the primary index used to monitor stock trends by FTG is the Ontario and Ohio august Interagency Trawl Survey (Figure 64). Species-specific abundance estimates (number/ha or number/m3) are combined with length-weight data to generate biomass estimates for each tow. Arithmetic mean volumetric estimates of abundance and biomass are extrapolated by depth strata (0-6m, >6m) to the entire western basin to obtain a fishing power correction - adjusted, absolute estimate of forage fish abundance and biomass for each species. FTG monitors the abundance of forage species and other species in Lake Erie. However, these are reported combined with other spiny rayed fishes in FTG (2013).

Figure 64 . White Bass Partnership Gillnet Catch in 2013



Source: Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildife Services Branch. London 2013.

Fisheries-independent index surveys have been adopted to estimate of annual biomass of fish species in Ohio waters of Lake Erie. Bottom trawl surveys are conducted monthly from May through October by district in Ohio waters of the Western and Central basins. From 1990 to 1992 the survey covered from Vermilion to Pennsylvania and has expanded in later years and modified to reflect LEC MU boundaries. Also in Ohio waters, a fall gill net survey is designed to assess adult abundance of walleye and white bass (ODNR 2013**)**. The survey was initiated in 1978 and now covers the Western and Central basin.

There is also a hydro-acoustic survey that has been conducted as part of an interagency forage assessment program under LEC. The survey started covering the eastern basin in 1993, was expanded to the central basin in 2000 and the western basin in 2004. This survey is mostly to estimate forage fish emerald shiner and rainbow smelt.

Further, some improvements have occurred to increase the spatial resolution of some of the programs listed in Table 30. In 2007, OMNR began a pilot project to assess the feasibility of implementing a combination of electronic catch reporting and real-time GPS monitoring of fishing tug position and activity. The pilot program is a cooperative project involving OCFA and commercial fishers in Lake Erie. Also, the State of Ohio in late 2008 implemented an electronic monitoring system for the Lake Erie commercial trap-net industry and mandated that commercial harvest be reported electronically. With Ohio’s monitoring system, commercial fishing vessels are required to be equipped with GPS receivers and transmitters that allow vessel tracks to be monitored by the DNR. This has already proven beneficial for obtaining more accurate measurements of commercial catch.

Management Strategy

Ontario Yellow perch

Gill Net

Limited entry, gear restrictions, closed seasons and areas, protected species and ITQs for quota species are the main measures. The minimum gill net mesh size is 57mm (2.25 inches). Several measures outlined in the Conditions of Ontario Commercial Fishing Licence cover retained species. Appendix C of the Licence lists quota species and species that can be retained with an unlimited quota; species not included in Appendix C are considered “no-harvest” permitted species.

The four quota species are Walleye, Yellow perch, Lake whitefish and Rainbow smelt. 11 species have unlimited harvest (Channelcatfish, White bass, Longnose gar, Bowfin, Alewife, Gizzard shad, Burbot, White perch, Rock bass, Freshwater drum, and crappie), and there are four unlimited harvest species groups (suckers excluding black and Bigmouth buffalo, Mooneye / Goldeye, Common carp >56 cm and smaller bullheads, and sunfish excluding Warmouth).

Ohio Trap Net

The main measures are limited entry (18 trap nets licenses), a TAC for Yellow perch, and several others relating to all retained catch (Commercial Fishing Law Digest Publication 5002 ODW, ODNR). These are: gear restrictions, closed seasons and areas, protected species (Walleye, smallmouth bass and steelhead), and minimum landing sizes (14½" for Channel catfish, 17" for Lake whitefish, 11" for White bass, and 9" for bullhead). There are no stock assessments or TACs for any of the main retained species in the Ohio trap net fishery. There are no interagency agreements for any of the retained species other than for Yellow perch.

All under size fish and protected fish ((Blue pike now extinct), Sauger (extirpated), sturgeon, brook, brown, rainbow, and Lake trout; and coho, chinook, and pink salmon; and cisco and Mooneye) must be released. The minimum mesh size for the backs of all trap nets is 0.25" inch or > 4" stretched mesh. Traps must be marked and identifiable and vessels must have a VMS. The electronic DCR records catch with data transmitted before landing.

Walleye

Ontario Gill Net

The measures in the Ontario conditions of licence are the same as for the Yellow perch gill net fishery except the minimum size of gill net mesh of 89 mm.

Lake whitefish stocks are assessed on a routine basis and TACs cover its retained catch in the Walleye fishery. White bass and White perch are an unlimited catch species for which there is not a routine stock assessment.

There is no clear strategy to manage the harvest of all main species retained in the Walleye gill net fishery.

Information & Monitoring.

Yellow perch

Ontario Gill Net

A 2005 survey estimated the composition of the retained catch and discards in gill net fisheries including the one for Yellow perch. Pre-2011 catch data is unreliable as reporting of discards was not mandatory. Hence, Zhao (2013) estimated that much higher proportions of Walleye were retained in the gill net fishery targeting Yellow perch in earlier years than previously calculated with, for all QZs combined, about 50% of the retained catch in the late 1990s being Walleye. This supported Li *et al* (2011) who found that the proportion of Walleye and White perch retained in the Yellow perch gill net fishery were much higher than estimates prior to 2011 that were based on DCRs.

However, since then landings, discarded, released and surrendered fish must be recorded in the DCRs. Landings are subject to weight verification. Data from DCRs are entered in the Canadian Fisheries Harvest Information System database (CFHIS). OCFA extracted requested data from CFHIS to inform the MSC process. This proved problematic and the team had to validate the data by comparing the final datasets provided with data published by LEMU.

Reporting for species groups, such as suckers, does not facilitate an evaluation the effect of the fishery on species which may be vulnerable.

Ohio Trap Net

The retained catch in the trap net fishery are recorded in DCRs; no data is available on released fish (undersized, protected and non-commercial). Dockside monitoring by Law Enforcement personnel inspects about 5% of the annual landings. It is considered that electronic reporting, VMS and penalties for inaccurate catch reporting ensure the accuracy of data. Collected data is stored in a database maintained by the ODW, ODNR which supplied data by targeted fishery (yellowperch and other) for the MSC assessement. Reporting for species groups, such as suckers, does not facilitate an evaluation the effect of the fishery on species which may be vulnerable.

Walleye

Ontario Gill Net

As yellow perch.

4.3 By-catch Species

4.3.1 Introduction

By-catch consists of those species that are discarded or released, as well unobserved fishing mortality. Similar to retained species (see above), by-catch may be classified as either minor or main; in most cases species comprising less than 5% are considered minor; a species that normally comprises 20% or more of the catch would almost always be considered a “main” by-catch species.

4.3.2 Background

Ontario

The Conditions of Licence define by-catch as capture in commercial gear which cannot be legally harvested. Legal species include quota species and unlimited harvest species. When no-harvest permitted species or over quota fish are caught and are dead they must be separated from the catch, recorded on the DCR and presented for inspection. Live fish must be returned to the water (OMNR 2013).

Two OMNR draft documents cover by-catch management for all commercial fisheries: *Managing By-catch in Ontario Commercial Fisheries* and *Developing By-catch Management Plans for Ontario Commercial Fisheries*. No date is given for their implementation. The initiative recognises that while by-catch has not been addressed by provincial policy, mitigating risks associated with by-catch is an essential component of the OMNR’s effective management of the commercial fishery. Two components are addressed: monitoring to evaluate by-catch; and management actions to minimize the risk. The documents support the implementation of the policy and describe the following steps to screen commercial fisheries for by-catch: fishery description, by-catch characterization, by-catch risk evaluation, documentation of existing management actions, potential management actions and criteria for review period.

In Canadian waters, the by-catch of non-targeted species in gill nets is minimized through the use of minimum mesh size requirements, species limitations and seasonal and area closures. Since 2011, MNRF has enforced conditions of license that require vessels to report on a daily basis the quantities of fish released, discarded and surrendered. This allows management to track, for example, the catch of Lake trout, Lake sturgeon and other No Harvest species.

Ohio

Several regulations relate to by-catch. It is unlawful for any commercial fisherman to take specified species (see above). Walleye can only be fished recreationally. All undersized fish and no-harvest species must be released immediately. While, in principle there should be no by-catch in the Ohio trap net fishery as fish should be released alive, there are no estimates of released by-catch and PRM.

4.3.3 Outcome

Yellow perch

Ontario Gill Net

Overall

Non-target species are harvested when they are found in the same area as the target species and are susceptible to capture by the gill net. As noted above, prior to 2011, by-catch was under-reported but with mandatory reporting data is considered more reliable. In general, by-catch in the gill net fishery targeting Yellow perch is not a significant proportion of the total catch. Post release survival of by-catch is potentially very low, except for Lake sturgeon.

In all QZs, a total of 24 species and five species groups are reported as by-catch.[1] Estimates indicate low total by-catch of about 10% for the fishery in QZ1 to QZ3E with Gizzard shad (up to 3%), White perch (up to 2%), and Freshwater drum (up to 1%) the most significant. None of the by-catch species are classified as main (i.e. > 5% of the total catch). However, some species are depleted or under recovery plans and the Yellow perch gill net fishery could hinder their recovery.

The Yellow perch fishery could hinder the recovery of Lake sturgeon which is one of the seven fish species at risk listed as threatened the Conditions of Licence for Lake Erie fisheries established for 2013 (Table 30). This follows its listing under the Ontario Endangered Species Act (ESA). As the species is not recognized by SARA as an endangered species (i.e. it is not national) it is not considered as an ETP species in MSC assessments.

Species groups *Lepomis, Moxostoma, Pomoxis,* and suckers could include vulnerable species.

Lastly, the by-catch includes cisco, Brown trout, Lake trout and rainbow trout, and small mouth bass that are no-harvest species. Presumably fishery removals may pose a threat to the populations. The level of unobserved fishing mortality caused by lost fishing gear is unknown.

Table 30: Lake Erie: Species at Risk as Listed in Ontario Conditions of Licence

	Common Name	Scientific Name
Endangered	Northern Madtom	Noturus stigmosus
	Pugnose shiner	Notropis anogenus
	Lake Sturgeon	Acipenser fulvescens
Threatened	Channel darter	Percina copelandi
	Eastern sand darter	Ammocrypta pellucida
	Lake Chubsucker	Erimyzon sucetta
	Spotted gar	Lepisosteus oculatus

Source: 2013 Ontario Fisheries

QZI

By-catch in QZ1 (2004 - 2013) includes 14 species beside the target, and three species groups including Lepomis, Moxostoma, and suckers (Table 31).

[1] Besides yellow perch - alewife, black crappie, burbot, brown trout, Channelcatfish, cisco, common carp, Freshwater drum, gizzard shad, goldfish, lake sturgeon, lake trout, Lake whitefish, mooneye, rainbow smelt, rainbow trout, rock bass, round goby, sea lamprey, smallmouth bass, walleye, White bass, white perch, white sucker, and species groups *Lepomis, Moxostoma, Pomoxis, Oncorhynchus,* and suckers.

Table 31: QZ1 By-catch in the Yellow perch Gill Net Fishery (lbs) (2004-2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Channel Catfish	0	2154	0	12	0	0	0	2451	1953	1060
Common Carp	0	15	1	0	0	0	0	0	0	5
Freshwater Drum	0	1,197	1,830	222	60	29	219	6,233	7,222	6,516
Gizzard Shad	0	4,557	1,337	421	15	0	2,442	17,933	37,780	13,258
Goldfish	0	0	0	0	0	0	0	1	0	0
Lake Sturgeon	1	0	0	0	0	0	0	12	8	9
Lepomis	0	0	0	0	0	0	0	3	0	0
Moxostoma	0	0	0	0	0	0	0	97	0	0
Rainbow Smelt	0	0	0	0	0	15	60	0	0	0
Rock Bass	0	0	0	0	0	0	0	7	0	1
Round Goby	0	0	0	0	0	0	0	8	0	0
Sea Lamprey	0	0	0	0	0	0	0	3	0	0
Smallmouth Bass	2	0	0	0	0	0	0	40	67	1,146
Suckers	0	637	340	85	140	79	314	4,306	3,369	3,809
Walleye	2	93	61	9	0	123	0	65	43	22
White Bass	0	0	0	0	0	0	0	556	456	2,372
White Perch	247	5,110	5,884	4,107	460	65	1,049	50,647	50,725	74,333
Yellow Perch	0	0	0	0	0	420	1,010	0	0	0
Total By-catch	252	13,763	9,453	5,001	675	731	5,094	823,62	101,623	102,531
Total Catch	1,855,638	1,742,217	1,552,986	728,065	591,488	828,690	903,072	931,856	877,781	899,760

Note: By-catch include discarded, released, and surrendered catch. Source: CFHIS as extracted by OCFA

Total by-catch between 2011 and 2013 was less than 12% of the catch. The species with highest discards were Gizzard shad (0 - 4.3%), White perch (0.1 - 8.3%) and Freshwater drum (0 – 0.8%). Only White perch accounted for more than 5% of the total catch, but this species was considered under the QZ1 main retained species.

Reports do not indicate what species were included in the groups. Several species of Lepomis, which is a sunfish, are reported for Lake Erie: green sunfish (*L. cyanellus*), Bluegill (*L. m. macrichirus*), orangespotted sunfish (*L. humilis*), longearsunfish (*L. megalotis* which rare in the lake and declining), Warmouth (*L. gulosus,* previously *Chaenobryttus gulosus*) and pumpkinseed (*L. gibbosus*) (Van Meter & Trautman 1970). The *Lepomis* species more recently reported in the area in partnership index surveys are pumpkinseed and Bluegill (Zhu *et al.* 2008). Because the survey selectivity is different to that of the commercial gear it is impractical to assert the species.

Warmouth and orange spotted sunfish are Species of Concern under Species at Risk Act (SARA) Schedules 1 and 3 respectively. Under Ontario licence conditions Warmouth is a non-harvest species. The total catch of *Lepomis* is 3 lbs in a 10 year period, which even if it corresponds to the species of concern is a small quantity and is not considered as a main bycatch species. *Moxostoma* species, which are suckers (redhorse), reported in Lake Erie are *M. anisurum* (silver), *M. duquesnei* (black), *M. erythrurum* (golden), and *M. macrolepidotum* (shorthead) (VanMeter & Trautman 1970). Moxostoma species reported in the partnership index surveys are *M. anisurum, M. erythrurum,* and *M. macrolepidotum,* (Zhu *et al.* 2008). Black redhorse is considered threatened by COSEWIC. All these species constitute small populations and are in decline, and thus vulnerable.

The total amount of Moxostoma in the last 10 years is 97 lbs; as it is a small quantity even if it corresponds to black redhorse is not considered as a main bycatch species. Other species of suckers reported in Lake Erie are Bigmouth buffalo (*Ictiobolus cyprinellus*), black buffalo (*I. niger*), Quillback (*Carpiodes cyprinus*), White sucker (*Catostomus c, commersoni*), longnose sucker (*C. catostomus*), Spotted sucker (*Minytrema melanops),* and Lake chubsucker (*Erimyzon sucetta kennerlyi*) (Van Meter & Trautman 1970). Among these sucker species Quillback and White sucker are reported in the partnership index survey (Zhu *et al.* 2008). Chubsucker is endangered under SARA schedule 1, Spotted sucker is a Species of Concern under SARA Schedule 1, and black buffalo is a Species of Concern under SARA Schedule 3. Given Ontario licence conditions suckers should not include black and Bigmouth buffalo; also licence conditions list Lake chubsucker as threatened. Thus, in principle these species should be reported separately. Spotted sucker is an Unlimited Catch species.

The Canadian distribution of Spotted sucker is limited to south western Ontario, where it occurs in the western basin of Lake Erie. The species was common in Lake Erie during the mid to late 1800s, but the population began to decline prior to 1920 and has since dropped considerably. In fact, there have been no recent records for Spotted sucker from Lake Erie. Because of its low abundance it is unlikely that the species is caught in the gill net fisheries. Nevertheless, it would not be possible to corroborate this from DCRs as suckers are reported as one group. In the last 10 years, the by-catch of suckers in the fishery was 13,079 lbs. While discards were likely under reported until 2011, since then over 3,000 lbs have been removed annually. Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing**. However future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species and it is recommended that data be taken on species composition to allow this to be considered in future annual audits**.

The annual average catch of Lake sturgeon is about 3 lbs over a 10 year period. **Because this is only a small quantity, it is not regarded as a main species; but future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock.**

Currently, there is no information on size; and it is recommended that data should be collected to allow this to be considered in future annual audits.

There are no main discarded species for the MU1 Yellow perch fishery based on proportion of the catch discarded or released.

QZ2

By-catch in QZ2 (2004 - 2013) includes 20 species besides the Yellow perch target, and two species group including Pomoxis and suckers (Table 32).

Table 32: QZ 2 - By-catch in the Yellow perch Gill Net Fishery (lbs) (2004-2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Alewife	0	0	87	0	0	0	0	0	0	0
B. Crappie	0	0	0	0	0	0	0	2	0	0
Burbot	0	0	0	0	0	0	0	5	0	0
C. Catfish	0	0	0	0	0	0	0	225	506	1,035
C. Carp	0	0	0	0	0	0	0	0	19	0
FW Drum	0	754	1,436	180	581	243	305	12,239	13,521	26,252

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Gz Shad	0	39	2,492	221	24	7	411	7,639	59,274	17,598
L. Trout**	0	0	0	0	0	0	0	1	0	0
L. W'fish*	0	0	0	0	0	0	0	15	0	0
Moxostoma	0	0	0	0	0	0	0	1	0	0
Pomoxis	0	0	0	0	0	0	0	0	0	19
R. Smelt	0	0	19	150	55	63	184	94	79	77
R. Trout**	0	3	0	0	0	0	0	0	0	0
Rock Bass	0	0	0	0	0	0	0	0	0	1
R. Goby	0	0	0	0	0	0	0	11	0	17
S. Lamprey	0	0	0	0	0	0	0	11	1	0
SM Bass**	0	0	0	0	0	0	0	0	0	232
Suckers	0	37	36	61	25	97	26	1,018	719	1,311
Walleye*	0	153	16	0	0	7	0	22	0	25
White Bass	0	0	60	0	0	0	0	943	418	1,103
W. Perch	0	909	4,120	1,086	115	172	1,306	73,282	69,622	94,544
Y. Perch*	724	11	0	0	0	220	1,650	62	544	21
By catch all	724	1,906	8,266	1,698	800	809	3,882	95,570	144,703	142,235
Total catch	1,963,500	2,809,351	3,405,393	1,513,913	1,662,643	1,991,752	1,398,172	1,447,965	1,805,245	1,911,799

Note: By-catch includes discarded, released, and surrendered catch

* Quota species, ** No harvest species, and all other unlimited catch species

Source: CFHIS as extracted by OCFA.

Total by-catch was less than 5% of the catch. The species with highest discards were Freshwater drum (0 - 0.9%), Gizzard shad (0 - 1.9%), White perch (0 - 1.9%), and Yellow perch (0 - 0.1%). Lake trout, Northern pike and small mouth bass are no-harvest species and are released. Although there is no information on potential PCMs, catches were small and sporadic.

Reports do not indicate what species are included in the groups. Pomoxis, which are sunfishes, reported in Lake Erie are *P. annularis* (White crappie) and *P. nigromaculatus (*black crappie) (Van Meter & Trautman 1970). Among Pomoxis species, White crappie is reported in the partnership index survey (Zhu *et al*. 2008). Sunfishes constitute small populations and are declining. Crappie is "unlimited" catch in conditions of licence. The total Pomoxis by-catch of 19 lbs over the 10 years is small and Pomoxis is not considered as main by-catch species. The total by-catch of suckers over the 10 year was 3,330 lbs but removals were under reported until 2011. Since then more than over 1,000 lbs were removed annually.

Removals can be significant for some sucker populations and information to determine the status of species in the group as main bycatch is missing**. However it is recommended that future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species with data collected on species composition to allow this to be considered in future annual audits**.

There were no main by-catch species in QZ2.

QZ3W

By-catch in QZ3W (2004 – 2013) includes 18 species, and one species group corresponding to suckers (Table 33).

Table 33: QZ3 (W) By-catch in the Yellow perch Gill Net Fishery (lbs) (2004-2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Alewife	0	0	0	0	0	0	0	0	33	43
Burbot	0	0	0	0	0	0	0	8	20	11
C. Catfish	0	0	0	0	0	0	16	5	7	237
Cisco	0	1	0	0	0	0	2	1	0	0
C. Carp	0	0	0	0	0	0	0	2	0	0
FW. Drum	0	0	812	0	0	804	728	5,382	15,981	10,706
Gz Shad	2,031	0	1,053	0	0	91	532	1,101	34,945	5,220
L. Sturgeon	2	0	0	0	0	0	3	1	0	34
L. Trout	2	0	0	0	0	0	0	7	6	0
L. Whitefish	0	0	2	0	0	0	0	0	0	0
Mooneye	0	0	0	0	0	0	2	0	0	0
Oncorhynchus	0	0	0	0	0	0	0	6	0	0
R. Smelt	0	0	10	0	0	13	64	254	399	264
R. Goby	0	0	0	0	0	0	3	28	10	3
S. Lamprey	0	0	0	0	0	0	0	4	1	0
Suckers	0	0	5	0	0	201	271	1,786	3,040	1,971
Walleye	75	123	35	9	0	0	3	0	3	12
W. Bass	0	1	0	0	2	0	0	225	212	1,285
W. Perch	48	290	1,116	0	0	20	625	23,524	35,087	36,637
W. Sucker	0	0	0	0	0	0	0	0	0	2,635
Y. Perch	99	75	10	0	0	1,000	550	7	0	2
By-catch all	2,257	490	3,043	9	2	2,129	2,799	32,341	89,744	59,060
Total catch	1,458,586	1,899,408	3,711,497	2,906,827	2,099,193	2,120,134	3,076,558	3,129,510	3,515,411	2,972,152

Note: By-catch includes discarded, released, and surrendered catch

* Quota species, ** No harvest species, and all other unlimited catch species

Source: CFHIS as extracted by OCFA.

Total by-catch was up to 2% of the catch. Species with highest proportions in the catch were Freshwater drum, Gizzard shad, White perch and White bass. None of these accounted for more than 1% of the total.

The total by-catch of suckers in the last 10 year is 7,274 lbs but removals were under reported until 2010 and about 2,000 lbs were removed annually since 2011. Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing. **However it is recommended that future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species with data taken on species composition to allow this to be considered in future annual audits.**

Thus, there are no main discarded species in QZ3 W based on the proportion of the catch discarded. There are, though, vulnerable species. Lake trout is listed as No Harvest and caught fish were released. As catches were sporadic and the amount caught was insignificant the species is not considered as a main species.

The annual average catch of Lake sturgeon is about 4 lbs over a 10 year period. As this is small, for the moment it is not regarded as a main species. **However, it future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock. Currently, there is no information on size; it is recommended that data should be taken to allow this to be considered in future annual audits.**

There are no main by-catch species in QZ3W.

QZ3E

By-catch in QZ3E (2011 – 2013) includes eight species and one species group which corresponds to suckers (Table 34). By-catch was up to 2% of the catch. The species with highest proportions in the catch were White perch and Gizzard shad. None accounted for more than 1% of the total catch. Thus, there are no main discarded species in the QZ3E Yellow perch fishery based on proportion of the catch discarded.

Table 34: QZ3 (E) By-catch in the Yellow perch Gill Net (lbs.) (2004- 2013)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Alewife	0	0	0	0	0	0	0	0	0	111
B. Trout	0	0	5	0	0	0	0	0	0	0
Burbot	63	0	484	0	0	0	0	9	3	4
C. Carp	0	0	0	0	0	0	0	0	0	1
FW Drum	53	0	0	0	0	0	0	418	939	853
Gz Shad	0	0	0	0	0	0	0	194	3,222	1,848
L. St'eon**	0	0	3	0	0	0	0	0	0	0
L. Trout**	0	0	0	0	0	0	1	65	78	12
R. Smelt*	0	0	0	0	0	0	0	294	34	47
R. Trout	0	0	0	0	0	0	0	0	5	0
R. Bass	0	0	0	0	0	0	0	18	0	6
R. Goby	0	0	0	0	0	0	0	310	72	35
SM Bass**	0	44	3	0	0	0	1	2	0	121
Suckers	58	0	0	0	0	29	0	2,064	3,370	1,787
Walleye*	0	44	0	0	0	0	0	0	2	0
W. Bass	0	0	0	0	0	0	0	193	107	388
W. Perch	0	0	0	0	0	0	0	1,205	2,057	4,924
W. Sucker	0	0	0	0	0	0	0	0	0	216
Y. Perch*	300	150	0	0	0	0	0	0	2	118
By-catch all	474	238	495	0	0	29	2	4,772	9,891	10,471
Total Catch	95,480	161,693	195,984	140,228	184,263	250,104	444,008	453,913	503,880	513,225

Note: By-catch includes discarded, released, and surrendered catch

* Quota species, ** No harvest species, and all other unlimited catch species

Source: CFHIS as extracted by OCFA.

The total by-catch of suckers (excluding White sucker which is reported separately) in the 10 years was 7,308 lbs but removals were under reported until 2011 and about 2,000 lbs were removed annually since 2011. Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing. **Future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species with datataken on species composition to allow this to be considered in future annual audits.**

Lake trout is a non-harvest species recorded in the last three years in small quantities (12 lbs in 2013). It is not considered a main species. **Future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock.** Lake sturgeon was recorded as by-catch in one year (2006). It is not considered a main species. **Future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock.**

There are no major by-catch species in QZ3E.

Ohio Trap Net

While, in principle, there is no by-catch in the Ohio trap net fishery as unwanted fish is released alive, there is no information or monitoring on released species and no data are available to measure the quantities. As there is no data on PRM, it is not possible to be certain that all released fish survive and there is no by-catch in the fishery. Kinnunen & Pistis (2007) concluded that in general, trap nets have low impact on non-target species; trap nets collect live catches, they have small incidence of by-catch compared to other gear, and the survival of by-catch is high.

Walleye

Ontario Gill Net

Overall

The overall by-catch was below 8% of the total catch; Gizzard shad had an average > 5% in the past three years and is a main by-catch species. Additionally, some of the species in the by-catch are considered vulnerable under Ontario regulations. American eel is considered threatened under COSEWIC and endangered by COSSARO, but its by-catch is infrequent. Lake sturgeon is considered threatened by both entities and listed as a species at risk in the Licence Condition of the Ontario Fisheries. It is often reported in the catch with potentially significant amounts; while the fish are released there may be mortality and this should be considered a main by-catch species.

No Harvest species in the Conditions of Licence for the Ontario fishery and present in the by-catch are cisco, Lake trout, rainbow trout, muskellunge, northern pike, and pink salmon. Among those, any by-catch of Lake trout could hinder recovery plans for it and it should also be considered as a main by-catch species. Based on data from 2004 to 2013 daily catch reports and consideration on the status of the populations, the assessments considered three main by-catch species (Table 35).

Table 35: Summary of Main By-catch Species in the Walleye Gill Net Fishery

MU1 MU2 MU3
Gizzard Shad , Lake Sturgeon, Lake Trout

Reliable reports of discarded, surrendered and released catch are available from the 2011 to 2013 DCRs. Data for 2004 to 2013 by-catch identify 34 by-catch species and five species groups (*Lepomis, Moxostoma, Oncorhynchus, Pomoxis*, and suckers) (Table 36). Reports do not indicate what species were included in the groups, and except for

Table 36: By-catch in the Lake Erie Gill Net Walleye Fishery 2004-2013 (lbs)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
American Eel**	0	0	0	0	0	0	0	1	0	0
Black Crappie	0	0	0	0	0	0	0	1	0	0
Bowfin	0	0	0	0	0	0	0	4	4	0
Brown Bullhead	0	0	0	0	0	0	0	1	1	0
Brown Trout	0	0	2	0	0	0	0	5	1	2
Burbot	1,170	484	967	1,518	0	195	0	2,867	12	0
Channel Catfish	0	7,215	10	132	0	205	106	5,395	10,611	6,633
Chinook Salmon	0	0	0	0	0	0	0	9	0	2
Cisco	0	1	0	3	4	0	0	0	0	0
Coho Salmon	0	0	0	0	0	0	0	7	1	0
Common Carp	0	261	926	261	507	145	97	2,362	5,023	2,146
FW Drum	2,708	12,607	18,319	8,880	5,445	12,144	13,201	227,305	164,043	177,959
Gizzard Shad	8,292	14,501	26,563	30,796	18,265	23,202	34,919	253,780	515,659	574,897
Lake Sturgeon**	39	192	21	3	0	677	222	249	276	266
Lake Trout**	10	241	0	25	0	0	2	292	74	108
Lake Whitefish*	0	35	101	209	0	4	0	76	3	0
L Mouth Bass	0	0	0	0	0	0	0	252	0	2
Lepomis	0	0	1	0	0	0	0	0	0	0
Longnose Gar	0	0	3	3	0	2	0	63	3	3
Mooneye	0	0	0	0	0	0	0	0	2,133	7,236
Moxostoma	0	20	0	0	0	0	0	740	0	0
Muskellunge**	19	0	0	0	0	0	518	97	474	76
Northern Pike**	0	19	0	0	0	300	0	25	2	87
Oncorhynchus**	21	0	0	0	0	0	389	186	99	41
Pink Salmon**	0	0	0	0	0	0	0	3	0	0
Pomoxis	0	1	0	0	0	4	0	10	0	1
Quillback	0	0	0	0	0	0	0	1	21	6
Rainbow Smelt*	0	0	0	108	123	341	72	1,733	238	266
R. Trout**	2	76	0	0	7	88	0	93	21	41
Rock Bass	0	0	5	1	0	0	0	28	222	10
Round Goby	0	0	0	0	0	0	0	37	0	6
Sea Lamprey	1	0	0	0	0	0	0	21	2	18
S. mouth Bass	97	2,795	18	0	967	8,706	0	2,089	28	632
Suckers	817	540	2,860	976	629	441	624	11,604	12,960	20,976
Walleye*	1,841	2,565	1,883	3,556	1,526	8.972	1,767	2,763	1,932	765
White Bass	1,017	0	0	975	455	569	3	18,297	9,019	19,186
White Perch	0	25	6	1,596	1	272	20	8,065	6,695	23,363
White Sucker	0	0	0	0	0	0	0	12	0	168
Yellow Perch*	73,285	17	30	6	580	0	0	0	21	2
Total by-catch	89,489	41,595	51,715	49,851	28,557	56,267	51,979	538,473	729,578	834,898
Total Catch	6,743,329	9,332,069	10,318,460	9,522,210	9,906,388	7,379,621	7,417,454	7,156,223	9,117,176	10,453,472

Note: By-catch includes discarded, released, and surrendered catch

* Quota species, ** No harvest species

Source: CFHIS as extracted by OCFA.

Oncorhynchus which are non-native, they could include vulnerable species (see gillnet fishery sections on retained catch). The total by-catch reported in the last 10 years is 1 lb for *Lepomis,* 760 lbs for Moxostoma, and 16 lbs for Pomoxis; these are small quantities and thus these groups are not considered in determining main by-catch species. The total by-catch of suckers in the last 10 years is 51,827 lbs, excluding Quillback and White sucker which are reported separately, but by-catch was under reported before 2011. Over 10,000 lbs were removed annually since 2011 and quantities doubled by 2013. Removals can be significant for some sucker populations, in particular since they are also retained in the fishery, but information to determine the status of species in the group as main bycatch species is missing. However future annual audits must review the situation to ensure that by-catch does not pose a threat to sucker species and it is recommended that data be taken on species composition to allow this to be considered in future annual audits.

Lake Sturgeon

Catches of Lake sturgeon are reported in the Ontario gill net fisheries targeting Yellow perch and Walleye. Catches reported as bycatch in the Walleye fishery have increased after 2008, reaching 677 lbs caught during 2009 (Table 35). There is no information on individual sizes and, given the mesh sizes in use, the probability of catching juveniles and subadults is high. The specimens are released and expected to survive, but data from the fishery are missing to estimate survival. In the Ohio trap net fishery, fishers occasionally catch and release some individuals of these species. These catches cannot be reported in the current reporting system.

Biology. Lake Sturgeon is one of the few sturgeon species that spends its entire life cycle in freshwater. It is widely distributed through eastern USA and Canada occurring in the Great Lakes, Hudson Bay-James Bay and Mississippi watersheds. It migrates to rivers throughout the lake basins to spawn and spend the remaining time in the open waters of the Great Lakes.

Lake Erie supports several non-spawning and few spawning populations of Lake sturgeon (Welsh 2004). Some rivers off Lake Erie have been identified to be major spawning areas, including the Detroit River connecting Lake Erie and the St. Clair system and the Niagara River (Thomas & Haas 2002). There are no known Lake Sturgeon spawning tributaries in the Ontario portion of Lake Erie (OMNR 2009).

The age at first spawning ranges from 14-16 years with an average size of 114.3 cm for males and 24-26 years with an average size of 139.7 cm for females. Biological characteristics, such as long lifespan, late maturity, and intermittent spawning, make this species vulnerable to exploitation.

Outcome Status. Lake Sturgeon was abundant in the Great Lakes during the late 1800s, contributing to both recreational and commercial fisheries. Since then, populations have been dramatically reduced or extirpated due to overfishing, habitat degradation and anthropogenic impacts on nursery and spawning areas, damming that impedes migration, and water pollution (Li & Jiao 2010). It's abundance in Lake Erie has been severely reduced since the early 1900s and continues to be well below historic levels. Due to over exploitation five Lake sturgeon spawning sub-populations in the U.S. waters of Lake Erie are considered extirpated. Currently, there is a lack of knowledge on population status of Lake sturgeon in western Lake Erie. However, individuals are consistently captured in assessment gear in the western basin, but rarely in the central and eastern basins (State of the Great Lakes 2009).

Because of the overlap in life history traits between juvenile Lake sturgeon and the major target species in the Lake Erie gill net fisheries, the high size selectivity and mortality of gill nets, and the management status of Lake sturgeon, gill net by-catch might cause additional threats to Lake sturgeon populations (Johnson *et al*. 2004).

A recent study funded in part by the OCFA showed a high incidence of juvenile Lake sturgeon caught in deep waters by experimental gillnets in Ontario waters of Lake Erie (Li & Jiao 2011). The study noted that continued gill net fishing could "*reduce recruitment in subsequent years and impede population recovery over the long term*" and highlighted the conservation and management implications by examining the influences of gillnet fishing on the probability of obtaining Lake sturgeon by-catch. The study points out that information on overall population size, age structure, spatial and temporal distribution of Lake sturgeon, gillnet fishing efforts, and gillnet set distribution in the commercial gillnet fisheries would be needed for assessing the influences of gillnet fishing its population. Further, the study points out that failure to take the influence of gillnets fishing into account in Lake sturgeon conservation and fishery management may ignore the potential threats from gillnet fishing, and may reduce the efficiency of recovering Lake sturgeon populations.

There are no estimates of PCM of sturgeon in the gillnet fisheries. Pre-released mortality alone has been estimated at 1.5% in gillnet experimental surveys (Haxton *et al.* 2014). Tim Haxton (OMNR), Cam Barth (North South Consultants, MB) comment that >400 transmitters have been planted into Lake sturgeon captured in gillnets and reports mortality at <5%. Some of these transmitters go missing so it is not certain whether the fish has been harvested, entrained etc. (i.e., the cause of disappearance may not be latent mortality). Latent mortality may also be a function of duration in the nets.

Management Strategy. No commercial or recreational fishing is permitted for Lake Sturgeon anywhere in Lake Erie. Recreational fishing for Lake Sturgeon existed throughout Ontario until 2008 when the OMNR restricted the sport fishery to catch-and-release only. In 2010, Ontario completely closed the sport fishery within waters inhabited by the North-western Ontario and Great Lakes/Upper St. Lawrence River Lake Sturgeon populations. As closures of both commercial and sport fisheries in Ontario are relatively recent, it is too early to detect recovery responses of Lake Sturgeon populations.

Lake Sturgeon in U.S. and Canadian waters of the Great Lakes basin do not receive protection under federal legislation and depend on the protection offered by the individual states and tribal jurisdictions around the Great Lakes (Manny & Lloyd 2012).

Ohio: Lake Sturgeon is state-listed as an endangered species and may not be caught and possessed but there is not a management plan.

Ontario: Lake Sturgeon is considered threatened and listed among the Species at Risk of COSEWIC. It is also designated at risk under the Ontario Endangered Species Act (COSSARO).

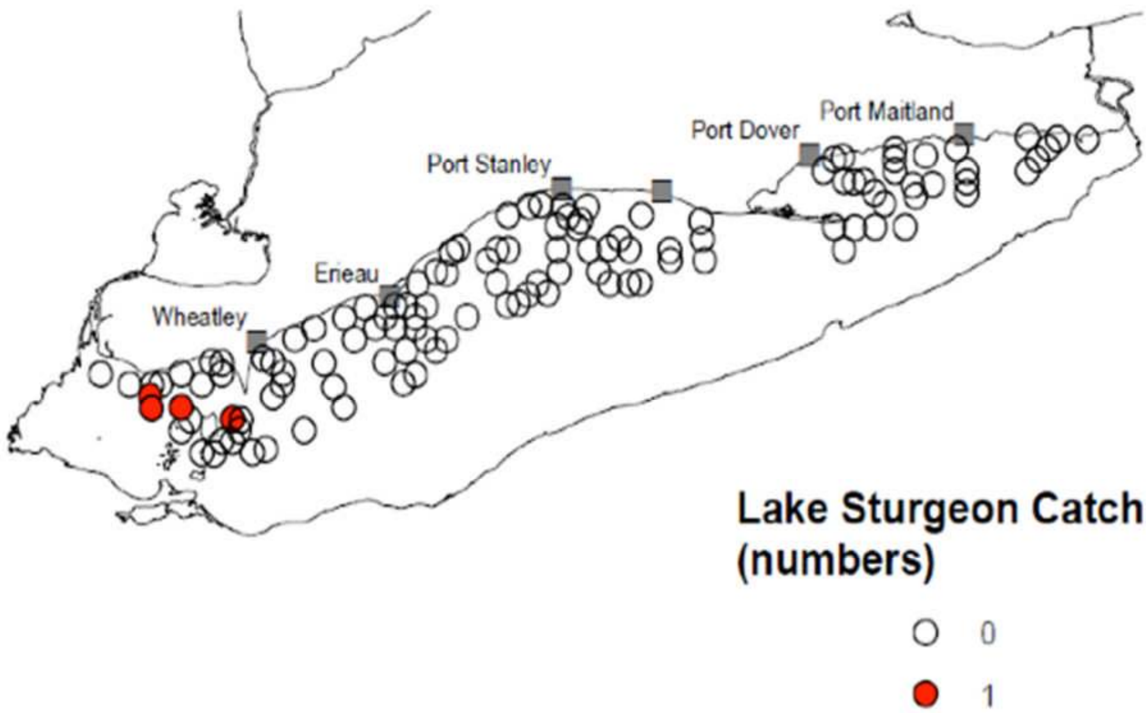
Information/Monitoring*:* Catches of released Lake Sturgeon should be recorded in DCR in Ohio and Ontario fisheries.

Ohio: Based on information provided by Hartman Ohio DNR- ODW, prior to 2008 some trap net license holders would write in Lake sturgeon catches and releases on the paper catch reports. From 2008 through 2012 the new electronic catch reporting system prevented this. From 2013 fishers may report released species, and in October a fisher reported two released sturgeon. Accordingly, catches cannot be quantified until fishers all start utilizing the released species field in the reporting system. Personnel at Ohio DNR plan to emphasize this need in the 2014 pre-season industry meeting, but there is a low expectation that fishers will accurately report releases.

Ontario: The number of released fish is reported in the DCR of gillnet fisheries targeting Yellow perch and Walleye. Lake sturgeon tagging studies are carried out (Li & Jiao 2011). Commercial gill net fishers are participating in a Lake sturgeon monitoring program conducted by USFWS with crews informing details at stakeholder meetings. The program includes tagging Lake sturgeon to determine spawning sites and to provide information on distribution and migration within and into/out of the Lake Erie.

The Partnership Gillnet Survey provides indices for Lake sturgeon (Figure 65). There are no estimates of PCM from gill net commercial fisheries.

Figure 65: Partnership Gillnet Index 2013 for Lake Sturgeon in standard gear



Source. Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks, Fish and Wildlife Services Branch. London 2013

Lake Trout

Complete loss of the native Lake trout in Lake Erie was thought to have occurred around 1965 (Cornelius *et al.* 1995). Since then, recruitment of naturally produced Lake trout has not been detected despite over 30 years of restoration efforts. Populations are maintained through stocking.

Biology. Lake trout is long-lived (20+ years), matures at a late age (5-10 years), and has narrow spawning requirements. Although the mean age at onset of maturity for female Lake trout was 4.5 in Lake Erie, the original plan for Lake Erie adopted the Lake Ontario target of 7.5 years, which was attained in 2001 but not maintained. Females can release anywhere from 400 to 5,000 eggs, depending on size and condition. In Lake Superior females produced an average of 1,351 eggs per fish or 516 per pound. Spawning occurs at night during late autumn, with multiple males and females broadcasting their eggs over hard substrate such as cobbles or boulders. Nests are not guarded but hatching success is high (70-80 %).

Survival from eggs to juveniles is much smaller, however, with estimated rates of between 0.1% and 10% (Bronte *et al*. 2002). This translates to a reproductive potential of tens of individuals per female per year. Spawning grounds can range from offshore reefs to near-shore shoals to tributaries, depending on the Lake trout strain.

Mean length-at-age and mean weight-at-age of lean strains of Lake trout have remained unchanged over the past ten years (Coldwater Task Group 2008). Lake trout average over 700 mm in length and 4,300 g in weight by age 5. Growth slows down considerably thereafter as both males and females reach maturity. Condition coefficients, *K* for age-5 male and female Lake trout have remained above 1.0 for 1986-2007.

Life history characteristics are presented in Table 37.

Table 37: Life history characteristics of Lake Trout

Intrinsic Rate Increase (r)	Age at MaTurity	Growth Rate K	Max Age years	Max Size	Fecundity	Species Range	Special Behaviors	Sources
0.05-0.15	5-8 years	0.05-0.12	25-50	30 in.	500-5,000	Widely distributed (US & Canada)	Spawning site fidelity, sea lamprey predation	Hansen 1996; Eshenroder & Amatangelo 2002; Horns *et al*. 2003; Woldt *et al*. 2006; Froese & Pauly 2007

Source: Seafood Watch Great Lakes Region Monterrey Bay Aquarium, 2008.

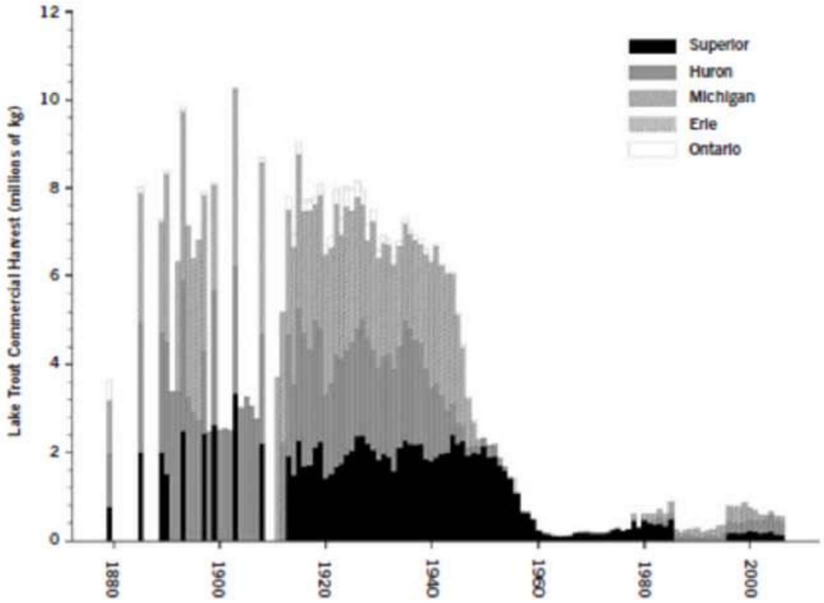
Based on a cohort analysis using a three-year running average of CPE for ages 4-10, mean adult survival for the Lake Erie strain was high (0.79), but this estimate was based on only two year-classes with relatively low returns.

Lake trout was the dominant cold-water predator in the eastern basin and utilized many food resources (e.g., benthic and pelagic invertebrates and fishes). Predation by non-native species (smelt and round gobies) on Lake trout eggs and fry reduces potential recruitment. Lake trout eggs and fry are vulnerable to predation from a number of species including sculpins, crayfish, and non-indigenous species such as round goby and Alewife (Eshenroder *et al.* 1999). Young Lake trout consume plankton, insects, and aquatic invertebrates, while adults are primarily piscivorous. Historic diets were dominated by Lake herring, ciscoes, and whitefish, while more recent diets have been dominated by non-indigenous rainbow smelt and Alewife (Hansen 1996).

Harvest. Catches of Lake Trout from Lake Erie's eastern basin were greatest during the late 1800s and lower after 1900. Commercial harvest of Lake trout is not allowed after the fishery collapsed (Fig. 66).

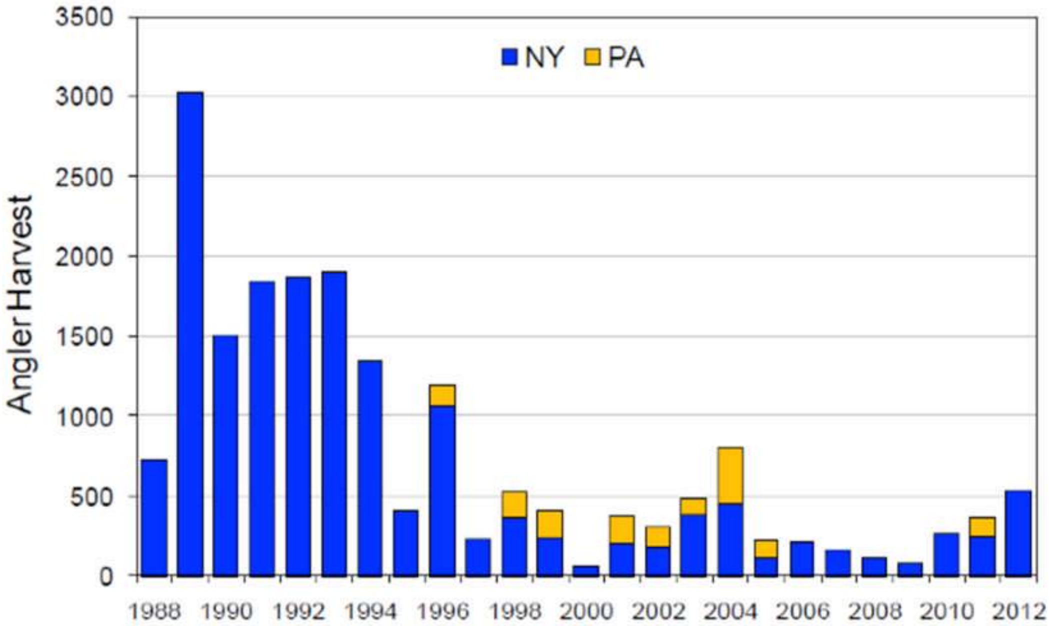
Lake trout are currently caught in recreational fisheries. CWTG reported in 2013 that angler harvest remains very low; approximately 528 Lake trout were harvested in New York waters out of an estimated catch of 1,345 in 2012 (Fig. 67).

Figure 66: Commercial Harvest of Lake Trout



Source: Baldwin *et al*. 2009.

Figure 67: Recreational harvest of Lake trout in Lake Erie

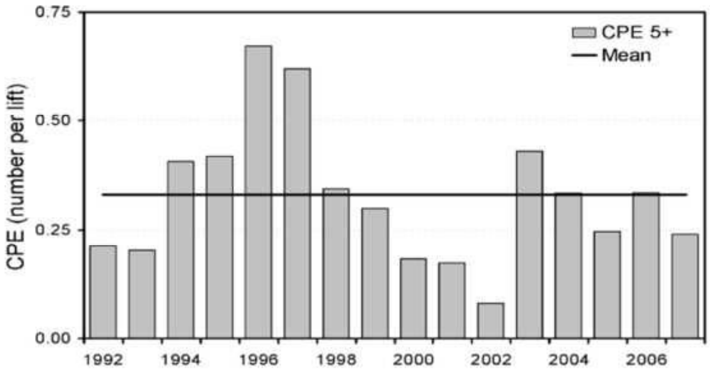


Source: CWTG 2013.

Outcome Status. Lake trout was a major component of the fish community before colonization of the area by European settlers in the 1700s and was confined mostly to the eastern basin but was occasionally found in the central and western basins of the lake. Commercial exploitation began as early as the late-1700s, and populations started to decline between 1850 and 1900 when populations were subjected to an intense exploitation by a poorly regulated and expanding commercial fishery (Lake Trout Task Group 1985a). A directed fishery for Lake trout continued into the 1930s, but catches thereafter were typically by-catch in the Lake whitefish and cisco (formerly Lake herring) commercial fisheries.

Harvest, habitat change, and the invasion of exotic species (such as sea lamprey, Alewife, and rainbow smelt), contributed to nearly eliminate lake trout by 1950. Complete loss of the native Lake trout was thought to have occurred around 1965 (Cornelius *et al.* 1995). For this reason, LEC identified the rehabilitation of Lake trout as a key step in the restoration of a balanced cold-water community in the eastern basin. Still, recruitment of naturally produced Lake trout has not been detected in Lake Erie and the populations are maintained through stocking. Population abundance of age 5 and older fish fluctuated following stocking and diverse sources of mortality (Fig. 68).

Figure 68: Relative Abundance of Lake Trout Age 5 and older in Gill Net Surveys in Lake Erie Eastern Basin

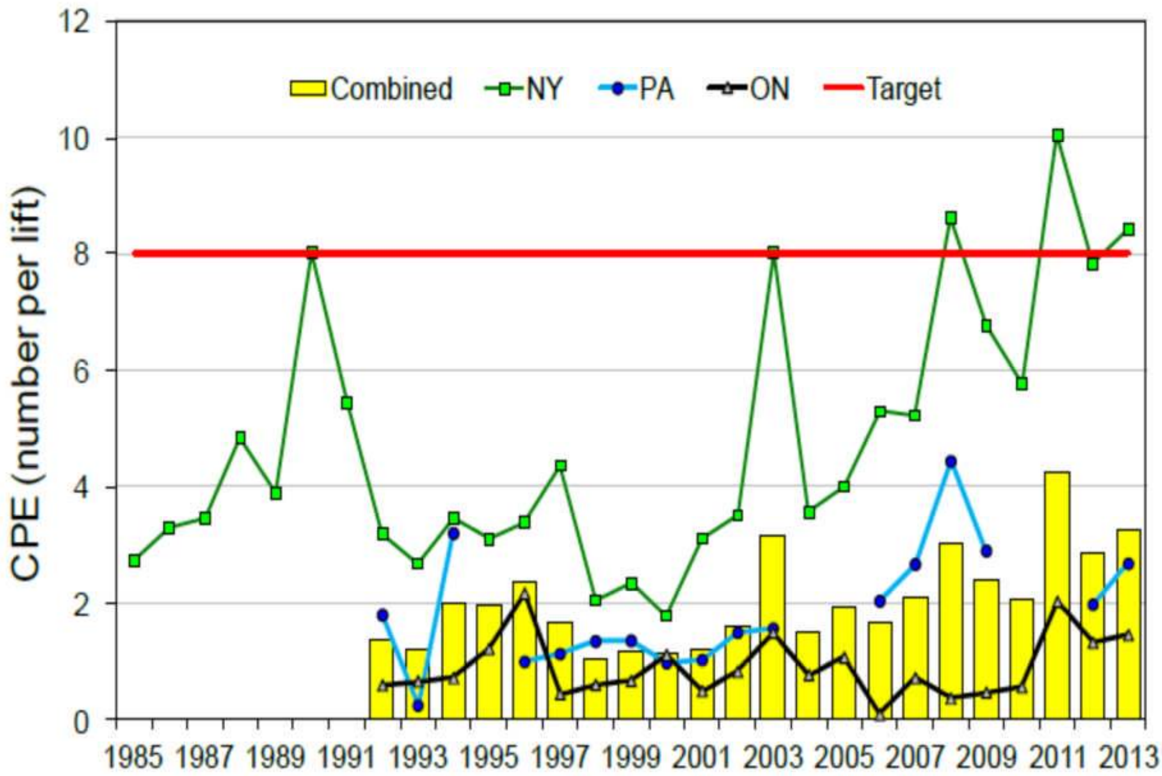


Source: Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008-2020, Great Lakes Fishery Commission.

The overall trend in area-weighted mean CPUE of Lake trout all ages caught in standard nets in the eastern basin has increased in the last years up to 3.3 fish per lift in 2013 (Fig. 69). Basin-wide abundance remains well below the rehabilitation target of 8.0 fish/lift (Markham *et al.* 2008).

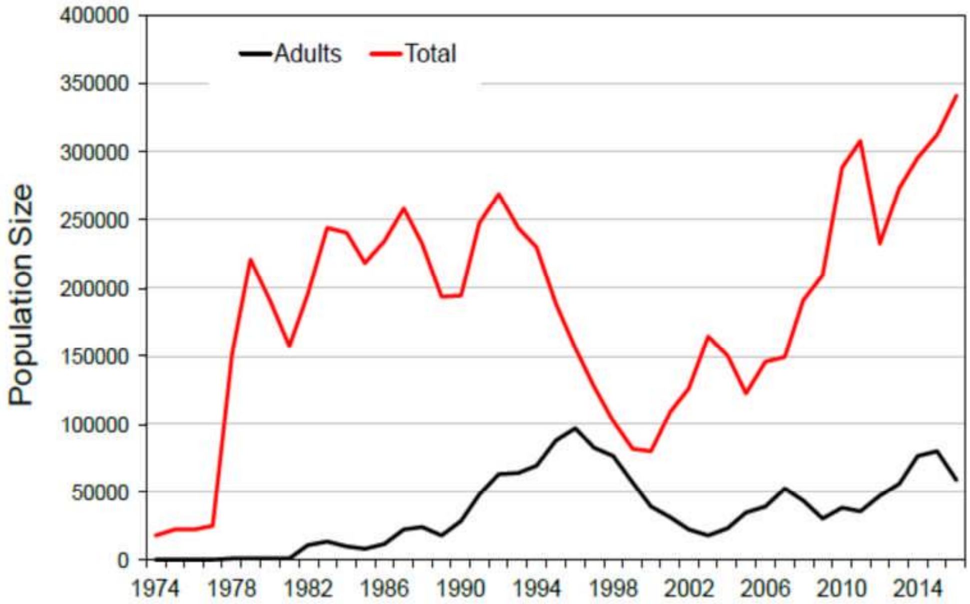
The 2013 estimate for the total Lake Erie population using the CWTG Lake Trout model at 272,981 fish and the age-5 and older population at 56,264 fish, was about half the number estimated in 1996 when the adult Lake Trout population was at its peak (Fig. 70). The Strategic Plan for Lake Trout Restoration (LTTG 1985) suggested that successful Lake Erie rehabilitation required an adult population of 75,000 Lake Trout. Model projections were made using low and moderate rates of Sea Lamprey mortality and proposed stocking rates, and show that the adult Lake Trout population is suppressed by one-third over the next decade with moderate mortality compared to low mortality. Model simulations indicate that both stocking and Sea Lamprey control are major influences on the Lake Erie Lake Trout population.

Figure 69: Lake Trout Mean CPUE (number per lift) by jurisdiction and combined (weighted by area) in Eastern Basin gill net surveys



Source: CWTG 2013

Figure 70: Estimates of Lake Trout Abundance Using the CWTG Lake Trout Model with Moderate Mortality and Proposed Stocking Rate



Source: CWTG 2014.

Management. Modern Lake trout rehabilitation efforts began in 1969 when 17,000 yearlings were stocked and this level of stocking continued in an *ad hoc* manner through 1982 (Cornelius *et al.* 1995). Beginning in 1982, USFWS committed to an annual production and stocking of at least 160,000 yearlings. Sampling programs were also established to monitor progress. Recruitment of stocked juveniles was good, but their survival to adulthood was poor due to excessive sea lamprey predation. Lake trout rehabilitation efforts in Lake Erie have been guided since 1985 by a strategic plan that defined goals and specific quantitative objectives for restoration. Then, a formal Lake Trout rehabilitation plan was developed by LTTG (1985). A higher goal of stocking 200,000 yearlings per year was generally met or exceeded from 1986 to 1994. The rapid increase in the adult Lake trout population in the early 1990s caused concerns about the predatory demand on rainbow smelt, a species important in the diet of Walleye and the object of a commercial trawl fishery in Ontario's waters. A draft revision of the plan (Pare 1993) was presented to LEC in 1993, but the revision was never formally adopted by the LEC because of a lack of consensus regarding the position of Lake Trout in the Lake Erie fish community goals and objectives (Cornelius *et al.* 1995). To protect smelt, stocking was held at 120,000 yearlings per year from 1996 to 2004. A revision of the Lake Erie FCGOs was completed in 2003 and identified Lake Trout as the dominant predator in the profundal waters of the eastern basin. Following a large decline in adult Lake trout abundance in 2004, LEC increased the stocking target to 160,000 yearlings per year. A subsequent revision of the Lake Trout Rehabilitation Plan was completed by the task group in 2008 (Markham *et al*. 2008).

Sport-fishing regulations aim to minimize losses to the spawning population. Directed commercial fishing is not allowed, and losses due to commercial by-catch are largely unknown. Based on the Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008-2020, by-catch is a source of mortality on Lake trout that is largely unquantified and hence not included in assessments.

The plan recommended that for better prediction of Lake trout populations, estimates of commercial by-catch should be included in the Lake Trout Population Model.

The recreational fishery has a 12 inches size limit and up to 5 fish in a combination of Lake trout and salmon can be taken between May 16th and August 31 and up to two between September 1 and May 15th. Lake trout are also caught in trap net and gill net fisheries as by-catch, though gillnets are prohibited in Lake trout recovery areas. Gill Nets can have high impacts due to their high rates of mortality and low selectivity.

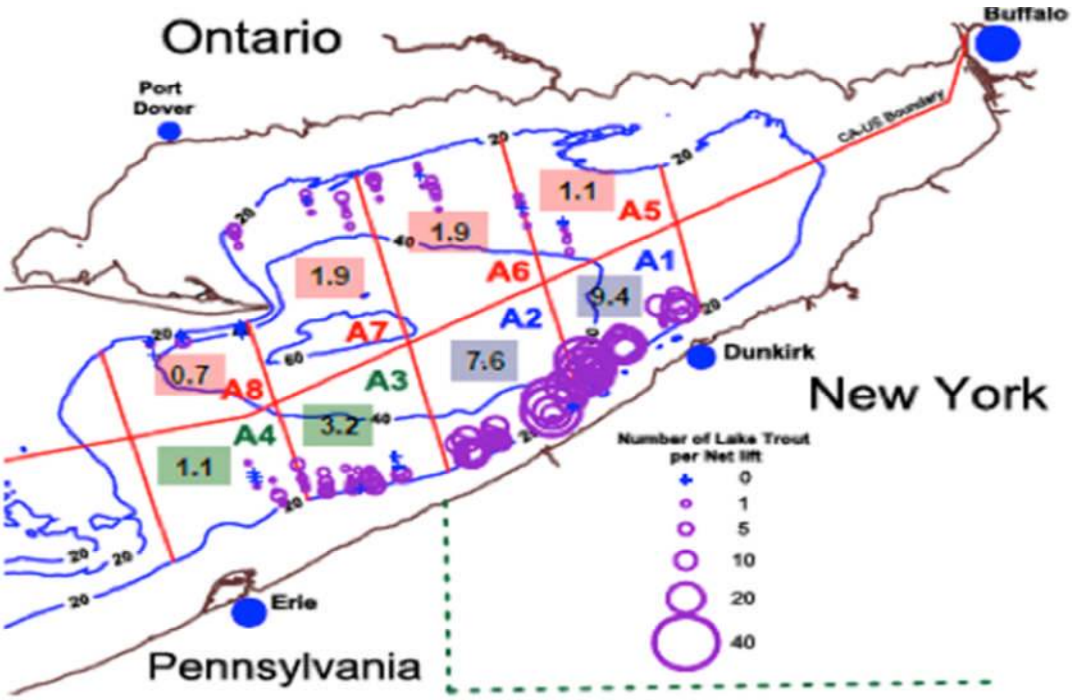
Information: Monitoring and assessments are routinely conducted. There are Lake Trout assessments in Lake Erie eastern basin (Fig. 71). The OMNR Partnership Index Fishing Program provides another data source for assessing Lake Trout abundance in Ontario waters that includes suspended and bottom set gill net catches (Fig. 72).

Gizzard Shad

There is considerable speculation about the origin of Gizzard shad, an invasive benthivore, in Lake Erie (Scott & Crossman, 1973). While it has been proposed that it is native to Lake Erie, evidence is lacking and the species probably entered Erie through the Great Lakes drainage from the Mississippi River basin. The species was reported from Lake Erie in 1848, 18 years after the completion of the first canal to connect Lake Erie and the Ohio River. Thus, is it also possible that it is an exotic species introduced from human landscape intervention.

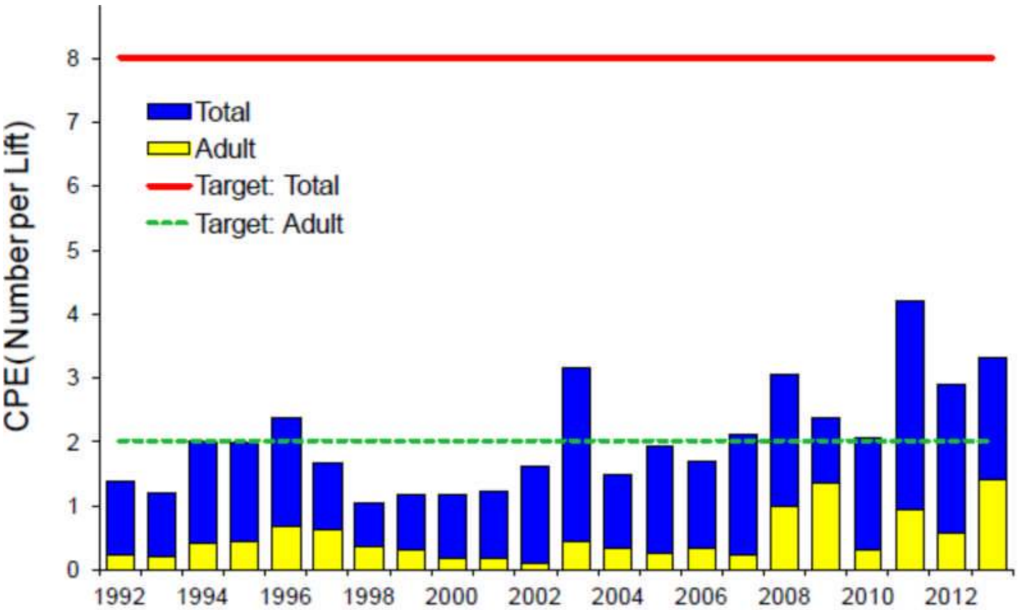
Biology. The Gizzard shad belongs to clupeidae (herring) family which is predominantly marine. Because of high abundance and tolerable adaptation to varying environments, it ubiquitously distributed throughout many larger rivers, reservoirs, lakes, swamps, floodwater pools, estuaries, and blackish waters in North America. The species is most often found in large schools. Individuals within a school may often be observed leaping out of the water or skipping along the surface on their sides. Massive die-offs occur in extreme cold weather.

Figure 71: Standard Sampling Areas for Assessment of Lake Trout in the Eastern Basin, 2013 & CPUE



Source: CWTG 2014

Figure 72: Lake Erie Basin wide Lake Trout CPUE in Gill Net Surveys



Source: CWTG 2014

Gizzard shad are prolific spawners from March through August usually in shallow protected water. Eggs and milt are released in the school, seemingly without regard for individual mates. Females release sticky eggs that adhere to shallow water substrates until they hatch in about 4 days. Peak spawning occurs in May in a diversity of habitats that include large rivers, small streams, ponds, and large lakes. Both females and males usually reach maturity by age 2 – 3, with females producing 50,000 – 400,000 eggs. FishBase reports maturity at L_m 36.1 cm. Mature Gizzard shad broadcast their eggs and sperm simultaneously near the surface. The eggs sink to the bottom where they adhere to submerged objects. After spawning, and throughout the summer, adults and young can be found both close to the bottom in shallow water. Although adult shad are moderately deep-bodied, fry are extremely slender and delicate looking until they reach about 3 cm in length. The young grow rapidly during their first year, making them available prey for a short period of time.

The importance of YOY Gizzard shad to Lake Erie food web has been generally recognized as key prey species for most of piscivorous fish in Lake Erie. More specifically, the YOY took up 32.74% of abundance in western trawl databases; overwhelmingly amounted prey resources have greatly supported feeding demands for most of piscivorous predators in the ecosystem (Zhu et al., 2008). In particular, Gizzard shad are an important prey species for many game fish from hatching through adulthood including Walleye. However, at full size, they are too large for all but the biggest striped bass, largemouth bass and catfish to consume. They are also prey of piscivorous waterbirds doubled crested cormorants and of mergansers. Gizzard shad are planktivorous. Diet includes phytoplankton and zooplankton by filter feeding with their gill rakers and detritus.

The individual size in Lake Erie surveys has ranged from 7 to 63 cm total length and 4-3216g round weight (Johnson *et al.,* 2006). Although the species commonly grows to lengths of 20 to 36 cm, some have been reported to exceed 50 cm in length. FishBase reports Max length: 57 cm FL male/unsexed; common length: 35 cm SL male/unsexed; max published weight: 2 kg; max reported age: 10 years. Bayesian length-weight: a=0.00891 (0.00547 - 0.01451), b=3.03 (2.89 - 3.17), based on LWR estimates for species & Subfamily-BS. Trophic Level: 2.4 ±0.21 se; Based on food items. Resilience: Medium, minimum population doubling time 1.4 - 4.4 years (tm=2; tmax=6). Vulnerability: Low to moderate (30 of 100).

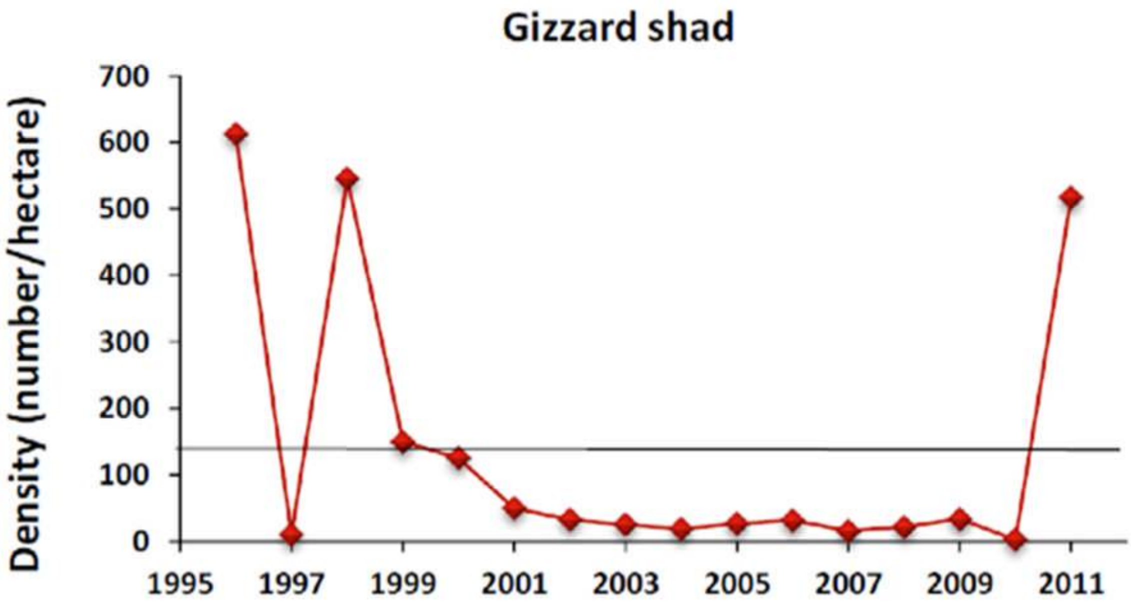
Harvest. Gizzard shad is not a species commonly harvested in commercial or sport fisheries. Small catches are retained in the Ohio trap net fishery. They are commonly used as bait for other fisheries.

Outcome Status. There are no stock assessments for the Gizzard shad stock in Lake Erie. Trends are assessed by several surveys. The species constitutes one of the most important components of the Partnership Gillnet Survey, both in canned and bottom set gillnets.

The population is assessed among other forage fish within surveys of FFTF and forage fish trends are reported annually. These are surveys to evaluate the prey fish basis in Lake Erie but do not provide information for individual species.

Surveys conducted by USGS indicated high CPUE for 2011 after low levels between 1999 and 2010, suggesting increasing abundance (Fig. 73).

Figure 73: Abundance Index of YOY Gizzard Shad from USGS bottom trawl surveys in Western Lake Erie



Source : Fisheries Research & Monitoring Activities of the Lake Erie Biological Station 2011, USGS. Reported to the GLFC for LEC Meeting 2012.

Management Strategy. There are no regulations specific for Gizzard shad as the species belongs to the unlimited harvest group of species. In the Walleye fishery, the amount of Gizzard shad by-catch is only regulated by the target fishery quota. Other conditions of license for gill net fisheries in Ontario apply to Gizzard shad.

Information / Monitoring. Information on discards in gill net fisheries is available from DCR.

A multi-agency project (USGS, LEBS, OMNR and ODNR-ODW), has assessed forage fish populations in the western basin of Lake Erie since 1987 using bottom trawl surveys. The primary long-term objective of the assessment is to contribute estimates of forage fish catch per hectare (CPH) and weight per hectare to the interagency database for assessing seasonal and spatial distributions of 15 forage fish species. The short-term objective is to estimate year-class strength of key forage and predator species.

The USGS-LEBS has conducted annual bottom trawl surveys near East Harbor State Park, Ohio during spring from 1961 to 2008 and during autumn beginning in 2009. The objectives of the surveys have been to estimate relative abundance and growth of YOY of common fish species. Abundance indices and growth data from these surveys provide an index of recruitment for species including Gizzard shad.

By-catch Management

Yellow perch

Ontario Gill Net

The Conditions of Licence for gill net fisheries in Ontario define by-catch as capture in commercial gear which cannot be legally harvested. There are four quota species (Walleye, Yellow perch, Lake whitefish, and smelt) and 11 species with unlimited catch, and all those species not included in these two species category are considered No Harvest permitted species. All fish named on Appendix "C" and all no harvest permitted species must be reported and landed except as provided in Condition 12(b).[1] There is no explicit strategy in place to manage the harvest of by-

[1] When no harvest permitted species or over quota fish are caught and are no longer alive, they must be separated from the catch, recorded appropriately on the Daily Catch Report and turned over to a Port Officer or Conservation Officer at the time of inspection. If a Port Officer or Conservation Officer is not present, these fish shall not be landed until a Port Officer or Conservation Officer is contacted for direction on disposal. Any live fish must be returned to the water in

catch species in the gill net fishery to ensure the health of Yellow perch and their predators and prey. Also, there is no enforcement and evidence of compliance of the conditions of licence with respect to reporting of by-catch, as there are no observers on board to survey the fishing operations. The only available reporting of by-catch by observers on board commercial operations is from a low coverage survey conducted in 2005; the survey quantified composition of retained and discarded catch.

During the site visit two draft documents on ONMR by-catch management for all commercial fisheries were presented (see above).

Ohio Trap Net

In principle, there should not be by-catch because fish that cannot be retained should be released alive. Nevertheless, fish that will not be retained will still be retained by the gear for as long the gear remains in the water and can cause mortality. There is a requirement to lift nets at least every 5 days to minimize by-catch mortality.

There are several regulations that define species and size of fish that cannot be retained. These include that all undersized fish and species that cannot be taken commercially must be released immediately with as little injury as possible while the fishing device is lifted, pulled, or hauled. Also it is unlawful for any commercial fisher to take Walleye, sauger, sturgeon, Mooneye, cisco, or brook, brown, rainbow, or Lake trout, or coho, chinook, or pink salmon from Lake Erie or its tributaries or to possess any of the aforementioned species while on Lake Erie or its tributaries. It is unlawful for any licensed commercial fisherman to take, possess, buy, sell, transport, deliver, or trade Walleye, or any part thereof including roe, from Lake Erie or its tributaries, or to possess such fish or part thereof aboard a boat while lifting or attending a net or when going to or returning from nets.

Walleye

Ontario Gill Net

An explicit strategy is not in place to manage the harvest of by-catch species in the Walleye gill net fishery designed to ensure the health of the stocks of both Walleye and their predators and prey. See section for Yellow perch management.

The two ONMR draft documents described in the Yellow perch section detail planning for a by-catch policy that could be implemented in the gill net fisheries in general.

4.3.4 Information & Monitoring

Yellow perch

Ontario Gill Net

Information of by-catch including the weight of discarded, released and surrendered fish is recorded in DCRs. Prior to 2011 discards and releases were sometimes recorded but reporting was not enforced and estimates were not reliable. A 2005 observer program survey estimated by-catch in gill net fisheries including the fishery targeting Yellow perch. Misreporting of earlier years was confirmed by comparing the DCRs data available to the audit team with the discards estimates in the 2005 survey. The survey reported on a catch 1,656,760 lbs for all MUs including 29,047 lbs of White perch and 8,429 lbs of Freshwater drum that were discarded. The 2005 DCR reported a total catch of 4,106,631 lbs but discards of the two species were 5,923 lbs and 1,516 lbs respectively. The information presented for by-catch in the Yellow perch gillnet fishery (above) shows the increase in by-catch in 2011 in all MUs which tends to confirm that by-catch was under-reported in earlier years.

accordance with the Ontario Fishing Regulations.

Li *et al* (2011) estimated the theoretical non-landed (discarded) by-catch of Yellow perch and White perch in the gillnet fishery targeting Walleye prior to 2011. Their results indicated that there were no discards of White perch and about 0.6% of the total Yellow perch landed catch. This is consistent with the data made available to the auditors as discards of those two species are low.

Since 2011 it is mandatory to record the weight of species that are discarded, released and surrendered, as well as of those species that are landed, in the DCRs. Nevertheless, there is no evidence that the regulation is being fully implemented as only landed catch is subject to weight verification and there are no on-board observers.

Information on by-catch is recorded on DCRs where data of up to three efforts can be entered in the same form. Data are stored in a database administrated by the OMNR. The same issues described in the retained catch section apply to the by-catch section. Reporting in some cases lacks species definitions and more than one species is reported within a group. Thus, it is not possible to evaluate the significance of the removals for species within these groups. This is the case for example for suckers.

Ohio Trap Net

There is no information available to determine released by-catch in the trap net fishery and PCM.

Walleye

Ontario Gill Net

As described for the Yellow perch gill net fishery.

4.4 ETP Species

4.4.1 Introduction

ETP species are those species recognized by national legislation and / or binding international agreements (e.g. CITES), to which the jurisdictions controlling the fishery under assessment are party (MSC, 2013). Accordingly, for Ontario fisheries, this assessment takes into account those species that are listed under the Canadian Species at Risk Act (SARA) Schedule 1. In particular, this assessment considers species that are classified as endangered or threatened in SARA. Species of concern are considered under the by-catch section. For the Ohio fishery, the assessment considers the US Endangered Species Act (ESA).

4.4.2 Background

Ontario

13 species, one turtle species and four freshwater mussel species (unionids) found in Ontario are recognized as at risk by SARA schedule 1. Of these species five are endangered, six are threatened and six are of special concern (Table 38). Several of these species have been observed in Lake Erie. Some of these species are thought to be extirpated from Lake Erie (Morris & Burridge 2006, DFO 2011).

Table 38: Lake Erie Endangered and Threatened Species in SARA Legislation

Common Name	Scientific Name	SARA
Channel Darter	*Percina copelandi*	THR
Eastern Sand Darter	*Ammocrypta pellucida*	THR
Lake Chubsucker	*Erimyzon sucetta*	END
Northern Madtom	*Noturus stigmosus*	END
Pugnose Shiner	*Notropis anogenus*	END
Shortjaw Cisco	*Coregonus zenithicus*	THR
Spotted Gar	*Lepisosteus oculatus*	THR
Eastern Spiny Softshell	*Apalone spinifera*	THR
Round Pigtoe	*Pleurobema sintoxia*	END
Eastern Pondmussel	*Ligumia nasuta*	END
Rainbow mussel	*Villosa iris*	END
Mapleleaf mussel	*Quadrula quadrula*	THR

Source: http://www.sararegistry.gc.ca

The resident taxa in Lake Erie potentially affected by the Ontario gill net fisheries and that have been designated as at risk under SARA as endangered or threatened include fish species: Channel darter, http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=914, eastern sand darter, Lake chubsucker, northern madtom, pugnose shiner, shortjaw cisco and Spotted gar. The turtle species at risk is the eastern spiny softshell turtle. The species of mussels at risk are the round pigtoe mussel, the eastern pondmussel, the rainbow mussel, and the mapleleaf mussel. The fish and turtle species can potentially be caught by the fishing gear, while freshwater mussels could potentially be affected by the fishery through the gill net anchoring to the lake bottom where these species are found. There are no studies or records of fishery interactions with mussel species, and limited information on mussel distribution and abundance. There are no records of fishery interactions with turtles.

Ohio

Information on the spatial distribution of the species at risk both in Ontario and Ohio was used to identify potential interaction with the trap net and gill net fisheries (Table 39). 11 species in Ohio waters are listed as at risk on ESA (Table 40). There is one fish species, Scioto madtom catfish, listed as endangered in Ohio but the species inhabits streams and would not overlap with Lake Erie fisheries. Other taxa listed include ten species of unionids.

Table 39: ETP Species Profiles

<table>
<tr><th>Trap Fishery</th><th>Gill net Walleye</th><th>Gill net Yellow perch</th></tr>
<tr><td colspan="3">Channel darter is a small bottom-dwelling species that has a wide and patchy distribution in central North America west of the Appalachian Mountains. It is believed that the distribution was wider and less disjointed. There are several populations throughout the lower Great Lakes Basin, from the Detroit River through Lake Erie, and in tributaries of Lake Ontario and the St. Lawrence River. It is commonly found over sand and gravel shoals of larger rivers or beaches, where the current is slow. The species was very common along beaches and gravel bars in Lake Erie until the invasion of the exotic round goby. Now, this species is no longer found in Lake Erie.</td></tr>
<tr><td></td><td>It is unlikely that Channel darter interacts with the gill net gear used in the Walleye fishery because of the small size, the distribution mostly in streams, and low population numbers. No records of catching the species are listed in daily catch records in the gill net fishery targeting Walleye.</td><td>It is unlikely that the species interacts with the gill net gear used in the Yellow perch fishery because of the small size and the distribution mostly in streams and low population numbers. No records of catching the species are listed in daily catch records in the gill net fishery targeting Yellow perch.</td></tr>
<tr><td colspan="3">Clubshell mussel prefers clean, loose sand and gravel in medium to small rivers and streams. This mussel will bury itself in the bottom substrate to depths of up to four inches. It occurs today in portions of only 12 streams. Reasons for its decline in the upper Ohio and Wabasha watersheds have been principally due to pollution from agricultural run-off and industrial wastes, and extensive impoundments for navigation.</td></tr>
<tr><td>The species distribution does not overlap with the yellow perch trap net fishery.</td><td></td><td></td></tr>
<tr><td colspan="3">Eastern pondmussel The range of the Eastern Pondmussel is restricted to eastern North America where it extends from the lower Great Lakes east through New York to New Hampshire and south, in coastal rivers, to South Carolina. In Canada, the species is known only from the Great Lakes region of Ontario where it historically occurred in Lakes St. Clair, Erie and Ontario, their connecting channels, and the lower reaches of some tributaries. The species was once the most common mussels in the lower Great Lakes. The current distribution of the Eastern Pondmussel is similar to its historical distribution, but the species is declining in many places, particularly the Great Lakes. The Eastern Pondmussel appears to have been lost from nearly all of its former range in Canada, but still occurs in the delta area of Lake St. Clair. Another population was recently discovered in Lyn Creek, a small tributary of the upper St. Lawrence River near the outlet of Lake Ontario.The preferred habitat of the Eastern Pondmussel is sheltered areas of lakes or slow streams in substrates of fine sand and mud at depths 0.3 m up to 4.5 m.</td></tr>
<tr><td></td><td>Gill nets are set in shallow water (>4 m (Client comment on draft report review September 2014); >3 m (Li et al. 2011). Thus, there are potential, although limited, interactions with the gill net gear targeting Walleye because of some degree of overlapping distributions and low population</td><td>Gill nets are set in shallow water (>4m (Client comment on draft report review September 2014); 3 m (Li et al. 2011). Thus, there are potential, although limited, interactions with the gill net gear targeting Yellow perch because of some degree of</td></tr>
</table>

<table>
<tr><td></td><td>numbers. .</td><td>overlapping distributions and low population numbers.</td></tr>
<tr><td colspan="3">Eastern sand darter reaches around 5 cm in length and prefers sand bottom areas of lakes and streams. There is continuing decline in the already small and fragmented populations where four of 11 have probably been extirpated. The extent of occurrence in Ontario is approximately half of what it was in the 1970s as a result of habitat loss and degradation, stream channelization and competition with invasive species. It has been recently collected in Lake Erie, Lake St. Clair, the Grand, Sydenham and Thames rivers, and Big Creek.</td></tr>
<tr><td></td><td>It is unlikely that this species interacts with the large mesh gill net used in the Walleye fishery because of its small size. No records of the species have been reported in the daily catch records in the Walleye fishery.</td><td>It is unlikely that this species interacts with the large mesh gill net used in the Yellow perch fishery because of its small size. No records of the species have been reported in the daily catch records in the Yellow perch fishery.</td></tr>
<tr><td colspan="3">Fanshell mussel is found in medium to large rivers. It buries itself in sand or gravel in deep water of moderate current, with only the edge of its shell and its feeding siphons exposed.</td></tr>
<tr><td>The species distribution does not overlap with the yellow perch trap net fishery.</td><td></td><td></td></tr>
<tr><td colspan="3">Lake Chub Sucker is a robust and deep-bodied species and adults in Ontario seldom grow longer than 26 cm. Distribution is restricted to drainages of Niagara River and lakes Erie, St. Clair and Huron, in south western Ontario. It prefers clear, still waters with abundant vegetation. Such habitat is found in backwaters, bayous, drainage ditches, floodplain lakes, marshes, oxbows, sloughs and wetlands. Since the mid-1980s specimens have not been captured from the three large Lake Erie marshes (Point Pelee, Rondeau, Long Point) despite sampling attempts. Critical habitats are likely decreasing in size and quality. OMNR (2010) in the recovery strategy for the specie lists commercial fisheries as a threat that requires investigation.</td></tr>
<tr><td></td><td>It is unclear if the Lake chubsucker interacts with the gill nets targeting Walleye since most suckers are reported in daily catch reports as one group. There is little potential, although size is >26 cm, for interactions with the gill net gear targeting Walleye because of the lack of evidence for overlapping distributions.</td><td>It is unclear if the species interacts with the gill nets targeting Yellow perch since most suckers are reported in daily catch reports as one group. There is little potential for interactions , although size is >26 cm, with the gill net gear targeting Yellow perch because of the lack of evidence for overlapping distributions.</td></tr>
<tr><td colspan="3">Mapleleaf mussel occurs through the Ohio-Mississippi drainages and extends into southern Ontario to larger rivers draining into St. Clair and Lake Erie. It is found in a variety of habitats ranging from medium to large rivers with slow to moderate current, lakes, and reservoirs in mud, sand or gravel substrates. Known fish host are Channelcatfish. In Ontario, the species has been reported from Lake St. Clair and western Lake Erie and tributaries. In Ontario, recent data indicate populations have been almost entirely lost due to effects of dreissenids.</td></tr>
</table>

	There are potential interactions with the gill net gear targeting Walleye because of overlapping distributions. Nevertheless, the probability is low given the population status.	There are potential interactions with the gill net gear targeting Yellow perch because of overlapping distributions. Nevertheless, the probability is low given the population status.
Northern madtom. In Canada, this species is known from Lake St. Clair and the Detroit, Sydenham, and Thames rivers. The species prefers habitats ranging from large creeks to big rivers, with clear to turbid water, and moderate to swift current. Fish are found on bottoms of sand, gravel, and stones, occasionally with silt, detritus, & accumulated debris. It is sometimes associated with large aquatic plants, & is typically collected at depths of less than 7 m.		
	Because of their distribution there should be no spatial overlap with the area of operation of the fishery targeting Walleye. There are no recordings of northern madtom in daily catch reports.	Because of their distribution there should be no spatial overlap with the area of operation of the fishery targeting Yellow perch. There are no recordings of northern madtom in daily catch reports.
Northern riffleshell mussel is found in a wide variety of stream sizes. It buries itself in bottoms of firmly packed sand or gravel with its feeding siphons exposed. Today its range is restricted to southwestern Ontario, the Green River in Kentucky, Big Darby Creek in Ohio and French Creek, LeBoeuf Creek and Allegheny River in Pennsylvania.		
The species distribution does not overlap with the yellow perch trap net fishery.		
Pink mucket mussel is found in mud and sand and in shallow riffles and shoals swept free of silt in major rivers and tributaries. This mussel buries itself in sand or gravel, with only the edge of its shell and its feeding siphons exposed.		
The species distribution does not overlap with the yellow perch trap net fishery.		
Pugnose shiner. This slender, fragile minnow rarely exceeds 5 cm. It is mostly restricted to the Great Lakes and Mississippi River drainage basins. In Canada, sampling between 1994 and 1997 detected their presence in the St. Lawrence River, Long Point Bay of Lake Erie, Lake St. Clair, and the Old Ausable Channel. No data on population sizes or trends have been collected. Declines have been attributed to increases in turbidity of the water, destruction of large aquatic plants near the shore, and loss of habitat.		
	It is unlikely that the species interacts with the large mesh gill net used in the Walleye fishery because of its small size. There are no recordings of pugnose shiners in daily catch reports.	It is unlikely that the species interacts with the large mesh gill net used in the Yellow perch fishery because of its small size. There are no recordings of pugnose shiners in daily catch reports.
Purple catspaw_This mussel lives in large rivers of the Ohio river basin. It prefers shallow water and requires a swift current to avoid being buried in silt. It is found on bottom substrates ranging from sand to boulders.		
The species distribution does not overlap with the yellow perch trap net fishery.		

Rabbitsfoot mussel is found in rivers and streams in Alabama, Arkansas, Georgia, Kansas, Kentucky, Illinois, Indiana, Louisiana, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, Tennessee, and West Virginia.		
The species distribution does not overlap with the yellow perch trap net fishery.		
Rainbow mussel is distributed in eastern North America from Wisconsin east to Ontario and New York and south to Oklahoma, Arkansas and Alabama. Its current distribution includes much of its historical distribution; however, it is in decline in the western part of its range. In Canada, it occurs only in Ontario rivers. It has also been collected in lakes Huron, Ontario, Erie and St. Clair but now only occurs in the delta of Lake St. Clair. Overall, this mussel no longer exists in roughly 30% of its historical Canadian range.		
	Their distribution does no longer overlap with the fishery.	Their distribution does no longer overlap with the fishery.
Rayed bean mussel was historically found in across a wide expanse that included parts of the Midwest, the eastern United States and north to Ontario. The species generally lives in smaller, headwater creeks, but they are found sometimes in large rivers and wave-washed areas of glacial lakes, including Lake Erie. The rayed bean population in Lake Erie was once considerable, but has been eliminated by the zebra mussel (8632 Federal Register Vol. 77, No. 30 / Tuesday, February 14, 2012)		
The species has been eliminated from Lake Erie.		
Round pigtoe is an obligate riverine species preferring larger perennial rivers where it occurs in gravel substrates with swift currents.		
	Their distribution does not overlap with the fishery.	Their distribution does not overlap with the fishery.
Scioto madtom prefers stream riffles of moderate current over gravel bottoms. Water must be of high quality and free of suspended sediments. Only 18 individuals have ever been found. Although this madtom may be extinct, the U.S. Fish and Wildlife Service is keeping the fish on the Endangered Species list.		
The species distribution does not overlap with the yellow perch trap net fishery.		
Sheepnose mussel was found across streams in the Midwest and Southeast. However, it has been eliminated from two-thirds of the total number of streams from which it was historically known. Today, the sheepnose is found in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Mississippi, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. It lives in larger rivers and streams where it is usually found in shallow areas with moderate to swift currents flowing over coarse sand and gravel.		
The species distribution does not overlap with the yellow perch trap net fishery.		
While best known from the Great Lakes, shortjaw ciscoes have a widespread distribution throughout central Canada. Reports of the longjaw cisco, *C. alpenae*, in Lake Erie (Scott and Smith 1962) should be attributed to *C. zenithicus* based on re-examination of the original specimens and the findings of Todd *et al.* (1981) that concluded *C. zenithicus* and *C. alpenae* were conspecific. The absence of *Coregonus zenithicus* from Lakes Michigan (since 1975), Huron (since 1982), and Erie (since 1957) supports a conclusion that the species has been extirpated in these lakes (Todd 1985).		

	Although the species is listed in SARA as threatened in Ontario, it seems to be extirpated from Lake Erie.	Although the species is listed in SARA as threatened in Ontario, it seems to be extirpated from Lake Erie.
Snuffbox mussel is found in Alabama, Arkansas, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. It lives in small to medium-sized creeks in areas with a swift current, although it is also found in Lake Erie and some larger rivers.		
There are potential interactions with the gear but given the depth where yellow perch trap nets are deployed this is limited.		
Spotted gar is a long, cylindrical, primitive fish that reach over 100 cm in length and 13 kg in weight. More commonly found are 28 to 60 cm and 1kg specimens. The species inhabits quiet bays and backwater areas along Lake Erie's north shore. It is tolerant of warm waters and low dissolved oxygen levels and can survive in these conditions for a long time. Gars are voracious predators and Yellow perch and minnows form a large part of their diet. Habitat destruction of the north shore of Lake Erie could have a serious effect on the lake populations. Spotted gar records were noted by commercial fisherman from Lake Erie proper (1925, 1938). Lesser threats that may be affecting the survival of Spotted Gar include the introduction of exotic species, and incidental harvest through the baitfish, recreational, and commercial fishing industries. Recovery Potential Assessment of Spotted Gar (*Lepisosteus Oculatus*) In Canada http://www.dfo-mpo.gc.ca/Library/341746.pdf, Proposed Recovery Strategy for Spotted Gar Plain Language Summary http://www.mbq-tmt.org/assets/Infrastructure/SpottedGarRSplainlangsummApr2012.pdf		
	Cited threats to Spotted Gar populations include possibly fishing pressure (commercial/recreational incidental harvest). It is possible that the population in Lake Erie is affected by the Walleye fishery. Nevertheless, overlap would be minimal given distribution (client comment on draft report Sept 2014) and population status.	Cited threats to Spotted Gar populations include possibly fishing pressure (commercial/recreational incidental harvest). It is possible that the population in Lake Erie is affected by the fishery targeting Yellow perch. Nevertheless, overlap would be minimal given distribution and population status.
White catspaw mussel prefers coarse sand or gravel bottoms of small to mid-sized freshwater streams and rivers. It prefers shallow water and requires a swift current to avoid being buried in silt. With only one known population, the species is one of the most critically endangered animals.		
The species distribution does not overlap with the yellow perch trap net fishery.		

Table 40: Lake Erie Species at Risk Designated by USA Federal Government

Species		Status
Scioto Madtom	*Noturus trautmani*	E
Rayed Bean	*Villosa fabalis*	E
White Catspaw	*Epioblasma obliquata perobliqua*	E
Clubshell	*Pleurobema clava*	E
Fanshell	*Cyprogenia stegaria*	E
Pink Mucket	*Lampsilis abrupta*	E
Sheepnose Mussel	*Plethobasus cyphyus*	E
Snuffbox Mussel	*Epioblasma triquetra*	E
Purple Catspaw	*Epioblasma obliquata obliquata*	E
Rabbitsfoot	*Quadrula cylindrica cylindrica*	T
Northern Riffleshell	*Epioblasma torulosa rangiana*	E

Source: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=OH&s8fid=112761032792&s8fid=112762573902

4.4.3 Outcome

Yellow perch

Ontario Gill net

Based on information provided by stakeholder consultation during the site visit there is limited interaction between the candidate fishery and ETP species as their distributions do not overlap, while many of the smaller species are able to pass through the large gill net mesh without becoming entangled. Also, ETP unionids could be affected by interaction of the gear with the lake benthic habitat. There are no studies to evaluate negative effects. Species at risk with likelihood of interaction with the gear follows. See table 44 for details on identified interactions:

Fish

Lake chub sucker, Spotted gar

Unionids

Eastern pondmussel.

Trap Net

There is no information on the Yellow perch trap net fishery interactions with ETP fish species. This could be in part because the interactions are rare and/or because there is no reporting even when interactions take place. In principle, ETP species should be released before the gear is lifted out of the water. Further, the fish listed by US Federal Law, Scioto Madtom, are distributed in streams and not in Lake Erie.

Fish

None

Unionids

Snuffbox mussel

Walleye

Ontario Gill net

As Yellow perch.

4.4.4 Management Strategy

Overview

Ontario

As described in the Species at Risk Public Registry website, Schedule 1 of the *Species at Risk Act* is the official list of wildlife species at risk in Canada. It includes species that are extirpated (extinct in Canada), endangered, threatened, and of special concern. Species listed on Schedules 2 and 3, and are not yet officially protected under SARA. Once a species is listed on Schedule 1, protection and recovery measures are developed and implemented. Recovery Strategies are detailed plans that outline short-term objectives and long-term goals for protecting and recovering species at risk. These strategies reflect the requirements of SARA, although previously existing recovery strategies and action plans may not. SARA recovery strategies: describe the particular species and its needs; identify threats to survival; classify the species' critical habitat, where possible; provide examples of activities that are likely to result in destruction of the critical habitat; set goals, objectives and approaches for species recovery; identify information gaps that should be addressed; and state when one or more action plans relating to the strategy will be completed.

Once a species is added to the list and protected officially under SARA, a recovery strategy must be developed. For endangered species, this strategy must be developed within a year of the listing; for threatened or extirpated (extinct in Canada) species, it must be developed within two years. Action plans summarize the projects and activities required to meet recovery strategy objectives and goals. They include information on habitat, details of protection measures, and evaluation of socio-economic costs and benefits. Action plans are the second element of the Act's two-part recovery planning process, and are used to implement projects and activities to improve species status. Management plans differ from recovery strategies and action plans. Management plans set goals and objectives for maintaining sustainable population levels of one or more species that are particularly sensitive to environmental factors, but which are not yet considered in danger of becoming extinct. Whenever possible, management plans are prepared for multiple species on an ecosystem or landscape level.

SARA prohibits individuals to kill, harm, harass, capture or take any individual from a species listed as endangered, threatened or extirpated. Species listed as special concern are not automatically afforded the same protection as mentioned above, however once listed as a species of special concern there is a requirement that a management plan is prepared for the species and its habitat. The management plan outlines appropriate measures to be implemented for conservation of the species and to prevent further decline.

Currently, commercial fishers are exempted, under O. Reg. 242/08, from the *Endangered Species Act, 2007* provision prohibiting the harm of species at risk (Environmental Commissioner of Ontario 2013). Nevertheless, the Condition of Licence for Lake Erie fisheries lists three Endangered species and four Threatened species that are considered at risk (Table 33). Conditions of licence indicate that any species of fish or wildlife that is listed on the Species at Risk in Ontario list as an extirpated, endangered, or threatened species under the Endangered Species Act, 2007 that are caught and no longer alive must be brought in and turned over to the Ministry. Any of the above species which are caught and still alive must be released in a manner which causes the least harm to the fish. All species must be recorded on the DCR.

Ohio

The US Congress passed the ESA in 1973. Under the ESA, species may be listed as either endangered or threatened. “Endangered” means a species is in danger of extinction throughout all or a significant portion of its range. “Threatened” means a species is likely to become endangered within the foreseeable future. The Fish and Wildlife Service and NOAA-Fisheries in the Department of Commerce share responsibility for administration of the Endangered Species Act. There is internal guidance and national policies to promote efficiency and nationwide consistency in implementing the ESA to conserve and recover listed species of plants and animals native to the United States and its territories

USFWS determined endangered status in Ohio for the mussels listed as in potential interaction with the trap net fishery as follows: the White cat’s paw and the pink mucket mussel were listed as endangered on June 1976, the fan shell mussel on June 1990, the purple Cat’s paw on July 1990, the club shell and northern riffle shell on February 1993, the sheep nose mussel on April 2012 and the rayed bean and snuffbox on March 2012.The rabbits foot was listed as threatened on October 2013.

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness. Also listing results in conservation measures by Federal, State, Tribal, and local agencies, private organizations, and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species’ decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed, preparation of a draft and final recovery plan, and revisions to the plan as significant new information becomes available. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. The recovery plan identifies site- specific management actions that will achieve recovery of the species, measurable criteria that guide when a species may be down listed or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks.

The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt any of these), import or export, deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. It is the policy published in the Federal Register, to identify, to the maximum extent practicable at the time a species is listed, those activities that would or not constitute a violation of section 9 of the Act and associated regulations at 50 CFR 17.21. For unionids and the interaction with fisheries, there are two actions that could pertain: Unauthorized killing, collecting, handling, or harassing of individual at any life stage; Unauthorized destruction or alteration of the species’ habitat (in-stream dredging, channelization, impoundment, stream bank clearing, discharge of fill material) that actually kills or injures individual rayed bean by significantly impairing their essential behavioral patterns, including breeding, feeding, or sheltering.

FWS reviews other activities not identified above on a case-by-case basis to determine whether they may be likely to result in a violation of section 9 of the Act. The list of actions that result in violation is considered not to be exhaustive and provide them as information to the public.

4.4.5 Information

Ontario

Data on all species caught in gill net fisheries including ETP species should be recorded in DCRs. OMNR has not undertaken dedicated research on the by-catch of species at risk in Ontario's commercial fishery or by-catch mortality of these species (Environmental Commissioner of Ontario 2013). General information on ETP species is collected and recorded during Lake Erie multiple surveys to assess lake stocks. There is no information on unionid interactions with fixed gears in Ontario. There is little monitoring of unionids in Lake Erie and is mostly related to assessment required by COSEWIC and SARA.

Ohio

As law requires release there is no information on the occurrence of ETP species in the fishery. There is no information on unionid interactions with trap net gear in Ohio. There is little monitoring of unionids in Lake Erie and is mostly related to assessment required by US Federal ESA.

4.5 Habitat

4.5.1 Introduction

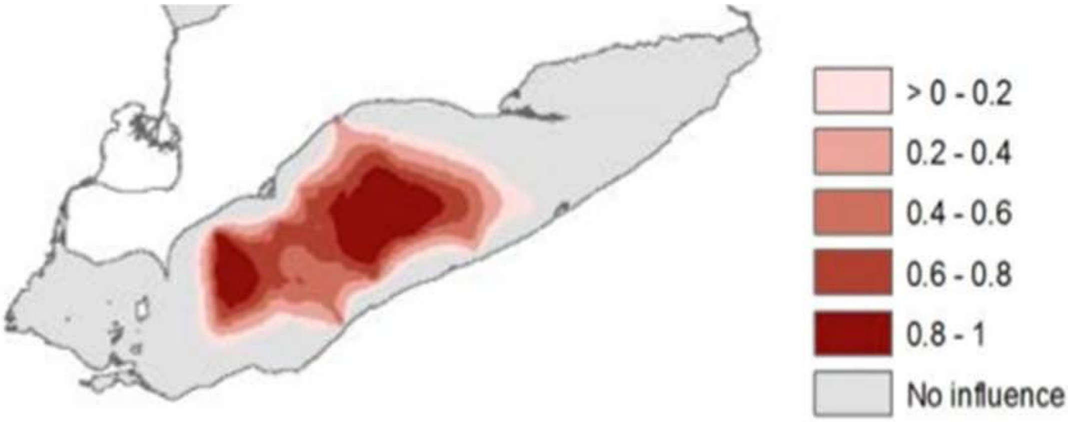
Under this component the concept of 'serious or irreversible harm' refers to change caused by the fishery that fundamentally alters the capacity of habitat to maintain its function or to recover from the impact (MSC, 2013). The habitat component is assessed in relation to the impacts of the fishery on the structure and role of the habitats. Usually habitats impacted by the fishery are bottom habitats rather than pelagic habitats, which would be the case in the Yellow perch and Walleye gill net fisheries in Ontario waters of Lake Erie as well as in the Yellow perch trap net fishery in Ohio.

4.5.2 Overview

The decline of the lake, manifested in the 1960s as impaired water quality, massive, summer-long algal blooms, hypoxia and fish kills, focused attention on the need for rapid action to reduce external inputs of total phosphorous Hypoxia, or low oxygen, is commonly defined as dissolved oxygen levels (DO) at or below the 2-4 mg/L range. Hypoxia occurs in the bottom layer (hypolimnion) of the central basin of Lake Erie (Fig. 74) influenced by several factors including lake circulation (Fig. 75).

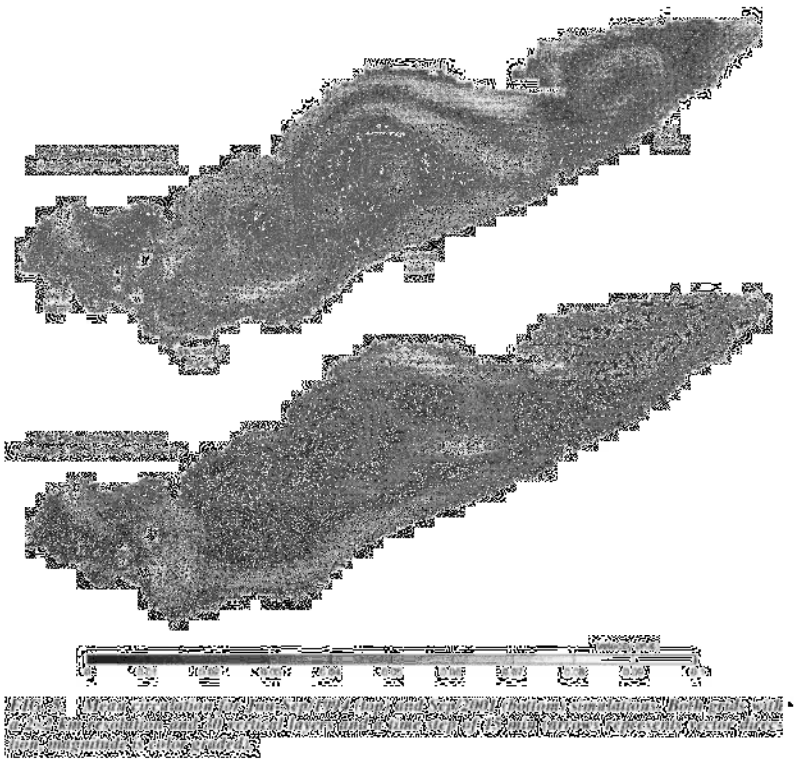
Seasonal hypoxia is a natural, long-standing phenomenon in the central basin of Lake Erie that has been exacerbated by cultural eutrophication, and was particularly problematic during 2005. Fish acoustics and trawl data collected along with our diet data demonstrate for example that hypoxia (b2mgO2/L) likely forced rainbow smelt to reside in a 1–2 m band of water above the oxycline (Pothoven *et al*. 2009). Also, reduced access to hypoxic bottom waters was reported to be likely responsible for the lack of benthic prey such as chironomid larvae in rainbow smelt diets.

Figure 74: Hypoxia Distribution in Lake Erie



Source: GLEAM

Figure 75: Lake Erie Circulation from Hydrodynamic models

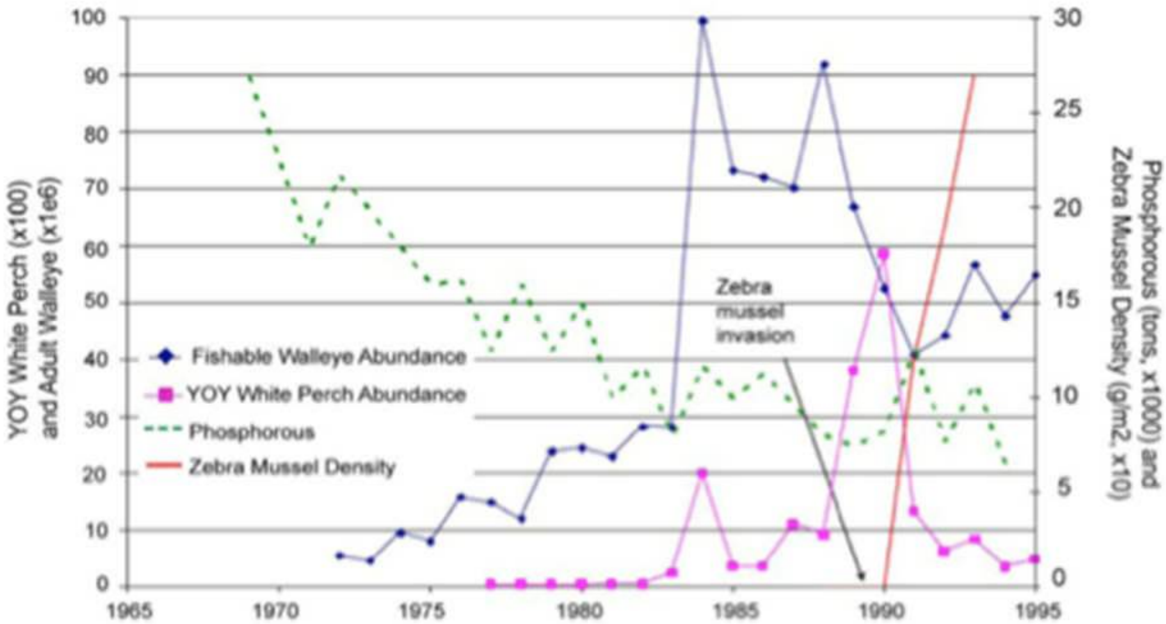


Source: Tyson 2010

The return of severe Lake Erie algal blooms in the 2000s galvanized public concern and a governmental response. The worst algal bloom occurred in 2011. The described characteristics make Lake Erie most susceptible to eutrophication and effects of climate change. These habitat characteristics become relevant when assessing effects of fisheries, as removal by fisheries can have profound and variable effects on ecosystem functioning. Characteristics are also relevant to the distribution of the various fish species in the ecosystem.

Lake productivity and interaction with invasive species are among the factors that can impact fish spawning and recruitment. In Lake Erie, invasive species in particular are thought to affect native species populations. Dreissenids, zebra and later quagga mussels substantially impacted lake trophic status through their high filtration rates, and thus have impacted the lake's carrying capacity for forage species and also through food web interactions top predators such as Walleye. Another invasive with significant effects is the White perch, which competes for example with Walleye for prey and also feeds on eggs of several species in particular Walleye. As an example highlighting some of these interactions, concurrent changes in Lake Erie's trophic condition and species abundance affected overall Walleye recruitment (Gopalan *et al.* 1998) (Fig. 76).

Figure 76: Walleye & YOY White Perch Abundance, Phosphorous Loads & Zebra Mussel Density in Lake Erie



Source: Golapan *et al*. 1998

Geomorphology

The Lake Erie geomorphology is such that the nearshore zone surrounding the main basins deepens to 5-15 m within the first 1-3 km of the shore, exposing bedrock, glacial drift, and glaciolacustrine clay (Thomas *et al.* 1976). Lake Erie has the smallest profundal zone of the Laurentian Great Lakes. The deepwater zone, between the 30-m contour and the maximum depth in the lake (64 m), covers an area of 2,260 km^2, all in the east basin to the south and east of Long Point. Lake floor topography is the result of the cumulative effect of repeated episodes of erosion of lake floor sedimentary deposits and bedrock, and re-deposition of the sedimentary products of this erosion. Shoreline erosion and deposition of the sand and gravel components of this erosion, has formed beaches, bars, and spits along the shoreline. In the deeper parts of the lake basins there has been preferential deposition of finer-grained sediments.

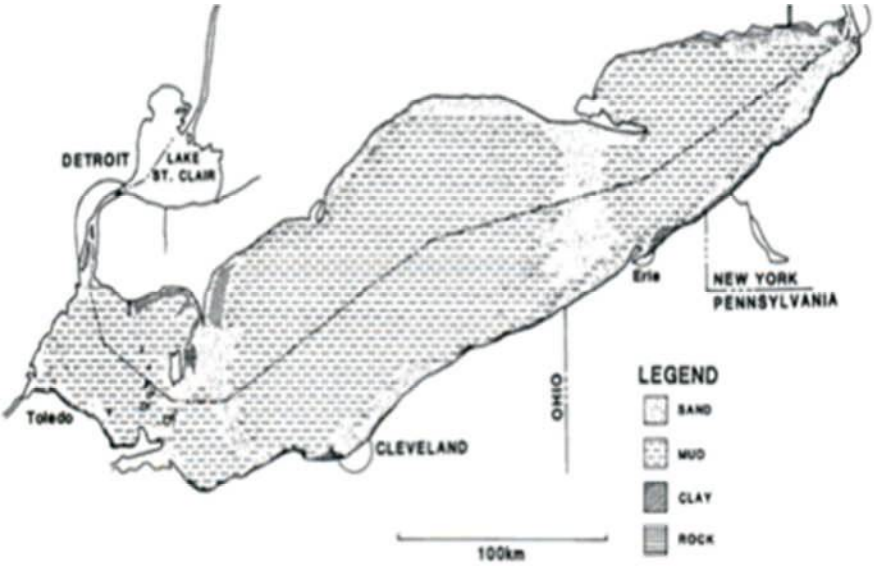
Substrates

The bottom deposits of Lake Erie consist of silt and clay, mud, sand, gravel, peat, compact glacio-lacustrine clays, glacial till, shoals of limestone and dolomite bedrock and rubble, shale bedrock shelves and erratic cobbles and boulders, composed chiefly by igneous and metamorphic rocks (Bolsenga & Herdendorf 1993). The distribution of bottom sediments is closely related to depth (Fig. 77).

Benthic community

The benthic community in Lake Erie is dominated by oligochaetes, chironomids, amphipods and sphaeriids. Prior to the invasion by dreissenid mussels, the profundal community in Lake Erie was typical of that throughout the Great Lakes, being dominated by oligochaete worms *Stylodrilus heringianus* and tubificids and the amphipods *Diporeia spp* (Table 41). Together, these represented over 80% of the total biomass. Nevertheless, after the invasion of dreissenid mussels in the 1990s, the production was dominated by dreissenids (Fig.78).

Figure 77: Lake Erie Bottom Surface Sediments



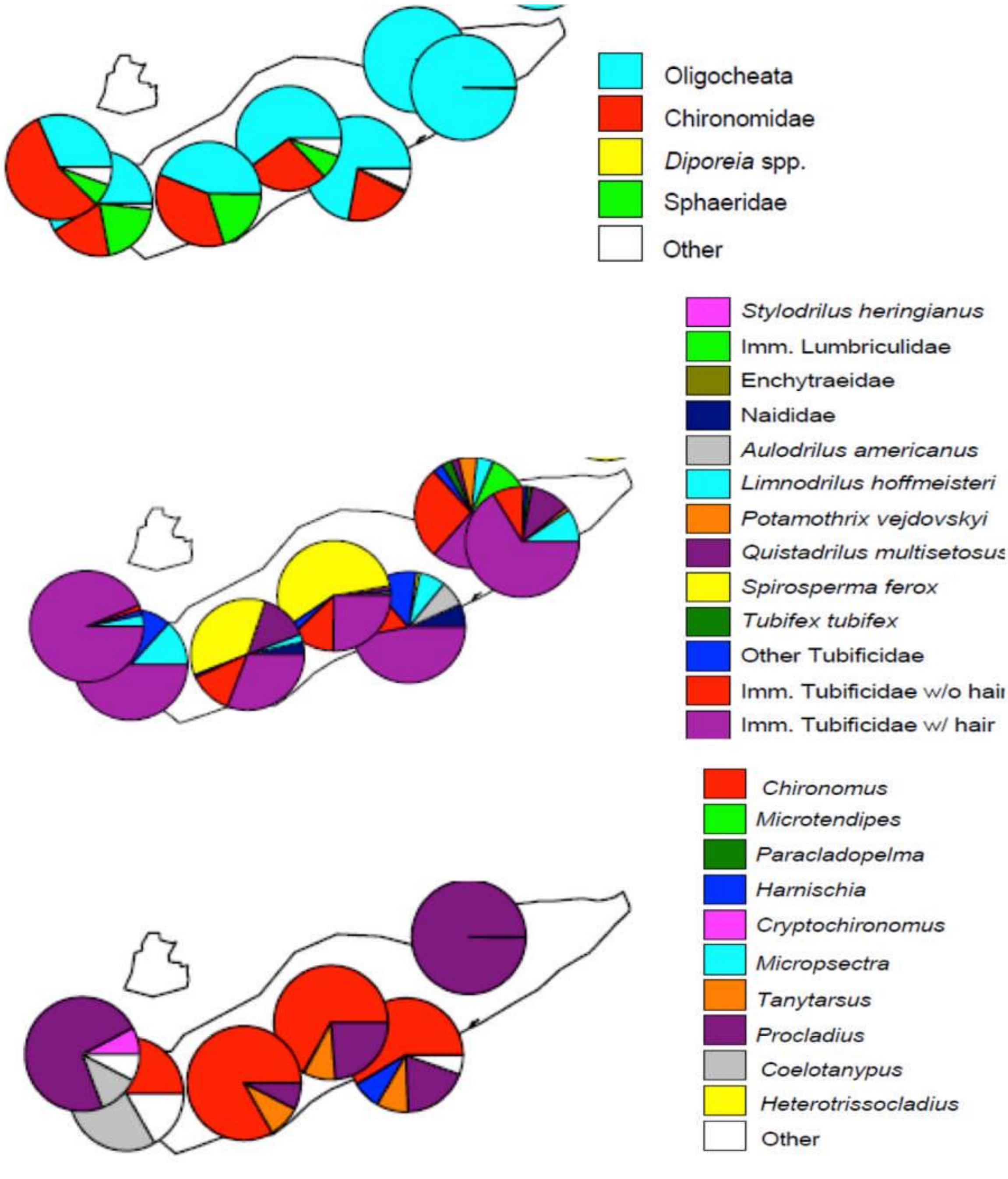
Source: Bolsenga & Herdendorf 1993.

Table 41: Benthic Biomass (wet wt g/m^2) of Main Macroinvertebrates: Selected Stations of L. Erie 1993

	W1		W3		WC1		WC2		E2		E3	
Species	Biomass	S.E.	Biomass	S.E.	Biomass	S.E	Biomass	S.E.	Biomass	S.E.	Biomass	S.E.
Nematoda	0.064	0.030	0.081	0.018	0.022	0.010	0.129	0.028	0.155	0.020	0.171	0.030
Platyhelminthes/ Nemertea	0.001	0.001	0.187	0.104	0.050	0.031	0.075	0.055	0.074	0.029	0.392	0.072
Oligochaeta	4.002	0.989	4.068	0.831	1.649	0.426	6.647	1.185	12.593	1.555	3.906	0.440
Hirudinae	0.094	0.033	0.752	0.153	0.010	0.007	0.022	0.022	0.004	0.004	0.090	0.064
Amphipoda	0.050	0.025	0.925	0.585	0.112	0.106	0.002	0.002	0.000	0.000	3.573	0.926
Isopoda	0.000	0.000	0.000	0.000	0.066	0.059	0.000	0.000	0.000	0.000	0.030	0.030
Ostracoda	0.286	0.046	0.076	0.018	0.105	0.053	0.129	0.022	0.143	0.021	0.055	0.016
Harpacticoida	0.222	0.031	0.109	0.019	0.005	0.002	0.070	0.013	0.021	0.006	0.177	0.047
Ephemeroptera	0.009	0.006	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
Trichoptera	0.031	0.031	0.038	0.021	0.000	0.000	0.000	0.000	0.000	0.000	1.669	0.553
Chironomidae	1.630	0.781	0.299	0.081	1.445	0.827	12.311	1.583	0.114	0.054	2.653	0.479
Gastropoda	0.014	0.009	0.655	0.273	0.291	0.125	0.000	0.000	0.001	0.000	1.623	0.139
Sphaeriidae	0.188	0.046	0.148	0.057	0.008	0.005	1.206	0.127	0.091	0.048	0.039	0.011
Dreissena polymorpha	64.800	64.416	624.100	249.577	347.633	161.073	0.263	0.218	0.552	0.366	115.382	52.370
Dreissena bugensis	0.000	0.000	0.001	0.001	416.490	171.374	5.147	3.875	264.005	81.157	246.287	63.893
Total *Dreissena*	64.800	65.599	624.101	254.033	764.120	244.812	5.410	3.995	264.557	79.321	361.669	111.460
% Quagga	0.0	—	0.0	—	54.5	—	95.1	—	99.8	—	68.1	—
Total Benthos	71.393	66.669	631.440	250.533	767.884	247.250	26.002	5.630	277.753	83.414	376.050	113.823
% *Dreissena*	90.8	8.2	98.8	6.9	99.5	9.4	20.8	5.9	95.2	0.9	96.2	1.6

Source: Johansson *et al*. 2000

Figure 78: Benthic Invertebrate Composition (% abundance, counts/m2) in GLNPO-EPA 1999 survey; top=overall composition, middle=oligochaetes, low= chironomids



Source: Barbiero & Tuchman 2002

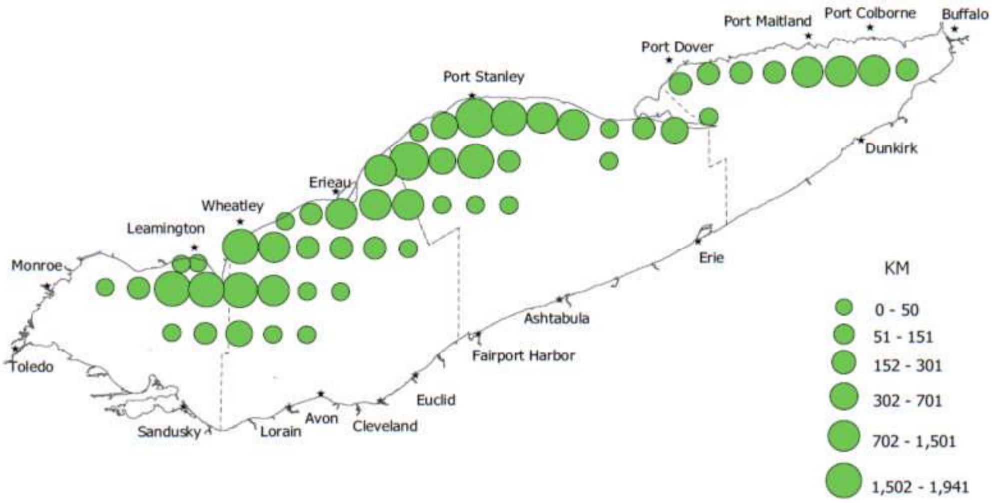
4.5.3 Outcome

Yellow perch

Ontario Gill Net

The Canadian gill net commercial fishery targeting Yellow perch operates from Lake Erie coastal areas to the international boundary, with most of the effort distributed in shallow waters of the western and central basins (Fig. 79).

Figure 79: Yellow perch Gill Net: Distribution of Effort 2012 (km*10-min grid)



Source: YPTF 2013

Direct habitat structure effects

Substratum where the gill net fishery targeting Yellow perch operates corresponds to sandy sediments, varying from sand to mud. Within the candidate fishery, these bottom habitats are potentially impacted by deployed anchors and lead lines when gear is set near the bottom. There was no evidence presented during the site visit that indicated that impacts of the gill net fishery had been evaluated to determine quality and quantity of potential impacts.

Despite lack of information on habitat effects of the fishing gear, it is highly unlikely that the fishery is reducing habitat structure and function to a point of serious or irreversible harm. The fishing method does little damage to physical or biogenic habitats. The gill net fishing gear used in the commercial Yellow perch fishery does not have a significant physical interaction with the lake bottom. Anchors which hold the nets are set every time in a different place and weigh about 20 lb and cover an area of 0.5 m^2. Gill nets have a very low to medium impact on bottom habitat depending on where they are placed in the water column (Morgan & Chuenpagdee 2003). Gill nets are set in soft bottoms where abundant and diverse macro-invertebrate communities are found but organisms would not be displaced or be significantly disturbed by the gear. The only organisms that could potentially become in contact and be damaged with the gear are unionids, native freshwater mussels, which are found in the bottom of the lake. There is no information to evaluate such interactions.

Indirect effects

The loss of nets is reported. During the site visit different opinions were presented by Canadian and US stakeholders. While few cases of lost gill nets were reported for Canada, stakeholders from the US fishery indicated that the problem was more prevalent along US shores where nets are more often found than in Canadian shores. The settlement of dreissenids on lost nets, adding weight and grounding the lost structures, was reported to decrease the potential for ghost fishing. There should not be significant effects of lost nets on habitat structure. Lake Erie habitat has been classified relative to the distribution of Yellow perch in subareas. These are considered in quota allocations. Suitable areas for Yellow perch as considered by the YPTG are shown in Fig. 80.

Ontario Trap Net

Direct Effects

Substratum where the trap net fishery operates corresponds to sandy sediments, varying from sand to mud. Within the candidate fishery, these bottom habitats are potentially impacted when gear is set near the bottom. There was no evidence presented during the site visit that indicated that impacts of the trap net fishery had been evaluated to determine quality and quantity of potential impacts. Despite lack of information on habitat effects of the fishing gear, it is highly unlikely that the fishery is reducing habitat structure and function to a point of serious or irreversible harm. The fishing method does little damage to physical or biogenic habitats. The only organisms that could potentially become in contact and be damaged with the gear are unionids, native freshwater mussels, which are found in the bottom of the lake. There is no information to evaluate such interactions.

Trap nets are of variable size. A typical small mesh trapnet across the trap net fishery targeting Yellow perch would have average dimensions of 11 m (36 ft) in length, 7 m (24 ft) in width and 3 m (10 ft) in height. These dimensions are of the net itself, not including the lead that extends out for about 90 m to guide fish into the net. (Personal Communication, T. Hartman ODNR). Thus the area covered by each net is about 80 m2. Targeted distribution of effort for the small mesh trap net fishery targeting Yellow perch is concentrated in offshore areas > 7 m in depth.

Indirect effects

Indirect effects have not been identified in the fishery.

Walleye

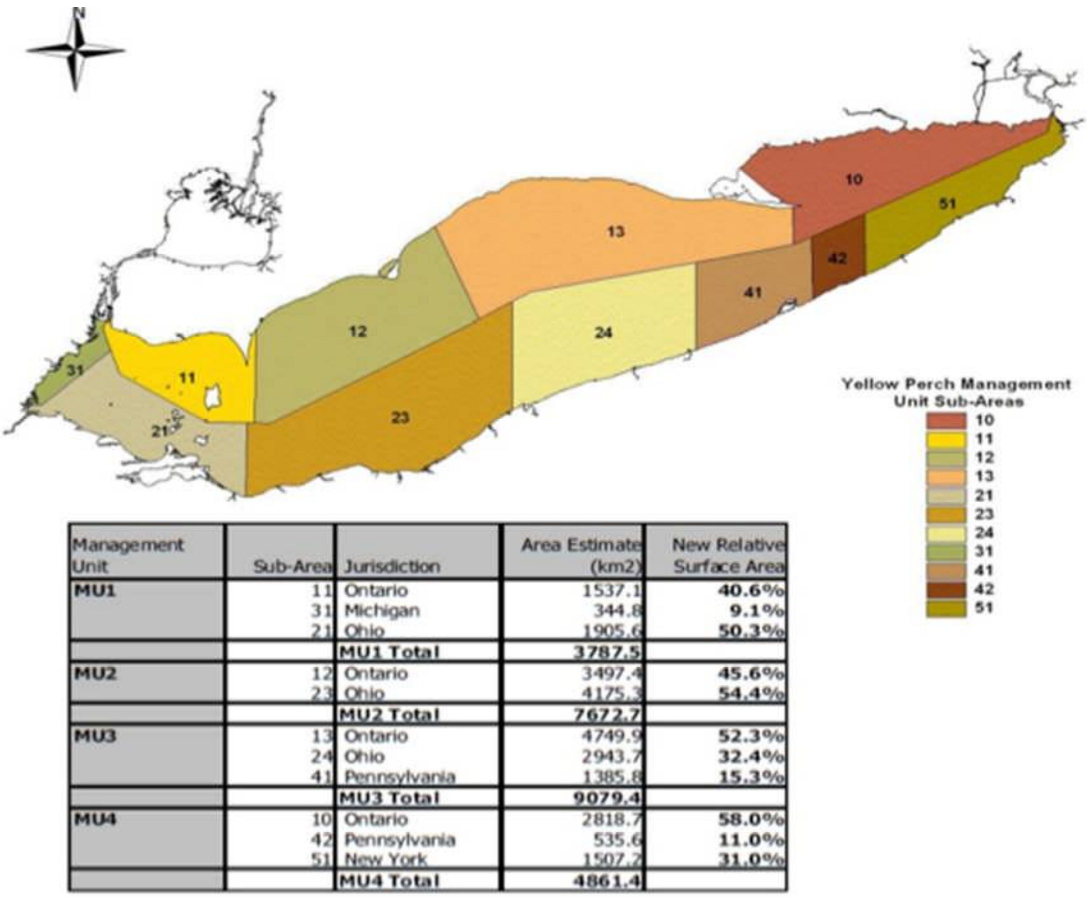
Gill Net

The Canadian large mesh gill net commercial fishery operates from Lake Erie coastal areas to the international boundary, with most of the catch generated in shallow waters of the western basin.

Direct effects

The large mesh gill net commercial fishery operates mostly in waters of the western basin and also in QZ2 and QZ3 when targeting White bass, where substratum corresponds to sandy sediments, varying from sand to mud. Within the candidate fishery, these bottom habitats are potentially impacted by deployed anchors and lead lines when gear is set near the bottom. There was no evidence presented during the site visit that indicated that impacts of the gillnet fishery had been evaluated to determine quality and quantity of potential impacts.

Figure 80: Yellow perch Gill Net: Calculations of sub-unit areas in the YPTG MUs



Management Unit	Sub-Area	Jurisdiction	Area Estimate (km2)	New Relative Surface Area
MU1	11	Ontario	1537.1	40.6%
	31	Michigan	344.8	9.1%
	21	Ohio	1905.6	50.3%
		MU1 Total	3787.5	
MU2	12	Ontario	3497.4	45.6%
	23	Ohio	4175.3	54.4%
		MU2 Total	7672.7	
MU3	13	Ontario	4749.9	52.3%
	24	Ohio	2943.7	32.4%
	41	Pennsylvania	1385.8	15.3%
		MU3 Total	9079.4	
MU4	10	Ontario	2818.7	58.0%
	42	Pennsylvania	535.6	11.0%
	51	New York	1507.2	31.0%
		MU4 Total	4861.4	

Source: YPTF 2013

Despite lack of information on habitat effects of the fishing gear, it is highly unlikely that the fishery is reducing habitat structure and function to a point of serious or irreversible harm. The fishing method does little damage to physical or biogenic habitats. The canned gill net fishing gear used in the commercial Walleye fishery in Lake Erie does not have a significant physical interaction with the lake bottom. Gill nets have a very low to medium impact on bottom habitat depending on where they are placed in the water column (Morgan & Chuenpagdee 2003). Gill nets are set in soft bottoms where abundant and diverse macro-invertebrate communities are found but organisms would not be displaced or be significantly disturbed by the gear.

The only organisms that could potentially come in contact and be damaged with the gear are unionids. There is no information to evaluate such interactions. This assessment has reviewed potential interactions in the ETP section as many of the unionid species are endangered.

Indirect effects

There is reporting of lost nets. During the site visit different opinions were presented by Canadian and US stakeholders. While few cases of lost nets were reported for Canada, the problem was reported by stakeholders to be more prevalent along US shores where nets are more often found. The settlement of dreissenids on lost nets, adding weight and grounding the lost structures, was reported to decrease the potential for ghost fishing. There should not be significant effects of lost nets on habitat structure.

4.5.4 Management

Introduction

MSC requires that if necessary there is a strategy in place designed to ensure that the fishery does not pose a risk of serious or irreversible harm to habitat types.

Overview

If fisheries pose potential threats on habitat structure, the HTG should incorporate this issue in their work. The strategic research direction (Environmental Objectives EOs) describes ecological conditions necessary for realizing FCOs. As part of a strategic approach to habitat management, the Habitat Task Group (HTG) proposes to summarize current state, trends, and potential threats for each of the EOs to better understand the types of research questions and answers that will be required by LEC to achieve the FCOs (HTG 2013).

Yellow perch

Ontario Gill Net

It is expected that the fishery would likely have minimal impact on the habitats of Lake Erie from anchoring the gear on the lake bottom and lost gear. Accordingly, within the current management regime there are no restrictions on gear usage specifically to mitigate potential or perceived habitat impacts on benthonic organisms. There are rules established in the conditions of licence that restrict location and timing for commercial fishing with gill nets and some are to minimize loss of gear. For example all gill nets must be retrieved within 8 days of being set during the period January 1st to March 31st and December 15th to December 3st.

Trap Fishery

It is expected that the Ohio trap net fishery would likely have minimal impact on the habitats of Lake Erie caused by the gear on the lake bottom. Accordingly, within the current management regime there are no restrictions on gear usage specifically to mitigate potential or perceived habitat impacts on benthonic organisms.

The general law establishes regulations that protect habitat from commercial fisheries. These include that it is unlawful to set a net within 1/4 mile of an island or the mainland bordering Lake Erie from June 15 through September 15. As yellow perch nets are set in deeper waters this is unlikely to affect the directed fishery. One cannot lay out or set a net of any kind in any Channel between islands or an island and the mainland at a distance from the shore of such islands or mainland greater than one-fourth the distance across such channel. Also it is unlawful to set a net within 1/4 mile of a reef from March 1 through May 10. Set fishing gear may not be left unattended for more than five days. It is unlawful to set a net or trot line on a reef at any time. Also, commercial fishing gear is not permitted in numerous defined zones of Lake Erie:

If fisheries pose potential threats on habitat structure, the HTG should incorporate this in their work programme. The strategic research direction for Lake Erie's EOs describes the ecological conditions necessary for realizing FCGOs. As part of a strategic approach to habitat management, the HTG is proposing to summarize the current state, trends, and potential threats for each of the EO in order to better understand the types of research questions and answers that will be required by LEC to achieve the FCGOs (HTG 2013).

Walleye

Gill Net

It is expected that the Ontario canned gill net fishery under consideration would likely have minimal impact on the habitats of Lake Erie from the anchoring of the gear on the lake bottom and by lost gear. Management does not restrict gear usage specifically to mitigate potential or perceived habitat impacts on benthonic organisms. Rules are established in the conditions of licence that restrict location and timing for commercial fishing with gill nets and some are to minimize loss of gear. For example all gill nets must be retrieved within 8 days of being set during the period January 1st to March 31st and December 15th to December 3st. Similar to other fisheries in Lake Erie, if fisheries pose potential threats on habitat structure HTG would consider this in their activities.

4.5.5 Information

Overview

A significant amount of work has been completed on habitat description by HTG. Several projects have been implemented by HTG that involve on-going, long term or annual programs that track habitat conditions within various regions of the lake. A bi-national mapping project is in place to support and provide information to the Lake Erie Lakewide Management Plan as well as to provide an inventory of the status and trends in the quantity and quality of fish habitat in all basins of the lake. Lake bottom types have been mapped. Projects involving monitoring or evaluation of habitat, developing rehabilitation strategies, and habitat rehabilitation have been implemented (Table 42). The US EPA Great Lakes National Program Office (GLNPO) conducts annual surveys of the Laurentian Great Lakes including monitoring of benthic invertebrates.

Table 42: Lake Erie Summary of Habitat Projects

Basin	Number of Projects
Western basin	10
Western and Central basin	3
Central basin	11
Central and Eastern basin	7
Eastern basin	15
Entire Lake Erie basin	11
Huron-Erie corridor	19

Source: Report to the Lake Erie Habitat Task Force 2013.

HTG is continually involved in further development and improvement of a Lake Erie GIS database. The database includes information on biological, chemical and physical data and ecological characteristics from Canada and the US. LEGIS has been incorporated into a larger initiative, the Great Lakes Aquatic Habitat Framework (GLAHF). The GLAHF is a GIS database of geo-referenced data for Great Lakes coastal, large river mouth, and open water habitats. The goal of the GLAHF is to develop a Great Lakes aquatic habitat database and classification framework to integrate and track data from habitat monitoring, assessment, indicator development, ecological forecasting, and restoration activities across the Great Lakes (http://ifrgis.snre.umich.edu/projects/GLAHF/glahf.shtml).

The Lakebed Alteration Decision Support Tool (LADST) is a research project to develop software and data to assist resource managers in making siting decisions for lakebed-altering projects in the Great Lakes. The project brings interactivity to bear upon the problems related to spatial planning. Users of the system can create their own suitability maps in an online tool, based upon suitability criteria of their own choosing. There is ongoing work within the area of the fishery to map habitat types, which when overlaid with information on the spatial extent, timing, and location of fish can offer an understanding of the impacts of the fishery on habitat in Lake Erie.

Yellow perch

Gill Net

In addition to efforts described in the overview section**,** HTG was charged with assisting WTG in identifying metrics related to Walleye habitat for the purpose of re-examining the extent of suitable adult Walleye habitat in Lake Erie. This effort adds information relevant to habitat where the Yellow perch fishery operates. There are no specific research projects to evaluate potential effects of fisheries on habitat structure or benthic biodiversity.

Trap Net

In addition to efforts described in the overview section, the ODNR continues to collect high resolution habitat mapping information on selected features in the western and central basins using commercially available side-scan sonar (ODW 2013). Nevertheless, there are no specific research projects to evaluate potential effects of fisheries on habitat structure or benthic biodiversity.

Walleye

Gill Net

In addition to efforts described in the overview section**,** HTG was charged with assisting WTG in identifying metrics related to Walleye habitat for the purpose of re-examining the extent of suitable adult Walleye habitat in Lake Erie. This information may ultimately be used to quantify the amount of preferred adult Walleye habitat by jurisdiction, thereby providing LEC with an alternate way to allocate fishery quota for Walleye. Presently, quotas are allocated proportionally based on surface area of waters less than or equal to 13 m deep by jurisdiction. This strategy, adopted in 2008, reflects an effort to utilize advances in GIS and LEGIS. There are no specific research projects to evaluate potential effects of fisheries on habitat structure or benthic biodiversity.

4.6 Ecosystem

4.6.1 Introduction

The ecosystem component considers the broad ecological community and ecosystem in which the fishery operates and addresses system-wide issues primarily impacted indirectly by the fishery, including ecosystem structure, trophic relationships and biodiversity. This component is meant to address the cumulative effects of the fishery on the broader ecological community and ecosystem, in contrast to fishery impacts on specific species addressed above as retained, by-catch or ETP. The three performance indicators for the ecosystem components verify if: i) the fishery causes irreversible harm to key components of the ecosystem, ii) confirms that there are measures in place to ensure that the fishery does not pose a risk of serious or irreversible harm, and iii) that there is adequate knowledge of the impacts of the fishery on the ecosystem (MCS 2013).

Background

Information presented in this section on Ecosystem background applies to Ontario Yellow perch and Walleye gill net fisheries as well as to the Ohio Yellow perch trap net fishery.

The fish community in Lake Erie has changed significantly since the mid-1800's due in part to ecosystem changes in the Lake. Stressors include over exploitation of fish resources, watershed deforestation, exotic species invasion, contaminants, dams, deterioration of tributary streams, losses of wetland habitat, and nutrient enrichment and the reversal of nutrient enrichment. Steep declines or extirpations of important terminal predators and native planktivores, along with the invasion and success of non-native species, has contributed to the instability of the fish community, leading to unpredictable and dynamic assemblages of fish species.

While over exploitation is cited as a historical contributing factor to the decline of some species in Lake Erie, including Lake sturgeon and cisco (Lake herring), current main pressures on the system have been identified as exotic species, habitat destruction and loss, shoreline development and alteration, agricultural and industrial practices, atmospheric contaminant deposition from outside the basin and global climate change (Environment Canada and US Environmental Protection Agency, 2005).

4.6.2 Outcome

Yellow perch

Ontario Gill Net

The main direct effects of the Yellow perch fishery and indirect effects of by-catch removals by the gillnet fishery on the ecosystem function is from cascading effects through the food web on prey and predators. Serious or irreversible harm in relation to the capacity of the ecosystem to deliver ecosystem services could include trophic cascade caused by depletion of top predators. Yellow perch is a key species in the Lake Erie ecosystem through its role in the food web as prey on main ecosystem predators. It consumes benthic invertebrates, including dreissenids, and also forage fish species. The species is one of the main prey of predators such as Walleye, and fishery removals could affect Walleye populations. The species is also part of cormorant diets. In the context of significant ecosystem changes that have occurred in Lake Erie, it is very difficult to qualitatively or quantitatively define those which may have resulted from the Yellow perch fishery.

With respect to effects of the commercial Yellow perch gill net fishery on the ecosystem trophic structure via removals of other species in the catch, effects will vary according to the magnitude of the removals relative to population size of the other species and their dynamics. The composition of other species in the catch is highly diverse. Although for some of these species there is monitoring and catch quotas, for others F is not well known, and overall understanding of the effects of the fishery on the broader ecosystem is poor. The largest weight among retained and discarded species in the catch corresponds to White perch, which is an invasive species, and thus removals might benefit ecosystem functioning.

Unlike many other aquatic ecosystems which have experienced regime shifts, Lake Erie fisheries still harvest Yellow perch and top-predators in the ecosystem. This suggests that there are mechanisms in the ecosystem which provide more resilience to fishing "down the food chain". (A. Debertin, Unintended consequences of shared fisheries on fish population sustainability: a food-web model approach to sympatric fish species in Lake Erie, www.cfrn-rcrp.ca). Fisheries resources are shared between Canadian commercial gillnet fisheries managed based on closed-quota system for Yellow perch, and American trap net and open-access sports fisheries targeting larger-sized individuals of the same species. Although there seem to be stability in the Lake Erie food web which could provide sustainability to the Yellow perch stocks as well as other ecosystem components despite removals by the candidate fishery, overfishing, habitat deterioration and invasive species have proven to be capable of collapsing fisheries.

Conflicting anecdotal information was collected during the course of the site visit about the loss of gill nets and associated threat of ghost net fishing in Lake Erie. The issue would not necessarily be associated with the Yellow perch fishery as other gill net fisheries operate in the area.

Ohio Trap Net

The main direct effects of the trap net fishery and indirect effects of non-target species removals by the fishery on the ecosystem function is from cascading effects through the food web on prey and predators. Serious or irreversible harm in relation to the capacity of the ecosystem to deliver ecosystem services could include trophic cascade caused by depletion of top predators. Yellow perch is a native key species in the Lake Erie ecosystem through its role in the food web as prey of main ecosystem predators. There is a limited number of main and other retained species that may be important ecosystem components as prey and predator. Nevertheless in the context of significant ecosystem changes that have occurred in Lake Erie, it is very difficult to qualitatively or quantitatively define those which may have resulted from a specific fishery. Although for some of these species there is monitoring and catch quotas, for others fishing mortality is not well known, and overall understanding of the effects of harvest of retained species on the broader ecosystem is poor.

With respect to effects of the trap net fishery on the ecosystem trophic structure via removals of released by-catch, effects will vary according to the magnitude of the removals relative to population size of the by-catch species and their dynamics. Although there are supposed to be no discards as fish should be released before lifting the gear, there is no information to estimate potential mortality associated with the operation.

Walleye

Ontario Gill Net

This performance element is difficult to evaluate. The main direct effects of the Walleye gillnet fishery and indirect effects of by-catch removals by the fishery on the ecosystem function is from the potential for cascading effects through the food web on prey and predators. Serious or irreversible harm in relation to the capacity of the ecosystem to deliver ecosystem services could include trophic cascade caused by depletion of top predators. Walleye is a key species in the Lake Erie ecosystem through its role in the food web as top predator. Nevertheless in the context of significant ecosystem changes that have occurred in Lake Erie, it is very difficult to qualitatively or quantitatively define those which may have resulted from the Walleye fishery. Walleye are considered to be critically important to the ecology of Lake Erie even when their role in community-structuring has been reduced in recent years as the populations have moved into deeper waters, due to increased transparency of the water column, and replaced Blue pike which were extirpated in the 1970s (LaMP 2008; Roseman *et al*. 2008).

In Lake Erie, Walleye diet is mostly made of up Gizzard shad in the western region and smelt in the east (Anonymous 2010). In addition, when normal prey is scarce, Walleye have been known to become cannibalistic. In recent years round gobies, which have spread throughout Lake Erie, have become a significant prey source for Walleye and other lake predators (LaMP 2008). White perch are known to commonly prey on Walleye eggs during the spawning season, while Channelcatfish, Johnny darter, Quillback, rock bass, round goby, sculpin, silver chub, spottail shiner, trout perch, White sucker and Yellow perch also feed on Walleye eggs to a lesser extent (Roseman *et al*. 2006). Walleye make up a large portion of cormorants diets, and this predation has been linked to declines in sub adults elsewhere (Rudstam *et al*. 2003).

With respect to effects of the commercial Walleye fishery on the ecosystem trophic structure via removals of other species, these will vary according to the magnitude of the removals relative to population size of the species and their dynamics. Composition of the catch is highly diverse. Although for some of these species there is monitoring and catch quotas, for others F is not well known, and overall understanding of the effects of the fishery on the broader ecosystem is poor. In particular the catch includes several forage species that are largely discarded such as Freshwater drum and gizzard shard.

Fisheries resources are shared between Canadian commercial gillnet fisheries and the Walleye fisheries is managed based on closed-quota system and harvesting mostly catch mid-sized Walleye, and American open-access sports fisheries targeting larger-sized individuals. Although there seem to be stability in the Lake Erie food web which could provide sustainability to the Walleye stock as well as other ecosystem components despite removals by the candidate fishery, overfishing, habitat deterioration and invasive species have proven to be capable of collapsing fisheries. Such was the case of the Blue pike, not only fishery collapsed but the species is now biologically extinct in this lake (Ryan *et al.* 2003).

There is conflicting anecdotal information collected during the course of the site visit about the loss of nets and associated threat of ghost fishing in Lake Erie. The issue would not necessarily be associated with the Walleye fishery as other gill net fisheries operate in the area.

4.6.3 Management Strategy

Yellow perch

Ontario Gill Net

Although there are several measures in place within the fishery that would minimize ecosystem fishery direct impacts on the target species, there are no measures that consider ecosystem impact from Yellow perch removals by the fishery on trophic structure. Although a food web ecosystem model is available for Lake Erie, fishery management has not been used it to evaluate allowable catch for the main species in the commercial fishery.

There are some regulations in place on indirect effects of ghost fishing. There is mandatory reporting of lost nets, as a means of decreasing the potential for ghost fishing. Also, conditions of licence issued for commercial fisheries in Lake Erie require that all harvesters fishing with gill nets between January 1 and March 15 have a GPS tracking device installed that is functional for the entirety of the fishing trip. GPS monitoring not only tracks fleet activity but also adds accountability in the fleet. Additional monitoring during the winter months is considered a deterrent for setting in icy conditions, when there is a greater risk of losing gear. In addition, it is a means by which it can be ensured that nets are hauled, and that lost nets are reported. Similarly, the conditions of licence requires that any lost or stolen nets during any time of the year are reported, so that effort can be made to recover the gear, minimizing the impacts of ghost fishing and other ecosystem impacts associated with lost fishing gear.

Ohio Trap Net

Although there are several measures in place within the yellow perch trap net fishery that would minimize ecosystem fishery direct impacts on the target species, there are none that consider ecosystem impact from removals by the fishery on trophic structure. Food web ecosystem models available for Lake Erie have not been used for fishery management and to evaluate effect of catch for the main species by Lake Erie fisheries.

Walleye

Ontario Gill Net

Although there are several measures in place within the Walleye gill net fishery that would minimize ecosystem fishery direct impacts, there are no measures in place that consider ecosystem impact from Walleye removals by the fishery on trophic structure. Although a food web ecosystem model is available for Lake Erie, fishery management has not been used it to evaluate allowable catch for the main species in the commercial fishery.

There are some regulations in place to limit potential indirect effects of ghost fishing. There is mandatory reporting of lost nets. Also, conditions of licence issued for commercial fisheries in Lake Erie require that all harvesters fishing with gill nets between January 1 and March 15 have a GPS tracking device installed that is functional for the entirety of the fishing trip. GPS monitoring not only tracks fleet activity but also adds accountability in the fleet. Additional monitoring during the winter months is considered a deterrent for setting in icy conditions, when there is a greater risk of losing gear. In addition, it is a means by which it can be ensured that nets are hauled, and that lost nets are reported. Similarly, the conditions of licence requires that any lost or stolen nets during any time of the year are reported, so that effort can be made to recover the gear, minimizing the impacts of ghost fishing and other ecosystem impacts associated with lost fishing gear.

4.6.4 Information & monitoring

Significant ecosystem work has been conducted in Lake Erie which provides an adequate understanding of key ecosystem functions, and from which the impact of the fishery on these functions can be inferred. Ongoing research and monitoring continually contributes to ecosystem understanding, and would likely detect changes in ecosystem functioning over time.

Several research projects have been completed and on-going projects being conducted in Lake Erie which contribute to the knowledge and understanding of the lake's ecosystem. LaMP was developed and implemented to focus on monitoring and measuring ecosystem health, identifying stressors responsible for impairments, implementation of programs to deal with impairments and evaluating the effectiveness of existing programs in resolving stress on the system though continual monitoring. The role of LaMP is to restore chemical, biological and physical integrity as outlined in the Great Lakes Water Quality Agreement (Lake Erie Lakewide Management Committee, 2008).

Since 1994 there has been a State of the Lakes Ecosystem Conference (SOLEC) hosted by the United States EPA and Environment Canada every two years in response to reporting requirements of the bi-national GLWQA. The aim of the agreement is to restore and maintain physical, chemical and biological integrity of the waters of the Great Lakes Basin Ecosystem. Through the analysis of the state of the ecosystem using science based indicators programs are evaluated (Government of Canada and the US Environmental Protection Agency, 2008). The conferences are intended to report on the state of the Great Lakes ecosystem, and the major impacting factors, in addition to providing a forum for the exchange of information amongst Great Lakes decision makers. The state of the ecosystem report considers contaminant loading, status of biotic communities, presence and impact of invasive species, habitat issues, human health related indicators, land use and land cover, resource utilization and climate change. Each year the conference focuses in on a specific issue, contributing to the knowledge base of that ecosystem component in the Great Lakes. The conference addresses issues of all Great Lakes, including Lake Erie.

There is a lower trophic and limnological sampling in the western and central basins as a cooperative effort between ODNR, Ohio State University and FTG. Data collection includes temperature, dissolved oxygen, water clarity, chorophyll –a, and zooplankton. The annual assessment of Nearshore Fish Community (FSGRO2) was started in 2007 by the ODNR in the western basin to assess the composition and abundance of the nearshore habitat. The survey started using a trawl but was changed for electrofishing and trap nets. The trophic function of non-indigenous Ponto-Caspian species in re-engineering the eastern Lake Erie food web was investigated using stable isotopes (Campbell *et al.* 2009). Key Ponto-Caspian invaders in the study are quagga mussels, an amphipod *Echinogammarus ischnus* and the round goby.

Further, there have been some efforts in building ecosystem models. There is an ecological model that couples hydrodynamics and detailed food web of lower trophic levels (EcoLE, Zhang *et al.* 2008). Further, there are models for the food web in the Lake Erie central basin implemented using the Ecopath and Ecosim approach (Christensen & Pauly 2002, Christensen *et al.* 2004). These are models of food webs developed worldwide that consider trophic structure, energy flows, and integrate aspects previously described and allow exploring the effects of fishing at the ecosystem level. Many of the studies were motivated by declines in Lake Erie stocks, and to quantify the role of fisheries and invasive species on the declines. Models for Lake Erie have not been yet used to evaluate the effect of harvest and by catch on ecosystem functioning.

To implement ecosystem models, OMNR has invested resources in collecting and compiling data on many of Lake Erie food web components and conducted analysis to develop a modelling framework; but results are currently unavailable (Zhu & Johnson unpublished and report not available for distribution). Currently, scientists at NOAA-Great Lakes Environmental Laboratories are building upon those efforts and have developed a Lake Erie EwE model

(E. Rutherford personal communication). The model is being used to predict the effects of potential invasion of Asian carp in the ecosystem and will soon be published. Also a model is being developed at the University of Guelph (Unintended consequences of shared fisheries on fish population sustainability: a food-web model approach to sympatric fish species in Lake Erie, doctoral dissertation, A. Debertin). Given the importance of food web interaction in Lake Erie, it seems necessary to implement food web models to undertake a formal ecosystem approach to management.

5 PRINCIPLE THREE: MANAGEMENT SYSTEM BACKGROUND

5.1 Introduction

This section covers: (i) Governance and policy aspects of the fishery under assessment with the aim of assessing the broad, high-level context of the fishery management system for the fishery under consideration; and (ii) the fishery specific management system i.e. that relating to the Lake Erie fisheries for Yellow perch and Walleye.

5.2 The Context of the Fishery Management System

5.2.1 Legal and / or Customary Framework

The Legal System

International

Management of the Yellow perch and Walleye fisheries are based national (Canadian and U.S.) regulations in the context of an over arching framework for bi-national cooperation cooperation between agencies and stakeholders for Great Lakes resource management including the shared resources of Lake Erie.

Roseman *et al* note that:

> *"Governance of the Lake Erie Walleye and Yellow perch fisheries is complex. The process involves multiple jurisdictions, diverse stakeholders (e.g., commercial industry, recreational fishers, charter boat industry) with different interests (e.g., profit versus recreational benefits), varying approaches to harvest monitoring and fishery regulation, all combined with highly variable ecological and stock conditions. The complexity of the interagency fishery management system mirrors the complexity of the environmental and sociological issues on Lake Erie*"

Initial examples of cooperation were the International Waterways Commission (1905) and the consequent Boundary Waters Treaty and the International Joint Commission (IJC); the latter consists of six commissioners; three each from the U.S. and Canada.

To coordinate the maintenance of Great Lakes fisheries, the GLFC was established in 1955 by the Canadian / U.S. Convention on Great Lakes Fisheries. The 1980 JSP for Management of Great Lakes Fisheries, was signed by each of the state, provincial, federal, and tribal natural resource agencies in the Great Lakes basin. Individual lake committees, that comprise representatives from each agency, implement the strategic plan. Hence, bi-national FCOs for each of the Great Lakes are achieved through management programs (such as stocking and regulations) developed and implemented by individual jurisdictions. Five individual lake committees are the major action arms for implementing the strategic plan and developing operational procedures (Roseman *et al*).

> "*the lake committees and the Council of Lake Committees have addressed a wide variety of issues critical to a healthy Great Lakes ecosystem. The GLFC plays a pivotal role in the implementation of the JSP through facilitation of the lake committees. Without the GLFC in its facilitation role, it is highly unlikely that interjurisdictional fisheries management would occur efficiently, if at all*".

LEC is the bi-national committee of state and provincial fisheries agencies operating under the auspices of GLFC that manages fish communities and fisheries in Lake Erie. Involved agencies are the Michigan Department of Natural Resources (MDNR), the New York State Department of Environmental Conservation (NYSDEC), ODNR, OMNR, and the Pennsylvania Fish and Boat Commission (PFBC). LEC uses the JSP to guide management of internationally shared resources.

United States

In the U.S., FWS is the national government agency concerned with the management of fish, wildlife, and natural habitats. FWS' stated mission is "*working with others to conserve, protect, and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people*." http://www.fws.gov/help/about_us.html. It works to protect the interests of endangered species, migratory birds, and interjurisdictional fishery resources, such as the Lake trout and Lake sturgeon, and supports the States and other Federal agencies with population and habitat inventories. Its two main obejctives are: to assist in the development and application of an environmental stewardship ethic based on ecological principles, scientific knowledge of fish and wildlife, and a sense of moral responsibility; and guide the conservation, development, and management of the Nation's fish and wildlife resources.

The Endangered Species Act of 1973 is designed to protect critically imperiled species from extinction as a "*consequence of economic growth and development untempered by adequate concern and conservation*." The Act is administered by FWS and the National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA). FWS and NMFS are required to create an Endangered Species Recovery Plan outlining the goals, tasks required, likely costs, and estimated timeline to recover endangered species. Section 6 of the Endangered Species Act provides funding for development of programs for management of threatened and endangered species by state wildlife agencies. The States list endangered and threatened species within their boundariesand these often include species which are considered endangered or threatened in a specific state but not within all states, and which therefore are not included on the national list of endangered and threatened species.

The Fish and Wildlife Coordination Act (1934) protects fish and wildlife when federal actions result in the control or modification of a natural stream or body of water.

The Lacey Act (1900) protects plants and wildlife by creating civil and criminal penalties for those who violate the rules and regulations. It prohibits trade in wildlife, fish, and plants that have been illegally taken, possessed, transported or sold.

The USA shares jurisdiction of four of the five Great Lakes with Canada. FWS coordinates activities with Canadian Federal agencies and provincial agency counterparts including Ontario. The U.S. Department of State assists all U.S. Federal agencies as they address Great Lakes issues of concern to both countries. GLNPO coordinates U.S. efforts with Canada under GLWQA to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem, which includes Lakes Superior, Michigan, Huron, Erie, and Ontario. GLNPO brings together federal, state, tribal, local, and industry partners under the strategic framework of the Great Lakes Restoration Initiative (GLRI) to accomplish the objectives of GLRI action plan which in turn fulfills the aims of the GLWQA. It also informs the Canada-Ontario Agreement (COA) Review Committee (soon to be replaced by the COA Management Committee) about matters related to water quality and fishery resources.

ODNR has jurisdiction over more than 120,000 acres of inland waters and 7,000 miles of streams, as well as Ohio's portions of Lake Erie and the Ohio River. Among its responsibilities, ODNR manages fish resources. The Division of Wildlife promotes hunting and fishing opportunities in the state while it protects and improves wildlife resources, including fish, through law enforcement, research programs, improvement of habitat, and establishment of native species. The Law relating to fisheries in Lake Erie is contained in the Ohio Revised Code (Chapter 15.33) (http://codes.ohio.gov/orc/1533) e.g. 1533.342 DCRs, 1533.343 on VMS, 1533.349 trap net specifications.

Canada

The British North America Act (1867), now the Constitution Act (1867), vests the legislative authority for the protection and conservation of seacoast and inland fisheries to the Parliament of Canada. This was formally confirmed in 1868 with the Fisheries Act providing for a Minister of Marine and Fisheries to exercise responsibility.

The "*Canadian Code of Conduct for Responsible Fishing Operations*" (DFO 1998) outlines the general principles and guidelines for all commercial fishing operations that take place in Canadian waters based on the FAO "*Code of Conduct for Responsible Fisheries*". As such the principles and guidelines[4] form the basis for fishery management planning on a national basis. The most important principle relates to the need for fish harvesters to take appropriate measures to ensure fisheries are harvested and managed responsibly to safeguard sustainable use of Canada's freshwater and marine resources and their habitats for present and future generations of Canadians, the importance of ecological sustainability and shared responsibility for stewardship, the need to implement and comply with regulations, the promotion of public awareness of the need for responsible fishing, the use of fishers' knowledge in generating scientific advice and developing fishery management policies and regulations.

Since 2006, DFO has initiated various activities with the intent to place conservation and sustainable use of the fishery as a top management priority. In 2009, DFO adopted the Sustainable Fisheries Framework (SFF) that "*provides the basis for ensuring Canadian fisheries are conducted in a manner which support conservation and sustainable use*" (DFO 2012a). The SFF "*provides the foundation of an ecosystem-based and precautionary approach to fisheries management in Canada with new tools and policies being developed and implemented progressively over time*".

SARA (2003) provides a framework for actions across Canada to promote the survival of wildlife species and the protection of the natural heritage. It sets out how to decide which species are a priority for action and what to do to protect a species. It identifies ways governments, organizations and individuals can work together, and it establishes penalties for failures to obey the law. Two federal Ministers are responsible for the administration of SARA. The Minister of Fisheries and Oceans is the competent Minister for aquatic species. The Minister of the Environment is the competent Minister for all other species at risk, including those found in national parks, national historic sites and other protected heritage areas. The Minister of the Environment is also responsible for the overall administration of SARA. SARA protects the plants and animals included on a list in Schedule 1; which is also referred to as the List of Wildlife Species at Risk. Candidate species are proposed for addition to the SARA List as a result of the work of the scientists and conservationists who are members of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). They conduct scientific assessments of the status of species. Community and Aboriginal traditional knowledge are included in species assessments when available. The Government decides which species are added to the SARA List.

The management authority for specific fisheries issues is delegated to Canadian Provinces.

OMNR's authority for managing fish and their habitats in Lake Erie is based on a range of legislation (OMNR 2014) including: Federal Fisheries Act; Ontario Fishery Regulations; Ontario's Fish and Wildlife Conservation Act; Ontario's Endangered Species Act; and additional federal and provincial policies and national and international agreements that assist OMNR in achieving its mandate to manage Ontario's fisheries resources.[5]

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[4] For example, guideline 1 states "*Apply sustainable fishing principles and sustainable fisheries development to all aspects of fish harvesting and management of fisheries*" and guideline 5 is "*Establish fisheries policies in full consultation with management and other regulatory agencies to ensure conservation of fish resources and protection of the environment*".

[5] *Inter alia* Our Sustainable Future: A Renewed Call to Action (2011); Ontario's Biodiversity Strategy (2011); Ontario Invasive Species Strategic Plan (2012); Strategic Plan for Ontario Fisheries (SPOF and SPOF II) (1976, 1992); Strategic Policy for Ontario's Commercial Fisheries (2011); Canada –Ontario Agreement: Respecting the Great Lakes Basin Ecosystem, Ontario's Great Lakes Strategy (2012).

Resolution of Disputes & Court Challenges

GLFC has a dispute resolution mechanism. The original plan relied on GLFC to provide non-binding arbitration in the settlement of disputes between jurisdictions. Signatories to the JSP agreed to seek consensus when management practices may affect other jurisdictions. If consensus cannot be achieved, the revised plan allows for independent third-party mediation (Isbell).

> "*In 2003 LEC announced its intention to cut 2004 quotas in the case of Walleye by 40-60%, well before the 2003 fish stock data was available. Ontario fishermen saw this as a clear admission that the annual data analysis process was a mere formality used to justify political decisions that had no scientific basis. Yellow perch and Walleye were hatched in record numbers in 2003, but U.S. state fish regulatory agencies refused to admit the relevance of the 2003 data to the 2004 decision making process, further fuelling resentment among Ontario commercial fishermen. OMNR insisted that LEC revisit the 2003 TAC decision. The U.S. agencies, led by the ODNR, forced Ontario into a mediation process adjudicated by the Great Lakes Fishery Commission. The mediation process ultimately failed to produce a resolution, although cuts to the Walleye TAC ended up being somewhat lower in 2004 than had been called for in 2003*" (http://wikileaks.org/cable/2008/02/08TORONTO58.html).

In relation to the same issue, Haeffer writes:

> *".. dispute provisions were outlined in the Joint Plan. The Plan is non-binding, and the GLFC has no authority or mechanism to punish offenders – it can only rely on consensus. So, the GLFC set out to mediate the situation and repair bonds. The GLFC called for a conflict resolution meeting in which each side was permitted to debate the issue. In essence, they were facilitating the development of working relationships within the LEC with the Joint Strategic Plan serving as common ground. The compromise was not between managers and the commercial fishery, it was among LEC representatives. The agenda was to develop trust in working relationships is critical to implement agreements, especially non-binding agreements. In the end, the Committee compromised on a 30% cut. It was announced publicly at the next regularly scheduled meeting".*

In the United States there is a well defined procedure for challenging the decisions by authorities. Examples are:

- *Sea Watch International et al v. Mossbacher* (alleging serious economic harm from the new ITQ management plan for surf clam and quahog) (Meilander & Sullivan 1999);
- *Alliance against ITQs v.Brown* (1996); sablefish and Pacific halibut fisheries (Meilander & Sullivan 1999);
- *State of Connecticut v. US Department of Commerce* (2005) (the constitutionality of part of the MSA);[6]
- *Center for Biological Diversity v. Evans*, 2005 WL 1514102 (N.D. Ca. 2005) (The United States District Court for the Northern District of California agreed that NMFS had violated the Endangered Species Act and its own Recovery Plan for the Right Whale by failing to designate critical habitat).[7]
- In April, 2009 "*US District Judge Edward Harrington granted NMFS' motion to dismiss a civil case brought by the states of Massachusetts and New Hampshire; they argued a 2006 regulatory scheme known as Framework 42 was illegal and too restrictive*".[8]
- In 2008, Defenders of Wildlife, The Humane Society of the United States and Ocean Conservancy challenged NMFS's failure to protect and recover the North Atlantic right whale as required by the ESA and the MMPA.[9]

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[6] http://www.ctd.uscourts.gov/Opinions/051805.DJS.Connecticut.pdf
[7] http://www.meyerglitz.com/wildlife.html
[8] http://www.gloucestertimes.com/fishing/x645322800/Fed-judge-reinstates-fishing-regs/print
[9] http://www.defenders.org/newsroom/press_releases_folder/2008/06_26_2008_whale_advocates_file_suit_to_protect_endangered_whales_from_ship_collisi

In 2008 (http://www.outdoornews.com/January-2008/Commercial-fishing-group-sues-over-net-regulations/):

> *"A lawsuit challenging the constitutionality of Ohio's amended Senate Bill 77, which went into effect Oct. 10 and aims to more tightly monitor the activities of the state's Lake Erie commercial fishermen, has been filed in U.S. District Court in Toledo. The suit was filed by a new commercial group, Great Lakes Commercial Fishermen, LLC, … ODNR has proposed various restrictions against commercial fishermen with the purpose of limiting and/or eliminating the industry. These regulations, if allowed, will have a significant effect on society with higher costs for industry workers as well as consumers."*

In Canada the Minister of Fisheries and Oceans has broad discretionary powers and the decisions are often the result of balancing interests, backed by strong public policy (Lawseth). This also applies to the responsible Minister in the Province. The Federal and Provincial management system is well defined by the legislation and FMPs. Disputes can be proactively resolved through the management arrangements that seek improved compliance with regulations and safer fishing practices and put in place joint scientific, monitoring, and enforcement programmes.

The ultimate appeal of last resort is to the Minister of Ontario Natural Resources and the Minister of Fisheries at the Federal level. These are the final authorities under Canadian legislation. Where parties are not satisfied with the decision of the Minister they have the right to redress through the Federal Court and Federal Court of Appeal system. There have been some examples of this at the Federal level: ((*R. v. Sparrow*, [1990],[10] *R. v. Marshall (No. 1)* [1999],[11] and *R. v Larocque* [2006][12]; and the Ecology Action Centre Society v Attorney General of Canada[13]. The confirmation of FN rights points to DFO compliance with binding judicial decisions. The Canadian Government's Aboriginal Fisheries Strategy (AFS) was established in 1992 to implement the Supreme Court of Canada's "Sparrow Decision". In response to that decision, DFO implemented the Initial Marshall Response Initiative in 2000. In 2001, DFO introduced the longer-term Marshall Response Initiative.

> "*After the GLFC mediation failed, Ontario's commercial fishermen formally appealed the 2004 Lake Erie Walleye quotas to Ontario's Fish and Wildlife Conservation Act Hearing Officer. In his report to the Minister of Natural Resources, the Hearing Officer wrote, "...my opinion is that the current Walleye quotas for Lake Erie are unsupported by the data available at the hearing, and are therefore not reasonable for the conservation of fish." Then-Ontario Minister of Natural Resources … cited obligations to the LEC process in his justification for not unilaterally increasing Ontario's TAC. Ontario commercial fisherman subsequently argued that the province has inappropriately handed over its responsibility to manage fish stocks to the LEC*" (http://wikileaks.org/cable/2008/02/08TORONTO58.html).

Haeffer writes:

> "*While the judge recommended improvements in the Lake Erie Committee, particularly to make their data available to the industry, he ruled in favor of the decision to implement the 30% reduction in TAC. Since then, the Ontario commercial fisheries have relied on the strategy of suing the Committee when they disagree, but they have never won a case. The failure of commercial fisheries to persuade the courts to rule on their side implies*

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[10] 1 S.C.R. 1075 was adecision of the Supreme Court of Canada concerning the application of Aboriginal rights under section 35(1) of the Constitution Act, 1982. The Court held that Aboriginal rights, such as fishing, that were in existence in 1982 are protected under the Constitution of Canada and cannot be infringed without justification on account of the government's fiduciary duty to the Aboriginal peoples of Canada. http://en.wikipedia.org/wiki/R._v._Sparrow

[11] The Court held in the first decision that catching and selling of eels was valid under 1760 and 1761 treaties between the Mi'kmaq and Britain, and that federal fishery regulations governing a closed fishing season and the regulating and the requirement of licenses to fish and sell the catch would infringe the treaty right. In the second decision the Court elaborated the extension of Aboriginal treaty rights stating that they are still subject to Canadian law. http://en.wikipedia.org/wiki/R._v._Marshall. http://reports.fja.gc.ca/eng/1999/1999fc24617.html

[12] It was ruled that the Minister of Fisheries and Oceans did not have the power to finance his Department's scientific research by issuing licences to fish and sell snow crab. http://www.fishharvesterspecheurs.ca/product/larocque-supreme-court-decision

[13] http://reports.fja.gc.ca/eng/2005/2004fc1087.html

support from the Provincial government, and this has ultimately strengthened the authority of Canadian officials while confirming the value of consensus in the LEC process".

In September 2007, two Lake Erie fishermen announced that they were taking the Ontario government to court on behalf of Ontario's commercial fishing industry to challenge how fishing quotas are set. Their suit alleged that LEC was favouring the U.S. sports fishing industry at the expense of Ontario's commercial fishing industry.[14]

Legal Rights

International

The assessment team was told that there are no aboriginal / First Nation fishing in Lake Erie.

Where there are fishery rights these are considered withing the GLFC. For example, the Great Lakes Indian Fish & Wildlife Commission (GLIFWC)

> "*represents eleven Ojibwe tribes in Minnesota, Wisconsin, and Michigan who reserved hunting, fishing and gathering rights in the 1837, 1842, and 1854 Treaties with the United States government. GLIFWC provides natural resource management expertise, conservation enforcement, legal and policy analysis, and public information services in support of the exercise of treaty rights during well-regulated, off-reservation seasons throughout the treaty ceded territories. GLIFWC is guided by its Board of Commissioners along with two standing committees, the Voigt Intertribal Task Force and the Great Lakes Fisheries Committee, which advise the Board on policy*" (http://www.glifwc.org).

United States

While National Standard 8[15] relates specifically to the Magnusson Stevens Act and FMPs in marine fisheries,[16] it can be taken to show the overall approach to respecting the legal rights of customary users. Specifically for the Great Lakes:

> "*Through long standing treaties, Native Americans in the region maintain their rights to fish in the waters of the Great Lakes. Treaty rights pertaining to hunting and fishing are very similar to modern-day property rights. Retaining certain rights when land is sold is a common practice. A property owner might decide to sell land, but retain some property right, such as an easement or mineral rights*" (http://www.great-lakes.net/teach/envt/fish/fish_2.html).

Canada

In Canada, the Aboriginal Fisheries Strategy (AFS) of 1992 provides the framework for the management of fisheries in compliance with the Sparrow decision. DFO negotiates annual agreements with Aboriginal groups that provide communal food, social and ceremonial fishing opportunities, co-operative management arrangements and economic development opportunities. Commercial communal licences have been provided to Aboriginal groups under the Allocation Transfer Programme. (DFO 2003). Together, the bi-national, federal, and nonfederal management agencies approach. the Great Lakes from the same general perspective and with the same goals in mind. Ontario is "*committed to fulfilling its constitutional obligations with respect to aboriginal and treaty rights incluing obligations to consult and where appropriate accommodate*". (ODNR 2011). One of the aims of Ontario policy is to balance

[14] http://wikileaks.org/cable/2008/02/08TORONTO58.html
[15] http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/documents/national_standard_8_cfr.pdf
[16] "*conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities*".

"*the interests of stakeholders, including those of sport, commercial, and tribal fisheries, the environmental community, and many others*". A goal is "*Informed and engaged stakeholders, partners, Aboriginal communities and members of the public*" (Dunlop).

Gaden *et al* (2009)

> "*Canadian First Nations do not have direct management authority in their treaty waters, as courts have ruled provincial and federal regulations do not inherently deny tribal access to fish. In the 1990 case R. v. Sparrow (R. v. Sparrow 1990), the court, while explicitly recognizing and affirming Aboriginal treaty rights, nevertheless held that fishing regulations were established to manage fisheries, not to limit Aboriginal rights, and that federal regulatory authorities to manage fisheries were valid. In the Canadian waters of the Great Lakes, Ontario manages on behalf of the First Nations, though the province negotiates fishery management agreements with the First Nations*".

5.2.2 Consultation, Roles & Responsibilities

Roles & Responsibilities

As described by Gaden *et al* (2009)

> "*Three levels of government are involved in Great Lakes fishery governance: (1) The nonfederal governments (states, the Province of Ontario, and the two U.S. intertribal agencies); (2) the U.S and Canadian federal governments; and (3) the bi-national Great Lakes Fishery Commission. Combined, fourteen jurisdictions—and many more agencies and departments within those jurisdictions—have some role in the Great Lakes fishery, though the non-federal agencies have primary management authority; the authority to regulate harvest, stock fish, and enforce fishery regulations. Despite the large number of jurisdictions, the role of each type of jurisdiction is defined, accepted, and respected, and the management authorities tend to complement, not contradict or duplicate, each other*".

In Erie primary management authority rests with the four states and the province of Ontario.

> "*This non-federal management authority is found in constitutions and common law, and was recognized long ago by courts and tradition. Provinces own the fish in their inland waters, though the British North America Act (the Canadian Constitution) makes management somewhat confusing by suggesting that inland fishery management authority rests with both the provinces and the federal government. To work through this awkward situation, Ontario and the federal government have established a working arrangement whereby Ontario develops fishery conservation regulations and then refers these regulations to the federal government for incorporation into the Ontario Fisheries Regulations under the federal Fisheries Act. The province of Ontario then implements the regulations*".

While there are different agencies and departments, to a large extent they carry out cooperative activities that are coordinated by GLFC and LEC.

International

Great Lakes Commission

The U.S. and Canada maintain the GLFC that was initially established to respond to the invasive lamprey problem. Apart from lamprey, the treaty charged GLFC to coordinate fisheries research on the Great Lakes and making recommendations about fish stocks of common concern. Subsequently the role was strengthened with responsibility for the implementation of the JSP. In relation to Walleye and Yellow perch, one of the two main responsibilities of GLFC is to develop coordinated programs of research on the Great Lakes, and, on the basis of the findings, to recommend measures which will permit the maximum sustained productivity of stocks of fish of common concern.

(http://www.glfc.org/aboutus/brief.php#mission).

Council of Lake Committees

CLC addresses issues from a basin wide perspective by coordinating activities between the individual Lake Committtees and support them in identifying and achieving their shared goals and objectives. Each lake committee may have a technical committee and task groups tasked with specific parts of the fishery. These comprise professionals from government and academia that decide on data (needs, collection and interpretation) and provide advice to their respective lake committees. Scientists, assessment biologists, and managers participate in the technical committees. The committees and groups hold regular meetings.

Lake Erie Committee

LEC comprises fishery managers from MDNR, NYSDEC, ODNR, OMNR, and PFBC. LEC's purposes are to: consider issues pertinent to, or referred by, the GLFC; consider issues and problems of common concern to member agencies; develop and coordinate joint programs and research projects; and serve as a forum for state, provincial, tribal, and federal agencies. Decisions are reached by consensus; when this cannot be achieved, the views of all agencies are described in the LEC report. LEC developed the FCOs to guide the development of strategies and management actions within a framework of sound ecological concepts and basic guiding principles. LEC supports the maintenance of mesotrophic conditions across much of Lake Erie, believing that the ecosystem "*will provide optimal environmental conditions for a more balanced, stable, and predictable fish community with maximum potential benefits for fisheries*" (Roseman *et al* 2009). Each year it recommends TACs for Walleye and Yellow perch that are sustainably harvested by sport and commercial fishers. The individual agencies implement the allocation of their share of the TAC. LEC uses the JSP to guide management decisions

Standing Technical Committee

The LEC STC consists several inter-jurisdictional technical working groups, including the YPTG and the WTG, to carry out stock assessment surveys, population modeling, and exploitation strategy modeling that provide LEC with annual harvest recommendations.Under the JSP, LEC makes the final decisions on Yellow perch and Walleye TACs in the spring of each year. A surface area sharing formula is used to determine each jurisdiction's share of the TAC, also known as an agency quota, and each agency determines allocation of their agency quota among sport and commercial fisheries.

> "*As stipulated in the JSP, all decisions are consensus-based and nonbinding, yet agencies have consistently adhered to TAC decisions. This reflects a commitment to responsible management and a common goal of maintaining healthy fish community from which all parties can derive benefits. For the most part, committee members share a high level of trust between agencies and individuals on the committees, and also have developed a level of respect and trust with their stakeholders*". (Roseman *et al*).

Walleye Task Group.

WTG was formed in 1980. As the other TGs below, it consists of fisheries scientists from state, provincial, federal and university agencies conducting research on Lake Erie. It addresses charges from LEC relevant to Walleye management in Lakes Erie and St. Clair and connecting waters and is dedicated to employing the best science in order to support international management of Walleye on Lake Erie. WTG adheres to the following principles: sustainability of Lake Erie Walleye component stocks, their fisheries, harvests, and a broad distribution of benefits; wise use of the Lake Erie Walleye resource to promote its health for the future. The primary objectives of WTG are to: describe the status of Walleye stocks in Lake Erie; and provide sound scientific advice and background material to LEC for the annual allocation process. The WTG annual work programme is covered below.

Yellow perch Task Group.

YPTG addresses charges from the LEC relevant to Yellow perch management in Lakes Erie and St. Clair and connecting waters. The YPTG annual work is covered below.

Cold Water Task Group.

Formed in 1980, CWTG addresses charges from LEC relevant to cold water fisheries management. The species covered are Burbot, Lake whitefish, cisco and the stocked and naturalized trout and salmon species. Additionally CWTG monitors sea lamprey control and assessment activities and progress in the Lake Erie basin. The CWTG annual work programme is covered below.

Forage Task Group.

FTG, formed in 1986, addresses charges from LEC relevant to forage fish issues/management. The FTG annual work programme is covered below.

Habitat Task Group.

HTG addresses charges from LEC relevant to fisheries habitat issues/management. The HTG annual work programme is covered below.

The Lake Erie Percid Management Advisory Group

LEPMAG: See below.

Michigan State University Quantitative Fisheries Center

QFC seeks to provide a research, outreach/service and teaching program to: build greater capacity within fishery management agencies in quantitative methods; improve quantitative methods for assessing fish stocks; assist agencies to use model-based approaches in decision making; anddevelop a better understanding of fish community and population dynamics. The LEC agencies are sustaining partners of the QFC.

Lakewide Action and Management Plans

Under GLWQA, Canada and U.S. agreed to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. This has led to the definition of Lakewide Action and Management Plans (LAMPs) for each lake. The Lake Erie LAMP identified ecosystem goals and objectives and assessed the state of the lake. Through the development of issue related strategies, it identifies actions required to restore and protect the lake and evaluate the effectiveness of those actions. It is coordinated by a committee of water quality and natural resource managers from Canada and U.S., with participation from federal, provincial, state and local governments.

United States

The ODNR manages sport and commercial fisheries within the 2.24 million acres of Lake Erie under Ohio's jurisdiction. Fisheries personnel are based at Sandusky and Fairport Harbor Fisheries Research Units (ODNR 2014).

Canada

OMNR works with a wide variety of partners, environmental organizations, private resource sector industry, fish and game associations, researchers, and other government agencies to support sustainability. The defined principles for managing Ontario's natural resources include: seek to understand natural and ecological systems; promote the use of adaptive management and an ecosystem approach to manage risk; exercise precaution and special concern for the ecological, social and economic value of nature; recognize there are thresholds for ecosystem resilience when making planning and management decisions; conserve environmental health by mitigating negative impacts and restoring degraded environments; balance competing public interests to enable long-term sustainability of Ontario's natural resources through integrated decision-making; and achieve outcomes through measuring and evaluating results.

The Lake Erie Management Unit (LEMU) of OMNR is the body responsible for management of the fishery resources of, *inter alia*, the Ontario waters of Lake Erie. LEMU achieves this through annual fisheries assessment, enforcement and management activities.

OCFA, formed in 1945, contributes to the knowledge and management decisions of the two fisheries. It was originally formed as an advocacy association for commercial fishermen, but has grown to perform a number of additional administrative and operational fisheries assessment functions under contractual agreements with the OMNR. These include the Lake Erie Partnership Indexing Fishing Survey, development and collection of royalty billing and the entry and collation of data derived from the daily catch reports from across the province. Through employment of weight observers the OCFA is also involved in monitoring commercial fish landings throughout the province.

<u>Consultation Process</u>

<u>International</u>

The Lake Erie Percid Management Advisory Group

Locke writes:

> "*Walleye (Sander vitreus) and Yellow perch (Perca flavecens) in Lake Erie support one of the most valuable freshwater fisheries in the world, including commercial food fish, charter boat, and recreational fisheries. As members of LEC, four US states and Ontario share the management of these fisheries within a cooperative framework. Vocal stakeholder groups in all jurisdictions ensure that management agencies are always balancing sustainable harvest with stakeholder expectations. Over 15 years, this has resulted in increasingly rancorous communication between stakeholders and agencies. This included challenges to the science of exploitation policy setting and government decision making authority through quasi-judicial hearings, judicial review, and international arbitration. To solve this problem and achieve balance between stakeholder interests, the LEC has implemented a new process for making allocation decisions. This process relies on third party facilitation to implement structured decision analysis and (MSE) to develop and evaluate population models, population/exploitation targets and exploitation polies. This is done within a transparent process involving stakeholders at every step*".

In reviewing the development of LEPMAG, Haeffer writes:

> "*The LEC is seeking a more formal role for all stakeholders in quota decisions, not governance per se, which is bound by statutes that differ among agencies. Stakeholders have always been able to make recommendations for the LEC to consider when setting quotas. This new effort formalizes this process, ensuring more explicit involvement in understanding the scientific uncertainties, potential policies and outcomes, when making their recommendations… This process has been effective in helping stakeholders understand what it takes to craft policy options amidst competing interests. In similar kinds of processes, participants have become advocates for new data collection procedures and take ownership by volunteering data that they have collected. Often, they become cautious proponents of the scenario planning process - cautious because it is still a very new idea and models always present uncertainties, but proponents, because it has worked so far*".

LEC 2014 notes

> "*LEPMAG was convened in 2010 and serves as the primary method to incorporate stakeholder needs and objectives into the Lake Erie Yellow perch and Walleye decision-making process. LEPMAG consists of senior representatives from all provincial and state jurisdictions on the lake, recreational fishers, commercial fishers, and other interested organizations. Through LEPMAG, fishery managers and stakeholders work together to identify the harvest policies for Lake Erie percids that meet the needs of all stakeholders while maintaining stability in the percid fishery. MSU'S QFC facilitates the LEPMAG process. Walleye are now being fully managed through the recommendations and population objectives developed through LEPMAG. This will be documented by the LEC as they draft and complete the revised Walleye Management Plan this year. The main focus of LEPMAG will now shift to developing population objectives and harvest strategy development for Yellow perch in Lake Erie. This process is expected to take approximately two years*."

In 2010 – 13 LEPMAG held 12 meetings where participants identified common goals and stakeholders provided direct advice to LEC on Walleye management objectives, alternatives, and the evaluation of trade-offs between various management options (also see above). Scientists presented stakeholders with details on the assessment programs, data sources, stock assessment model, and HS. In February 2012, a Technical Review Panel, comprised of modeling and fisheries management experts, reviewed the statistical catch at age stock assessment model and made recommendations for LEPMAG to consider on potential improvements within the stock assessment model.

In February 2013, QFC wrote (http://www.cfrn-rcrp.ca/article75):

> "*At the most recent meeting the LEPMAG reached consensus on several recommendations for changes to the assessment model used to inform decisions about Walleye harvest in Lake Erie, and on adoption of a reference-point based harvest policy for the future. These recommendations were shared with the Lake Erie fishery managers at this meeting. The group did not reach consensus on a new HCR, but urged managers to use LEPMAG's deliberations to inform their decisions about quotas for Walleye harvest in 2013 and going forward. LEPMAG participants have expressed strong support for the value of this process for increasing transparency in the management process and thereby building greater trust among managers and stakeholders. The group is now shifting their attention to Yellow perch and will be meeting to discuss this fishery several times during the coming year, following the same approach as has been taken for Walleye*".

In December 2013, after a review of the data, presentation of analyses, and comments and suggestions by stakeholders on the Walleye assessment model and HCR, LEC announced that WTG would use an updated recruitment integrated Walleye assessment model.

United States

In Ohio a Lake Erie Improvement Association investigates and reports on specific issues. At the assessment workshop in October 2013, stakeholders reported that they were fully consulted by ODNR and had the opportunity to present their views to personnel. They are encouraged to participate in the LEPMAG process.

Canada

DFO's legislated mandate in fresh waters includes: management and control of the fisheries; and conservation, protection and restoration of fish and fish habitat. This is implemented through agreements with provincial and territorial governments and other federal departments and this results in the shared stewardship of freshwater resources result. A fundamental aspect of policy and its implementation is confirmation of roles and responsibilities for freshwater fisheries management. For its part, the federal government sets national standards for fish habitat management; conduct scientific research to provide information for the conservation, restoration and development of fish habitats; and promote and encourage the participation of the public and private sectors and other interests in integrated resource planning and conservation of fish habitats. (DFO 1999).

In 2012, DFO concluded that in the Integrated Fisheries Resource Management Program Activity the *engagement of stakeholders in harvest decision-making is significant and includes annual consultations with stakeholders on management plans. However, few fisheries (29%) evaluated the effectiveness of the stakeholder engagement process as effective, and no official surveys have been undertaken to determine the effectiveness of national stakeholder feedback*". (DFO 2012a) The DFO Fishery Checklist indicated that there is a good governance regime to manage fisheries including stakeholder participation.[17]

LEMU consults regularly on emergent and long-term fisheries issues with resource management partners through the Lake Erie Program Committee (LEPC) that comprises commercial, sport fishers, charter (recreational) operators, bait fishers, processors and First Nations representatives (OMNR 2008 (b)). Although all groups may not be involved directly in the fishery they are invited to attend the three to four annual committee meetings, and participate actively in discussion and decisions and provide input on what positions the LEMU should take at an international level (Devitt *et al* 2010).

OCFA plays an important role in terms of stakeholder consultation for Lake Erie fisheries.

In early 2014, there was an extended public consultation period on the draft of the new fishery strategy for Ontario (see below) so that stakeholder views may be taken into consideration in the final document.

ECO issues http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies reports:

> "*OMNR recognizes the importance of open and transparent policy development. MNR recently released the Strategic Policy for Ontario's Commercial Fisheries which sets the framework for the development of future operational policies and procedures. It details the goal, guiding principles and objectives of a well-managed, sustainable commercial fishery. Ontario will engage Aboriginal communities, organizations and key stakeholders in the development of future operational commercial fishing policies*".

5.2.3 <u>Long Term Objectives</u>

<u>International</u>

The JSP for Management of Great Lakes Fisheries was ratified in June 1981 (GLFC 2007).

> "*In formulating the original plan, the parties acknowledged that mandated and other legal responsibilities under which their agencies operated could not be abridged. In 1986, the parties undertook a review of the original plan, and the resultant findings were disseminated by the fishery commission. The review did not result in any textual changes to the body of the original plan, but it did provide for the addition of two parties. In 1995, the parties …. agreed to a second review of the progress in implementing the original plan .. this … resulted in changes to the body of the original plan. The impetus for another review was driven in part by a perceived need to better coordinate fishery and environmental management, especially with the (LaMP) process called for in the (GLWQA) and by a need to refine the procedures for settling conflicts between agencies*".

As detailed by Ryan *et al* the JSP directed each lake committee to prepare a set of fish-community objectives for their respective Great Lakes. Within the JSP, the following common goal was established:

[17] In 2008, the Checklist reported that stakeholders had the opportunity to participate in the collection of information for 100 stocks (92%), in decision making for 97 stocks (89%) and in the stock assessment process for 80 stocks (73%). The 2009 Checklist reported that stakeholders have the opportunity to participate in the collection of information for 117 stocks (97.5%), in decision making for 114 stocks (95.0%) and the stock assessment process for 93 stocks (77.5%). However, there is no process in place to evaluate the effectiveness of the engagement with stakeholders.

“*To secure fish communities, based on foundations of stable self-sustaining stocks, supplemented by judicious plantings of hatchery-reared fish, and provide from these communities an optimum contribution of fish, fishing opportunities and associated benefits to meet needs identified by society for: wholesome food, recreation, cultural heritage, employment and income, and a healthy aquatic ecosystem*”.

GLWQA (1978 amended 1987) has the objective to "*restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem.*" One of the programs designed to reach the goals of GLWQA is having a LaMP for each lake to "*embody a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses...in open lake waters*." The aim of the Lake Erie LaMP is to restore and protect the beneficial uses of Lake Erie.

Roseman *et al* write

> “*LEC believes that maintenance of mesotrophic conditions across much of Lake Erie will provide optimal environmental conditions for a more balanced, stable, and predictable fish community with maximum potential benefits for fisheries. These attributes clearly point to harmonic percid communities in the western, central, and nearshore waters of the eastern basins as the logical starting points for developing fish-community goals and related objectives. Accordingly, the LEC endorses, in principle, the mesotrophic concept …. the restoration and perpetuation of a cool-water community of organisms dominated by a balanced and harmonic percid community in which the Walleye is the dominant predator. Where suitable conditions exist, salmonid or centrarchid species will be appropriate secondary components of the harmonic percid community*”.

Ryan *et al* 2003 “*demonstrate the linkages between the Fish Community Goals and Objectives and the Environmental Objectives*” (Roseman *et al*).

- Lake Erie Goals
    - To secure a balanced, predominantly cool-water fish community, with Walleye as a key predator in the western basin, central basin, and the near-shore waters of the eastern basin, characterized by self-sustaining indigenous and naturalized species that occupy diverse habitats, provide valuable fisheries, and reflect a healthy ecosystem.
    - To secure a predominately cold-water fish community in the deep, offshore waters of the
    - Eastern basin with Lake trout and Burbot as key predators.
- Fish Community Objectives
    - Ecosystem Conditions: Maintain mesotrophic conditions (10-20 µg·L-1 phosphorus) that favor a dominance of coolwater organisms in the western, central, and nearshore waters of the eastern basins; summer water transparencies should range from 3-5 m (9.75-16.25 ft) in mesotrophic areas.
    - Productivity and Yield: Secure a potential annual sustainable harvest of 13.6-27.3 million kg (30-60 million lb) of highly valued fish.
    - Nearshore Habitat: Maintain nearshore habitats that can support high quality fisheries for smallmouth bass, northern pike, muskellunge, Yellow perch, and Walleye.
    - Riverine and Estuarine Habitat: Protect and restore self-sustaining, stream-spawning stocks of Walleye, White bass, Lake sturgeon, and rainbow trout.
    - Western Basin: Provide sustainable harvests of Walleye, Yellow perch, smallmouth bass, and other desired fishes.
    - Central Basin: Provide sustainable harvests of Walleye, Yellow perch, smallmouth bass, rainbow smelt, rainbow trout, and other desired fishes.
    - Eastern Basin: Provide sustainable harvests of Walleye, smallmouth bass, Yellow perch, Lake whitefish,

rainbow smelt, Lake trout, rainbow trout, and other salmonids; restore a self-sustaining population of Lake trout to historical levels of abundance.

- Fish Habitat: Protect, enhance, and restore fish habitat throughout the watershed to prevent degradation and foster restoration of the fish community.
- Genetic Diversity: Maintain and promote genetic diversity by identifying, rehabilitating, conserving and/or protecting locally adapted stocks.
- Rare, Threatened, and Endangered Species: Prevent extinction by protecting rare, threatened, and endangered fish species (e.g. Lake sturgeon and Lake herring) and their habitats.
- Forage Fish: Maintain a diversity of forage fishes to support terminal predators and to sustain human use.
- Food Web Structure: Manage the food web structure of Lake Erie to optimize production of highly valued fish species. Recognize the importance of Diporeia sp. and Hexagenia sp. as key species in the food web and as important indicators of habitat suitability.

Ohio

Of the 41 policies in the Ohio Coastal Management Program number 27 relates to fisheries management.

> "*it is the policy of the state of Ohio to assure the continual enjoyment of the benefits received from the fisheries of Lake Erie and to maintain and improve these fisheries by: a. regulating the taking of fish (O.R.C. 1531.08 and O.A.C. 1501:31); b. prosecuting persons responsible for stream litter and for water pollution resulting in fish kills (O.R.C. 1531.29 and 1531.02); c. protecting fish habitat through Ohio EPA's section 401 water quality certification authority (O.R.C. 6111.03(o) and 6111.03(p) and O.A.C. 3745-1 and 3745-32); d. considering the protection of fish habitat through the review of state and federal permit applications; e. establishing state wildlife areas for fish and wildlife habitat (O.R.C. 1531.06); f. surveying fish populations and trends and conducting other fishery research studies; g. providing access to the fishery; and h. providing technical and general information about the Lake Erie fisheries*".

The long term objective of Ohio fisheries policy is part of its overall approach to conservation as presented in the Strategic Plan 2011 – 30 (ODNR 2010).

> "*This strategic plan is a common, shared vision of the future of fish and wildlife conservation in Ohio. By design, it doesn't list how many fi sh are stocked into each lake, identify individual research projects, or determine when deer season will open from year to year. Instead, the plan steps back from detail to give a bird's-eye view of fi ve cornerstones of Ohio conservation, our desired objective for each, and paths of direction. These include: 1) stewardship of our resources; 2) opportunities for participation in fish and wildlife recreation; 3) connections we make with all fish and wildlife enthusiasts; 4) traditions related to conservation; and, 5) a standard of excellence in the work we do for you*".

Concerning stewardship, defined objectives are:

- "*Diverse and sustainable fish and wildlife populations and habitats representative of healthy ecosystems and sustainable use (and) Minimized impacts from habitat loss, invasive and nuisance species, pollution, disease, climate change, and other challenges*"

Ontario

DFO's freshwater activities adhere to the department's sustainable development principles as stated in *Sustainable Development – A Framework for Action*: shared stewardship, integrated management, an ecosystems approach, continuous improvement, the precautionary approach, and pollution prevention. Freshwater fisheries management activities include some or all of: fisheries policy, planning and legislation; integrated fishery management plans;

fiduciary responsibilities; allocation; licensing; harvest monitoring; compliance monitoring and enforcement; fishing industry analysis; and fisheries management administration (DFO 1999).

DFO's Sustainable Development Strategy (SDS) is an overarching policy to ensure sustainability in Canada's fisheries. One of the specific outcomes of SDS is a new fisheries management governance model to meet the needs of an evolving industry, recognizing principles of sustainable development, as well as the precautionary and ecosystem approach. DFO is preparing other policies on benthos, forage species and the precautionary approach.

Five strategies are proposed as the means for the Government of Canada to contribute to the attainment of the national freshwater goals: Partnership with the Provinces and Territories; Science and Technology; Public Participation and Community Action; Legislation and Regulation; and Market Instruments.

Ryan *et al* define the two following goals for Lake Erie:

> "*To secure a balanced, predominantly cool-water fish community with Walleye as a key predator in the western basin, central basin, and the near-shore waters of the eastern basin, characterized by self-sustaining indigenous and naturalized species that occupy diverse habitats, provide valuable fisheries, and reflect a healthy ecosystem; and yo secure a predominately cold-water fish community in the deep, offshore waters of the eastern basin with Lake trout and Burbot as key predators*".

Other goals concern desired ecosystem conditions;

> "*the composition of fisheries and their link to supporting habitat; contaminants in fish; conservation of genetic diversity and of rare, threatened and endangered species; and the ecology of fish production*".

The authors go on to list the following principles:

> "*Self-sustaining stocks—naturally reproducing indigenous species provide the most predictable, sustainable, and cost-effective benefits to society; The stock concept—stocks (or populations) are the basic unit for conservation and management and should, where feasible, be identified, monitored, and appropriately managed; Indigenous species—where competitive interactions between indigenous and non-indigenous species are limiting, priority will be given to indigenous species; Introductions—no non-native animals or plants will be intentionally introduced into Lake Erie; although each member agency has its own review mechanisms for proposed introductions and the conduct of aquaculture within the Lake Erie watershed, no agency will approve such proposals without review by all other agencies on the LEC, a procedure consistent with the Joint Plan; Preservation and restoration of habitat—maintenance of quality habitat is fundamental to fish and fish-community conservation; preservation and restoration of habitat must be the foremost concern for achieving these objectives; Preservation of rare and endangered species—rare and endangered indigenous fish species add to the richness of a fish community through biodiversity and should be safeguarded in recognition of their ecological significance and intrinsic value; Recognition of naturalized species—a number of non-indigenous species such as rainbow trout, Browntrout, coho salmon, rainbow smelt, Alewife, carp, White perch, round goby, and sea lamprey have become established and must be considered part of the fish community; the sea lamprey, although naturalized, is considered a pest species requiring control; Harvest—species of value to sport and commercial fishermen should be harvested on a sustainable basis; Recognition of the limit on productivity—a biological limit exists to ecological productivity and fishery sustainable yield; managers must be guided by the best approximation of that limit to maintain a healthy fish community; fish yields are ultimately limited by lake productivity and the efficiency of trophic transfer, which is a function of the composition and structure of the fish community*"

Developed in 1976, the original Strategic Plan for Ontario Fisheries (SPOF I) provided a long-term plan for managing Ontario's fisheries resources. In 1989, OMNR, in consultation with the public, designed SPOF II (1991). It identified the ecological, economic, and social values placed on fisheries.

SPOF II was composed of four important elements: a goal for Ontario fisheries, objectives to meet the goal, guiding principles to form the foundation of fisheries management, and, strategic management actions to resolve important fisheries management issues.

OMNR is preparing a Provincial Fish Strategy to guide fisheries management. Made available for stakeholder comment in early 2014[18] its main aims are to: improve the conservation and management of Ontario's fisheries resources; and encourage fishing to benefit individuals and communities. Its need reflects the changes since SPOF II, with the need to account for new factors and an increase in OMNR responsibilities to include species at risk, biodiversity, renewable energy and other programs that influence management.

The Strategy comprises of: (i) principles; (ii) long-term goals; (iii) shorter term objectives; and (iv) related tactics.

The principles used to guide fisheries management planning and decision making are considered key to achieving the desired future state of fisheries resource in Ontario. They are derived from broader OMNR strategic direction such as Our Sustainable Future: A Renewed Call to Action, the Ontario Biodiversity Strategy, and MNR's Statement of Environmental Values. The Ecological Principles are:

- **Ecosystem approach.** Fisheries will be managed within the context of an ecosystem approach where all ecosystem components including humans and their interactions will be considered at appropriate scales.
- **Natural capacity.** There is a limit to the natural capacity of aquatic ecosystems and hence the benefits that can be derived from them.
- **Naturally reproducing fish communities**. Self-sustaining fish communities based on native fish populations will be the priority for management. Non-indigenous fish species that have become naturalized, and are consistent with management objectives are managed as part of the fish community.
- **Protect, restore, rehabilitate**. The composition, structure and function of ecosystems is the first priority for management, as it is a lower-risk and more cost effective approach than recovering or rehabilitating ecosystems that have become degraded. Priority will be placed on protecting fish, fisheries and supporting ecosystems and restoration or rehabilitation of degraded systems when necessary**.**
- **Fish and aquatic ecosystems are valued.** Fisheries, fish communities, and their supporting ecosystems provide important ecological, social, cultural, and economic services that will be considered when making resource management decisions.

The principles of conduct are:

- **Aboriginal and treaty rights.** Aboriginal rights and interests in fisheries resources will be recognized and will help guide OMNR's plans and activities. OMNR is committed to meeting any existing and future legal obligations in respect of Aboriginal peoples.
- **Informed transparent decision taking.** Resource management decisions will be made using the best available science and knowledge in an open, accountable way. The sharing of scientific, technical, cultural, and traditional knowledge will be fostered to support the management of fish, fisheries and their supporting ecosystems.
- **Collaboration.** While OMNR has a clear mandate for the management of fisheries in Ontario, successful delivery of this mandate requires collaboration with other responsible management agencies and those who have a shared interest in the stewardship of natural resources.

[18] http://www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_165902.html

5.2.4 Incentives to Sustainable Fishing

Overall policy is aimed at establishing sustainable economic efficiency in the Lake Erie fishery in the context of the sustainable commercial harvest of the available fish. Restrictive licensing and the quotas for Walleye and Yellow perch established in consultation with stakeholders provide a sense of ownership of Lake Erie fish resources. Limited entry for commercial fishers provides an incentive for sustainable fishing as the benefits from effective management will not be dissipated.

Previously fishers may not have considered policy sufficient to provide them with a sense of stewardship; this was one of the comments made in the appeal against Senate Bill 77 (http://www.outdoornews.com/January-2008/Commercial-fishing-group-sues-over-net-regulations/).

The assessment team has not found any evidence of any perverse incentives such as fuel subsidies that could encourage fishermen to fish unsustainably. Sanctions are applied to when there is an infringement of regulations and these provide a further incentive to sustainable fishing.

5.3 The Fishery Specific Management System

5.3.1 Objectives

Yellow perch

LEPMAG is currently engaged in a structured decision making process for the management of Lake Erie Yellow perch. The Quantitative Fsisheries Center at MSU is assisting the LEC and LEPMASSG through an MSE for Yellow perch. It is expected that new Yellow perch stock assessments and harvest control rules will emerge within two years. The key parts of the draft FMP relative to this component are:

- To help ensure that Yellow perch populations in Lake Erie will not experience the low abundance levels experienced in all management units in the early-1990s, the LEC pursed development of a plan that could be implemented to manage Yellow perch populations and to effectively limit the need for drastic management actions with respect to quota management. This plan establishes fishery sustainability and quality objectives based upon historic fishery performance which the LEC will employ as a basis for Yellow perch management. This plan focuses primarily on the Yellow perch stocks that inhabit the four previously-defined Management Units in Lake Erie.
- It is important, for future sustainability, that Yellow perch populations in each management unit have an age structure that provides stable fisheries, sufficient spawner biomass, and broad benefits to all jurisdictions
- The following are the goal and objectives from the Fish Community Goals and Objectives for Lake Erie that are relevant to Yellow perch: Secure a balanced, predominantly cool water fish community with Walleye as a key predator in the western basin, central basin, and the nearshore waters of the eastern basin. Relevant Objectives: Provide sustainable harvests of Yellow perch for all areas of the lake; Genetic diversity – maintain and promote genetic diversity by identifying, rehabilitating, conserving, and/or protecting locally adapted stocks; and Food web structure – manage the food web structure of Lake Erie to optimize production of highly valued fish species; recognize the importance of Diporeia and Hexagenia as key species in the food web and as important indicators of habitat suitability.

Walleye

As stated in the WMP (LEC 2005):

> *"LEC manages the entirety of the Lake Erie Resource using the Fish Community Goals and Objectives for Lake Erie. As a terminal predator, Walleye are a key component of the Lake Erie Ecosystem, and any management*

of this species must take this fact into consideration. For example, mismanagement of this species, to either end of the population abundance spectrum, could potentially lead to instability in the fish community, and have subsequent negative impacts on the integrity of the ecosystem or on other economically important species. Moreover, as an important commercial food fish, and a desirable sport fish species, Walleye need to be managed for these uses as well. Ideally, this management objective should occur within the context of first sustainability, second ecosystem integrity, and human benefit third"

As reported in the WFMP, following stock issues in from the early 1980s arising from fishing pressure, poor recruitment, and environmental changes (invasive species) LEC CPMS. During the CPMS, the annual TAC was set at no more than 3.4 million Walleye for the period. Review indicated that the first objective, to reverse declines and rebuild percid stocks to achieve a broad distribution of benefits throughout the lake, was only partially achieved; although there was success the period coincided with poor recruitment. The second objective of the CPMS, to improve approaches used to estimate percid abundance and determine sustainable harvest levels, was achieved. "*To help ensure that the Walleye population would not need such rapid and drastic management action as that taken during the CPMS, the LEC determined that it required a plan that it could implement to manage Walleye. This plan establishes fishery sustainability and quality objectives that the LEC will employ as a basis for Walleye management*".

The FCO goals and objectives relevant to Walleye were: Goal - secure a balanced, predominantly cool water fish community with Walleye as a key predator in the western basin, central basin, and the nearshore waters of the eastern basin. Objectives - Provide sustainable harvests of Walleye for all areas of the lake; and maintain and promote genetic diversity by identifying, rehabilitating, conserving, and/or protecting locally adapted stocks.

Part of the LEPMAG ToR are: Lake Erie percid fisheries will be transparently managed using sound science and partnerships to achieve stable and sustainable harvests from shared stocks providing broad and equitable benefits for all jurisdictions. A defined primary option is adjusting fishing rates for commercial and recreational fisheries, while the three primary objectives are: minimize economic risk to commercial fishers; maintain acceptable catch rates for recreational fishers; and minimize risk of low spawning stock abundance.

5.3.2 Decision Making Processes

Yellow perch & Walleye

See LEPMAG and the WGs.

5.3.3 Monitoring, Control & Surveillance

International

As detailed at http://www.glfc.org/boardcomm/lawenforce/lawenf.php

"*The Law Enforcement Committee of GLFC consists of representatives of each resource agency with enforcement responsibility in the basin. Each agency has one vote. The business of the Committee shall be conducted by consensus of agencies present…. The Mission of the International Great Lakes Fishery Law Enforcement Program is to participate in the management of the fisheries resources by preventing exploitation by unlawful means. The Committee: provides a conduit for the transfer of information between fisheries managers and law enforcement in order to design enforceable regulations; provides a forum for the transfer of information between law enforcement agencies within the Great Lakes basin; facilitates the establishment of law enforcement subcommittees on each lake; identifies and evaluates the problems associated with control of illegal fishery activities in the Great Lakes basin, and supports agencies in their resolution; drafts recommendations for consideration by the Council of Lake Committees on the cooperative procedures and the practical fishery management policies required to reduce and prevent illegal commercialization in the Great Lakes basin; and* *advises the Council of Lake Committees on all matters pertaining to efficient law enforcement in the Great Lakes basin*".

The Committee reports to the Council of Lake Committees. An assessment team review of the minutes of Council meetings (http://www.glfc.org/boardcomm/clc/clchome.php#pub) did not identify any compliance issues.

Ohio

ODNR Division of Wild Life reports that

"*The chief of the Division of Wildlife has broad authority, with approval of the Wildlife Council, to adopt rules and regulations for managing lands and waters that will ensure sound management of fish and wildlife, to conduct management activities and acquire property to develop and conserve the wildlife resources, and to promote programs to educate Ohio citizens about conservation, fishing, hunting, and trapping" and "A state wildlife officer is assigned to each of Ohio's 88 counties. The officer is required to live in their area of assignment. Several officers in an area report to a wildlife officer supervisor who oversees routine activities. Wildlife investigators are assigned to each district and handle criminal investigations and other law enforcement duties. Law enforcement supervisors oversee all law enforcement operations on a district level, including the Lake Erie Enforcement Unit*".

Emphasis is on recreational fishing, and the limited number of commercial fishing units means that compliance is relatively straight forward. Nevertheless, there have been examples of non-compliance.

In 2006, the captain of a boat from Port Clinton was fined $12,100 illegally netting thousands of pounds of Yellow perch from Lake Erie. In 2006

"*Numerous licensed commercial fishermen, two fishing companies, and three fish wholesale companies were charged with selling tons of Yellow perch in excess of their allotted quotas, filing false catch reports, and selling unreported Yellow perch. Division of Wildlife investigators said all the offenses took place between 2001 and 2003. Several of those involved have pled guilty and received steep fines. The largest fine thus far was $87, 000 levied on Lake Fish, Inc. of Sandusky. Other cases are still pending*" (http://www.fishlakeerie.com/news/articles-erie/607.html).

In an unconnected case

"*Ohio commercial fishermen and 7 businesses have been convicted of over-fishing about 120 tons of regulated fish in the Ohio waters of Lake Erie during the past few years. In June 2005, in Cuyahoga County, Ohio, a two-year undercover investigation of commercial trap net fishermen ended with Cuyahoga County prosecutors indicting 14 people and five businesses for money laundering, theft, and receiving stolen property, including 40-80 tons of unreported yellow perch*". (http://wikileaks.org/cable/2008/02/08TORONTO58.html).

This led to Senate Bill 77 (see above).

In 1999, a Canadian commercial fishermanwas sentenced Wednesday in U.S. Federal Court in Cleveland, Ohio, to two years probation and ordered to pay $15,425 for violating federal wildlife protection laws after illegally harvesting fish from U.S. waters of Lake Erie (http://www.longpoint.on.ca/lpbaa/usfwpr.htm). This case

"*resulted from unprecedented cooperation between the U.S. Coast Guard, the Ontario Ministry of Natural Resources, Ohio Division of Wildlife and the U.S. Fish and Wildlife Service*" (http://www.angelfire.com/la/outdoorspot/page40.html).

In 2012 in Pennsylvania a fisher was fined for using illegal gill nets (banned in 1996) to seine prize perch, bass and other fish species (http://www.goerie.com/article/20120504/NEWS02/305039883/Erie-men-on-trial-on-illegal-fishing-charges).

Ontario

Enforcement of fishery regulations in Ontario in the responsibility of the Enforcement Branch of the OMNR, which cooperates with OCFA.

A three tier approach monitors compliance on Lake Erie.

1. Weight observers contracted by OCFA are responsible for in-plant checking individual catch to verify weights recorded on DCRs.
2. Port conservation officers, also known as deputy conservation officers, working for OMNR are present at all major offloading ports in Ontario. These inspect vessels to ensure compliance with licence conditions. This includes inspection of catch, nets, vessel inspections to ensure there is no undeclared catch, and DCRs. Port officers also monitor packers (incluing 100 % coverage of the company handling the greatest volume) to ensure catch is within weight tolerances and corresponds with weights recorded on the DCR.
3. Appointed under the Ontario Fish and Wildlife Conservation Act, conservation officers are involved in monitoring compliance and enforcement within the commercial fishery in Ontario. Conservation officers have the authority to inspect, arrest, search and seize under various statues they enforce, including the Fish and Wildlife Conservation Act and Fisheries Act. The duties of a conservation officer primarily include enforcement of law protecting resources, conduct investigations, gather evidence, and participate in undercover and special investigations, regular audits of resource users, licences and commercial operations, and present evidence in court (http://www.mnr.gov.on.ca/en/Business/Enforcement/2ColumnSubPage/STEL01_130158.html)

Conservation Officers support fisheries management primarily by promoting compliance with the *Fish and Wildlife Conservation Act*, *1997*, the Ontario Fishery Regulations, 2007 and the federal *Fisheries Act*. Regulatory compliance is achieved through activities ranging from outreach and education to field inspections and prosecutions.

Enforcement priorities are set as part of an annual planning process. Fisheries managers and enforcement specialists determine which activities that pose risks can be managed by compliance and enforcement actions. Priorities are then set on the basis of risk posed to human health and safety, natural resources, the economy and social/cultural values.

The role of officers covers both the recreational and commercial sectors. The former involves a large number of units along the lake shore; in contrast the commercial catch is concentrated at a limited number of designated landing port. This increases efficiency. Occasionally, vessels are inspected while on the lake, but there is no on-board observer coverage. All commercial vessels require VMS.

Non-compliance with management measures maybe dealt with through the issuance of a ticket or court action. The costs of non-compliance (fines, loss of license, quota hold backs) are thought to be an effective deterrent. Nevertheless there have been some instances of non-compliance.

As reported in the media (http://blogs.windsorstar.com/2012/05/10/troubled-fishing-vessel-accused-of-illegally-fishing-in-u-s-waters/) in 2012 a Leamington fishing vessel was stopped by the U.S. Coast Guard after it was observed fishing about 140 m inside U.S. territorial waters. After boarding the vessel, officers seized about 960 feet of fishing nets and five anchors. This wasn't the first time the vessel operators had been fined for illegal fishing practices. In 2007 there was a fine for fishing in a location where it was not licensed and in 2011, the captain was fined $1,000 for failing to report he had caught more than 1,000 lbs of fish. In both cases, an Ontario commercial fish operation was fined as well.

In 2010, "*two anglers in southwest Ontario convicted of possessing fish over the legal limit, and selling their catch,* *have been fined $12,000, and had their vehicles and gear confiscated"* (http://outdoorcanada.ca/11850/news/ontario-anglers-net-big-fines-for-selling-their-catch).

ECO issues http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies reports:

> "*The number of inspections and audits of commercial fishers by MNR varies by lake. The ministry places a high priority on enforcement in Lake Erie, where the bulk of the commercial catch occurs. MNR notes that Lake Erie is also the easiest of the Great Lakes to enforce, since fish processing plants are concentrated in specific ports (e.g., Kingsville, Port Dover and Wheatley). Port Officers on Lake Erie inspect fishers for compliance at all ports of landing, Weight Observers are also stationed at major processing plants to record actual weights of fish harvested. The ministry estimates that 45 per cent of all landings on Lake Erie are inspected or weight observed, and MNR is confident that the actual catch is within 5 to 7 per cent of the reported catch*".

and

> *"Some common licence violations include: fishing more than allocated quota; failure to declare landed fish; and inaccurate information on a daily catch report. Licence conditions appear to target issues of concern, and MNR lake managers can provide additional restrictions when needed. However, enforcement may not be targeting some problematic activities of concern to commercial fishers, such as high-grading; curbing these practices may need additional on-board enforcement*".

5.3.4 Research Programme

Yellow perch & Walleye

GLFC has responsibility to formulate a coordinated research program between the United States and Canada that has the goals of identifying ways to achieve MSYs for the various stocks and recommend specific management initiatives. GLFC's Strategic Vision identifies two broad priorities: research in support of healthy Great Lakes ecosystems and research in support of sea lamprey control. Additionally, the commission directs and supports projects designed to transfer science to managers. GLFC 2001 notes:

> "*The Commission is charged in the Convention on Great Lakes Fisheries to formulate research needs and to undertake such research as necessary. Early in the previous decade, the Commission, in response to its Strategic Vision, developed fishery research priorities for the entire Great Lakes. In the coming decade, the Commission seeks to identify research priorities for individual lakes and to communicate and encourage their adoption by research organizations and granting agencies and by researchers and managers. This milestone is more ambitious than what was accomplished in the 1990s. Although research priorities were developed and distributed, they did not stimulate an active discussion within the Great Lakes research community… Research priorities will be developed from a variety of sources such as Lake Committees, fishery and environmental organizations, funding partners, and individual researchers. To ensure that research priorities promoted by the Commission remain both current and relevant to fishery needs, priorities for each lake will be evaluated in conjunction with State of the Lake Conferences and the ensuing published report. These reports are used by Lake Committees to document progress on the achievement of Fish Community Objectives. A new report for each lake is produced every 5 years on a rotational schedule among the lakes. Therefore, priorities for each lake will be updated twice in the next decade. ..Research priorities have been developed for each of the five Great Lakes that consider inter alia Fish Health and Ecosystem Dysfunction, Human Dimensions, Physical Processes and Fish Recruitment in Large Lakes, and Reintroduction of Native Deep-water Fish. Also supported are projects that address the research priorities identified by the Lake Committees, and the Great Lakes Fish Health Committee. Research projects that do not fit into an existing theme area are supported under the category of Non-Theme Research*".

GLFC 2009 considers the following in relation to research plan.

"***Ecosystem Conditions Objective****: How can we best monitor, manage, and maintain optimum mesotrophic conditions in the west, central, and nearshore east basin? How can we best develop bathy/thermographic (and other habitat) maps that facilitate our understanding of the size, dynamics, and impact of river or tributary plumes in Lake Erie? How can we best describe important habitat characteristics, complete mapping of Lake Erie habitat, and distribute this information to managers, researchers, stakeholders, and the public? How can we best map or model known disease dynamics in Lake Erie?*

Productivity and Yield Objective*. What are appropriate biological reference points and fisheries reference points for fished populations and how can they be estimated? How can we best describe, map, evaluate and maintain suitable nearshore habitats that can support high quality fisheries for smallmouth bass, northern pike, muskellunge, Yellow perch, and Walleye using hydroacoustics/GIS software? What is the influence of size or slot limits on fish population dynamics? What is the impact of fishing sanctuaries on fish populations of interest and are the goals of sanctuaries being met? How can we optimize the potential for sustainable harvests of highly valued fish species? What changes in catchability have occurred in the commercial and sport fisheries operating on Lake Erie over time? What are the spatial and temporal dynamics of invasive species in Lake Erie and what are their impacts on desired fisheries productivity and yields?*

Nearshore Habitat Objective*. How can we best describe, map, evaluate and maintain suitable nearshore habitats that can support high quality fisheries for smallmouth bass, northern pike, muskellunge, Yellow perch, and Walleye using hydroacoustics/GIS software? How can we best describe important habitat characteristics, complete mapping of Lake Erie habitat, and distribute this information to managers, researchers, stakeholders, and the public?*

Western Basin Objective*. What are the stock structures of Walleye, Yellow perch, smallmouth bass and other desired fish? How can we identify, rehabilitate, conserve, or protect locally adapted stocks? How can we best provide sustainable harvest of desirable fish species of fish? What are the stock/spawner-recruitment relationships in desired fish populations? What are the natural mortality (M) rates in desired fish populations? What are the limiting factors and causes leading to reduced or lost recruitment of desired fish species and what are the solutions to remedy this lost recruitment?*

Central Basin Objective*. What are the stock structures of Walleye, Yellow perch, smallmouth bass and other desired fish? How can we identify, rehabilitate, conserve, or protect locally adapted stocks? How can we best provide sustainable harvest of desirable fish species of fish? What are the stock/spawner-recruitment relationships in desired fish populations? What are the natural mortality (M) rates in desired fish populations? What are the limiting factors and causes leading to reduced or lost recruitment of desired fish species and what are the solutions to remedy this lost recruitment?*

Eastern Basin Objective*. What are the stock structures of Walleye, Yellow perch, smallmouth bass and other desired fish? How can we identify, rehabilitate, conserve, or protect locally adapted stocks? How can we best provide sustainable harvest of desirable fish species of fish? What are the stock/spawner-recruitment relationships in desired fish populations? What are the natural mortality (M) rates in desired fish populations? What are the limiting factors and causes leading to reduced or lost recruitment of desired fish species and what are the solutions to remedy this lost recruitment? How can we best restore self-sustaining populations of Lake trout to historic levels of abundance in the east basin?*

Fish Habitat Objective*. What are the best methods for evaluation, protection, and enhancement of fish habitat throughout the Lake Erie watershed? How can we update the Great Lakes Spawning Atlas to reflect recent* *changes in the Lake Erie basin?*

Genetic Diversity Objective. *What are the stock structures of Walleye, Yellow perch, smallmouth bass and other desired fish? How can we identify, rehabilitate, conserve, or protect locally adapted stocks?*

Food Web Structure Objective. *How can we best manage the food web structure of Lake Erie to optimize production of highly valued fish species?*

Each TG defines annual work activities to meet the overall research programme. These include:

- YPTG (2014-2015).
  - Maintain and update centralized time series of datasets required for population models and assessment including: a) Fishery harvest, effort, age composition, biological and stock parameters b) Survey indices of young of year, juvenile and adult abundance, size at age and biological parameters c) Fishing harvest and effort by grid;
  - Report RAH levels for 2015; and
  - Participate in the LEPMAG Yellow perch harvest strategy evaluation process by assisting the STC with the development of new catch-at-age models and exploitation strategies for Yellow perch, leading to the development of a Yellow perch Management Plan.
- WTG (2014-2015):
  - maintain and update the centralized time series of datasets required for population models and assessment including: Tagging and population indices (abundance, growth, maturity); Fishing harvest and effort by grid; improve existing population models to produce the most scientifically defensible and reliable method for estimating and forecasting abundance, recruitment, and mortality;
  - explore additional recruitment indices for incorporation into catch-at-age model;
  - explore ways to account for tag loss and non-reporting in M estimates for Statistical Catch at Age modeling;
  - explore and advise on feasibility of integrating east basin Walleye assessments into lake wide management;
  - advise on RAH levels for 2015; and
  - provide guidance/recommendations for future tagging strategies to the LEC.
- HTG (2014-2015):
  - document habitat improvement projects and research into fish use of habitat in Lake Erie. Identify and prioritize potential projects and research for future funding;
  - assist member agencies with the use of technology (i.e., side-scan, GIS, remote sensing, etc.) to facilitate better understanding of habitat in Lake Erie, particularly in the Huron-Erie corridor, the near shore, and other critical areas by participating in/supporting the following opportunities: side-scan mapping techniques workshop; Lake Erie GIS / GLAHF development and deployment; spawning habitat mapping; and near shore substrate mapping;
  - support other task groups by compiling metrics of habitat use by fish; and
  - develop a strategic research direction for EOs.
- STC (2014-2015):
  - prepare the agenda for the 2015 LEC meeting;
  - represent the LEC STC on the Council of Lake Committee's sub-committee, "Technical Committee Chairs";
  - oversee Structured Decision Making application with QFC), WTG and YPTG towards development of new exploitation policies within the LEPMAG process; and
  - produce a Walleye Management Plan.
- CWTG researches Lake trout, Lake whitefish and Burbot and participates in the Integrated Management of Sea Lamprey (IMSL) process on Lake Erie to outline and prescribe the needs of the Lake Erie sea lamprey

management program; it maintains an annual interagency electronic database of Lake Erie salmonid stocking for the STC, GLFC, and Lake Erie agency data depositories; continues to assess the steelhead and other salmonid fisheries; and report on the status of Cisco in Lake Erie.

5.3.5 Monitoring & Evaluation

Yellow perch & Walleye

The GLFC has initiated external reviewsthrough an independent analysis of Yellow perch and Walleye populations in Lake Erie by Myers & Bence(2001; 2002) In general, results of their analysis were in agreement with the TG assessments, with suggestions provided on how assessment strategies could be improved.

In 2003, the CPMS was evaluated to determine if it met the intended objectives (LEC 2005). The conclusions were

> “ *The first objective, to reverse declines and rebuild percid stocks to achieve a broad distribution of benefits throughout the lake, was only partially achieved. With good management decisions (i.e., the implementation of the CPMS and changes to harvest levels) the three year CPMS period was long enough to stop the decline in Walleye abundance. Unfortunately, year class failures, just prior to and during the CPMS time frame, prevented Walleye stocks from increasing in abundance within the three year time frame. The second objective of the CPMS, to improve approaches used to estimate percid abundance and determine sustainable harvest levels, was achieved. Changes were made that improved the approach to estimating abundance and determining sustainable harvest levels. Reliance on strong information sources and up-to-date fish population models is imperative to understanding fish stock status. By moving to state-of-the-art population modeling techniques, and having them independently reviewed by fisheries experts, the LEC was able to better their understanding of Walleye stock status*”.

In 2005 , an external review of the Yellow perch and Walleye fisheries in Lake Erie was conducted by the Blue Ribbon Panel. The review was conducted to evaluate efficiency, precision and accuracy of techniques (sampling and statistical analysis) used to estimate total percid (Walleye and Yellow perch) harvest by both sport and commercial fisheries in Lake Erie (Lester *et al*. 2005).

In 2005, WTG and LEC completed the first WMP (WMP; Locke *et al*. 2005). This plan recommended that the actions and their outcomes be reviewed every 5 years to evaluate the success, looking specifically at the status and outlook for the Walleye population against population abundance and fisheries objectives (annual), the overall status of Walleye relative to changes in carrying capacity and the impact of long term exploitation policy implementation on population abundance and demographic attributes.

In 2007, the Canadian standing committee on public accounts held hearings on the Auditor Generals 2007 audit on OMNR’s fish and wild life program. The objective was to assess whether the Ministry had in place adequate resources to fulfil its mandate to sustainably manage fish resources and ensure compliance with regulations and legislation. The auditor expressed concerns about habitat management and the lack of a by-catch policy. The auditor

> “*recommended that the Ministry take appropriate enforcement action when the number of fish harvested is above the quotas set for sustainability and consider developing a by-catch policy to help reduce the ecological impact on aquatic ecosystems and sustainability of the by-catch species*”.

In 2010-2011, STC conducted an internal review which concluded that the performance of the WFMP varied. While some fishery catch rate objectives were achieved, other factors such as instability in harvest and TAC, due in part to recruitment patterns, were a cause for concern (WTG 2013).

QFC notes that

"*since November 2010 the QFC has facilitated and conducted technical (Management Strategy Evaluation) analyses for a group of Lake Erie Walleye and Yellow perch fishery stakeholders…. Their results have then been used to inform discussions of improvements to Walleye management at the LEPMAG meetings. At the most recent meeting the LEPMAG reached consensus on several recommendations for changes to the assessment model used to inform decisions about Walleye harvest in Lake Erie, and on adoption of a reference-point based harvest policy for the future… The group did not reach consensus on a new harvest control rule, but urged managers to use LEPMAG's deliberations to inform their decisions about quotas for Walleye harvest in 2013 and going forward... The group is now shifting their attention to Yellow perch and will be meeting to discuss this fishery several times during the coming year, following the same approach as has been taken for Walleye*".

Through the task group and LEPMAG process there is a continual review of the management process.

6 EVALUATION PROCEDURE

6.1 Harmonised Fishery Assessment

It may be considered that the Yellow perch and Walleye fisheries are overlapping due to commonalities in the management approach and P2 issues. The same team undertook both assessments; used the same assessment trees; identified relevant fishery information and explicitly reviewed findings to ensure consistent conclusions with respect to evaluation, scoring and conditions.

6.2 Previous assessments

6.2.1 Yellow perch

There have been no previous assessments of this fishery.

6.2.2 Walleye

There have been no previous assessments of this fishery.

6.3 Assessment Methodologies

6.3.1 Yellow perch

MSC CR v 1.3 was used to assess the fishery.

MSC Full Assessment Reporting Template v 1.3 was used to produce this report.

The RBF was only used for PI 2.5.1 – ecosystem. The team considered that there was insufficient information on this component to justify use of the default assessment tree. The stakeholder workshops provided limited information and views; the team relied on identified literature. The RBF was considered in-depth by the team. There was agreement that the most vulnerable element was removal of a top predator from the ecosystem.

6.3.2 Walleye

MSC CR v 1.3 was used to assess the fishery.

MSC Full Assessment Reporting Template v 1.3 was used to produce this report.

The RBF was only used for PI 2.5.1 – ecosystem. The team considered that there was insufficient information on this component to justify use of the default assessment tree. The stakeholder workshops provided limited information and views; the team relied on identified literature. The RBF was considered in-depth by the team. There was agreement that the most vulnerable element was removal of a top predator from the ecosystem.

6.4 Evaluation Processes and Techniques

6.4.1 Site Visits

There were two site visits in the course of the assessment; the first 22 – 25 October 2013 and the second 23 – 27 June, 2014 (table 43).

In the latter, meetings were arranged to provide specific information to the assessment team and to provide forum for stakeholder input into the risk based approach.

6.4.2 Consultations

Table 43: Meetings Site Visits 1 & 2

1	21 October	Guelph	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
2		Guelph	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
			Tom Nudds	Univ. Guelph
			David Gislasson	Univ. Guelph
			Allan Debertin	Univ. Guelph
3	22 October	Blenheim	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
			Vito	
			Tim	
4		Tel Conf	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Matt de Mille	OFH
5	23 October	Wheatley	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
			Brian Locke	Assessment Supervisor LEMU
6		Wheatley	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
			Andy Cook	OMNR Assessment Biologist
			Rich Drouin	OMNR Management Biologist
			Brian Locke	Assessment Supervisor LEMU
			Jason Bork	OMNR Senior Fish Biologist Fish Policy
			Yu Min Zhao	OMNR Resource Scientist
			Kurt Oldenburg	OMNR Fish Ecology Supervisor
7	24 October	Sandusky	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Jeff Tyson	LE Prog Admin Ohio Div Wildlife
			Jeff Herr	Fisher
			Holly Szuch	Fisher
			Richard Stimpson	Port Clinton, Bayside Madison.
			Bill Gullow	Kent & East Classic Seafood Cleveland.
8	23 June	Blenheim	Ian Scott	LA/P3
			Sara Adlerstein	P2
			Bob O'Boyle	P1
			Kevin Reid	OCFA
			Dennis Cartier	OCFA
			Jane Graham	OCFA CEO

6.4.3 Evaluation Techniques

"The Londoner" newspaper (http://www.thelondoner.ca/) was used as the media outlet for the public announcement of the assessment. It was selected due to its visibility to stakeholders around Lake Erie.

The site visit included meetings to deal with specific issues (resource assessment, compliance, P2 issues) along with two stakeholder workshops (one in Blenheim ON, the other in Sandusky OH) to gain insights into the information required for any RBS.

Scoring was undertaken through the team meeting on two occasions; 10- 14 March in Halifax Nova Scotia and 23-27 June in Blenheim / Chatham, Ontario. The expert for each Principle described findings and suggested scores and these were amended according to the comments of other team members.

The recommendation on certification was based on the scores achieved by each UoC for the individual Principles and the scores achieved for specific performance indicators.

The scoring elements considered for PIs in P1 and P2 are shown in Table 44. Note that invasive species (White perch and Alewife) were not considered in scoring as the implicit policy is to extirpate them if possible.

Table 44: Yellow perch & Walleye: Scoring elements

Component	Scoring elements	Main/not main	Data-deficient or not
1.1.1	Yellow perch	Main	No
2.1.1	Walleye (all QZs)	Main	No
2.1.1	Channel catfish (MU1)	Main	No
2.1.1	Freshwater Drum (MU1)	Main	No
2.2.1	MU2 / MU3 – no main species	-	-
2.2.1	All QZs – no main species	-	-
2.3.1	Eastern pondshell (all QZs)	-	No
2.3.1	No ETP species (all MUs)		No
2.4.1	Bottom habitat (all UoCs)	-	No
2.5.1	Removal of top predator (all UoCs)		Yes
1.1.1	Walleye	Main	No
2.1.1	Lake whitefish	Main	No
2.1.1	White Bass	Main	No
2.2.1	Lake Sturgeon	Main (vulnerable)	No
2.2.1	Lake trout	Main (vulnerable)	No
2.3.1	Suckers		No
2.4.1	Bottom habitat (all UoCs)	-	No
2.5.1	Removal of top predator (all UoCs)		Yes

7 TRACEABILITY

7.1 Eligibility Date

7.2 Yellow perch

The target eligibility date of January 1, 2015 is within 6 months of the publication of the PCDR. The TED has been chosen to allow processors time to decide on their production strategies with the new fishing year.

7.3 Walleye

The target eligibility date of January 1, 2015 is within 6 months of the publication of the PCDR. The TED has been chosen to allow processors time to decide on their production strategies with the new fishing year.

7.4 Traceability within the Fishery

7.4.1 Yellow perch

Yellow perch vessels are licensed to fish in a specific quota zone and must complete a log book and DCR while their activities are monitored by VMS. In the past, there have been examples of fishing outside the licensed zone but this appears to be no longer an issue and is considered to be a low risk.

The main risks for substitution are:

1. Yellow perch caught in the "other" trap nets i.e. large mesh would not be certified. While the DCRs identify the catch from the different nets that may be lifted on a single fishing trip, there is no separation of the catch on-board. **While the amount of Yellow perch taken in this gear is small (table 4) and indeed nothing is recorded in MU3, nevertheless there is a high risk of mixing with the current working practises and the management authority must introduce required changes before trap net yellow perch may be sold as certified.**
2. Over quota Yellow perch caught in one gear and declared as landings from another. There is a low risk due to the potential high sanctions if caught.
3. Non-MSC Yellow perch from other lakes being sold as MSC Lake Erie fish. Fish processing companies must have effective mechanisms to separate MSC fish from non-MSC fish. This will be an important aspect that will be checked at a chain of custody audit.

There is no on-lake processing. Trans-shipping on Lake Erie has not been reported. In Ontario landings of the large vessels are mainly limited to Port Colborne, Port Dover, Port Burwell, Port Stanley, Erieau Harbour, Wheatley Harbour and Kingsville Harbour. In Ohio landings of trap vessels are mainly limited to Sundusky, Fairport, Port Clinton. The combination of management measures allied with plant accounting is considered a robust management approach to traceability and ensuring the integrity of MSC certified product.

7.4.2 Walleye

Walleye vessels are licensed to fish in a specific quota zone and must complete a log book and DCR while their activities are monitored by VMS. In the past, there have been examples of fishing outside the correct zones but this no longer appears to be an issue. It is now considered to be a low risk.

The main risks for substitution are:

1. Walleye caught in the non-certified east basin Lake Erie fishery. DCRs should clearly note if the landed fish is MSC certified or MSC not-certified and fish must be kept separate. Where certified and non-certified fish is taken on the same trip there shall be in place a system to physically separate the catch of them on-board the vessel.
2. Walleye caught in the Yellow perch gillnet fishery or in the gear used in other fisheries would not be certified. This

moderate risk shall be mitigated through appropriate landing and chain of custody processes that ensure that certified and non-certified landings are physically and administratively separated.

3. Walleye caught illegally on the U.S. part of Lake Erie. There is a low risk due to the potential high sanctions if caught. Fish processing companies must have effective mechanisms to separate MSC fish from non-MSC fish.
4. Non-MSC Walleye from other lakes being sold as MSC Lake Erie fish. Fish processing companies must have effective mechanisms to separate MSC fish from non-MSC fish.

There is no on-lake processing. Transshipping on Lake Erie has not been reported. In Ontario landings of the large vessels are mainly limited to Port Colborne, Port Dover, Port Burwell, Port Stanley, Erieau Harbour, Wheatley Harbour and Kingsville Harbour. The combination of management measures allied with plant accounting is considered a robust management approach to traceability and ensuring the integrity of MSC certified product.

7.5 Eligibility to Enter Further Chains of Custody

7.5.1 Yellow perch

Product from the certified UoC will be eligible to enter further certified chains of custody when caught and landed by a licensed fishing vessel with an available quota and using the required gear. Only licensed vessels approved by the client group may market certified product. Only processors belonging to the client group may market certified product.

In both Ontario and Ohio landings may be made at those landing points approved and made known to the relevant authority.

Where a vessel sells all of its catch to a single processor and the product is transported directly from the vessel to the processing facility, the chain of custody shall begin in the processing facility. Where there is an intermediary between the landing and the processing plant the intermediary must have chain of custody certification.

7.5.2 Walleye

Product from the certified UoC will be eligible to enter further certified chains of custody when caught and landed by a licensed fishing vessel with an available quota and using the required gear. Only licensed vessels approved by the client group may market certified product. Only processors belonging to the client group may market certified product.

In Ontario landings may be made at those landing points approved and made known to the relevant authority.

Where a vessel sells all of its catch to a single processor and the product is transported directly from the vessel to the processing facility, the chain of custody shall begin in the processing facility. Where there is an intermediary between the landing and the processing plant the intermediary must have chain of custody certification.

7.6 Eligibility of Inseparable or Practically Inseparable (IPI) stock(s) to Enter Further Chains of Custody

7.6.1 Yellow perch

There are no IPI stocks in the fishery.

7.6.2 Walleye

There are no IPI stocks in the fishery.

8 EVALUATION RESULTS

8.1 Yellow perch

8.1.1 Scores

A summary of the scores for each Principle from the weighted average of the scores for individual PIs is given in Table 45.

Table 45: Yellow perch – Summary Scores

	Gill Net				Trap Net		
Principle	**QZ1**	**QZ2**	**QZ3(E)**	**QZ3(W)**	**MU1**	**MU2**	**MU3**
P 1 – Target Species	81.9	84.4	84.4	84.4	81.9	84.4	84.4
P 2 – Ecosystem	81.7	81.7	81.7	81.7	80.0	81.3	81.7
P 3 – Management System	85.3	85.3	85.3	85.3	85.3	85.3	85.3

The scoring tables that present the scores for each PI in the individual UoCs as assessed in Appendix 1 are shown in Tables 46 – 49.

8.1.2 Summary of Conditions

The fishery attained a score of below 80 against three PIs. This leads to conditions for continuing certification that the client is required to address (Table 50). The conditions are applied to improve performance to at least the 80 level within a defined period. As a standard condition of certification, the client has developed an 'Action Plan' to address the conditions for continued certification. The responsibilities of the implementing agencies has ben confirmed.

8.1.3 Recommendations

The assessment team made a number of recommendations that apply to a number of UoCs.

1. To ensure correct information is available to managers, the audit team recommends that OCFA and OMNR work together to design and implement a data system that provides consistently accurate data, and the data on catch, retained catch and by-catch is published and made available to stakeholders on a regular basis.
2. The Canadian distribution of Spotted sucker is limited to south western Ontario, where it occurs in the western basin of Lake Erie. Because of its low abundance it is unlikely that the species is caught in the gill net fisheries. Nevertheless, it would not be possible to corroborate this from DCRs as suckers are reported as one group. In the last 10 years, the by-catch of suckers in the fishery was 13,079 lbs. While discards were likely under reported until 2011, since then over 3,000 lbs have been removed annually. Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing. However future annual audits should review the situation to ensure that by-catch does not pose a threat to sucker species and it is recommended that data be taken on species composition to allow this to be considered in future annual audits.
3. While the assessment team did not identify main by-catch species in any of the QZs it was noted that DCRs do not identify individual species of the sucker family, some of which could be vulnerable. Further, there are Species of Concern in the area that could be part of the by-catch. It is recommended that to support the annual surveillance programme, OCFA and OMNR should work to modify the reporting protocol so that sucker species are individually recorded.

4. The annual average catch of Lake sturgeon is about 3 lbs over a 10 year period. This is in small quantity and for the moment it is not regarded as a main species; but future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock.
5. Currently, there is no information on size of Lake Sturgeon; and it is recommended that data should be collected to allow this to be considered in future annual audits.
6. Lake trout is a non-harvest species recorded in the last three years in small quantities (12 lbs in 2013). It is not considered a main species. Future annual audits should review the situation to ensure that the by-catch has not increased to pose a threat to the recovery of the stock. Lake sturgeon was recorded as by-catch in one year (2006). It is not considered a main species.
7. Future annual audits should review the situation to ensure that the by-catch of Lake trout has not increased to pose a threat to the recovery of the stock.

8.1.4 Draft Determination

Yellow perch - QZ1, QZ2, QZ3 (E), QZ3 (W), MU1, MU2, MU3

The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any PIs. **It is therefore recommended that THE LAKE ERIE YELLOW PERCH COMMERCIAL FISHERY in QZ1, QZ2, QZ3 (E), QZ3 (W), MU1, MU2, and MU3 be certified against the Marine Stewardship Council Principles and Criteria for Sustainable Fishing.**

Table 46: Yellow perch MU1

P	Component	Performance Indicator (PI)		Score	Wt Score
1	Outcome	1.1.1	Stock status	90	22.50
		1.1.2	Reference points	75	18.75
		1.1.3	Stock rebuilding	0	0.00
	Management	1.2.1	Harvest strategy	85	10.63
		1.2.2	Harvest control rules & tools	75	9.38
		1.2.3	Information & monitoring	80	10.00
		1.2.4	Assessment of stock status	85	10.63
2	Retained species	2.1.1	Outcome	80	5.33
		2.1.2	Management	60	4.00
		2.1.3	Information	80	5.33
	Bycatch	2.2.1	Outcome	80	5.33
		2.2.2	Management	80	5.33
		2.2.3	Information	75	5.00
	ETP species	2.3.1	Outcome	80	5.33
		2.3.2	Management	85	5.67
		2.3.3	Information	80	5.33
	Habitats	2.4.1	Outcome	80	5.33
		2.4.2	Management	80	5.33
		2.4.3	Information	90	6.00
	Trophic function	2.5.1	Outcome	80	5.33
		2.5.2	Management	85	5.67
		2.5.3	Information	85	5.67
3	Governance and policy	3.1.1	Legal & customary framework	100	12.50
		3.1.2	Consult., roles & respons.	90	11.25
		3.1.3	Long term objectives	80	10.00
		3.1.4	Incentives for sustainable fishing	80	10.00
	Fishery specific management system	3.2.1	Fishery specific objectives	80	8.00
		3.2.2	Decision making processes	85	8.50
		3.2.3	Compliance & enforcement	80	8.00
		3.2.4	Research plan	80	8.00
		3.2.5	Management Perf. Eval.	90	9.00

Table 47: Yellow perch MU2 MU3

P	Component	Performance Indicator (PI)		Score	Wt Score
1	Outcome	1.1.1	Stock status	100	25.00
		1.1.2	Reference points	75	18.75
		1.1.3	Stock rebuilding	0	0.00
	Management	1.2.1	Harvest strategy	85	10.63
		1.2.2	Harvest control rules & tools	75	9.38
		1.2.3	Information & monitoring	80	10.00
		1.2.4	Assessment of stock status	85	10.63
2	Retained species	2.1.1	Outcome	80	5.33
		2.1.2	Management	80	5.33
		2.1.3	Information	80	5.33
	Bycatch	2.2.1	Outcome	80	5.33
		2.2.2	Management	80	5.33
		2.2.3	Information	75	5.00
	ETP species	2.3.1	Outcome	80	5.33
		2.3.2	Management	85	5.67
		2.3.3	Information	80	5.33
	Habitats	2.4.1	Outcome	80	5.33
		2.4.2	Management	80	5.33
		2.4.3	Information	90	6.00
	Trophic function	2.5.1	Outcome	80	5.33
		2.5.2	Management	85	5.67
		2.5.3	Information	85	5.67
3	Governance and policy	3.1.1	Legal & customary framework	100	12.50
		3.1.2	Consult., roles & respons.	90	11.25
		3.1.3	Long term objectives	80	10.00
		3.1.4	Incentives for sustainable fishing	80	10.00
	Fishery specific management system	3.2.1	Fishery specific objectives	80	8.00
		3.2.2	Decision making processes	85	8.50
		3.2.3	Compliance & enforcement	80	8.00
		3.2.4	Research plan	80	8.00
		3.2.5	Management Perf. Eval.	90	9.00

Table 48: Yellow perch QZ1

P	Component		Performance Indicator (PI)	Score	Wt Score
1	Outcome	1.1.1	Stock status	90	22.50
		1.1.2	Reference points	75	18.75
		1.1.3	Stock rebuilding	0	0.00
	Management	1.2.1	Harvest strategy	85	10.63
		1.2.2	Harvest control rules & tools	75	9.38
		1.2.3	Information & monitoring	80	10.00
		1.2.4	Assessment of stock status	85	10.63
2	Retained species	2.1.1	Outcome	80	5.33
		2.1.2	Management	80	5.33
		2.1.3	Information	80	5.33
	Bycatch	2.2.1	Outcome	80	5.33
		2.2.2	Management	80	5.33
		2.2.3	Information	80	5.33
	ETP species	2.3.1	Outcome	80	5.33
		2.3.2	Management	85	5.67
		2.3.3	Information	80	5.33
	Habitats	2.4.1	Outcome	80	5.33
		2.4.2	Management	80	5.33
		2.4.3	Information	90	6.00
	Trophic function	2.5.1	Outcome	80	5.33
		2.5.2	Management	85	5.67
		2.5.3	Information	85	5.67
3	Governance and policy	3.1.1	Legal & customary framework	100	12.50
		3.1.2	Consult., roles & respons.	90	11.25
		3.1.3	Long term objectives	80	10.00
		3.1.4	Incentives for sustainable fishing	80	10.00
	Fishery specific management system	3.2.1	Fishery specific objectives	80	8.00
		3.2.2	Decision making processes	85	8.50
		3.2.3	Compliance & enforcement	80	8.00
		3.2.4	Research plan	80	8.00
		3.2.5	Management Perf. Eval.	90	9.00

Table 49: Yellow perch QZ2, QZ3 (E), QZ3 (W)

P	Component	Performance Indicator (PI)		Score	Wt Score
1	Outcome	1.1.1	Stock status	100	25.00
		1.1.2	Reference points	75	18.75
		1.1.3	Stock rebuilding	0	0.00
	Management	1.2.1	Harvest strategy	85	10.63
		1.2.2	Harvest control rules & tools	75	9.38
		1.2.3	Information & monitoring	80	10.00
		1.2.4	Assessment of stock status	85	10.63
2	Retained species	2.1.1	Outcome	80	5.33
		2.1.2	Management	80	5.33
		2.1.3	Information	80	5.33
	Bycatch	2.2.1	Outcome	80	5.33
		2.2.2	Management	80	5.33
		2.2.3	Information	80	5.33
	ETP species	2.3.1	Outcome	80	5.33
		2.3.2	Management	85	5.67
		2.3.3	Information	80	5.33
	Habitats	2.4.1	Outcome	80	5.33
		2.4.2	Management	80	5.33
		2.4.3	Information	90	6.00
	Trophic function	2.5.1	Outcome	80	5.33
		2.5.2	Management	85	5.67
		2.5.3	Information	85	5.67
3	Governance and policy	3.1.1	Legal & customary framework	100	12.50
		3.1.2	Consult., roles & respons.	90	11.25
		3.1.3	Long term objectives	80	10.00
		3.1.4	Incentives for sustainable fishing	80	10.00
	Fishery specific management system	3.2.1	Fishery specific objectives	80	8.00
		3.2.2	Decision making processes	85	8.50
		3.2.3	Compliance & enforcement	80	8.00
		3.2.4	Research plan	80	8.00
		3.2.5	Management Perf. Eval.	90	9.00

Table 50: Yellow Perch: Summary of Conditions

	Condition	PI	UoCs
YP1	By the third annual surveillance audit, the following SG80 SIs must be met: The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	1.1.2	All
YP2	By the fourth annual surveillance audit, the following SG80 SI must be met: Well-defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	1.2.2	All
YP3	By the fourth annual surveillance audit, the following SG80 SIs must be met: - There shall be a partial strategy that is expected to maintain all main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved.	2.1.2	MU1
YP4	By the third annual surveillance audit, the following SG80 SI must be met: Qualitative information and some quantitative information are available on the amount of main by-catch species taken by the fishery.	2.2.3	All MUs

8.2 Walleye

8.2.1 Scores

A summary of the scores fpr each P. from the weighted average of the scores for individual PIs is given in Table 51.

Table 51: Walleye – Summary Scores

Principle	Large Mesh Gill net
P 1 – Target Species	90.0
P 2 – Ecosystem	80.3
P 3 – Management System	85.3

The scoring table that presents the scores for each PI in the individual UoCs as assessed in Appendix 1 are shown in Table 52.

8.2.2 Summary of Conditions

The fishery attained a score of below 80 against two PIs (Table 53). This leads to conditions for continuing certification that the client is required to address. The conditions are applied to improve performance to at least the 80 level within a defined period. As a standard condition of certification, the client has developed an 'Action Plan' to address the conditions for continued certification.

8.2.3 Recommendations

The assessment team did not make any recommendations.

8.2.4 Draft Determination

The fishery attained a score of 80 or more against each of the MSC Principles and did not score less than 60 against any PIs. **It is therefore recommended that THE LAKE ERIE WALLEYE COMMERCIAL FISHERY be certified against the Marine Stewardship Council Principles and Criteria for Sustainable Fishing.**

Table 52: Walleye - All UoC

P	Component		Performance Indicator (PI)	Score	Wt Score
1	Outcome	1.1.1	Stock status	100	25.00
		1.1.2	Reference points	80	20.00
		1.1.3	Stock rebuilding	0	0.00
	Management	1.2.1	Harvest strategy	95	11.88
		1.2.2	Harvest control rules & tools	90	11.25
		1.2.3	Information & monitoring	80	10.00
		1.2.4	Assessment of stock status	95	11.88
2	Retained species	2.1.1	Outcome	70	4.67
		2.1.2	Management	60	4.00
		2.1.3	Information	85	5.67
	Bycatch	2.2.1	Outcome	80	5.33
		2.2.2	Management	80	5.33
		2.2.3	Information	80	5.33
	ETP species	2.3.1	Outcome	80	5.33
		2.3.2	Management	85	5.67
		2.3.3	Information	80	5.33
	Habitats	2.4.1	Outcome	80	5.33
		2.4.2	Management	80	5.33
		2.4.3	Information	95	6.33
	Trophic function	2.5.1	Outcome	80	5.33
		2.5.2	Management	85	5.67
		2.5.3	Information	85	5.67
3	Governance and policy	3.1.1	Legal & customary framework	100	12.50
		3.1.2	Consult., roles & respons.	90	11.25
		3.1.3	Long term objectives	80	10.00
		3.1.4	Incentives for sustainable fishing	80	10.00
	Fishery specific management system	3.2.1	Fishery specific objectives	80	8.00
		3.2.2	Decision making processes	85	8.50
		3.2.3	Compliance & enforcement	80	8.00
		3.2.4	Research plan	80	8.00
		3.2.5	Management Perf. Eval.	90	9.00

Table 53: Walleye: Summary of Conditions

	Condition	PI
WE 1	By the third annual surveillance audit, based on Condition WE2 the partial strategy of demonstrably effective management measures will be in place such that the fishery does not hinder the recovery and rebuilding of the Lake whitefish stock.	2.1.1
WE 2	By the third annual surveillance audit , there is will be a partial strategy in place for managing the catch of Lake whitefish and White bass that is designed to ensure the large mesh fishery does not pose a risk of serious or irreversible harm them.	2.1.2

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10 APPENDIX 1: YELLOW PERCH - SCORING AND RATIONALES

<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>It is likely that the stock is above the point where recruitment would be impaired.</td><td>It is highly likely that the stock is above the point where recruitment would be impaired.</td><td>There is a high degree of certainty that the stock is above the point where recruitment would be impaired.</td></tr>
<tr><td>Met?</td><td>MU 1: Y
MU 2: Y
MU 3: Y
MU 4: Y</td><td>MU 1: Y
MU 2: Y
MU 3: Y
MU 4: Y</td><td>MU 1: Y
MU 2: Y
MU 3: Y
MU 4: Y</td></tr>
<tr><td>Justification</td><td colspan="3">The biomass of all management units is well above 20% SSB_0, the MSC default LRP, this being particularly the case in MUs 2 to 4. All MUs meet SG60 SIa

The biomass of all management units is well above 20% SSB_0, the MSC default LRP, this being particularly the case in MUs 2 to 4. That of MU1 was above the MSC default LRP during 2007-2012 with an average 97% probability. All MUs meet SG80 SIa

The biomass of MUs 2 to 4 is well above 20% SSB_0, the MSC default LRP, and even 40% SSB_0, the MSC default TRP. That of MU1 was above the MSC default LRP during 2007-2012 with an average 97% probability. All MUs meet SG100 SIa</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td></td><td>The stock is at or fluctuating around its target reference point.</td><td>There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.</td></tr>
<tr><td>Met?</td><td></td><td>MU 1: Y
MU 2: Y
MU 3: Y
MU 4: Y</td><td>MU 1: N
MU 2: Y
MU 3: Y
MU 4: Y</td></tr>
<tr><td>Justification</td><td colspan="3">The biomass of MUs 2 - 4 is well above 40% SSB_0, the MSC default TRP, and has been so since the early 2000s. The biomass of MU1 was above 40% SSB_0 up until 2007, at which time it dropped below the default TRP and has varied about 90% of this reference point since then, a period of about one generation. It has varied about 101% of an estimate of SSB_{MSY} from the 2010 YPTG simulation study during this same period. Since 2007, fishing mortality has been significantly below the 50% F_{MSY} target, and certainly well below F_{MSY} since the mid 1990s. With recruitment of a strong 2013 year-class, SSB is expected to increase in 2016. SSB is also expected to increase with harvesting at the relatively conservative harvest rate of 50% F_{MSY}. These observations suggest that current SSB is at level consistent with SSB_{MSY}. All MUs meet SG80 Sib.

The biomass of MUs 2 - 4 is well above 40% SSB_0 and has been so since the early 2000s. It is not possible to state that the SSB of MU1 has been above a level consistent with SSB_{MSY} with a high degree of certainty (95% probability). MU1 does not meet SG100 SIb. MUs 2-4 meet SG100 Sib.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">YPTG (2013; 2015)</td></tr>
</table>

<table>
<tr><td colspan="4">Stock Status relative to Reference Points</td></tr>
<tr><td></td><td>Type of reference point</td><td>Value of reference point</td><td>Current stock status relative to reference point</td></tr>
</table>

Target reference point	40 % SSB_O /SSB_{MSY}	MU 1	2.194/1.908	MU 1	0.803/0.923
		MU 2	3.366	MU 2	1.944
		MU 3	1.931	MU 3	3.682
		MU 4	0.479	MU 4	6.240
Limit reference point	20 % SSB_O	MU 1	1.097	MU 1	1.605
		MU 2	1.683	MU 2	3.889
		MU 3	0.966	MU 3	7.360
		MU 4	0.239	MU 4	12.506
OVERALL PERFORMANCE INDICATOR SCORE		Gill Net			
		QZ1	90		
		QZ2	100		
		QZ3(W)	100		
		QZ3(E)	100		
		Trap Net			
		MU1	90		
		MU2	100		
		MU3	100		

PI 1.1.2		Limit and target reference points are appropriate for the stock		
SI		SG 60	SG 80	SG 100
a	Guidepost	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	
	Justification	A number of reference points have been estimated for the four management units. The primary one used in management is 50%F_{MSY} which is used to estimate annual RAH. This implies a biomass target that is consistent with B_{MSY} and likely in excess of it. While an explicit biomass limit reference point is not used in the Harvest Control Rule, the draft management plan outlines management modes of abundance which include an implied limit reference point. These are interpreted as generic limit and target reference points. All MUs meet SG60 SIa. A number of reference points have been estimated for the four MUs, although many are not used to inform annual management. Since 2010, the 50% F_{MSY} target reference point, and the implied associated target biomass reference point, has been used to inform management decisions. It was chosen amongst a number of possibilities based on simulations which took into account the dymanics of the stock and fishery. All MUs meet SG80 SIa.		
b	Guidepost		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		MU 1 N MU 2 N MU 3 N MU 4 N	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	While there is an explicit target fishing mortality, implying a target biomass reference point, this is not the case for a biomass limit reference point. There is not an explicitly recognized biomass LRP. All MUs do not meet SG80 Sib or SG100 SIb.		
c	Guidepost		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N

	Justification	The 50%F_{MSY} target reference point implies a biomass target of at least SSB_{MSY} and certainly in excess of this. All MUs meet SG80 SIc. The assessments are conducted separately for MUs 1-4 based on the definition of their respective stock boundaries. It is recognized that there is some movement amonst these, particularly in the central basin. Current reference points do not consider uncertainty implied by these movments. As well, the role of Yellow perch in the Lake Erie ecosystem is not explicltiy addressed. All MUs do not meet SG100 SIc.		
d	Guidepost		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		MU 1: NA MU 2: NA MU 3: NA MU 4: NA	
	Justification	Yellow perch is not considered a key low trophic level species.		
References		YPFMP (2007); YPTG (1997-2013); Zhou *et al* (2012)		

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net	
	QZ1	75
	QZ2	75
	QZ3(W)	75
	QZ3(E)	75
	Trap Net	
	MU1	75
	MU2	75
	MU3	75
CONDITION NUMBER	YP1	

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
SI		SG 60	SG 80	SG 100
a	Guidepost	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?	MU 1 NA MU 2 NA MU 3 NA MU 4 NA		MU 1 NA MU 2 NA MU 3 NA MU 4 NA
	Justification	Not applicable		
b	Guidepost	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
	Met?	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	MU 1 NA MU 2 NA MU 3 NA MU 4 NA
	Justification	Not applicable		
C	Guidepost	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	
	Justification	Not applicable		
References				

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net		
	QZ1	NA	
	QZ2	NA	
	QZ3(W)	NA	
	QZ3(E)	NA	
	Trap Net		
	MU1	NA	
	MU2	NA	
	MU3	NA	

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
SI		SG 60	SG 80	SG 100
a	Guidepost	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met ?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	The harvest strategy consists of objectives, a HCR, reference points, both implicit and explicit, a suite of tools and annual assessment by the YPTG. The strategy consists of components observed to be required in other fisheries. All MUs meet SG60 SIa. Since 2005, TACs have been set according to the scientific advice which is in turn based on the annual assessments. Reported catch has not exceeded TACs and in most cases is well below these. All MUs meet SG80 SIa. The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives through an explicit 50% F_{MSY} harvest rate. However, biomass TRP and LRPs are only implied and are not designed into the strategy. All MUs do not meet SG100 SIa.		
b	Guidepost	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met ?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	Fishing mortality has been below the 50% F_{MSY} in all MUs since at least the mid-2000s and in most cases (MUs 2 – 4) well before then. While the target reference point changed in 2010, it is likely that the harvest strategy can control harvesting. All MUs meet SG60 SIb. Fishing mortality has been below the 50% F_{MSY} management target in all MUs since at least the mid-2000s and in most cases (MUs 2 – 4) well before then. When $F_{0.1}$ fishing morality rates were introduced in 1992, the four MUs responded with large increases in biomass due to a combination of low exploitation rates and strong incoming recruitment. It is evident that the harvest strategy is capable of maintaining fishing mortality at or below its target. All MUs meet SG80 Sib. The harvest strategy has undergone some testing but this is incomplete. Further evaluation through an MSE process is warranted. All MUs do not meet SG100 Sib.		
c	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		

	Met?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y		
	Justification	The annual assessment meetings conducted by the YPTG review a suite of datasets used to monitor Yellow perch status. All MUs meet SG60 SIc.		
d	**Guidepost**			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			MU 1 Y MU 2 Y MU 3 Y MU 4 Y
	Justification	The harvest strategy was reviewed in 2001 and was substantially updated in 2010. During the intervening years, the YPTG considered updates to the strategy on an on-going basis. All MUs meet SG100 Sid.		
e	**Guidepost**	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	MU 1 NA MU 2 NA MU 3 NA MU 4 NA	MU 1 NA MU 2 NA MU 3 NA MU 4 NA
	Justification	Not applicable		
References		YPFMP (2007); YPTG (2013)		

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	85
QZ2	85
QZ3(W)	85
QZ3(E)	85
Trap Net	
MU1	85
MU2	85
MU3	85

PI 1.2.2		There are well defined and effective harvest control rules in place		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met ?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N	
	Justification	The suite of management modes in the draft YPMP and the explicit HCR with a 50% F_{MSY} target harvest rate are evidence of the general requirement to reduce exploitation as abundance declines to a critically low level. All MUs meet SG60 SIa. The HCR does not make explicit reference to an LRP and it is unclear what actions will be taken as the MSC default LRP of 20% SSB_0 is approached. No MU meets SG80 SIa.		
b	**Guidepost**		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met ?		MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	By design, the HCR accounts for the main uncertainties identified in the annual stock assessment. It does this through provision in the scientific advice of minimum, mean and maximum RAHs. As uncertainty in current stock size changes, so too do these RAHs. All MUs meet SG80 SIb. Processes such as movements amongst the MUs are not considered in the HCR. All MUs do not meet SG100 SIb.		
c	**Guidepost**	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met ?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y

Justification	The primary tool to control harvesting is the TAC. This is set based on the annual scientific advice. The reported catch has not exceeded the TAC since 2005. All MUs meet SG60 SIc. Since 2005, reported catch has been below the TAC and the latter has been set consistent with the scientitic advice. The primary regulatory tool, TACs, is successfully used in many fisheries to control exploitation. All MUs meet SG80 SIc. Long term trends in fishing mortality under quota management clearly indicate that this tool is effective in controlling F. All MUs meet SG100 SIc.
References	YPFMP (2007); YPTG (2013)

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	75
QZ2	75
QZ3(W)	75
QZ3(E)	75
Trap Net	
MU1	75
MU2	75
MU3	75

CONDITION NUMBER	YP2.

PI 1.2.3		Relevant information is collected to support the harvest strategy		
SI		SG 60	SG 80	SG 100
a	Guidepost	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met ?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	While there may be movement between management units, genetic and morphological studies support the basis of the stock units. Maturity and fecundity data come from variety of sources. Natural mortality (M) is estimated to be 0.40 based upon 1997 review. Gamma and more recently a Ricker stock-recruit relationship characterizes production dynamics and allows estimation of stock production reference points. Information is available on fleet composition in both Ontario and Ohio. Information in the licensing systems catalogue vessel and gear characteristics of each participant. Through the Vessel Monitoring System (VMS), good information is also provided on fishing location which supplements the logbook data. All MUs meet SG60 SIa. Genetic and morphological studies support the basis of the stock units. Maturity and fecundity data come from variety of sources and M is estimated to be 0.40 based upon 1997 review. Gamma and more recently a Ricker stock-recruit relationship characterizes production dynamics and allows estimation of stock production reference points. Information is available on fleet composition in both Ontario and Ohio while information in the licensing systems catalogue vessel and gear characteristics of each participant. Through the VMS The range of information on Yellow perch could be considered comprehensive although the lack of verification of the discard data is a concern. Indications are that discards are low but this needs to be verified. VMS provides good information on fishing location which supplements the logbook data. Other data includes on-going monitoring of environmental conditions in Lake Erie which may be associated with Yellow perch productivity. Overall, there is sufficient information on stock structure, stock productivity, and fleet composition. In addition, other data on environmental conditions is sufficient to monitor potential abiotic – induced changes in Yellow perch productivity. All MUs meet SG80 SIa. The range of information on Yellow perch could be considered comprehensive although the lack of verification of the discard data is a concern. Indications are that discards are low but this needs to be verified. No MU meets SG100 SIa.		
b	Guidepost	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.

	Met?	MU 1: Y MU 2: Y MU 3: Y MU 4: Y	MU 1: Y MU 2: Y MU 3: Y MU 4: Y	MU 1: N MU 2: N MU 3: N MU 4: N
	Justification	A number of indices of fishery dependent and independent stock abundance are used in the Yellow perch assessments. The primary fishery dependent indices are of fishing effort since the mid-1970s for the Ontario gillnet, Ohio trap and Ohio sport fisheries. The primary fishery independent indices are provided by the Ontario partnership gillnet survey (1989 – present) and the Ontario/US western basin interagency trawling survey (1987 - present). These indices provide about 25 years of stock monitoring which is almost four generations of Yellow perch. Fishery removals have been recorded in daily catch records since 1997. Discards have been reliably recorded since 2011. Monitoring of dockside landings during 2004 – 2012 ranged 36 - 77% in MUs 1 – 3 and 8 - 55% in MU4. While there have been observer studies on specific issues (e.g. smelt fishery), there is no routine on-the-lake coverage. Although post-capture mortality from gillnets appears to be high (80%), given the reported magnitude of released fish compared to the total catch, post-capture mortality does not appear to be a big issue. All MUs meet SG60 Sib. As noted in SG60, a number of indices of fishery dependent and independent stock abundance are used in the Yellow perch assessments. These indices provide about 25 years of stock monitoring which is almost four generations of Yellow perch. There has been some examination of the statistical properties of these indices, the results of which may be incorporated into upcoming assessment. The relative uncertainty in the indices already is. Fishery removals have been recorded in daily catch records since 1997 and discards reliably since 2011. There is monitoring of dockside landings but there is no on-the-lake verification of the discard data, although this is reported to be low. All MUs meet SG80 Sib. All information required by the HCR is monitored with high frequency relative to the generation time of Yellow perch. There is good understanding of the uncertainties in the fishery removals and stock indices. Notwithstanding this, there is a concern on the reliability of the commercial fishery's discard data due to the lack of verification. As well, the robustness of the assessment and management to these uncertainties has not been fully examined. No MU meets SG100 SIb.		
c	**Guide post**		There is good information on all other fishery removals from the stock.	
	Met?		MU 1: Y MU 2: Y MU 3: Y MU 4: Y	
	Justification	There is a small recreational fishery in Ontario and a much larger one in Ohio. The fleet compositional and operational characteristics of these fisheries are well described. There is a comprehensive database of catch and effort, similar to those available for the commercial fisheries. There are small hoop, seine and bait fisheries which are considered to be small although there are no estimates of the catch of these. Notwithstanding this, the primary other fishery (Ohio recreational) is well monitored. All MUs meet SG80 SIc.		
References		Lester *et al* (2005); Li *et al* (2011a; 2011b); Locke (2013); OMNR (2013a; 2013b; 2013c); Sepulveda-Villet *et al* (2009); Tavel (2009); Tyson *et al* (2006)		

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	
MU1	80
MU2	80
MU3	80

PI 1.2.4		There is an adequate assessment of the stock status		
SI		SG 60	SG 80	SG 100
a	Guidepost		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	The SCAA model provides estimates of abundance, biomass and fishing mortality, along with estimates of their uncertainty, which is used by the HCR. The model, which incorporates error in both fishery removals and the indices, is appropriate given the nature of the fishery. It is also consistent with SCAA formulations elsewhere which inform comparable HCRs. All MUs meet SG80 SIa. A feature that the SCAA does not capture is the impact of mixing among the MUs. The YPTG has noted this as an issue and it is planned for future study. This could be important to the assessment and decision-making and does not permit scoring at SG100. No MU meets SG100 SIa.		
b	Guidepost	The assessment estimates stock status relative to reference points.		
	Met?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y		
	Justification	The assessment of each MU estimates fishing mortality relative to the 50% F_{MSY} reference point. All MUs meet SG60 Sib.		
c	Guidepost	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	Each of the fishery removal and index data sets has an associated estimate of the relative variance, based on the findings of a 2007 workshop and subsequent examination of relative error in each input dataset. As well, error around the Ricker stock-recruit relationship is documented and used in reference point determination. All MUs meet SG60 SIc. The model, through the use of lambda terms associated with each fishery removal and index data set, takes account of uncertainty. These lambda terms are based upon discussion at a 2007 workshop and subsequent examination of the relative error in each input dataset. All MUs meet SG80 SIc. While minimum, mean and maximum Recommended Allowable Harvest (RAH) is provided for the projection year, the assessment does not, per se, evaluate stock status relative to reference points in a probabilistic way. No MU meets SG100 SIc.		

d	Guidepost			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			MU 1 N MU 2 N MU 3 N MU 4 N
	Justification	The current SCAA model is a modification of a pre-2001 model based upon the recommendations of an external peer review. A full evaluation of the model and associated HCRs, as conducted during the MSE on Walleye, as not yet taken place. No MU meets SG100 SId.		
e	Guide post		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		MU 1 Y MU 2 Y MU 3 Y MU 4 Y	MU 1 Y MU 2 Y MU 3 Y MU 4 Y
	Justification	The YPTG provides an internal peer review forum, the results of which are produced in its annual reports. All MUs meet SG80 SIe. The YPTG provides internal peer review. From time to time, external peer review has been conducted, both by commissioned scientists (e.g. Myers and Bence, 2001) and on-going interaction with the QFC at Michigan State U. All MUs meet SG100 SIe.		
References		Myers & Bence (2001); YPTG (1997-2013); YPFMP (2007)		

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	85
QZ2	85
QZ3(W)	85
QZ3(E)	85
Trap Net	
MU1	85
MU2	85
MU3	85

<table>
<tr><td colspan="2">PI 2.1.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Main retained species are likely to be within biologically based limits (if not, go to SI c below).</td><td>Main retained species are highly likely to be within biologically based limits (if not, go to SI c below).</td><td>There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">
Gill net
QZ1, QZ2, QZ3(E), QZ3(W)
As Walleye and White perch have catch shares > 5 %, they are “main” species. White perch is invasive and not considered in scoring. Walleye is within biologically based limits and when assessed as a P1 species in the large mesh gill net fishery, the scoring concluded that “there is a high degree of certainty that the stock is above the point where recruitment would be impaired” and “there is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years” (i.e. the two issues at PI 1.1.1 SG100). The fishery meets SG60 & SG80 SIa.
SG100 SIa includes <u>all</u> retained species and there is not a high degree of certainty that all are within biologically based limits. The fishery does not meet SG100 SIa.
Trap net
MU1
Channel catfish, Freshwater drum and White perch are main species as their individual catch shares are >5%.
White perch is invasive and is not considered in scoring.
In Ohio, Channel catfish is mainly taken by seine net. Catch declined from the mid-1990s, suggesting either a decline in market demand, fishery interest or abundance. More recently, interagency surveys have documented strong increases in abundance. The trend in abundance occurred primarily in the western basin and in the warmer waters of the central basin (ODNR 2004; OMNR 2004). From 2010 to 2012 the harvest rate (lbs / 1,000 ft of seine haul) was above the 10 year average. For traps, the harvest rate was above the 10-year average from 2009 to 2011 before dipping below in 2012. However, the average data is weighted by the low rate recorded in 2004. Harvest rates in trap nets and seine fisheries reported by ODNR that are taken as indicators of abundance and show increases in Channel catfish since 2007. Nevertheless, the species may have recently experienced increased M due to outbreaks of disease (Channel catfish viral disease and type E botulism). Channel catfish is highly likely to be within biological limits.
The harvest for Freshwater drum in Ohio includes sport and commercial fisheries by trap nets, seines and trotline. The large mesh trap net fishery takes the highest share. In 2012, the total commercial harvest was 514,310 lbs., over half taken by the large mesh trap net fishery and in MU1. Harvest in the trap net fishery in the last 10 years ranged between 120,000 and 282,000 lbs and the small mesh trap net fishery constitutes about 10%. The abundance index of YOY drum from the bottom trawl USGS surveys in
</td></tr>
</table>

<table>
<tr><td></td><td></td><td colspan="3">western Lake Erie, show a strong recovery from the low point experienced in 2006, with the index reaching the third highest level recorded since 1996.

Interagency fishery independent surveys tend to indicate that harvest declines are independent of abundance for which they have documented a slight increase; primarily in the western basin and in the warmer waters of the central basin. The species may have experienced increased M due to outbreaks of disease.

The fishery meets SG60 & SG80 SIa.

SG100 SIa takes into account all retained species. There is not a high degree of certainty that these are within biologically based limits. The fishery does not meet SG100 SIa.

MU2

Of the species retained, only White perch is considered main as its harvest share is >5%. White perch is invasive and is not considered due to the lack of concern about its biological status. The fishery meets SG60 & SG80 SIa. SG100 SIa takes into account all retained species.

There is not a high degree of certainty that these are within biologically based limits. The fishery does not meet SG100 SIa.

MU3

There are no main retained species. The fishery meets SG60 & SG80 SIa. SG100 SIa takes into account <u>all</u> retained species. As there is not a high degree of certainty that these are within biologically based limits, the fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td></td><td></td><td>Target reference points are defined for retained species.</td></tr>
<tr><td>Met?</td><td></td><td></td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gillnet (All QZs)

The Walleye assessment concludes that “the species target fishing mortality is 60% F_{MSY}, which implies a stock biomass which is 65% of virgin biomass and in excess of B_{MSY} which is 42% of virgin biomass. Therefore the target biomass implied by the target fishing mortality is more precautionary than fishing towards B_{MSY} SG80 “.

This meets SG100 SIb. However, as TRPs are not set for all species the fishery does not meet SG100 SIb.

Trap net (All MUs)

The lack of TRPs for all species means the fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="2">c</td><td>Guidepost</td><td>If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.</td><td>If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.</td><td></td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y</td><td></td></tr>
</table>

		QZ3W	Y				QZ3W	Y	

Justification

Gill net (All QZs)

Walleye is not outside biological limits. The fishery meets SG80 SIc.

Trap net

MU1

White perch is not considered.

Channel catfish is not outside biological limits. The fishery meets SG80 SIc.

Freshwater drum is not outside biological limits. The fishery meets SG80 SIc.

MU2

There are no main retained species apart from white perch that is not considered. The fishery meets SG80 SIc.

MU3

There are no main retained species. The fishery meets SG80 SIc.

d **Guidepost**

If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.

Met?

MU 1	Y	QZ1	Y
MU 2	Y	QZ2	Y
MU 3	Y	QZ3E	Y
		QZ3W	Y

Justification

Gill net (All QZs)

The status of Walleye is well known. The fishery meets SG60 SId.

Trap net

MU1

The status of Channel catfish and Freshwater drum is known. White perch is not considered. The fishery meets SG60 SId

MU2

White perch is not considered. There are no main retained species. The fishery meets SG60 SId

MU3

There are no main retained species. The fishery meets SG60 SId

References

ODNR 2013, TF Report Final 2007, CFHIS / OCFA data; Baldwin *et al* 2002; ODNR 2004; OMNR 2004; Fremling 1980; Rypel 2007; Cook *et al* 2005; CWTG 2014; Zhu *et al* 2008; Davis 2013;

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	

		MU1	80	
		MU2	80	
		MU3	80	

<table>
<tr><td colspan="2">PI 2.1.2</td><td colspan="3">There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.</td><td>There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.</td><td>There is a strategy in place for managing retained species.</td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

The main retained species are Walleye and White perch. Neither measures nor a partial strategy are necessary for White perch which is an invasive species.

Several management measures cover all retained species in the fishery: minimum mesh size (57 mm), limited entry, gear restrictions, closed seasons and areas. The fishery meets SG60 SIa

The TAC for Walleye limits total annual catch including the quantity harvested as non-target species in the Yellow perch directed fishery. This together with the identified measures constitutes a partial strategy. The fishery meets SG80 SIa

The lack of a strategy to manage all retained species means the fishery does not meet SG100 SIa.

Trap net

MU1

The main retained species are Channel catfish, Freshwater drum and White perch. White perch is not considered in scoring as it is an invasive species.

Several management measures relate to all retained species in the Yellow perch fishery: limited entry, gear configuration, closed seasons and areas. All these measures control fishing effort, protect nursery areas and minimize catch of juveniles. There is an additional measure of minimum landing size for Channel catfish (14.5”), a similar measure has not been defined for Freshwater drum. The fishery meets SG60 SIa.

There is no partial strategy in place expected to maintain Channel catfish or Freshwater drum at levels which are highly likely to be within biological limits. The fishery does not meet SG80 SIa.

MU2

The only main retained species is White perch which is not considered in scoring as it is an invasive species. The fishery meets SG80 SIa. As there is not a strategy to manage all retained species, the fishery does not meet SG100 SIa.

MU3

There are no main retained species. The fishery meets SG80 SIa.

As there is not a strategy to manage all retained species the fishery does not meet SG100 SIa.</td></tr>
</table>

<table>
<tr><td rowspan="3">B</td><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).</td><td>There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.</td><td>Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.</td></tr>
<tr><td>Met?</td><td><table><tr><td>MU 1</td><td>Y</td><td>QZ1</td><td>Y</td></tr><tr><td>MU 2</td><td>Y</td><td>QZ2</td><td>Y</td></tr><tr><td>MU 3</td><td>Y</td><td>QZ3E</td><td>Y</td></tr><tr><td></td><td></td><td>QZ3W</td><td>Y</td></tr></table></td><td><table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>Y</td></tr><tr><td>MU 2</td><td>Y</td><td>QZ2</td><td>Y</td></tr><tr><td>MU 3</td><td>Y</td><td>QZ3E</td><td>Y</td></tr><tr><td></td><td></td><td>QZ3W</td><td>Y</td></tr></table></td><td><table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>N</td></tr><tr><td>MU 2</td><td>N</td><td>QZ2</td><td>N</td></tr><tr><td>MU 3</td><td>N</td><td>QZ3E</td><td>N</td></tr><tr><td></td><td></td><td>QZ3W</td><td>N</td></tr></table></td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

White perch is not taken into consideration in scoring. The measures applied for all retained species are considered likely to work as the gear is selective, there is limited effort and Yellow perch acts as a choke species in each QZ. The fishery meets SG60 SIb.

The Walleye TAC covering the catch in non-target fisheries has resulted in the species' stock status being above B_{MSY} since the mid-2000s. This provides an objective basis for confidence that the partial strategy will work. The fishery meets SG80 SIb.

While an MSE indicates that the Walleye strategy will work, there is not a strategy for other retained species. The fishery does not meet SG100 SIb.

Trap net

MU1

The main retained species are Channel catfish, Freshwater drum and White perch. White perch is not taken into consideration in scoring.

The measures that control fishing effort, protect nursery areas and minimize catch of juveniles, plus the minimun landing size for Channel catfish are expected to maintain by-catch at levels that are highly likely to be within biological limits.. The measures may work and the fishery meets SG60 SIb

There is no partial strategy for the main retained species. The fishery does not meet SG80 SIb.

MU2

White perch, the only main retained species and it is not considered in scoring as it is an invasive species. The fishery meets SG80 SIb.

The lack of a strategy for all retained species means that it does not meet SG100 SIb.

MU3

As there are not any main retained species, the fishery meets SG80 SIb.

The lack of a strategy for all retained species means that it does not meet SG100 SIb.</td></tr>
<tr><td rowspan="2">C</td><td>Guide post</td><td></td><td>There is some evidence that the partial strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td>Met?</td><td></td><td><table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>Y</td></tr><tr><td>MU 2</td><td>Y</td><td>QZ2</td><td>Y</td></tr><tr><td>MU 3</td><td>Y</td><td>QZ3E</td><td>Y</td></tr><tr><td></td><td></td><td>QZ3W</td><td>Y</td></tr></table></td><td><table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>N</td></tr><tr><td>MU 2</td><td>N</td><td>QZ2</td><td>N</td></tr><tr><td>MU 3</td><td>N</td><td>QZ3E</td><td>N</td></tr><tr><td></td><td></td><td>QZ3W</td><td>N</td></tr></table></td></tr>
</table>

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

There is evidence that the successful implementation of the partial strategy has contributed to the stock being maintained at a sustainable level. The fishery meets SG80 SIc.

The lack of a strategy for all retained species means the fishery does not meet SG100 SIc.

Trap net

MU1

White perch is not considered in scoring as it is an invasive species. The lack of a catch limit for Channel catfish means that the partial strategy of a minimum size and other measures is unlikely to work. A partial strategy has not been implemented for Freshwater drum. The fishery does not meet SG80 SIc

MU2

White perch, the only main retained species, is not considered in scoring as it is an invasive species. The fishery meets SG80 SIc.

The lack of a strategy for all retained species means the fishery does not meet SG100 SIc.

MU3

There are not any main retained species. The fishery meets SG80 SIc.

The lack of a strategy for all retained species means the fishery does not meet SG100 SIc.</td></tr>
<tr><td rowspan="3">d</td><td>Guide post</td><td></td><td></td><td>There is some evidence that the strategy is achieving its overall objective.</td></tr>
<tr><td>Met?</td><td></td><td></td><td><table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>N</td></tr><tr><td>MU 2</td><td>N</td><td>QZ2</td><td>N</td></tr><tr><td>MU 3</td><td>N</td><td>QZ3E</td><td>N</td></tr><tr><td></td><td></td><td>QZ3W</td><td>N</td></tr></table></td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs), Trap Net (all)

There is not a strategy for all retained species. The fishery does not meet SG100 SId.</td></tr>
<tr><td rowspan="3">e</td><td>Guide post</td><td>It is likely that shark finning is not taking place.</td><td>It is highly likely that shark finning is not taking place.</td><td>There is a high degree of certainty that shark finning is not taking place.</td></tr>
<tr><td>Met?</td><td></td><td></td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs) & Trap net (All MUs)

Not relevant.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Todd 1986; Debertin; Ontario License conditions; State of Lake Erie 2009; CTWG various; Ebener 2008; Brenden 2013;</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net	
	QZ1	80
	QZ2	80
	QZ3(W)	80
	QZ3(E)	80
	Trap Net	
	MU1	60
	MU2	80
	MU3	80
CONDITION NUMBER	YP3	

<table>
<tr><td colspan="2">PI 2.1.3</td><td colspan="3">Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Qualitative information is available on the amount of main retained species taken by the fishery.</td><td>Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.</td><td>Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.</td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs), Trap Net (all MUs)

The substantial amount of quantitative information on retained catch provided in DCRs is inputted into a data base by OCFA and used by OMNR, OCFA and others to provide information required.

The fishery meets SG60 & SG80 SIa.

While the accuracy of Information is improved by dockside monitoring, including forensic accounting at individual processing plants, as information is grouped for some species, accurate information is not available for all species. The available data is not used to assess the impact of the fishery on all retained species. There are not any published reports on the catch of retained species.

The fishery does not meet SG100 SIa.

The audit team and the client spent a substantial amount of effort to gain reliable data on the retained and by-catch species by quantity in Ontario. This led to a long delay in completing the report. While the assessment team is confident that reliable data has now been provided and inputted into this report, it is <u>recommended</u> that to support the annual surveillance program while ensuring correct information is available to managers, OCFA and OMNR should work together to design and implement a data system that provides consistently accurate data, and the data on catch, retained catch and by-catch is published and made available to stakeholders on a regular basis.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Information is adequate to qualitatively assess outcome status with respect to biologically based limits.</td><td>Information is sufficient to estimate outcome status with respect to biologically based limits.</td><td>Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.</td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs), Trap Net (all MUs)

Data gained from catch monitoring (DCRs, dockside monitoring, observer coverage, sampling) together with abundance surveys provide the information necessary for the fishery to meet SG60 SIb &SG80 SIb.

As a wide range of information is not available for all retained species and questions have arisen about the accuracy of the data the fishery does not meet SG100 SIb.</td></tr>
</table>

c	**Guidepost**	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 N QZ1 N MU 2 N QZ2 N MU 3 N QZ3E N QZ3W N
	Justification	Gill net (All QZs), Trap Net (all MUs) The amount of data available on the quantity of retained species is considered sufficient to identify the potential of the fisheries to affect the stocks and the fisheries meet SG60 & SG80 SIc. Given that data is not available for all species and there are questions about data accuracy, the fisheries do not meet SG100 SIc.		
d	**Guidepost**		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 N QZ1 N MU 2 N QZ2 N MU 3 N QZ3E N QZ3W N
	Justification	Gill net (All QZs), Trap Net (all MUs) DCRs and VMS data provide information on the operation of the fishery for all QZs & MUs and any increase in effort and catch that would be expected to increase the risk to retained species. The fisheries meet SG80 SId. There is insufficient monitoring of the ongoing mortalities for all retained species for the fisheries to meet SG100 SId.		
References		FTG 2013		

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	
MU1	80
MU2	80
MU3	80

PI 2.2.1		The fishery does not pose a risk of serious or irreversible harm to the by-catch species or species groups and does not hinder recovery of depleted by-catch species or species groups		
SI		SG 60	SG 80	SG 100
a	Guidepost	Main by-catch species are likely to be within biologically based limits (if not, go to SI b below).	Main by-catch species are highly likely to be within biologically based limits (if not, go to SI b below).	There is a high degree of certainty that by-catch species are within biologically based limits.
	Met?	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 N QZ1 N MU 2 N QZ2 N MU 3 N QZ3E N QZ3W N
	Justification	Gill net (All QZs) There are no main by-catch species. The fishery meets SG60 & SG80 SIa. The lack of information on all by- catch species prevents it meeting SG100 SIa. Trap net (All MUs) There are no main bycatch species in the trap net fishery. The fishery meets SG60 & SG80 SIa. Insufficient evidence on post release mortality of by-catch species released in the trap fishery means the fishery does not meet SG100 SIa.		
b	Guidepost	If main by-catch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.	If main by-catch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	MU 1 Y QZ1 Y MU 2 Y QZ2 Y MU 3 Y QZ3E Y QZ3W Y	
	Justification	Gill net (All QZs) There are no main by-catch species. The fishery meets SG60 & SG80 SIb. Trap net (All MUs) There are no main by-catch species in the yellow perch trap net fishery. The fishery meets SG60 & SG80 SIb.		
c	Guidepost	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the by-catch species to be outside biologically based limits or hindering recovery.		

	Met?	<table><tr><td>MU 1</td><td>Y</td><td>QZ1</td><td>Y</td></tr><tr><td>MU 2</td><td>Y</td><td>QZ2</td><td>Y</td></tr><tr><td>MU 3</td><td>Y</td><td>QZ3E</td><td>Y</td></tr><tr><td></td><td></td><td>QZ3W</td><td>Y</td></tr></table>
	Justification	Gill net (All QZs) There are not any main by-catch species. The fishery meets SG60 SIc. Trap net (All MUs) There are not any main by-catch species. The fishery meets SG60 SIc.
References		2013 Ontario Fisheries; Zhu *et al* 2008; VanMeter & Trautman 1970; CFHIS (OCFA); nunen & Pistis (2007)

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	
MU1	80
MU2	80
MU3	80

<table>
<tr><td>PI 2.2.2</td><td colspan="4">There is a strategy in place for managing by-catch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to by-catch populations</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There are measures in place, if necessary, that are expected to maintain the main by-catch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.</td><td>There is a partial strategy in place, if necessary, that is expected to maintain the main by-catch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.</td><td>There is a strategy in place for managing and minimizing by-catch.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 N
MU 2 Y QZ2 N
MU 3 Y QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

Discard is prohibited in Ontario. Conditions of licence define by-catch as capture which cannot be legally harvested. All no harvest permitted species must be reported and landed. Thus, there are no main by-catch species and therefore not a requirement for measures or a partial strategy. In the future, Lake sturgeon, lake trout and sucker species may need to be considered if annual catches are seen to increase. Accordingly, it is valid to note that Lake sturgeon is listed as endangered in Ontario; there is a recovery plan in place and any catch must be released live. Lake trout also should be released alive. In relation to these two species, the fishery would meet SG100 SIa. Nevertheless, it is also valid to note that suckers could include SARA species of concern not recognized by Ontario legislation and not awarded protection. While the assessment team members were told that discard was prohibited in Ontario, the data indicates otherwise.

Accordingly, there is not a strategy in place covering all species and the conclusion is that the fishery only meets SG60 & SG80 SIa.

Trap net (all MUs)

The strategy is to release by-catch live. The fishery meets SG100 SIa.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).</td><td>There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.</td><td>Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
</table>

	Justification	Gill net (All QZs) The lack of main by catch species and the minimal take of Lake sturgeon and lake trout indicate that the measures are considered likely to work and there is an objective basis for confidence that the partial strategy of not allowing catch and live release, with associated sanctions for non-compliance, is working. The fishery meets SG60 & SG80 SIb. As there has been no testing to confirm PCM, the fishery does not meet SG100 SIb. Trap net (All MUs) The lack of by catch species provides an objective basis for confidence that the partial strategy of live release, with associated sanctions for non-compliance, is working. The fishery meets SG60 & SG80 SIb. As there has been no testing to confirm PCM & PRM, the fishery does not meet SG100 SIb.		
c	**Guide post**		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		MU 1 | Y | QZ1 | Y MU 2 | Y | QZ2 | Y MU 3 | Y | QZ3E | Y | | QZ3W | Y	MU 1 | N | QZ1 | N MU 2 | N | QZ2 | N MU 3 | N | QZ3E | N | | QZ3W | N
	Justification	Gill net (All QZs) Lake sturgeon & Lake trout: data on released fish provides evidence that the partial strategy is being implemented successfully. The fishery meets SG80 SIc. The lack of observer coverage and evidence on PCM means the fishery does not meet SG100 SIc. Trap net (All MUs) The lack of by-catch provides the evidence that the strategy is being implemented successfully. The fishery meets SG80 SIc. The fishery does not achieve SG 100 SIc due to lack of observer coverage and evidence on PCM & PRM.		
d	**Guidepost**			There is some evidence that the strategy is achieving its overall objective.
	Met?			MU 1 | N | QZ1 | N MU 2 | N | QZ2 | N MU 3 | N | QZ3E | N | | QZ3W | N

	Justification	Gill net (All QZs) Lack of evidence showing there are no discards in the fishery and by-catch not covered in the recovery plans for Lake trout and Lake sturgeon means the fishery does not meet SG100 SId. Trap net (All MUs) Lack of information on the quantity and type of fish released means that the fishery does not achieve SG100 SId.
References		OMNR 2103; 2013 Ontario Fisheries;

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	
MU1	80
MU2	80
MU3	80

PI 2.2.3		**Information on the nature and the amount of by-catch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage by-catch**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Qualitative information is available on the amount of main by-catch species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main by-catch species taken by the fishery.	Accurate and verifiable information is available on the catch of all by-catch species and the consequences for the status of affected populations.
		MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 Y MU 2 N, QZ2 Y MU 3 N, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) Although not the case previously (as indicated by the increase in by catch), it is believed that since 2011 fishers comply in reporting bycatch. This information provides qualitative and quantitative information on the amount of bycatch. The fishery meets SG60 & SG80 SIa. Bycatch cannot be verified due to there not being any observer coverage. Also, while the assessment team did not identify main by-catch species in any of the QZs it was noted that DCRs do not identify individual species of the sucker family, some of which could be vulnerable. Further, there are Species of Concern in the area that could be part of the by-catch. **It is recommended that to support the annual surveillance programme, OCFA and OMNR should work to modify the reporting protocol so that sucker species are individually recorded.** The fishery does not meet SG100 SIa. Trap net (All MUs) Substantial qualitative information indicates there is no by-catch; unwanted catch remains alive in the trap until released by the fishers. The fishery meets SG60. However, the auditors have not identified any quantitative information as evidence on the quantity and type of fish that are released and the fishery does not meet SG80SIa.		
b	**Guidepost**	Information is adequate to broadly understand outcome status with respect to biologically based limits	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.
	Met?	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

The quantitative information (DCR, survey data and release of no harvest species) provides the basis estimate outcome status with respect to biologically based limits. The fishery meets SG60 & SG80 SIb.

Lack of information on all species means the fishery does not meet SG100 SIb.

Trap net (All MUs)

Although there is lack of quantitative information, reports by fishers who provide empirical information indicates that the amount of released live by-catch is limited and can be used to assess the impact of the fishery on outcome status with respect to biologically based limits. The fishery meets SG60 & SG80 SIb.

Data is insufficient for the fishery to meet SG100 SIb.</td></tr>
<tr><td>c</td><td>Guidepost</td><td>Information is adequate to support measures to manage by-catch.</td><td>Information is adequate to support a partial strategy to manage main by-catch species.</td><td>Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.</td></tr>
<tr><td></td><td>Met?</td><td>MU 1 | Y | QZ1 | Y
MU 2 | Y | QZ2 | Y
MU 3 | Y | QZ3E | Y
 | | QZ3W | Y</td><td>MU 1 | Y | QZ1 | Y
MU 2 | Y | QZ2 | Y
MU 3 | Y | QZ3E | Y
 | | QZ3W | Y</td><td>MU 1 | N | QZ1 | N
MU 2 | N | QZ2 | N
MU 3 | N | QZ3E | N
 | | QZ3W | N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

The weight of released Lake sturgeon and Lake trout in the large mesh fishery is recorded in DCR but not the number and size of individuals. This information is adequate to support measures for the by-catch of both species. The fishery meets SG60 SIc.

Reporting of Lake sturgeon catch and release is mandatory. Lake trout is a non-harvest species that must be released with data recorded in DCRs. This information together with survey data is adequate to support a partial strategy. The fishery meets SG80 SIc.

The PCM of the released species is not known, suckers are not reported to species level, and there is uncertainty about the reliability of data for all by-catch species as mandatory reporting has only been in place since 2011. As matters now stand it is considered that the information is not adequate to support and evaluate a strategy. The fishery does not meet SG100 SIc.

Trap net (All MUs)

All by catch is released live and this is the partial strategy. There are no main by-catch species. The fishery meets SG60 & SG80 SIc.

The lack of quantitative information on the number and type of released fish means the fishery does not meet SG100 SIc.</td></tr>
<tr><td>d</td><td>Guidepost</td><td></td><td>Sufficient data continue to be collected to detect any increase in risk to main by-catch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).</td><td>Monitoring of by-catch data is conducted in sufficient detail to assess ongoing mortalities to all by-catch species.</td></tr>
</table>

Met?		<table><tr><td>MU 1</td><td>Y</td><td>QZ1</td><td>Y</td></tr><tr><td>MU 2</td><td>Y</td><td>QZ2</td><td>Y</td></tr><tr><td>MU 3</td><td>Y</td><td>QZ3E</td><td>Y</td></tr><tr><td></td><td></td><td>QZ3W</td><td>Y</td></tr></table>	<table><tr><td>MU 1</td><td>N</td><td>QZ1</td><td>N</td></tr><tr><td>MU 2</td><td>N</td><td>QZ2</td><td>N</td></tr><tr><td>MU 3</td><td>N</td><td>QZ3E</td><td>N</td></tr><tr><td></td><td></td><td>QZ3W</td><td>N</td></tr></table>
Justification	Gill net (All QZs) Information on the operations of the fleet (scale and intensity) and data reported in DCRs are sufficient to any increase in risk to main bycatch species. The fishery meets SG80 SId. As there are concerns about the accuracy of monitoring of data on all species (lack of sucker species identification and observer coverage) the fishery does not meet SG100 SId. Trap net (All MUs) Information on the operations of the fleet (scale and intensity) and data reported in DCRs are sufficient to any increase in risk to main bycatch species. The fishery meets SG80 SId. As there is not any monitoring the fishery does not meet SG100 SId.		
References	Li *et al* 2011;		

OVERALL PERFORMANCE INDICATOR SCORE		
	Gill Net	
	QZ1	80
	QZ2	80
	QZ3(W)	80
	QZ3(E)	80
	Trap Net	
	MU1	75
	MU2	75
	MU3	75
CONDITION NUMBER	YP4	

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
SI		SG 60	SG 80	SG 100
a	Guidepost	Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.	The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.	There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.
	Met?	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) None of the ETP fish species recognized by national legislation (SARA) that could potentially overlap with the large mesh fishery (Lake chubsucker, Spotted gar) were recorded as catch in the fishery between 2004 and 2013. The fishery meets SG60 & SG80 SIa. One unionid mussel species (eastern pondshell) could be affected indirectly by the fishery and there is lack of specific research. While the limited foot print of the gear may lead to the conclusion that the fishery does not interact with the listed species, the lack of specific research means that the fishery does not meet SG100 SIa. Trap net (All MUs) There is potential interaction of the fishery with unionid (snuffbox mussel) ETP species recognized by national legislation (ESA). Given the footprint of the gear (limited number of traps), the distribution of yellow perch effort and the distribution of these species, it is considered that the effects of the fishery are highly likely to be within limits of national and international requirements for protection of ETP species. The fishery meets SG60 & SG80 SIa. The lack of specific research means that the fishery does not meet SG100 SIa.		
b	Guidepost	Known direct effects are unlikely to create unacceptable impacts to ETP species.	Direct effects are highly unlikely to create unacceptable impacts to ETP species.	There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.
		MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 N MU 2 Y, QZ2 N MU 3 Y, QZ3E N QZ3W N

	Justification	Gill net (All QZs) There are no known direct effects of this fishery on ETP fish species. Although there is potential interaction with the fishery, none of the ETP fish species was registered as catch in the fishery between 2004 and 2013. SG60 & SG80 SIb are met. There is not a high degree of confidence that there are no detrimental effects as only landed catch is subjected to inspection. The fishery does not meet SG100 SIb. Trap net (All MUs) There are no direct effects of the fishery with ETP species. The fishery meets SG60, SG80 & SG100 SIb

c	Guidepost		Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
			MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) The potential for ghost fishing to create unacceptable impacts has been considered and is considered low (site visit workshop). The small footprint of the gear and the soft ground leads to the reasonable conclusion that unacceptable impacts on unionid mussels are lacking. The fishery meets the SG80 SIc. As the potential of the fishing gear to cause mortality to unionid mussels has not been evaluated, the fishery does not meet SG100 SIc Trap net (All MUs) The small footprint of the gear and the soft ground leads to the reasonable conclusion that there are no unacceptable impacts on snuffbox mussel. The fishery meets SG80 SIc. As the potential of the fishing gear to cause mortality to those mussels has not been evaluated, the fishery does not meet SG100 SIc		

References	MSC CR 2013; Canada SARA; USA ESA; Morris & Burridge 2006, DFO 2011

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	80
QZ2	80
QZ3(W)	80
QZ3(E)	80
Trap Net	
MU1	80
MU2	80
MU3	80

PI 2.3.2		**The fishery has in place precautionary management strategies designed to: Meet national and international requirements; Ensure the fishery does not pose a risk of serious harm to ETP species; Ensure the fishery does not hinder recovery of ETP species; and Minimise mortality of ETP species.**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
	Met?	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y
	Justification	Gill net (All QZs) ETP species are protected under SARA that defines requirements for protection and rebuilding. The associated recovery plans form a comprehensive strategy to manage the fishery's impacts on ETPs. The fishery meets SG60, SG80 & SG100 SIa. Trap net (ALL MUs) ETP species are protected under ESA that defines requirements for protection and rebuilding. The associated recovery plans form a comprehensive strategy to manage the fishery's impacts on ETPs. The fishery meets SG60, SG80 & SG100 SIa.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
		MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

The objective basis for confidence that the fishery will not damage the unionid mussel species is the knowledge of the species, the limited potential for interaction with the gill net that have a limited footprint on a soft bottom. ETP species accidentally taken must be released alive. The fishery meets SG60 SIb.

There are no records of ETP in the catch in the gear and PCM in the fishery has not been evaluated. It may be concluded that the number would be low. SG80 SIb is met.

The lack of a quantitative analysis on the potential impact of the fishery means that SG100 SIb is not met.

Trap net (All MUs)

The objective basis for confidence that the fishery will not damage the unionid mussel species is the knowledge of the species, the limited potential for interaction with the yellow perch traps that have a limited footprint on a soft bottom. ETP species accidentally taken must be released alive. The fishery meets SG60 & SG80 SIb.

The lack of a quantitative analysis on the potential impact of the fishery means that SG100 SIb is not met.</td></tr>
<tr><td>c</td><td>Guide post</td><td></td><td>There is evidence that the strategy is being implemented successfully.</td><td>There is clear evidence that the strategy is being implemented successfully.</td></tr>
<tr><td></td><td></td><td></td><td>MU 1 | Y | QZ1 | Y
MU 2 | Y | QZ2 | Y
MU 3 | Y | QZ3E | Y
 | | QZ3W | Y</td><td>MU 1 | N | QZ1 | N
MU 2 | N | QZ2 | N
MU 3 | N | QZ3E | N
 | | QZ3W | N</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

The strategies defined under recovery plans are being implemented and there are monitoring (e.g. surveys), assessments and evaluations (e.g. recovery team meetings). The fishery meets SG80 SIc.

While ETP interactions are not reported in the DCRs and log books, this is not confirmed by observers. Recovery strategies do not generally include an evaluation of the effects of commercial fisheries on ETP species in Lake Erie. SG100 SIc is not met.

Trap net (All MUs)

The strategies defined under recovery plans are being implemented and there is monitoring, assessments and evaluations. The lack of concern about the impact of the gear on the species of mussel indicates that the strategy is being implemented successfully; although there is no clear evidence that this is the case. The fishery meets SG80 SIc but not SG100 SIc.</td></tr>
<tr><td>d</td><td>Guide post</td><td></td><td></td><td>There is evidence that the strategy is achieving its objective.</td></tr>
<tr><td></td><td>Met?</td><td></td><td></td><td>MU 1 | N | QZ1 | N
MU 2 | N | QZ2 | N
MU 3 | N | QZ3E | N
 | | QZ3W | N</td></tr>
</table>

	Justification	Gill net (All QZs) Recovery plans do not include an evaluation of whether or not the strategy related to commercial fisheries is achieving its objectives. SG100 SId is not met. Trap net (All MUs) Recovery plans do not include an evaluation of whether or not the strategy related to commercial fisheries is achieving its objectives. SG100 SId is not met.
References		SARA, ESA.

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	85
QZ2	85
QZ3(W)	85
QZ3(E)	85
Trap Net	
MU1	85
MU2	85
MU3	85

<table>
<tr><td colspan="2">PI 2.3.3</td><td colspan="3">Relevant information is collected to support the management of fishery impacts on ETP species, including: Information for the development of the management strategy; Information to assess the effectiveness of the management strategy; and information to determine the outcome status of ETP species.</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.</td><td>Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.</td><td>Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.</td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

DCRs record the catch of ETP species. The fishery meets SG60 SIa.

There is sufficient information to estimate the impact of the fishery on those listed as ETP. The fishery meets SG80 SIa.

However, lack of specific data on fish and unionid ETP species means that there is not a high degree of certainty on estimating outcome status and the fishery does not meet SG100 SIa.

Trap net (ALL MUs)

Information on the unionid mussel species and the fishery (location, scale and intensity) that show the limited potential for overlap are considered sufficient to allow fishery related mortality to be quantitatively estimated. The fishery meets SG60 & SG80 SIa.

However, lack of specific data means that there is not a high degree of certainty on estimating outcome status and the fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>Information is adequate to broadly understand the impact of the fishery on ETP species.</td><td>Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.</td><td>Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.</td></tr>
<tr><td>Met?</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 Y, QZ1 Y
MU 2 Y, QZ2 Y
MU 3 Y, QZ3E Y
QZ3W Y</td><td>MU 1 N, QZ1 N
MU 2 N, QZ2 N
MU 3 N, QZ3E N
QZ3W N</td></tr>
</table>

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

The DCRs provide information that allows broad understanding of the impact of the fishery on ETP species. The fishery meets SG60 SIb.

It is also considered that data in the context of the broader information available on SARA species is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species. The fishery meets SG80 SIb.

DCR data do not include ETP species but the lack of an observer program means that data for these cannot be verified for accuracy. The fishery does not meet SG100 SIb.

Trap net (All MUs)

The key information is that the fishery has few, if any, interactions with ETP species. Unless the character of the fishery was to remain the same, and in the context of the specific knowledge on the main threats to the listed species, this is sufficient to contribute to a full strategy. There is insufficient information to evaluate the fishery interactions with ETP species with a high degree of certainty. The fishery meets SG60 & SG80 SIb but not SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>Information is adequate to support measures to manage the impacts on ETP species.</td><td>Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.</td><td>Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

The available information that shows limited interactions with ETP is adequate to support measures to manage the fishery's impact on them. The fishery meets SG60 SIc.

On-going monitoring provides data trends that support a full strategy to manage the full strategy for ETP protection. The fishery meets SG80 SIc.

The information collected lacks details on number and size of ETP individuals caught, and PCM to evaluate with a high degree of certainty whether the strategy is achieving its objectives. The fishery does not meet SG100 SIc.

Trap net (All MUs)

The available information that shows limited interactions with ETP is adequate to support measures to manage the fishery's impact on them. The fishery meets SG60 SIc.

The information about the lack of interactions is sufficient to support a full strategy to manage the full strategy for ETP protection. The fishery meets SG80 SIc.

Lack of certainty prevents the fishery meeting SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Environmental Commissioner of Ontario 2013</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net		
	QZ1	80	
	QZ2	80	
	QZ3(W)	80	
	QZ3(E)	80	
	Trap Net		
	MU1	80	
	MU2	80	
	MU3	80	

<table>
<tr><td>PI 2.4.1</td><td colspan="3">The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function</td></tr>
<tr><td>SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td>a Guidepost</td><td>The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td>MU 1 Y | QZ1 Y
MU 2 Y | QZ2 Y
MU 3 Y | QZ3E Y
QZ3W Y</td><td>MU 1 Y | QZ1 Y
MU 2 Y | QZ2 Y
MU 3 Y | QZ3E Y
QZ3W Y</td><td>MU 1 N | QZ1 N
MU 2 N | QZ2 N
MU 3 N | QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill Nets (All QZs)

The gillnets (>89 mm) are stationary, although there may be some dragging in the current. There is contact with the bottom, but given the intensity of the fishery and the soft ground it is considered highly unlikely this will lead to serious or irreversible damage to the benthic habitat. The fishery meets SG60 & SG80 SIa.

Although the nature of the bottom, the minimal footprint of the fishery, and evidence on its scale and intensity suggest that it is highly unlikely that the fishery would reduce habitat structure and function to a point where there would be serious or irreversible harm, there have not been studies to evaluate the effects of the gear on habitat. The fishery does not meet SG100 SIa.

Trap Nets (All MUs)

The trap nets are stationary although there may be limited dragging in the current. While there is contact with the bottom, given the intensity of the fishery and the soft ground it is considered highly unlikely this will lead to serious or irreversible damage to the benthic habitat. The fishery meets SG60 & SG80 SIa.

Although the nature of the bottom, the minimal footprint of the fishery, and evidence on its scale and intensity suggest that it is highly unlikely that the fishery would reduce habitat structure and function to a point where there would be serious or irreversible harm, there have not been studies to evaluate the effects of the gear on habitat. The fishery does not meet SG100 SIa.</td></tr>
<tr><td>References</td><td colspan="3">Morgan & Chuenpagdee 2003;</td></tr>
<tr><td colspan="2">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">Gill Net
QZ1 80
QZ2 80
QZ3(W) 80
QZ3(E) 80
Trap Net
MU1 80
MU2 80
MU3 80</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.4.2</td><td colspan="3">There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.</td><td>There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.</td><td>There is a strategy in place for managing the impact of the fishery on habitat types.</td></tr>
<tr><td></td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

As it is considered that the gear does not damage habitat, neither measures nor a partial strategy are needed. Additionally, maintenance of the status quo (fishery scale and intensity) is a relevant partial strategy. Closed areas further reduce the potential impact on benthic habitat. The fishery meets SG60 & SG80 SIa.

At the same time, a strategy to manage the impact of the gear on habitat has not been defined and implemented. The fishery does not meet SG100 SIa.

Trap net

As it is considered that the gear does not damage habitat, neither measures nor a partial strategy are needed. Additionally, maintenance of the status quo (fishery scale and intensity) is a relevant partial strategy. Limited fishing areas further reduce the potential impact on benthic habitat. The fishery meets SG60 & SG80 SIa.

A strategy to manage the impact of the gear on habitat has not been defined and implemented. The fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).</td><td>There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.</td><td>Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
</table>

	Justification	Gill net (All QZs) Information on the fishing operation, habitat monitoring, VMS, DCRs and log books provide the information for the fishery to satisfy SG60 SIb. Such information is sufficient to inform managers on the nature of impacts, the spatial extent of interaction and the timing and location relating to the setting, soaking and lifting of the gillnets. The fishery meets SG80 SIb. Although the physical impacts of the gear on habitat types are considered to be minor, they have not been quantified. The fishery does not meet SG100 SIb. Trap net (All MUs) Information on the fishing operation, habitat monitoring, VMS, DCRs and log books provide the information for the fishery to satisfy SG60 SIb. This information is sufficient to inform managers on the nature of impacts, the spatial extent of interaction and the timing and location relating to the setting and lifting of the trap nets. The fishery meets SG80 SIb. Although the physical impacts of the gear on habitat types are considered to be minor, they have not been quantified. The fishery does not meet SG100 SIb.		
c	Guide post		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		MU 1 N, QZ1 Y MU 2 N, QZ2 Y MU 3 N, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) Some evidence is the character of the gear, the type of habitat and the limited scale and intensity if the fishery. The fishery meets SG80 SIc. Lack of a strategy means that the fishery does not meet the SG100 SIc. Trap net (All MUs) Some evidence is the character of the gear, the type of habitat and the limited scale and intensity if the fishery. The fishery meets SG80 SIc. Lack of a strategy means that the fishery does not meet the SG100 SIc.		
d	Guidepost			There is some evidence that the strategy is achieving its objective.
	Met?			MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) There is not a strategy and the fishery does not meet SG100 SId. Trap net (All MUs) There is not a strategy and the fishery does not meet SG100 SId.		
References		HTG 2013		

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net	
	QZ1	80
	QZ2	80
	QZ3(W)	80
	QZ3(E)	80
	Trap Net	
	MU1	80
	MU2	80
	MU3	80

<table>
<tr><td colspan="2">PI 2.4.3</td><td colspan="3">Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There is basic understanding of the types and distribution of main habitats in the area of the fishery.</td><td>The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.</td><td>The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.</td></tr>
<tr><td></td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

The distribution of habitats in Lake Erie has been mapped by a large number of surveys that are on-going. The fishery meets SG60 SIa.

The majority of the habitat on which the fishery operates consists of soft bottoms that are of limited vulnerability. The fishery meets SG80 SIa.

Vulnerable habitats such as nursery areas are protected from commercial operations. The fishery meets SG100 SIa.

Trap net (All MUs)

The distribution of habitats in Lake Erie has been mapped by a large number of surveys that are on-going. The fishery meets SG60 SIa.

The majority of the habitat on which the fishery operates consists of soft bottoms that are of limited vulnerability. The fishery meets SG80 SIa.

Vulnerable habitats such as nursery areas are protected from commercial operations. The fishery meets SG100 SIa.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.</td><td>Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.</td><td>The physical impacts of the gear on the habitat types have been quantified fully.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
</table>

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

Information on the fishing operation, habitat monitoring, VMS, DCRs and log books provide the information for the fishery to satisfy SG60 SIb.

Such information is sufficient to inform managers on the nature of impacts, the spatial extent of interaction and the timing and location relating to the setting, soaking and lifting of the gillnets. The fishery meets SG80 SIb.

Although the physical impacts of the gear on habitat types are considered to be minor, they have not been quantified. The fishery does not meet SG100 SIb.

Trap net (All MUs)

Information on the fishing operation, habitat monitoring, VMS, DCRs and log books provide the information for the fishery to satisfy SG60 SIb.

Such information is sufficient to inform managers on the nature of impacts, the spatial extent of interaction and the timing and location relating to the setting and lifting of the trap nets. The fishery meets SG80 SIb.

Although the physical impacts of the gear on habitat types are considered to be minor, they have not been quantified. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).</td><td>Changes in habitat distributions over time are measured.</td></tr>
<tr><td></td><td></td><td>MU 1 | Y | QZ1 | Y
MU 2 | Y | QZ2 | Y
MU 3 | Y | QZ3E | Y
 | | QZ3W | Y</td><td>MU 1 | Y | QZ1 | Y
MU 2 | Y | QZ2 | Y
MU 3 | Y | QZ3E | Y
 | | QZ3W | Y</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

The TAC and number of active vessels provide the data needed to detect if there is increase risk to habitat. The fishery meets SG80 SIc.

Because habitat is a determinant of quota allocations for the target species, there has been significant amount of work dedicated to measure habitat description on an ongoing basis. The fishery meets SG 100 SIc.

Trap net (All MUs)

The TAC and number of active vessels provide the data needed to detect if there is increase risk to habitat. The fishery meets SG80 SIc.

Because habitat is a determinant of quota allocations for the target species, there has been significant amount of work dedicated to measure habitat description on an ongoing basis. The fishery meets SG 100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Barbiero & Tuchman 2002; Johansson et al 2000; Bolsenga & Herdendorf 1993; Golapan et al. 1998; Tyson 2010; GLEAM; YPTF 2013; Report to the Lake Erie Habitat Task Force 2013; ODW 2013.</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE	Gill Net	
	QZ1	90
	QZ2	90
	QZ3(W)	90
	QZ3(E)	90
	Trap Net	
	MU1	90
	MU2	90
	MU3	90

<table>
<tr><td>PI 2.5.1</td><td colspan="4">The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td></td><td></td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

Due to the lack of specific research on the impact of the fishery on key elements of the ecosystem the RBF has been used to score PI 2.5.1. (see section 11.1)

Trap net (All MUs)

Due to the lack of specific research on the impact of the fishery on key elements of the ecosystem the RBF has been used to score PI 2.5.1. (see section 11.1)</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Environment Canada and US Environmental Protection Agency, 2005; A. Debertin, Unintended consequences of shared fisheries on fish population sustainability: a food-web model approach to sympatric fish species in Lake Erie, www.cfrn-rcrp.ca.</td></tr>
</table>

OVERALL PERFORMANCE INDICATOR SCORE (RBA CONVERTED)		
	Gill Net	
	QZ1	80
	QZ2	80
	QZ3(W)	80
	QZ3(E)	80
	Trap Net	
	MU1	80
	MU2	80
	MU3	80

<table>
<tr><td>PI 2.5.2</td><td colspan="4">There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guide post</td><td>There are measures in place, if necessary.</td><td>There is a partial strategy in place, if necessary.</td><td>There is a strategy that consists of a plan, in place.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
<tr><td>Justification</td><td colspan="3">Gill net (All QZs)

It is considered highly unlikely that the gill net fishery could reduce ecosystem structure and function to a point where there would be serious or irreversible harm. The potential risk of impact is reduced by limited entry in the fishery and the TAC for Yellow perch. The fishery meets SG60 SIa.

Since there are not any significant ecosystem impacts, a management strategy is not needed (paragraph 7.1.25, MSC FAM v2.1). The fishery meets SG80 SIa.

The lack of a strategy consisting of a plan means that SG100 SIa is not met

Trap net (All MUs)

It is considered highly unlikely that the yellow perch trap net fishery could reduce ecosystem structure and function to a point where there would be serious or irreversible harm. The potential risk of impact is reduced by limited entry in the fishery, the TAC for Yellow perch, the lack of by catch, and limited to no interactions with the habitat and ETP species. The fishery meets SG60 SIa.

Since there are not any significant ecosystem impacts, a management strategy is not needed (paragraph 7.1.25, MSC FAM v2.1). The fishery meets SG80 SIa.

The lack of a strategy consisting of a plan means that SG100 SIa is not met</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>The measures take into account potential impacts of the fishery on key elements of the ecosystem.</td><td>The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.</td><td>The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem.
This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
</table>

<table>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

It is highly unlikely that the Yellow perch gill net fishery will reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Measures and a partial strategy are not needed and the fishery meets SG60 & SG80 SIb.

The lack of a strategy consisting of a plan means that SG100 SIb is not met.

Trap net (All MUs)

It is highly unlikely that the yellow perch trap net fishery will reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Measures and a partial strategy are not needed and the fishery meets SG60 & SG80 SIb.

The lack of a strategy consisting of a plan means that SG100 SIb is not met.</td></tr>
<tr><td>c</td><td>Guidepost</td><td>The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).</td><td>The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ecosystems).</td><td>The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery/ecosystems involved.</td></tr>
<tr><td></td><td>Met?</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Gill net (All QZs)

Maintenance of the status quo would lead the measures and partial strategy to work. The Yellow perch fishery is considered highly unlikely to reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Since there are currently no significant ecosystem impacts, a management strategy is not deemed necessary at either the SG60 or SG80 level (paragraph 7.1.25, MSC FAM v2.1). The fishery meets SG60 & SG80 SIc.

Based on the knowledge of the catch of the target, retained, by-catch and ETP species in the context of work on food webs in other Canadian lakes, it is reasonable to consider that the measures and partial strategy will work. The fishery meets SG100 SIc.

Trap net (All MUs)

Maintenance of the status quo would lead the measures and partial strategy to work. The yellow perch trap net fishery is considered highly unlikely to reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Since there are currently no significant ecosystem impacts, a management strategy is not deemed necessary at either the SG60 or SG80 level (paragraph 7.1.25, MSC FAM v2.1). The fishery meets SG60 & SG80 SIc.

Based on the knowledge of the catch of the target, retained, by-catch and ETP species in the context of work on food webs in other lakes, it is reasonable to consider that the measures and partial strategy will work. The fishery meets SG100 SIc.</td></tr>
<tr><td>d</td><td>Guidepost</td><td></td><td>There is some evidence that the measures comprising the partial strategy are being implemented successfully.</td><td>There is evidence that the measures are being implemented successfully.</td></tr>
<tr><td></td><td>Met?</td><td></td><td>MU 1 Y QZ1 Y
MU 2 Y QZ2 Y
MU 3 Y QZ3E Y
QZ3W Y</td><td>MU 1 N QZ1 N
MU 2 N QZ2 N
MU 3 N QZ3E N
QZ3W N</td></tr>
</table>

	Justification	Gill net (All QZs) The catch of main retained species in the fishery in the context of their total removal, stock status and knowledge of their main ecosystem function, is considered sufficient to infer some of the fishery's main consequences. The situation is similar for main by-catch species. It is known that the fishery has a limited impact on habitat and ETP species. The fishery meets SG80 SId. A longer time series of information on by-catch in the fishery would be needed to infer the main consequences for the ecosystem. Further, the potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. The fishery does not meet SG100 SId Trap net (All MUs) The catch of main retained species in the fishery in the context of their total removal, stock status and knowledge of their main ecosystem function, is considered sufficient to infer some of the fishery's main consequences. The situation is similar for main by-catch species. It is known that the fishery has a limited impact on habitat and ETP species. The fishery meets SG80 SId. A longer time series of information on by-catch in the fishery would be needed to infer the main consequences for the ecosystem. Further, the potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. The fishery does not meet SG100 SId
References		

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	85
QZ2	85
QZ3(W)	85
QZ3(E)	85
Trap Net	
MU1	85
MU2	85
MU3	85

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
SI		SG 60	SG 80	SG 100
a	Guidepost	Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	
	Justification	Gill net (All QZs) & Trap net (All MUs) Information on key elements of the ecosystem (main predators, prey and the structure of lower food web) allows the fishery to meet SG60 SIa. This information is adequate to broadly understand the key elements of the ecosystem as: (i) there is continuous monitoring of fish community composition and lower food web levels; (ii) changes in productivity are identified through measurement of nutrient inputs, phytoplankton densities, presence of blooms and levels of hypoxia; and (iii) there is an understanding of the effects of invasive species. The fishery meets SG80 SIa.		
b	Guidepost	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, and have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
	Met?	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N
	Justification	Gill net (All QZs) & Trap net (All MUs) The main impacts of the fishery may be identified through the work on Ecopath and Ecosim food web models by researchers at OMNR and NOAA that is based on mass balance fluxes and integrates the information available. The fishery meets SG60 & SG80 SI b. Although the auditors are aware that the food web models are capable of identifying the main impacts of Lake Erie fisheries on key ecosystem elements, due to the lack of published information (it is understood that this is in the peer review process) it is not possible to identify if impacts of the yellow perch fisheries have been investigated in detail. The fishery does not meet SG100 SIb.		
c	Guidepost		The main functions of the Components (i.e., target, By-catch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, By-catch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.
	Met?		MU 1 Y, QZ1 Y MU 2 Y, QZ2 Y MU 3 Y, QZ3E Y QZ3W Y	MU 1 N, QZ1 N MU 2 N, QZ2 N MU 3 N, QZ3E N QZ3W N

<table>
<tr><td></td><td>Justification</td><td colspan="3">
Gill net
QZ1
Yellow perch has a trophic level of 3.7. Of the two main retained species; Walleye is a top predator with a trophic level of 4.5; White perch feeds on benthos including dreissenids as well as on fish eggs, and has trophic level of 3.14. The main bycatch species is Lake sturgeon; a Benthivore; trophic level 3.3; classified as vulnerable species. The fishery has limited impact on ETP species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc.
Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.
QZ2
Yellow perch has a trophic level of 3.7. Of the two main retained species; Walleye is a top predator with a trophic level of 4.5; White perch feeds on benthos including dreissenids as well as on fish eggs, and has trophic level of 3.14. There are no main bycatch species. The fishery has limited impact on ETP species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc.
Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.
QZ3E
Yellow perch has a trophic level of 3.7. Of the two main retained species; Walleye is a top predator with a trophic level of 4.5; White perch feeds on benthos including dreissenids as well as on fish eggs, and has trophic level of 3.14. The main bycatch species are Lake trout and Lake sturgeon. Lake trout is a long lived, main predator with a trophic level of 4.3. Lake sturgeon is a benthivore; trophic level 3.3. The latter two are both classified as vulnerable species. The fishery has limited impact on ETP species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc.
Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.
QZ3W
Yellow perch has a trophic level of 3.7. Of the two main retained species; Walleye is a top predator with a trophic level of 4.5; White perch feeds on benthos including dreissenids as well as on fish eggs, and has trophic level of 3.14. The main bycatch species is Lake sturgeon; a benthivore; trophic level 3.3; classified as vulnerable species. The fishery has limited impact on ETP species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc.
Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.
Trap net (All MUs)
Yellow perch has a trophic level of 3.7. The main functions of the 3 main retained species (Channelcatfish, Freshwater drum and White perch) are known. There are not any main bycatch species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc.
Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.
</td></tr>
<tr><td>d</td><td>Guidepost</td><td></td><td>Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.</td><td>Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.</td></tr>
</table>

	Met?		MU 1 Y, QZ1 Y; MU 2 Y, QZ2 Y; MU 3 Y, QZ3E Y; QZ3W Y	MU 1 N, QZ1 N; MU 2 N, QZ2 N; MU 3 N, QZ3E N; QZ3W N

Met? (SG80)

MU 1	Y	QZ1	Y
MU 2	Y	QZ2	Y
MU 3	Y	QZ3E	Y
		QZ3W	Y

Met? (SG100)

MU 1	N	QZ1	N
MU 2	N	QZ2	N
MU 3	N	QZ3E	N
		QZ3W	N

Justification

Gill net (All QZs)

The catch of main retained species in the fishery in the context of their total removal, stock status and knowledge of their main ecosystem function, is considered sufficient to infer some of the fishery's main consequences. The situation is similar for main by-catch species. The fishery has a limited impact on habitat and ETP species. The fishery meets SG80 SId.

A longer time series of information on by-catch in the fishery would be needed to infer the main consequences for the ecosystem. Further, the potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. The fishery does not meets SG100 SId

Trap net (All MUs)

The catch of main retained species in the fishery in the context of their total removal, stock status and knowledge of their main ecosystem function, is considered sufficient to infer some of the fishery's main consequences. There is limited by-catch. The fishery has a limited impact on habitat and ETP species. The fishery meets SG80 SId.

The potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. The fishery does not meets SG100 SId

e

Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).	Information is sufficient to support the development of strategies to manage ecosystem impacts.

Met? (SG80)

MU 1	Y	QZ1	Y
MU 2	Y	QZ2	Y
MU 3	Y	QZ3E	Y
		QZ3W	Y

Met? (SG100)

MU 1	Y	QZ1	Y
MU 2	Y	QZ2	Y
MU 3	Y	QZ3E	Y
		QZ3W	Y

Justification

Gill net (All QZs) & Trap net (All MUs)

Information on the scale and intensity of the fishery together with catch data is considered sufficient to detect any increase in the level of risk. The fishery meets SG80 SIe.

It is known that while not published food webs have been modeled to support the development of a strategy to manage ecosystem impacts and the fishery meets SG100 SIe.

References

Lake Erie Lakewide Management Committee, 2008; Government of Canada and the US Environmental Protection Agency, 2008; Campbell *et al.* 2009.

OVERALL PERFORMANCE INDICATOR SCORE

Gill Net	
QZ1	85
QZ2	85
QZ3(W)	85
QZ3(E)	85
Trap Net	
MU1	85
MU2	85
MU3	85

<table>
<tr><td colspan="2">PI 3.1.1</td><td colspan="3">The management system exists within an appropriate legal and/or customary framework which ensures that it: Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and Incorporates an appropriate dispute resolution framework.</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2</td><td>There is an effective national legal system and organised and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.</td><td>There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.</td></tr>
<tr><td>Met?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td></tr>
<tr><td>Justification</td><td colspan="3">Lake Erie fisheries fall under the jurisdiction of the U.S. and Canada. In the former, overall management authority is vested in FWS although other Federal agencies may be involved in specific aspects. The Walleye fishery in U.S. waters is entirely recreational; no commercial activity is permitted. This is the same in each of the four States adjacent to the Lake – Ohio, Michigan, Pennsylvania and Ohio. Each State has a legal framework for management of the Walleye fishery and issues related to the health of ecosystems and habitat. In Canada, the only Province involved in the fishery is Ontario. Combining National and Provincial policy on fisheries, habitats and environmental provides the framework for a rigorous management system. GLFC was established to coordinate work to maintain the Great Lake ecosystem. The 1980 JSP was signed by each of the state, provincial, federal, and tribal natural resource agencies in the Great Lakes basin. Individual lake committees, that comprise representatives from each agency, implement the strategic plan. For example, bi-national Fish Community Objectives for each of the Great Lakes specify lake-wide fish community goals and objectives that are achieved through management programs (such as stocking and regulations) developed and implemented by individual jurisdictions. LEC is a bi-national committee of state and provincial fisheries agencies operating under the auspices of GLFC to manage fish communities and fisheries in Lake Erie. LEC uses the Joint Strategic Plan for Management of Great Lakes Fisheries as a guide for managing internationally shared resources. The fishery meets SG60 SIa.

The GLFC, LEC and associated task groups provide a coherent, logical set of practices or procedures that deliver management outcomes consistent with MSC Principles 1 and 2. The fishery meets SG80 SIa.

The setting and allocation of quotas for some species and the work of the compliance committee can be taken as “binding procedures” and the fishery meets SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.</td><td>The management system incorporates or is subject by law to a transparent_mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.</td><td>The management system incorporates or subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.</td></tr>
<tr><td>Met?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td></tr>
<tr><td>Justification</td><td colspan="3">At the national and state /provincial levels all laws are open to appeal, initially to the relevant Ministry / Department / Division and up to the Ministerial level and on to the Federal and State system. GLFC has a dispute resolution mechanism that was strengthened by the JSP. The fishery meets SG60 SIb.

There are a number of examples of legal disputes in the U.S. and Canadian systems. These have covered a range of issues. In the U.S. cases relating to quotas, the constitutionality of laws, and environmental issues have all been heard in courts. In Canada, there is, for example, a case history linked to the confirmation of First Nation fishing rights. A dispute over the TAC setting for Walleye led to mediation under the prescribed GLFC procedures. Accordingly, while the agencies look to be proactive in minimizing the risk of disputes by involving stakeholders in the decision making process, parties may seek legal redress. It is concluded that this approach is effective in dealing with most issues and the fishery meets SG80 SIb.

The history of cases indicates that the dispute resolution procedure, including being proactive to avoid legal issues, has been tested and proven to be effective. The fishery meets SG100 SIb.</td></tr>
</table>

d				
	Guidepost	The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to observe_the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.	The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.
	Met?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y
	Justification	Management of Lake Erie at the local level is the responsibility of the National and Provincial / State jurisdictions. In the U.S. the rights of Native Americans are enshrined in treaties. Although not relevant to Erie, GLIFWC represents the interests of 11 tribes in relevant Great lakes. In Canada, the Aboriginal Fisheries Strategy (AFS) of 1992 provides the framework for the management of fisheries in compliance with the Sparrow decision. DFO negotiates annual agreements with Aboriginal groups that provide communal food, social and ceremonial fishing opportunities, co-operative management arrangements and economic development opportunities. Commercial communal licences have been provided to Aboriginal groups under the Allocation Transfer Programme (DFO 2003). Taken together, the bi-national, federal, and non-federal management agencies approach the Great Lakes from the same general perspective and with the same goals in mind. One of the aims of Ontario policy is to balance "*the interests of stakeholders, including those of sport, commercial, and tribal fisheries, the environmental community, and many others*". The fishery meets SG60 & SG80 SId. On the basis of the foregoing it is concluded that the management authorities are formally committed to respecting customary rights. However, this is in the context of fitting in with the established management system and those holding customary rights are bound to respect all regulations related to P1 and P2. The fishery meets SG100 SId.		
References		Roseman *et al*; Isbell, JSP; http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/documents/national_standard_8_cfr.pdf		

OVERALL PERFORMANCE INDICATOR SCORE		
	All MUs	100
	All QZs	100

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
	Met ?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y
	Justification	A wide range of organisations and individuals are engaged in the large variety of issues relating to Lake Erie; many are specific to fisheries while others deal with other factors that have an influence on fisheries e.g. habitat and ecosystem. The main fishery related players are the State and Province agencies in the U.S. and Canada and the GLFC with its specific committees and groups related to management of Lake Erie. Review of the web sites of the large number of agencies (identified in the main text above) strongly indicates that functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction. As stated by Gaden *et al* (2009) "*Despite the large number of jurisdictions, the role of each type of jurisdiction is defined, accepted, and respected, and the management authorities tend to complement, not contradict or duplicate, each other*". The fishery meets SIa at SG60, SG80 and SG100.		
b	**Guidepost**	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
	Met ?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: N All QZs: N
	Justification	Stakeholders have a key role to play in the Lake Erie management process and a wide range of groups represent specific interests. As Haeffer comments on LEPMAG, formed in 2010, it is "*a more formal role for all stakeholders in quota decisions, not governance per se, which is bound by statutes that differ among agencies. Stakeholders have always been able to make recommendations for the LEC to consider when setting quotas. This new effort formalizes this process, ensuring more explicit involvement in understanding the scientific uncertainties, potential policies and outcomes, when making their recommendations… This process has been effective in helping stakeholders understand what it takes to craft policy options amidst competing interests. In similar kinds of processes, participants have become advocates for new data collection procedures and take ownership by volunteering data that they have collected*". As LEC (2014) notes: "*Through LEPMAG, fishery managers and stakeholders work together to identify the harvest policies for Lake Erie percids that meet the needs of all stakeholders while maintaining stability in the percid fishery. MSU'S QFC facilitates the LEPMAG process. Walleye are now being fully managed through the recommendations and population objectives developed through LEPMAG. This will be documented by the LEC as they draft and complete the revised Walleye Management Plan this year. The main focus of LEPMAG will now shift to developing population objectives and harvest strategy development for Yellow perch in Lake Erie*". At the site visit fishers in Ohio and Ontario spoke of the high degree of interaction between themselves and the authorities. The fishery meets SG60 & SG80 SIb. At the site visit, concern was expressed by commercial fishers at the influence of the recreational fishers to the cost of the interests of commercial fishers e.g. the stocking of salmonids and the potential impact on commercial fisheries. The fishery does not meet SG100 SIb.		

<table>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>The consultation process provides opportunity for all interested and affected parties to be involved.</td><td>The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.</td></tr>
<tr><td>Met ?</td><td></td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td></tr>
<tr><td>Justification</td><td colspan="3">The LEPMAG process and the public consultation on the new Ontario fisheries strategy and the level of consultation in Ohio between the fishers leads to effective stakeholder engagement means the fishery meets SG80 & SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Gaden et al (2009); http://www.glfc.org/aboutus/brief.php#mission; Roseman et al 2009; ODNR 2014; Locke; Haeffer; LEC 2014; http://www.cfrn-rcrp.ca/article75; DFO 1999; DFO 2012a; Devitt et al 2010; OMNR 2008 (b); http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">All MUs: 90
All QZs: 90</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.1.3</td><td colspan="3">The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.</td></tr>
<tr><td>Met?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: N
All QZs: N</td></tr>
<tr><td>Justification</td><td colspan="3">The JSP, most significantly with the FCOs, and GLWQA provide explicit and clear long term objectives relating to the MSC principles and criteria. These objectives are reinforced in Ontario with the defined goals for Lake Erie in Ryan et al as strengthened by the new draft Provincial Fish Strategy. In Ohio, Policy 27 and the Strategic Plan 2011-30 provide clear long term objectives. While these objectives are explicit, no evidence has been presented to show that they are required. The best example of this is management of Lake Trout. The fishery meets SG60 and SG80 but not SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">GLFC 2007; Ryan et al 2003; GLWQA 1987; Roseman et al; Ohio Coastal Management Program; ODNR 2010; DFO 1999; Strategic Plan for Ontario Fisheries (SPOF I); SPOF II; Our Sustainable Future: A Renewed Call to Action; ntario Biodiversity Strategy, OMNR’s Statement of Environmental Values.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">All MUs: 80
All QZs: 80</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.1.4</td><td colspan="3">The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.</td><td>The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.</td><td>The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.</td></tr>
<tr><td>Met ?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: N
All QZs: N</td></tr>
<tr><td>Justification</td><td colspan="3">MSC CR v1.3 and related guidance state “this PI gives effect to Criterion P3, A6. When considering if the fishery management system provides for incentives that are consistent with achieving the outcomes expressed by P1 and P2 (SG60 and SG80), the key issue in this part of the SG is to score the system with reference to if it ‘opens the door’ for the possibility for positive incentives. Does the system have attributes, policies or principles that would tend to incentivise fishers to fish sustainably, that engender a sense of stewardship of the resources? For example, policies that attempt to provide stability and/or security for fishers amid the uncertainties that come with complex and dynamic systems. This may involve, but not be limited to: the system providing for reducing information gaps and uncertainties for fishers; providing for strategic or statutory management planning to give certainty about the rules and goals of management; providing for mechanisms and opportunities to gain support for the management system from fishers; or fishery management system features that encourage collective action while allowing individual choice such that individual decisions are steered towards public good; providing for the clarification of roles, rights and responsibilities of the various stakeholders; engenders a sense of ownership (possibly, but not necessarily, through rights-based measures); providing for a participatory approach to management, research and other relevant processes”.

In the Yellow perch fishery, the quota, the support of OCFA in contributing to research, the amount of research available to stakeholders, LEPMAG and other committee processes related to LEC all provide evidence that the fishery meets SG60 & SG80 SIa.

As the management system does not actively and explicitly consider and review management policies and procedures with particular attention paid to the issue of incentives to make sure they are not contributing to unsustainable fishing practices, the fishery does not meet SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">LEC 2005; LEPMAG ToR.</td></tr>
<tr><td colspan="3" rowspan="2">OVERALL PERFORMANCE INDICATOR SCORE</td><td>All MUs</td><td>80</td></tr>
<tr><td>All QZs</td><td>80</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.2.1</td><td colspan="3">The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system</td><td>Short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.</td><td>Well defined and measurable short and long-term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.</td></tr>
<tr><td>Met ?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: N
All QZs: N</td></tr>
<tr><td>Justification</td><td colspan="3">A large part of the overarching policy for Lake Erie with related short and term objectives are directly linked with the Yellow perch fisheries. The fishery meets SG60 SIa. Through the FCO and draft FMP, together with the terms of reference of the various TGs and related research it can be concluded that short and long term objectives are explicit within the fishery management system. The fishery meets SG80 SIa.

The lack of specific measurable objectives on retained catch and by catch prevents the fishery meeting SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Draft YP FMP; Fish Community Goals and Objectives for Lake Erie</td></tr>
<tr><td colspan="3" rowspan="2">OVERALL PERFORMANCE INDICATOR SCORE</td><td>All MUs</td><td>80</td></tr>
<tr><td>All QZs</td><td>80</td></tr>
</table>

PI 3.2.2		The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.		
SI		SG 60	SG 80	SG 100
a	Guidepost	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met ?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	
	Justification	The decision making process is well established through the GLFC, LEC, YPTG and LEPMAG processes. This leads to the setting of an annual quota that has the aims of meeting the fishery specific objectives related to sustainable long term fisheries. They are leading to formalization of the YPFMP. The fishery meets SG60 and SG80 SIa.		
b	Guidepost	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met ?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: N All QZs: N
	Justification	The research programme is founded on a lake objective that recognizes the need for sustainable fishing of the available fish resources in the context of a healthy ecosystem. The work of the TGs indicates that the fishery responds to serious and other important issues. However, there are a number of issues that are not covered e.g. PCM, observers and discards. The fishery meets SG60 and SG80 SIb but not SG100 SIb.		
c	Guidepost		Decision-making processes use the precautionary approach and are based on best available information.	
	Met ?		All MUs: Y All QZs: Y	
	Justification	A keystone of quota managed Yellow perch in the context of the overall approach to management in Lake Erie is the requirement for precaution. This is shown in a large number of reports. The fishery meets SG80 SIc.		
d	Guidepost	Some information on fishery performance and management action is generally available on request to stakeholders.	Information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders provides comprehensive information on fishery performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met ?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: N All QZs: N

<table>
<tr><td></td><td>Justification</td><td colspan="3">The research programme and associated reporting provides information on the fishery and management action, the most important source being the annual report of the YPTG. The fishery meets SG60 SId.

LEPMAG provides information on the decision making process and how this is responding to research findings. The fishery meets SG80 SId.

The lack of verified information on by catch prevents the fishery meeting SG100 SId.</td></tr>
<tr><td rowspan="3">e</td><td>Guidepost</td><td>Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.</td><td>The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.</td><td>The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.</td></tr>
<tr><td>Met ?</td><td>All MUs Y
All QZs Y</td><td>All MUs Y
All QZs Y</td><td>All MUs Y
All QZs Y</td></tr>
<tr><td>Justification</td><td colspan="3">In the past, the main court challenges related to consideration by fishers that quotas have been set unfairly.

There is no evidence that the management authorities have shown any disprespect for the law and the fishery meets SG60 SIe.

The work of the Blue Ribbon panel and the various task groups shows that managers are In response to this, the management approach changed to include greater stakeholder input with the expectation that a greater understanding of the large variety of issues would reduce the potential for conflict. Informed comment by a number of stakeholders and review of the literature indicates that this has proven to be the case – with LEPMAG providing a strong basis for cooperation between stakeholders and managers. The fishery meets SG80 SIe.

The introduction of LEPMAG had the specific aim of involving stakeholders in the decision making process and thus proactively avoid legal disputes. Similarly, the joint management by various jursidictions has a similar impact. The fishery meets SG100 SIe.</td></tr>
<tr><td colspan="2">References</td><td colspan="3"></td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">All MUs 85
All QZs 85</td></tr>
</table>

<table>
<tr><td colspan="2">PI 3.2.3</td><td colspan="3">Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.</td><td>A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.</td><td>A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.</td></tr>
<tr><td>Met?</td><td>All MUs Y
All QZs Y</td><td>All MUs Y
All QZs Y</td><td>All MUs N
All QZs N</td></tr>
<tr><td>Justification</td><td colspan="3">The commercial fisheries for Yellow perch in Ohio and Ontario are monitored for compliance by the respective law enforcement agencies. In Ohio responsibility lies with the ODNR Division while in Ontario it lies with the enforcement branch of OMNR that works closely with OCFA. At the international level, the GLFC has a Law Enforcement Committee that has detailed terms of reference mainly covering coordination and support between individual agencies. Given the low number of commercial fishing vessels in both the Ohio and Ontario fisheries allied with a risk based approach it may be expected that compliance mechanisms will be effective. The fishery meets SG60 SIa.

At the international level the Law Enforcement Committee identifies and evaluates the problems associated with control of illegal fishery activities in the Great Lakes basin, and supports agencies in their resolution. In both Ohio and Ontario the main tools are dockside monitoring, VMS and forensic accounting at the fish plant level in the context of an inter-agency approach and occasional inspections on the lake. While research indicates transgressions in the past there does not appear to have been any significant problems in more recent years. It may be concluded that the system has demonstrated an ability to enforce regulations on TACs, quotas, closed areas and seasons. The fishery meets SG80 SIa.

Given the range of enforcement activities, it may be concluded that it is comprehensive. While there is no evidence to suggest that a consistent ability to enforce relevant management has not demonstrated, the lack of on-water monitoring prevents the fishery meeting SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Sanctions to deal with non-compliance exist and there is some evidence that they are applied.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.</td></tr>
<tr><td>Met?</td><td>All MUs Y
All QZs Y</td><td>All MUs Y
All QZs Y</td><td>All MUs N
All QZs N</td></tr>
<tr><td>Justification</td><td colspan="3">Research indicates that there are sanctions (as established by regulations in the respective jurisdictions) and examples given in the main text of the report provides the evidence that they are applied. The fishery meets SG60 SIb.

From the evidence available from the limited number of major infractions it appears that the potential sanctions (high fines, custodial sentences, loss of license, confiscation of gear and and vessel) are applied and function as an effective deterrent. The fishery meets SG80 SIb.

Given the lack of recent court cases it may be concluded that the potential sanctions demonstrably provide an effective deterrent to non-compliance. However, there is not any evidence that the fishers comply with discard regulations in the Ohio and Ontario fisheries. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="2">c</td><td>Guidepost</td><td>Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.</td><td>Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.</td><td>There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.</td></tr>
<tr><td>Met?</td><td>All MUs Y
All QZs Y</td><td>All MUs Y
All QZs Y</td><td>All MUs N
All QZs N</td></tr>
</table>

	Justification	OCFA perform a number of administrative and operational fisheries assessment functions under contractual agreements with the OMNR; *inter alia* the Lake Erie Fall Indexing Assessment Program, development and collection of royalty billing and the entry and collation of data derived from the daily catch reports from across the province. Through employment of weight observers OCFA is also involved in monitoring commercial fishing activity throughout the province. Fishers provide DCRs and information needed to support resource assessments. The lack of court cases in recent years indicates that the fishers are complying with regulations. The fishery meets SG60 SIc. The lack of court cases is the evidence that fishers comply. The fishery meets SG80 SIc. However, the lack of on-board observers means that there is no evidence that the fishers are recording all discards. The fishery does not meet SG100 SIc.		
d	**Guidepost**		There is no evidence of systematic non-compliance.	
	Met?		All MUs: Y All QZs: Y	
	Justification	Discussions with fishery managers and compliance officers during the site visits and background research did not provide any evidence of systematic non-compliance of fishers with the regulations. Court cases over the past 5 years have been isolated. The fishery meets SG80 SId.		
References		http://www.glfc.org/boardcomm/lawenforce/lawenf.php; http://www.glfc.org/boardcomm/clc/clchome.php#pub; http://www.fishlakeerie.com/news/articles-erie/607.html; http://wikileaks.org/cable/2008/02/08TORONTO58.html; (http://www.goerie.com/article/20120504/NEWS02/305039883/Erie-men-on-trial-on-illegal-fishing-charges;http://www.angelfire.com/la/outdoorspot/page40.html;http://www.mnr.gov.on.ca/en/Business/Enforcement/2ColumnSubPage/STEL01_130158.html); http://blogs.windsorstar.com/2012/05/10/troubled-fishing-vessel-accused-of-illegally-fishing-in-u-s-waters/;http://outdoorcanada.ca/11850/news/ontario-anglers-net-big-fines-for-selling-their-catch; http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies		

OVERALL PERFORMANCE INDICATOR SCORE	All MUs	80
	All QZs	80

<table>
<tr><td>PI 3.2.4</td><td colspan="4">The fishery has a research plan that addresses the information needs of management</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.</td><td>A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.</td><td>A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.</td></tr>
<tr><td>Met ?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: N
All QZs: N</td></tr>
<tr><td>Justification</td><td colspan="3">The main vehicle for research is GLFC and the work of the associated LEC and the various task groups. The research priorities identified by GLFC covers a wide range of areas: ecosystem consitions; productivity and yield obejective; near shore habitat objective, western basin objective; central basin objective; eastern basin objective; fish habitat objective; genetic diversity objective; and food web structure objective. These cover objectives consistent with MSC P1 & P2. The fishery meets SG60 SIa.

GLFC has responsibility to formulate a coordinated research program between the United States and Canada that has the goals of identifying ways to achieve MSYs for the various stocks and recommend specific management initiatives. Each task group is charged with annual work objectives to meet the overall research programme. This may be considered as a strategic approach with the objective of providing tinely outputs that correspond to identified strategic needs. The fishery meets SG80 SIa.

The annual charges to each task group reflect priorities and represent a coherent and strategic approach to research across the three MSC principles. For example, in 2014 STC is charged with producing a Walleye management plan. Where research does not fit with the established theme areas, non-theme research may be financed. However the lack of a specific written research plan required by the MSC standard prevents the fishery meeting SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Research results are available to interested parties.</td><td>Research results are disseminated to all interested parties in a timely fashion.</td><td>Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.</td></tr>
<tr><td>Met ?</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: Y
All QZs: Y</td><td>All MUs: N
All QZs: N</td></tr>
<tr><td>Justification</td><td colspan="3">The results of research are available to all interested parties on the GLFC web site under in the web pages of various task group. The fishery meets SG60 SIb.

Wherever research has implications for the management process the details are presented with the LEPMAG process to guide the decision making process. The fishery meets SG 80 SIb.

All interested parties may review individual research plans and outputs in the web site with the annual reports of the various task groups providing the results of research undertaken. However the lack of a specific written research plan required by the MSC standard prevents the fishery meeting SG100 SIb.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">GLFC 2009; http://www.glfc.org/research/Erie%20Priorities%202009.pdf;</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">All MUs: 80
All QZs: 80</td></tr>
</table>

PI 3.2.5		**There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives** **There is effective and timely review of the fishery-specific management system**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system	The fishery has in place mechanisms to evaluate all parts of the management system.
	Met?	All MUs: Y All QZs: y	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y
	Justification	The work over the past 15 years, with an up-dated WFMP and progress on the YPFMP provide evidence that the fishery specific management systems for wallyeye and Yellow perch are evaluated to ensure that they meet the defined goals and related objectives. The mechanisms are the work of the various task groups and LEPMAG. The fishery meets all SGs at SIa.		
b	**Guidepost**	The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
	Met?	All MUs: Y All QZs: Y	All MUs: Y All QZs: Y	All MUs: N All QZs: N
	Justification	Over the past 15 years there have been a number of external and internal reviews. Given that Walleye and Yellow perch are important for recreational and sport fishing, it may be concluded that this sector performs the role of external review. As this is occasional rather than continuous the fishery meets SG60 & SG80 SIb but not SG100 SIb.		
References		Myers & Bence; LEC 2005; Lester *et al*. 2005; Locke *et al*. 2005; WTG 2013; Auditor Generals 2007 audit		
OVERALL PERFORMANCE INDICATOR SCORE			All MUs: 90	
			All QZs: 90	

11 APPENDIX 2.2 YELLOW PERCH - RISK BASED FRAMEWORK OUTPUTS

11.1 Appendix 2.2.1 SICA

Performance Indicator	Risk-causing activities from fishery under assessment	Spatial scale of activity	Temporal scale of activity	Intensity of activities	Relevant subcomponents	Consequence score	MSC Score
PRINCIPLE TWO: Ecosystem Outcome Ontario Small mesh Gill Net	• Fishing • Gear loss • Bait collection • Other identified risk-causing activities (please specify)	4	5	3	**Species composition**		
					Functional group composition		
					Distribution of the community		
					Trophic size/structure	2	80
Rationale for selecting worst plausible case scenario	The main risk causing element for the ecosystem is the fishery removing a predator. This has implications for the food web in Erie.						
Rationale for Spatial scale of activity	The fishery takes place in Ontario waters in QZ 1 thru QZ 3 (E&W) which represents more than 31% of the total surface area of the lake but less than 45 %. The score is 4.						
Rationale for Temporal scale of activity	The fishery is year round with a total of 65 vessels that do not fish at the same time. The gill net fishery is not seasonal and it is likely that there is at least some fishing activity on 200 to 300 days per year. The score is 5.						
Rationale for Intensity of activity	The fishery takes place over about 43 % of the lake, but seasonal patterns reflect localised availability that changes according to spawning migrations from the central to western basins. Accordingly, fishing intensity varies on a local basis and while it is difficult to characterise, it seems reasonable to conclude that there may be moderate detection of activity at broader spatial scale, or obvious but local detection. In some areas of the lake there will be no activity. The score is 3.						
Rationale for choosing most vulnerable sub-component	The risk from removing a predator is the potential impact on trophic structure.						
Rationale for Consequence score	As the fishery takes about 62 % of the total removals and the gear is selective by size, it is concluded that while there may be a change in mean trophic level, this will be less than 5%.						

Performance Indicator	Risk-causing activities from fishery under assessment	Spatial scale of activity	Temporal scale of activity	Intensity of activities	Relevant subcomponents	Consequence score	MSC Score
PRINCIPLE TWO: Ecosystem Outcome Ohio Yellow perch trap net	• Fishing • Gear loss • Bait collection • Other identified risk-causing activities (please specify)	3	5	3	**Species composition**		
					Functional group composition		
					Distribution of the community		
					Trophic size/structure	2	80
Rationale for selecting worst plausible case scenario	The main risk causing element for the ecosystem is the fishery removing a predator which has implications for the food web.						
Rationale for Spatial scale of activity	The fishery takes place in Ohio waters in MU 1 thru MU 3 (E&W) which represents less than 31% of the total surface area of the lake but more than 16 %. The score is 3.						
Rationale for Temporal scale of activity	There is a closed season and a seasonal trap net fishery so yellow perch is not targeted December thru April; there is at least some fishing activity on 200 days per year. The score of 5.						
Rationale for Intensity of activity	The fishery takes place over about 25 % of the lake. There are a limited number of traps operating in a large area and these are not moved frequently. Accordingly, it seems reasonable to conclude that there may be moderate detection of activity at broader spatial scale, or obvious but local detection. In large areas of the lake there will be no activity. The score is 3.						
Rationale for choosing most vulnerable sub-component	The risk from removing a predator is the potential impact on trophic structure.						
Rationale for Consequence score	As the fishery takes 16 % % of the total removals and landings are selective, it is concluded that while there may be a change in mean trophic level, this will be less than 5%.						

11.2 Appendix 1.2.2 Productivity-Susceptibility Analysis (PSA)

PSA was not used for the RBF

11.3 Appendix 1.3 Yellow perch - Conditions

Table 54: Yellow perch – Condition YP1

Condition YP1	1.1.2 Reference Points: Limit and target reference points are appropriate for the stock.
Performance Indicator	Issues at SG80 Reference points are appropriate for the stock and can be estimated. The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity. The target reference point is such that the stock is maintained at a level consistent with BMSY or some measure or surrogate with similar intent or outcome.
Score	75
Rationale	Issue b. While there is an explicit target fishing mortality, implying a target biomass reference point, this is not the case for a biomass limit reference point. There is not an explicitly recognized biomass LRP.
Condition	By the third annual surveillance audit, the following SG80 SIs must be met: A limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for a limit reference point that is appropriate for the stock. At the second annual audit, the client will present the CAB with evidence that the required limit reference point has been defined and accepted by LEC. At the third annual audit, the client will present the CAB with evidence to show that the limit reference point has been explicitly incorporated into advice on the annual TAC. These milestones provide incremental steps in achieving the condition. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.
Client action plan	The Lake Erie Percid Management Advisory Group (LEPMAG) is currently working toward the development of a lake wide management approach and plan for Lake Erie Yellow perch that will include both target and limit reference points. This will occur over the next two years, and will satisfy this condition. The on-going LEPMAG process will provide a full management strategy evaluation (MSE) for Lake Erie yellow perch in support of a LEC Yellow perch management plan expected by late 2016 or early 2017. LEMPAG and the QFC/LEC have already begun to consider options for limit and target reference points for all MUs. These options will be presented to the CAB at the first annual audit. The MSE process will be completed by the third annual audit and the LEC's final decision(s) on TRPs, LRPs, and SSB0 will be available to the CAB at that time. By 2017, the LEC decisions on HCRs will be used by the YPTG to generate RAH advice to the LEC on the annual TACs for all MUs. A new Yellow perch management plan will be available in late 2016 or early 2017.

<table>
<tr>
<td>Consultation on condition</td>
<td>
Lake Erie Committee
REPRESENTING THE FISHERY MANAGEMENT AGENCIES OF LAKE ERIE AND LAKE ST. CLAIR

March 6, 2015

Mr. Ian Scott
Intertek Fisheries Certification Ltd.

[redacted]

[redacted]

[redacted]

[redacted]

Please do not hesitate to get in touch if you have any questions.

Regards

Jim Francis – Co-Chair
Michigan Department of Natural Resources
[redacted]

Jeff Tyson
Ohio Department of Natural Resources
[redacted]
</td>
</tr>
</table>

Table 55: Yellow perch – Condition YP2

Condition YP2	**PI 1.2.2 Harvest control rules and tools: There are well defined and effective harvest control rules in place**
Performance Indicator	Issues at SG80 Well-defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached. The selection of the harvest control rules takes into account the main uncertainties. Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules
Score	75
Rationale	Issue a. The HCR does not make explicit reference to an LRP and it is unclear what actions will be taken as the MSC default LRP of 20% SSB_0 is approached.
Condition	By the fourth annual surveillance audit, the following SG80 SI must be met: Well-defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for an explicit algorithm or a decision rule which links observed changes in indicators to changes in annual TACs. At the second annual audit, the client will present the CAB with evidence that the explicit algorithm or decision rule which links observed changes in indicators to changes in annual TACs has been proposed. At the third annual audit, the client will present the CAB with evidence that the explicit algorithm or decision rule which links observed changes in indicators to changes in annual TACs has been defined. At the fourth annual, audit the client will present the CAB with evidence to show that explicit algorithm or decision rule which links observed changes in indicators to changes in annual TACs has been implemented and used in determining the TAC for the following year. The above provides incremental steps in achieving the condition. Only when the final step is complete will the team be able to provide a revised score. By the fourth audit the required minimum score is 80.
Client action plan	The Lake Erie Percid Advisory Group (LEPMAG) is currently working toward the development of a lake wide management approach and plan for Lake Erie Yellow perch that will include both target and limit reference points. This will occur over the next two to three years, and will satisfy this condition. The on-going LEPMAG process will provide a full management strategy evaluation (MSE) for Lake Erie Yellow perch in support of the evaluation of alternative HCRs and a LEC Yellow perch management plan expected by late 2016 or early 2017. LEMPAG and the QFC/LEC have already begun to consider options for state-dependent HCRs for all QZs and MUs. These options will be presented to the CAB at the first annual audit. The MSE process should be completed by the second annual audit and the LEC's final decision(s) on HCRs will be available to the CAB at that time. By 2017, the LEC decisions on HCRs will be used by the YPTG to generate RAH advice to the LEC on the annual TACs for all MUs. A new Yellow perch management plan will be available in late 2016 or early 2017.
Consultation on condition	As condition YP1.

Table 56: Yellow perch – Condition YP3

Condition YP3 **Trap Net MU1**	**PI 2.1.2 There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species**
Performance Indicator	Issues at SG80 a. There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. b. There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved. c. There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.
Score	60
Rationale	a. While there is a minimum landing size Channelcatfish (14.5"), specific measures have not been defined for Freshwater drum. b. Channel catfish. Although there is partial strategy of minimum landing size and other measures, this is unlikely to work as there is not a catch limit. Harvest is not constrained by the quota for Yellow perch quota as the fish can be released when the quota is reached. While the measures may work and the fishery meets SG60 SIb, the lack of catch limits fails to provide an objective basis for confidence that the partial strategy will work. Freshwater drum. There are measures but not a partial strategy. c. The lack of a catch limit for Channel catfish means that the partial strategy of a minimum size and other measures is unlikely to work. A partial strategy has not been implemented for Freshwater drum.
Condition	By the fourth annual surveillance audit, the following SG80 SIs must be met: - There shall be a partial strategy that is expected to maintain all main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved. - There shall be some objective basis for confidence that the partial strategy for all main retained species will work, based on some information directly about the fishery and/or species involved.
Milestones	At the first annual audit, the client will present the CAB with evidence that options to strengthen the approach to management of all identified main retained species have been identified. At the second annual audit, the client will present the CAB with evidence that options to strengthen the approach to management of all identified main retained species have been analysed. At the third annual audit, the client will present the CAB with evidence that options to strengthen the approach to management of all identified main retained species have been identified with partial strategies for all main retained species incorporated into relevant management plans. At the fourth annual, audit the client will present the CAB with evidence to show that the implemented strategies will work. The above provides incremental steps in achieving the condition. Only when the final step is complete will the team be able to provide a revised score. By the fourth audit the required minimum score is 80.
Client action plan	At the first annual audit, the client will present the CAB with evidence that options to strengthen the approach to management of all identified main retained species have been identified. At the second annual audit, the client will present the CAB with evidence that options to strengthen

	the approach to management of all identified main retained species have been analysed. At the third annual audit, the client will present the CAB with evidence that options to strengthen the approach to management of all identified main retained species have been identified with partial strategies for all main retained species incorporated into relevant management plans. At the fourth annual, audit the client will present the CAB with evidence to show that the implemented strategies will work. The above provides incremental steps in achieving the condition. Only when the final step is complete will the team be able to provide a revised score. By the fourth audit the required minimum score is 80.
Consultation on condition	As condition YP1.

Table 57: Yellow perch – Condition YP4

Condition YP4 **Trap Net All MU**	**2.2.3 Information on the nature and the amount of by-catch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage by-catch**
Performance Indicator	Issues at SG80 a. Qualitative information and some quantitative information are available on the amount of main by-catch species taken by the fishery. b. Information is sufficient to estimate outcome status with respect to biologically based limits. c. Information is adequate to support a partial strategy to manage main by-catch species. d. Sufficient data continue to be collected to detect any increase in risk to main by-catch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).
Score	75
Rationale	Issue a. There is substantial qualitative information that indicates there is no by-catch; unwanted catch remains alive in the trap until released by the fishers. However, the auditors have not identified any quantitative information as evidence on the quantity and type of fish that are released and the fishery does not meet SG80SIa
Condition	By the third annual surveillance audit, the following SG80 SI must be met: Qualitative information and some quantitative information are available on the amount of main by-catch species taken by the fishery, including the amount and types of released by-catch.
Milestones	At the first annual audit, the client will present the CAB with evidence that there has been consideration of the options for collecting released by-catch data in the Ohio trap net fishery. At the second annual audit, the client will present the CAB with evidence that a mechanism to collect released by-catch data has been designed and has been implemented. At the third annual audit, the client will present the CAB with evidence to show that released by-catch data has been collected and analysed. These milestones provide incremental steps in achieving the condition. Only when the final step is complete will the team be able to revise the score. By the third annual audit the required minimum score is 80.
Client action plan	The OCFA will request that the ODNR begin considering options for collecting data on released by-catch in the Ohio trap net fishery. Evidence of these considerations will be requested by the OCFA, and/or provided directly to the CAB by ODNR. ODNR will be requested to design and implement a mechanism for collecting the released by-catch data. OCFA will provide any help necessary to support this activity. It is important that evidence of the design and implementation of this data collection mechanism be provided to the CAB by the second annual audit. Once a data collection mechanism has been designed it is proposed that ODNR will begin to collect and analyse the released by-catch data. Evidence of this work will be provided to the CAB resulting in the removal of this Condition.
Consultation on condition	As condition YP1.

12 APPENDIX 2.1: WALLEYE – SCORING TABLES

<table>
<tr><td colspan="2">PI 1.1.1</td><td colspan="3">The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>It is likely that the stock is above the point where recruitment would be impaired.</td><td>It is highly likely that the stock is above the point where recruitment would be impaired.</td><td>There is a high degree of certainty that the stock is above the point where recruitment would be impaired.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">Biomass has been well above the LRP of 20% virgin biomass since the early 1980s. The WTG determined that the probability that biomass was below the LRP in 2014 was 0.011%. SG60 SIa is met.

Biomass has been well above the LRP of 20% virgin biomass since the early 1980s. The WTG determined that the probability that biomass was below the LRP in 2014 was 0.011%. SG80 SIa is met.

Biomass has been well above the LRP of 20% virgin biomass since the early 1980s. The WTG determined that the probability that biomass was below the LRP in 2014 was 0.011%. SG100 SIa is met.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td></td><td>The stock is at or fluctuating around its target reference point.</td><td>There is a high degree of certainty that the stock has been fluctuating around its target reference point, or has been above its target reference point, over recent years.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">Biomass has been well above the MSC default TRP of 40% SSB_0 since the early 1980s and is currently about 1.5 times the MSC default TRP. SG80 Sib is met.

Biomass has been well above the MSC default TRP of 40% SSB_0 since the early 1980s and above this TRP since the mid-2000s, which is about one generation time (8 years) and is interpreted as being ‘recent years’. SG100 Sib is met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">WTG (2013)</td></tr>
</table>

Stock Status relative to Reference Points			
	Type of reference point	**Value of reference point**	**Current stock status relative to reference point**
Target reference point	40% B_0	17.421 mil kg.	1.478
Limit reference point	20% B_0	8.561 mil kg.	3.009

OVERALL PERFORMANCE INDICATOR SCORE	100

PI 1.1.2		Limit and target reference points are appropriate for the stock		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Generic limit and target reference points are based on justifiable and reasonable practice appropriate for the species category.	Reference points are appropriate for the stock and can be estimated.	
	Met?	Y	Y	
	Justification	Limit and target reference points have been established based on an extensive MSE which evaluated the robustness of these reference points to a range of uncertainties. SG60 SIa is met. Limit and target reference points have been estimated based on Ricker stock-recruit and stock per recruit dynamics since 1994. The current biomass LRP and fishing mortality TRP are based upon extensive analyses which indicate their appropriateness for use in management. SG80 Sia is met.		
b	**Guidepost**		The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity.	The limit reference point is set above the level at which there is an appreciable risk of impairing reproductive capacity following consideration of precautionary issues.
	Met?		Y	N
	Justification	Based upon simulations, the LRP is set at 20% of virgin biomass which is consistent with the MSC certification requirements. SG80 Sib is met. The LRP, while the result of an MSE, did not consider the role of Walleye in the ecosystem. Also, the impact of migration in and out of MU4 as well as Lake Huron, has not been considered. SG100 Sib is not met.		
c	**Guidepost**		The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome.	The target reference point is such that the stock is maintained at a level consistent with B_{MSY} or some measure or surrogate with similar intent or outcome, or a higher level, and takes into account relevant precautionary issues such as the ecological role of the stock with a high degree of certainty.
	Met?		Y	N
	Justification	The target fishing mortality is 60% F_{MSY}, which implies a stock biomass which is 65% of virgin biomass and in excess of SSB_{MSY}. Therefore the target biomass implied by the target fishing mortality is more precautionary than fishing towards SSB_{MSY}. SG80 SIc is met. The implied target biomass (65% of virgin biomass) is the result of an MSE, but did not consider the role of Walleye in the ecosystem. Also, it is recognized that there are interactions amongst Walleye in MUs 1 – 3, MU4 and Lake Huron. The impact of these movements on the target reference point has not been considered. SG100 SIc is not met.		
d	**Guidepost**		For key low trophic level stocks, the target reference point takes into account the ecological role of the stock.	
	Met?		NA	

	Justification	
References		WFMP (2005); WTG (2013); Zhou *et al* (2012); Zhao *et al* (2011)
OVERALL PERFORMANCE INDICATOR SCORE		80

PI 1.1.3		Where the stock is depleted, there is evidence of stock rebuilding within a specified timeframe		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Where stocks are depleted rebuilding strategies, which have a reasonable expectation of success, are in place.		Where stocks are depleted, strategies are demonstrated to be rebuilding stocks continuously and there is strong evidence that rebuilding will be complete within the specified timeframe.
	Met?			
	Justification	Not applicable.		
b	**Guidepost**	A rebuilding timeframe is specified for the depleted stock that is the shorter of 30 years or 3 times its generation time. For cases where 3 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	A rebuilding timeframe is specified for the depleted stock that is the shorter of 20 years or 2 times its generation time. For cases where 2 generations is less than 5 years, the rebuilding timeframe is up to 5 years.	The shortest practicable rebuilding timeframe is specified which does not exceed one generation time for the depleted stock.
	Met?			
	Justification	Not applicable.		
c	**Guidepost**	Monitoring is in place to determine whether the rebuilding strategies are effective in rebuilding the stock within a specified timeframe.	There is evidence that they are rebuilding stocks, or it is highly likely based on simulation modelling or previous performance that they will be able to rebuild the stock within a specified timeframe.	
	Met?			
	Justification	Not applicable.		
References				
OVERALL PERFORMANCE INDICATOR SCORE			**NA**	

PI 1.2.1		There is a robust and precautionary harvest strategy in place		
SI		SG 60	SG 80	SG 100
a	Guidepost	The harvest strategy is expected to achieve stock management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy work together towards achieving management objectives reflected in the target and limit reference points.	The harvest strategy is responsive to the state of the stock and is designed to achieve stock management objectives reflected in the target and limit reference points.
	Met?	Y	Y	Y
	Justification	The harvest strategy consists of objectives, a HCR, explicit limit and target reference points, a suite of tools and annual assessment by the WTG. The strategy consists of components observed to be required in other fisheries. SG60 SIa is met. Since 2005, TACs have been set according to the scientific advice which is in turn based on the annual assessments. Reported catch has not exceeded TACs and in most cases is below these. SG80 SIa is met. The 2013 TAC setting process indicated that the strategy is responsive to the stock and, through the P* rule is designed to ensure that the stock does not fall below the LRP. SG100 SIa is met.		
b	Guidepost	The harvest strategy is likely to work based on prior experience or plausible argument.	The harvest strategy may not have been fully tested but evidence exists that it is achieving its objectives.	The performance of the harvest strategy has been fully evaluated and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels.
	Met?	Y	Y	N
	Justification	The harvest strategy is based upon extensive examination in an MSE. It consists of a relatively conservative 60% F_{MSY} target, a 20% B0 LRP and a P* rule which would reduce exploitation as the LRP is approached. Based on experience in other fisheries (e.g. US west coast groundfish), it is likely to work. SG60 Sib is met. The strategy has been tested through an MSE and the annual assessments provide the necessary monitoring. It was first implemented in 2013 and was implemented as planned. It was determined that biomass has not fallen below the LRP. SG80 Sib is met. The harvest strategy has been full evaluated in a recent MSE. While there is evidence that it is achieving its objectives, it is too soon to state whether or not it is clearly able to maintain the stock at the TRP. SG100 Sib is not met.		
c	Guidepost	Monitoring is in place that is expected to determine whether the harvest strategy is working.		
	Met?	Y		
	Justification	The annual assessment meetings conducted by the WTG review a suite of datasets used to monitor Walleye status. SG60 Sic is met.		
d	Guidepost			The harvest strategy is periodically reviewed and improved as necessary.
	Met?			Y
	Justification	There is a long history review of harvest strategies in the fishery. The recent MSE is arguably the most extensive to date but highlights the capacity of the management system to update the strategy as and when necessary. SG100 SId is met.		
e	Guidepost	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?			

	Justification	NA
References		LEC (2005); WFMP (2007); WTG (2013); Zhou e*t al* (2012)
OVERALL PERFORMANCE INDICATOR SCORE		95

PI 1.2.2		There are well defined and effective harvest control rules in place		
SI		SG 60	SG 80	SG 100
a	Guidepost	Generally understood harvest rules are in place that are consistent with the harvest strategy and which act to reduce the exploitation rate as limit reference points are approached.	Well defined harvest control rules are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as limit reference points are approached.	
	Met?	Y	Y	
	Justification	The explicit HCR with a 60% F_{MSY} target harvest rate, 20% B_0 LRP and a 5% P* rule are evidence of the general requirement to reduce exploitation as abundance declines to a critically low level. SG60 SIa is met. A well defined HCR is in place consistent with the strategy which, through an explicit LRP and a 5% P* rule will reduce exploitation as biomass declines. SG80 SIa is met.		
b	Guide post		The selection of the harvest control rules takes into account the main uncertainties.	The design of the harvest control rules takes into account a wide range of uncertainties.
	Met?		Y	N
	Justification	By design, the HCR accounts for the main uncertainties identified in the annual stock assessment. It does this through provision in the scientific advice both in stating whether or not projected biomass will fall below the LRP and in providing minimum, mean and maximum RAHs. As uncertainty in current stock size changes, so too do these RAHs. SG80 SIb is met. It is clear that the HCR takes into account the uncertainties recognized in the stock assessment. The WTG acknowledges that movement between the east and west basins are an issue in the lake-wide assessment of Walleye. There are also movements to and from Lake Huron that are a source of uncertainty. It is unclear what the impact of this movement is on the MU 1 – 3 Walleye assessment. SG100 SIb is not met.		
c	Guidepost	There is some evidence that tools used to implement harvest control rules are appropriate and effective in controlling exploitation.	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the harvest control rules.
	Met?	Y	Y	Y
	Justification	The primary tool to control harvesting is the TAC. This is set based on the annual scientific advice. The reported catch has not exceeded the TAC since 2005. SG60 SIc is met. Since 2005, reported catch has been below the TAC and the latter has been set consistent with the scientitic advice. The primary regulatory tool, TACs, is successfully used in many fisheries to control exploitation. SG80 SIc is met. The use of quotas to control exploitation in the fishery clearly indicates that tehse are effective in achieving the objectives of the harvest strategy. SG100 SIc is met.		
References		LEC (2013b); STC (2007a); WFMP (2007); WTG (2013)		
OVERALL PERFORMANCE INDICATOR SCORE:			90	

PI 1.2.3		Relevant information is collected to support the harvest strategy		
SI		SG 60	SG 80	SG 100
a	Guidepost	Some relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy.	Sufficient relevant information related to stock structure, stock productivity, fleet composition and other data is available to support the harvest strategy.	A comprehensive range of information (on stock structure, stock productivity, fleet composition, stock abundance, fishery removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available.
	Met?	Y	Y	N
	Justification	Genetic and tagging studies indicate western Lake Erie Walleye are genetically distinguishable from Walleye in eastern Lake Erie. However, there exists uncertainty associated with the annual age and size structure of the Walleye stock migrating from the west basin. As well, there is migration to and from Lake Huron. Maturity and fecundity data come from variety of sources. Natural mortality (M) is assumed = 0.32 based upon tagging studies. There is good understanding of the stock's productivity with a Ricker stock-recruit relationship with environmental covariates allowing estimation of stock production. Information is available on fleet composition in both Ontario and Ohio. Information in the licensing systems catalogue vessel and gear characteristics of each participant. Through the Vessel Monitoring System (VMS), good information is also provided on fishing location which supplements the logbook data. SG60 SIa is met. Genetic and morphological studies support the basis of the stock unit. Maturity and fecundity data come from variety of sources and natural mortality (M) is estimated to be 0.32 based upon tagging studies. A Ricker stock-recruit relationship with describes the decline in productivity since 1994 characterizes production dynamics and allows estimation of stock production reference points. Information is available on fleet composition in both Ontario and Ohio while information in the licensing systems catalogue vessel and gear characteristics of each participant. Through the Vessel Monitoring System (VMS), good information is provided on fishing location which supplements the logbook data. Other data includes on-going monitoring of environmental conditions in Lake Erie which are associated with Walleye productivity. Overall, there is sufficient information on stock structure, stock productivity, and fleet composition. In addition, other data on environmental conditions is sufficient to monitor potential abiotic – induced changes in Walleye productivity. SG80 SIa is met. The range of information on Walleye could be considered comprehensive although the lack of verification of the discard data is a concern. Indications are that discards are low but this needs to be verified. Also, there are no estimates of Walleye post-capture mortality. Further, uncertainties in the effects of migrations between and within the lakes need to be addressed to ensure that the objectives of the harvest strategy are met. SG100 SIa is not met.		
b	Guidepost	Stock abundance and fishery removals are monitored and at least one indicator is available and monitored with sufficient frequency to support the harvest control rule.	Stock abundance and fishery removals are regularly monitored at a level of accuracy and coverage consistent with the harvest control rule, and one or more indicators are available and monitored with sufficient frequency to support the harvest control rule.	All information required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent uncertainties in the information [data] and the robustness of assessment and management to this uncertainty.
	Met?	Y	Y	N

<table>
<tr><td></td><td>Justification</td><td colspan="3">A number of indices of fishery dependent and independent stock abundance are used in the Walleye assessment. The primary fishery dependent indices are of fishing effort since the late-1970s for the Ontario gillnet and Ohio sport fisheries. The primary fishery independent indices are provided by the Ontario partnership gillnet survey (1989 – present), the Ontario/US western basin interagency trawling survey (1988 - present) and the Ohio/Michigan gillnet survey (1978 – present). These indices provide about 30 years of stock monitoring which is over five generations of Walleye. Fishery removals have been recorded in daily catch records since 1997. Discards have been reliably recorded since 2011. Monitoring of dockside landings during 2004 – 2012 ranged 36 - 77% in MUs 1 – 3 and 8 - 55% in MU4. While there have been observer studies on specific issues (e.g. smelt fishery), there is no routine on-the-lake coverage. Given the reported magnitude of released fish compared to the total catch, post-capture mortality does not appear to be a big issue. SG60 SIb is met.

As noted in SG60, a number of indices of fishery dependent and independent stock abundance are used in the Walleye assessment. These indices provide about 30 years of stock monitoring which is over five generations of Walleye. The relative uncertainty in the indices is incorporated into the assessment. Fishery removals have been recorded in daily catch records since 1997 and discards reliably since 2011. There is monitoring of dockside landings but there is no on-the-lake verification of the discard data, although this is reported to be low. SG80 SIb is met.

All information required by the HCR is monoitored with high frequency relative to the generation time of Walleye. There is good understanding of the uncertainties in the fishery removals and stock indices. Notwithstanding this, there is a concern on the reliability of the commercial fishery's discard data due to the lack of verification. As well, the robustness of the assessment and management to these uncertainties has not been fully examined. All information required by the HCR is monoitored with high frequency relative to the generation time of Walleye. There is good understanding of the uncertainties in the fishery removals and stock indices. Notwithstanding this, there is a concern on the reliability of the commercial fishery's discard data due to the lack of verification. As well, the robustness of the assessment and management to these uncertainties has not been fully examined. SG100 SIb is not met.</td></tr>
<tr><td>c</td><td>Guide post</td><td></td><td>There is good information on all other fishery removals from the stock.</td><td></td></tr>
<tr><td></td><td>Met?</td><td></td><td>Y</td><td></td></tr>
<tr><td></td><td>Justification</td><td colspan="3">There is a small recreational fishery in Ontario and a much larger one in Ohio. The fleet compositional and operational characteristics of these fisheries are well described. There is a comprehensive database of catch and effort, similar to those available for the commercial fisheries. There are small hoop, seine and bait fisheries which are considered to be small although there are no estimates of the catch of these. Notwithstanding this, the primary other fishery (Ohio recreational) is well monitored. SG80 SIc is met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Einhouse et al (2010); Jiao et al (2009); Gatt et al (2003); Haas et al (2003); LEC (2013b); Lester et al (2005); Li et al (2011a; 2011b); Locke (2013); OMNR (2013a; 2013b; 2013c); Stepien et al (1998); Strange et al (2007); Tyson et al (2006); Wilson (2003); Zhao (2013); Zhao et al (2011)</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 1.2.4		There is an adequate assessment of the stock status		
SI		SG 60	SG 80	SG 100
a	Guidepost		The assessment is appropriate for the stock and for the harvest control rule.	The assessment is appropriate for the stock and for the harvest control rule and takes into account the major features relevant to the biology of the species and the nature of the fishery.
	Met?		Y	N
	Justification	The SCAA model provides estimates of abundance, biomass and fishing mortality, along with estimates of their uncertainty, which is used by the HCR. The model, which incorporates error in both fishery removals and the indices, is appropriate given the nature of the fishery. It is also consistent with SCAA formulations elsewhere which inform comparable HCRs. SG80 SIa is met. The assessment has been reviewed extensively and determined to be appropriate for the stock and HCR. It describes the major biological processes of Walleye and the fisheries exploiting it. However, acknowledged movements amongst MUs 1-3 and MU4 are yet to be incorporated. SG100 SIa is not met.		
b	Guidepost	The assessment estimates stock status relative to reference points.		
	Met?	Y		
	Justification	The assessment estimates spawning biomass relative to 20% virgin biomass (LRP) and 60%F_{MSY} (target fishing mortality). SG60 SIb is met.		
c	Guidepost	The assessment identifies major sources of uncertainty.	The assessment takes uncertainty into account.	The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a probabilistic way.
	Met?	Y	Y	Y
	Justification	Each of the fishery removal and index data sets has an associated estimate of the relative variance (lambda), based on the findings of a 2007 workshop and subsequent examination of the relative error in each input dataset. As well, error around the Ricker stock-recruit relationship is documented and used in reference point determination. SG60 SIc is met. The model, through the use of lambda terms associated with each fishery removal and index data set, takes account of uncertainty. These lambda terms are based upon discussion at a 2007 workshop and subsequent examination of the relative error in each input dataset. SG80 SIc is met. Minimum, mean and maximum Recommended Allowable Harvest (RAH) is provided for the projection year. As well, stock biomass at the end of the projection year is evaluated, in a probabistic manner, relative to 20% virgin biomass. SG100 SIc is met.		
d	Guidepost			The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored.
	Met?			Y
	Justification	The assessment model has been extensively tested as part of a three MSE in which alternative hypotheses and model sensitivities were examined. SG100 Sid is met.		

e	Guidepost		The assessment of stock status is subject to peer review.	The assessment has been internally and externally peer reviewed.
	Met?		Y	Y
	Justification	The WTG provides an internal peer review forum, the results of which are produced in its annual reports. SG80 SIe is met. The WTG provides internal peer review. From time to time, external peer review has been conducted, both by commissioned scientists (e.g. Myers & Bence, 2002) and on-going interaction with the QFC at Michigan State U. SG100 SIe is met.		
References		Berger (2011); Francis (2011); Jiao *et al* (2009); LEC (2005); Myers and Bence (2002); Sainsbury *et al* (2000); STC (2007b; 2007c); WFMP (2007); WTG (2013)		
OVERALL PERFORMANCE INDICATOR SCORE			95	

PI 2.1.1		The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.		
SI		SG 60	SG 80	SG 100
a	Guidepost	Main retained species are likely to be within biologically based limits (if not, go to SI c below).	Main retained species are highly likely to be within biologically based limits (if not, go to SI c below).	There is a high degree of certainty that retained species are within biologically based limits and fluctuating around their target reference points.
	Met?	Y	Y	N
	Justification	Of the large number of retained species, only Lake whitefish, White bass and White perch are considered main; the first as it is both vulnerable species and has a catch share >5%; the other two have a catch share > 5 %. White perch is an invasive species and is not taken into consideration. There are no defined biological based limits for Lake whitefish or White bass from stock assessments. The decline in Lake Erie's lake whitefish population is evident from both fishery and survey indicators. The 2014 CWTG report stated that continued poor recruitment elevates the need for reduced fishing mortality and habitat improvement. Some indicators suggest that mean condition factors have dropped below historic averages. Further, Ontario annual commercial catch rates dropped precipitously from 2011 to 2013. Thus it is obvious that the species is not within biological limits. Trends in White bass CPUE from surveys and commercial catch indicate stock recovery since the 1990s; surveys by ODNR and ODW show a consistently increasing trend in CPUE over recent years (ODNR 2013), with sub-adult and adult White bass abundance being high since 2011. Also, recent increases in the abundance of juvenile White bass have been >20-year average. The length-at-age for ages in the 2013 Ohio fall surveys was generally at, or above, the long-term mean. Thus it is clear that the species is within biological limits. The fishery meets SIa at SG60 & SG80. The White bass stock has not been assessed and does not have a TRP; while there is a lack of understanding of the status of all retained species. The fishery does not meet SG100 SIa.		
b	Guidepost			Target reference points are defined for retained species.
	Met?			N
	Justification	There are not TRPs for all retained species. The fishery does not meet SG100 SIb.		
c	Guidepost	If main retained species are outside the limits there are measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding of the depleted species.	If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.	
	Met?	Y	N	
	Justification	Lake whitefish. There are measures in place such as that Lake whitefish is a quota species and the retained Lake whitefish catch in the walleye fishery is counted against the quota. The fishery meets SG60 SIc. The annual TAC constitutes also a partial strategy. But, the poor condition of the stock indicates that the partial strategy is not effective The decline in the Lake whitefish population is shown by fishery and survey indicators. The continued poor recruitment means F must be reduced. In fact the quota has not been caught since at least 1984. The fishery does not meet SG80 SIc.		

d	Guidepost	If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the retained species to be outside biologically based limits or hindering recovery.		
	Met?	Y		
	Justification	The status of Lake whitefish & White bass are not poorly known.		
References		CWTG 2014; Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks; Fish and Wildife Services Branch. London 2013; LEC, 2013; Allan Debertin, University of Guelph, Site visit presentation 2013.		
OVERALL PERFORMANCE INDICATOR SCORE			**70**	
CONDITION NUMBER			**WE1**	

PI 2.1.2		There is a strategy in place for managing retained species that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to retained species		
SI		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary, that are expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing retained species.
	Met?	Y	N	N
	Justification	The main retained species are Lake whitefish, White bass and White perch. Neither measures nor a partial strategy are necessary for White perch which is an invasive species. For Lake whitefish there are measures that are necessary to ensure that the fishery does not hinder recovery and for white bass to maintain the species within biological based limits. Several management measures relate to all retained species in the large mesh gill net fishery: minimum mesh size (89 mm), limited entry, gear restrictions, closed seasons and areas. The fishery meets SG60 SIa. As there is a TAC for Lake whitefish, this may be considered a partial strategy that meets SG80 SIa. White bass does not have a TAC and catch is not limited. While its harvest may be constrained by the Walleye quota and other general measures the lack of a White bass catch limit means that it is not possible to conclude that the large mesh fishery maintains White bass catch at levels which are highly likely to be within biologically based limits. It is essential to have a TAC because while the stock seams to be within biological levels, it is possible that harvest can increase in response to markets and status of other species such as Lake whitefish, which quota will probably be all allocated to by-catch.. The fishery does not meet SG80 SIa.		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	N	N
	Justification	White perch is not considered. The measures applied (selective gear, effort limitation and the Walleye quota) are considered likely to work for Lake whitefish and White bass. The fishery meets SG60 SIb. Due to the poor condition of the stock despite the partial strategy in place and influence of other environmental factors, the partial strategy for Lake whitefish may not work and the TAC needs to be calculated based on a peer reviewed stock assessment. There is not a partial strategy for White bass. The fishery does not meet SG80 SIb.		
c	Guide post		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		N	N
	Justifica tion	There is no evidence that the partial strategy for Lake whitefish is being implemented successfully. The White bass fishery does not have a partial strategy. There is not a strategy for all retained species.The fishery does not meet SG80 SIc.		
d	Guide post			There is some evidence that the strategy is achieving its overall objective.
	Met?			N

	Justification	There is not a strategy for all retained species. The fishery does not meet SG100 SId.		
e	Guide post	It is likely that shark finning is not taking place.	It is highly likely that shark finning is not taking place.	There is a high degree of certainty that shark finning is not taking place.
	Met?	NA	NA	NA
	Justification			
References		CWTG 2014; Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks; Fish and Wildife Services Branch. London 2013; LEC, 2013; Allan Debertin, University of Guelph, Site visit presentation 2013.		

OVERALL PERFORMANCE INDICATOR SCORE	60
CONDITION NUMBER	WE2

PI 2.1.3		Information on the nature and extent of retained species is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage retained species		
SI		SG 60	SG 80	SG 100
a	Guidepost	Qualitative information is available on the amount of main retained species taken by the fishery.	Qualitative information and some quantitative information are available on the amount of main retained species taken by the fishery.	Accurate and verifiable information is available on the catch of all retained species and the consequences for the status of affected populations.
	Met?	Y	Y	N
	Justification	Discussions with fishers indicates knowledge of retained species allowing the fishery to meet SG60 SIa. Information fron mandatory DCRs is inputted into a data base by OCFA and is used by OMNR, OCFA and others to provide information on retained catch by species. The fishery meets SG80 SIa. Notwithstanding the experience of the assessment team that information may not be accurate, log books data is checked by dockside and fish plant monitoring. However, due to the lack of understanding of the status of all retained species, the available data is not used to address the consequences of catch in the fishery on the status of all affected populations. The fishery does not meet SG100 SIa.		
b	Guidepost	Information is adequate to qualitatively assess outcome status with respect to biologically based limits.	Information is sufficient to estimate outcome status with respect to biologically based limits.	Information is sufficient to quantitatively estimate outcome status with a high degree of certainty.
	Met?	Y	Y	N
		The data from the catch monitoring system (DCRs, dockside monitoring, observer coverage, sampling) together with abundance surveys provide the information necessary for the fishery to meet SG60 & SG80 SIb. As a wide range of information is not available for all retained species and questions have arisen about the accuracy of the data, the fishery does not meet SG100 SIb.		
c	Guidepost	Information is adequate to support measures to manage main retained species.	Information is adequate to support a partial strategy to manage main retained species.	Information is adequate to support a strategy to manage retained species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.
	Met?	Y	Y	N
	Justification	As an invasive species White perch is not subject to management measures. Information available on White bass, as described under SIb, is considered adequate to support a partial strategy. The same applies to Lake whitefish. The fishery meets SG60 & SG80 SIc. A lack of knowledge on their status means that there is inadequate information to support a strategy to manage all retained species. The fishery does not meet SG100 SIc.		
d	Guidepost		Sufficient data continue to be collected to detect any increase in risk level (e.g. due to changes in the outcome indicator score or the operation of the fishery or the effectiveness of the strategy)	Monitoring of retained species is conducted in sufficient detail to assess ongoing mortalities to all retained species.
	Met?		Y	Y

	Justification	Continued catch reporting and VMS data provide information on the operation of the fishery. The various surveys on Erie provide sufficient indicators on trends in the abundance of White bass, Lake whitefish and White perch. Sufficient data are collected for Lake whitefish to detect any increase in risk level. The fishery meets SG80 SId. Comprehensive landing data provides sufficient detail to monitor ongoing mortalities for all retained species. The fishery meets SG100 SId.
References		CWTG 2014; Fisheries Management Zone 19 Meeting. Status of Lake Erie Stocks; FWS. London 2013; LEC, 2013; Allan Debertin, University of Guelph, Site visit presentation 2013.
OVERALL PERFORMANCE INDICATOR SCORE		85

<table>
<tr><td colspan="2">PI 2.2.1</td><td colspan="3">The fishery does not pose a risk of serious or irreversible harm to the bycatch species or species groups and does not hinder recovery of depleted bycatch species or species groups</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Main bycatch species are likely to be within biologically based limits (if not, go to SI b below).</td><td>Main bycatch species are highly likely to be within biologically based limits (if not, go to SI b below).</td><td>There is a high degree of certainty that bycatch species are within biologically based limits.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The main bycatch species are Gizzard shad (>5% of the total catch), Lake sturgeon (vulnerable) and lake trout (vulnerable). The latter two stocks are not within biologically based limits and are not considered under SIa. Gizzard shad is an invasive species and is not considered. The fishery meets SG60 & SG80 SIa.

Information is not available on all by-catch species. The fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>If main bycatch species are outside biologically based limits there are mitigation measures in place that are expected to ensure that the fishery does not hinder recovery and rebuilding.</td><td>If main bycatch species are outside biologically based limits there is a partial strategy of demonstrably effective mitigation measures in place such that the fishery does not hinder recovery and rebuilding.</td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Lake sturgeon and lake trout are protected species under Ontario legislation and their catch is prohibited. These mitigation measures mean that the fishery does not hinder recovery and rebuilding of the two stocks. The fishery meets SG60 SIb.

The two measures constitute a strategy; their efficacy is shown by the low recorded catch and the fishery does not hinder the recovery and rebuilding of the stocks. The fishery meets SG80 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>If the status is poorly known there are measures or practices in place that are expected to result in the fishery not causing the bycatch species to be outside biologically based limits or hindering recovery.</td><td></td><td></td></tr>
<tr><td>Met?</td><td>Y</td><td></td><td></td></tr>
<tr><td>Justifi cation</td><td colspan="3">The status of both lake trout and Lake sturgeon are well known. The fishery meets SG60 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">CWTG 2013, 2014; Baldwin et al. 2009; Strategic Plan, GLFC 2008-2020; Markham et al. 2008; USGS, 2013;</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 2.2.2		There is a strategy in place for managing bycatch that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to bycatch populations		
SI		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary, that are expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a partial strategy in place, if necessary, that is expected to maintain the main bycatch species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding.	There is a strategy in place for managing and minimizing bycatch.
	Met?	Y	Y	N
	Justification	Gizzard shad is an invasive species measures or a partial strategy are not necessary. Lake sturgeon is listed as endangered in Ontario, a recovery plan is in place and any catch must be released live. Lake Trout is a no-harvest species, a recovery plan is in place and any catch must be released live. This fishery meets SG60 & SG80 SIa. Suckers could include vulnerable species and SARA species of concern not recognized by Ontario legislation and not awarded protection. While the assessment team members were told that discard was prohibited in Ontario, the data indicates otherwise. Accordingly, there is not a strategy in place covering all species and the conclusion is that the fishery doeds not meet SG100 SIa.		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/species).	There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or species involved.
	Met?	Y	Y	N
	Justification	The release live requirement for Lake sturgeon and lake trout works. The fishery meets SG60 SIb. The recording of release on the DCR and release data provide an objective basis for confidence that the partial strategy of not allowing catch and live release, with associated sanctions for none compliance, is working. The fishery meets SG80 SIb. As there has been no testing to confirm PCM, the fishery does not meet SG100 SIb.		
c	Guidepost		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y	N
	Justification	Lake sturgeon & lake trout: the data on released fish provides evidence that the partial strategy is being implemented successfully. The fishery meets SG80 SIc. The lack of observer coverage and evidence on PCM means the fishery does not meet SG100 SIc.		
d	Guidepost			There is some evidence that the strategy is achieving its overall objective.
	Met?			N
	Justification	Lack of evidence showing there are no discards in the fishery and by-catch not covered in the recovery plans for lake trout and Lake sturgeon means the fishery does not meet SG100 SId.		
References		OMNR 2013. Conditions of Licence.		
OVERALL PERFORMANCE INDICATOR SCORE			80	

<table>
<tr><td colspan="2">PI 2.2.3</td><td colspan="3">Information on the nature and the amount of bycatch is adequate to determine the risk posed by the fishery and the effectiveness of the strategy to manage bycatch</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Qualitative information is available on the amount of main bycatch species taken by the fishery.</td><td>Qualitative information and some quantitative information are available on the amount of main bycatch species taken by the fishery.</td><td>Accurate and verifiable information is available on the catch of all bycatch species and the consequences for the status of affected populations.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The main bycatch species are Gizzard shad, Lake sturgeon and Lake trout. It is thought that since 2011 fishers comply in reporting bycatch. This information provides qualitative and quantitative information on the amount of bycatch. The fishery meets SG60 & SG80 SIa.

Also, while the assessment team did not identify main sucker by-catch species in the fishery it was noted that DCRs do not identify individual species within the group, some of which could be vulnerable. Further, there are Species of Concern in the area that could be part of the by-catch. It is recommended that to support the annual surveillance programme OCFA and OMNR must work to modify the reporting protocol so that sucker species are individually recorded.

This and the lack of confirmation that reported by-catch information after 2011 is accurate and verifiable due to lack of observer coverage means that the fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Information is adequate to broadly understand outcome status with respect to biologically based limits</td><td>Information is sufficient to estimate outcome status with respect to biologically based limits.</td><td>Information is sufficient to quantitatively estimate outcome status with respect to biologically based limits with a high degree of certainty.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Lake sturgeon and Lake trout are often caught in the large mesh fishery. The weight of catch is recorded, but not the number and size of individuals; nevertheless, these are likely to be juveniles. The collected information for both species in DCR and survey data is adequate to broadly understand outcome status with respect to biologically based limits. The fishery meets SG60 SIb.

The conditions of license require recording of Lake sturgeon; lake trout is a non-harvest species that must be released with numbers recorded in DCRs. The fishery meets SG80 SIb.

Lack of information on all species means the fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>Information is adequate to support measures to manage bycatch.</td><td>Information is adequate to support a partial strategy to manage main bycatch species.</td><td>Information is adequate to support a strategy to manage bycatch species, and evaluate with a high degree of certainty whether the strategy is achieving its objective.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The weight of released Lake sturgeon and Lake trout in the large mesh fishery is recorded in DCR but not the number and size of individuals. This information is adequate to support measures for the by catch of both species. The fishery meets SG60 SIc.

Reporting of Lake sturgeon catch and release is mandatory. Lake trout is a non-harvest species that must be released with data recorded in DCRs. This information together with survey data is adequate to support a partial strategy. The fishery meets SG80 SIc.

The PCM of the released species is not known and there is uncertainty about the reliability of data for all by-catch species as mandatory reporting has only been in place since 2011. As matters now stand it is considered that the information is not adequate to support and evaluate a strategy. The fishery does not meet SG100 SIc.</td></tr>
</table>

d	Guidepost		Sufficient data continue to be collected to detect any increase in risk to main bycatch species (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectively of the strategy).	Monitoring of bycatch data is conducted in sufficient detail to assess ongoing mortalities to all bycatch species.
	Met?		Y	N
	Justification	Information on the operations of the fleet (scale and intensity) and data reported in DCRs are sufficient to any increase in risk to main bycatch species. The fishery meets SG80 SId. As there are concerns about the accuracy of monitoring of data on all species (lack of observer coverage) the fishery does not meet SG100 SId.		
References				
OVERALL PERFORMANCE INDICATOR SCORE			80	

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The fishery meets national and international requirements for the protection of ETP species: The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.</td><td>The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.</td><td>There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">None of the ETP fish species (Lake chubsucker, Spotted gar) recognized by national legislation that could potentially overlap with the large mesh fishery were recorded as catch in the fishery between 2004 and 2013. The limited foot print of the gear may lead to the conclusion that the fishery does not interact with unionid listed species that overlap in distribution. The fishery meets SG 60 & SG80 SIa.

While the limited foot print of the gear may lead to the conclusion that the fishery does not interact with the listed species, the fishery lacks specific research. Unionid mussel species could be affected indirectly but there are no studies to evaluate the interaction. There are no efforts to evaluate if the effects of the fishery are within limit requirements, thus SG100 SIa is not met.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Known direct effects are unlikely to create unacceptable impacts to ETP species.</td><td>Direct effects are highly unlikely to create unacceptable impacts to ETP species.</td><td>There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">There are no known direct effects of this fishery on ETP fish species. Although there is potential interaction with the fishery, none of the ETP fish species was registered as catch in the fishery between 2004 and 2013. SG60 & SG80 SIb are met.

As there is no on board observer coverage there is not a high degree of confidence that there are no detrimental effects. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.</td><td>There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The potential for ghost fishing to create unacceptable impacts has been considered and is considered low (site visit workshop). The small footprint of the gear leads to the reasonable conclusion that there are no unacceptable impacts on unionid mussels. The fishery meets SG80 SIc.

As the potential of the fishing gear to cause mortality to unionid mussels has not been evaluated, the fishery does not meet SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">http://www.dfo-mpo.gc.ca/species-especes/, http://www.sararegistry.gc.ca, http://www.mnr.gov.on.ca/en/Business/species/index.html</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 2.3.2		**The fishery has in place precautionary management strategies designed to: Meet national and international requirements; Ensure the fishery does not pose a risk of serious harm to ETP species; Ensure the fishery does not hinder recovery of ETP species; and Minimise mortality of ETP species.**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	There are measures in place that minimise mortality of ETP species, and are expected to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to be highly likely to achieve national and international requirements for the protection of ETP species.	There is a comprehensive strategy in place for managing the fishery's impact on ETP species, including measures to minimise mortality, which is designed to achieve above national and international requirements for the protection of ETP species.
	Met?	Y	Y	Y
	Justification	ETP species are protected under SARA that defines requirements for protection and rebuilding. The associated recovery plans form a comprehensive strategy to manage the fishery's impacts on ETPs. The fishery meets SG60, SG80 & SG100 SIa.		
b	**Guidepost**	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species).	There is an objective basis for confidence that the strategy will work, based on information directly about the fishery and/or the species involved.	The strategy is mainly based on information directly about the fishery and/or species involved, and a quantitative analysis supports high confidence that the strategy will work.
	Met?	Y	Y	N
	Justification	ETP species accidentally taken must be released alive. The fishery meets SG60 SIb. There are no records of ETP in the catch in the gear and PCM in the fishery has not been evaluated. It may be concluded that the number would be low. SG80 SIb is met. The lack of a quantitative analysis on the potential impact of the fishery means that SG100 SIb is not met.		
c	**Guidepost**		There is evidence that the strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y	N
	Justification	The strategies defined under recovery plans are being implemented and there are monitoring (e.g. surveys), assessments and evaluations (e.g. recovery team meetings). The fishery meets SG80 Sic. While ETP interactions are not reported in the DCRs and log books, this is not confirmed by observers. Recovery strategies do not generally include an evaluation of the effects of commercial fisheries on ETP species in Lake Erie. SG100 SIc is not met.		
d	**Guidepost**			There is evidence that the strategy is achieving its objective.
	Met?			N
	Justification	Recovery plans do not include an evaluation of whether or not the strategy related to commercial fisheries is achieving its objectives. SG100 SId is not met.		
References		SARA, ESA.		
OVERALL PERFORMANCE INDICATOR SCORE			**85**	

<table>
<tr><td colspan="2">PI 2.3.3</td><td colspan="3">Relevant information is collected to support the management of fishery impacts on ETP species, including: Information for the development of the management strategy; Information to assess the effectiveness of the management strategy; and Information to determine the outcome status of ETP species.</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.</td><td>Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.</td><td>Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">DCRs record the catch of ETP species. The limited foot print of the gear may lead to the conclusion that the fishery does not interact with the listed species and fishery related mortality can be considered insignificant. The fishery meets SG60 SIa.

There is sufficient information to estimate the impact of the fishery on those listed as ETP. The fishery meets SG80 SIa.

The quality of data means that the fishery does not meet SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Information is adequate to broadly understand the impact of the fishery on ETP species.</td><td>Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.</td><td>Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The DCRs provide information that allows broad understanding of the impact of the fishery on ETP species. The fishery meets SG60 SIb.

It is also considered that this data in the context of the broader information available on SARA species is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species. The fishery meets SG80 SIb.

The lack of an observer program means that data for these cannot be verified for accuracy. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td>Information is adequate to support measures to manage the impacts on ETP species.</td><td>Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.</td><td>Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The available information that shows limited interactions with ETP is adequate to support measures to manage the fishery's impact on them. The fishery meets SG60 SIc.

On-going monitoring provides data trends that support a full strategy to manage the full strategy for ETP protection. The fishery meets SG80 SIc.

The information lacks number and size of ETP individuals caught, and PCM to evaluate with a high degree of certainty whether the strategy is achieving its objectives. The fishery does not meet SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Environmental Commissioner of Ontario 2013</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 2.4.1		The fishery does not cause serious or irreversible harm to habitat structure, considered on a regional or bioregional basis, and function		
SI		SG 60	SG 80	SG 100
a	Guidepost	The fishery is unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	The fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.	There is evidence that the fishery is highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm.
	Met?	Y	Y	N
	Justification	The large mesh gillnets (>89 mm) are stationary in the water column with habitat contact limited to the anchors. While these may drag a little, it is highly unlikely this will lead to serious or irreversible damage to the sandy bottoms. The fishery meets SG60 & SG80 SIa. Although the nature of the bottom, the minimal footprint of the fishery, and evidence on its scale and intensity suggest that it is highly unlikely that the fishery would reduce habitat structure and function to a point where there would be serious or irreversible harm, there have not been studies to evaluate the effects of the gear on habitat. The fishery does not meet SG100 SIa.		
References		Morgan & Chuenpagdee 2003;		
OVERALL PERFORMANCE INDICATOR SCORE			80	

PI 2.4.2		There is a strategy in place that is designed to ensure the fishery does not pose a risk of serious or irreversible harm to habitat types		
SI		SG 60	SG 80	SG 100
a	Guidepost	There are measures in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance.	There is a partial strategy in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above.	There is a strategy in place for managing the impact of the fishery on habitat types.
	Met?	Y	Y	N
	Justification	As it is considered that the gear does not damage habitat, neither measures nor a partial strategy are needed. Additionally, maintenance of the *status quo* (fishery scale and intensity) is a relevant partial strategy. Closed areas further reduce the potential impact on benthic habitat. The fishery meets SG60 & SG80 SIa. At the same time, a strategy to manage the impact of the gear on habitat has not been defined and implemented. The fishery does not meet SG100 SIa.		
b	Guidepost	The measures are considered likely to work, based on plausible argument (e.g. general experience, theory or comparison with similar fisheries/habitats).	There is some objective basis for confidence that the partial strategy will work, based on information directly about the fishery and/or habitats involved.	Testing supports high confidence that the strategy will work, based on information directly about the fishery and/or habitats involved.
	Met?	Y	Y	N
	Justification	Plausible argument is the character of the gear in the context of the soft bottom where the fishery is active. The fishery meets SG60 SIb. Stability in the fishing operatic (scale and intensity) and the sandy bottom provide the objective basis for confidence that the partial strategy will work. The fishery meets SG80 SIb. The lack of a strategy means the fishery does not meet SG100 SIb.		
c	Guide post		There is some evidence that the partial strategy is being implemented successfully.	There is clear evidence that the strategy is being implemented successfully.
	Met?		Y	N
	Justificat ion	The evidence is the character of the gear, the type of habitat and the limited scale and intensity if the fishery. The fishery meets SG80 SIc. Lack of a strategy means that the fishery does not meet the SG100 SIc.		
d	Guide post			There is some evidence that the strategy is achieving its objective.
	Met?			N
	Justifica tion	There is not a strategy and the fishery does not meet SG100 SId.		
References		HTG 2013		
OVERALL PERFORMANCE INDICATOR SCORE			80	

<table>
<tr><td colspan="2">PI 2.4.3</td><td colspan="3">Information is adequate to determine the risk posed to habitat types by the fishery and the effectiveness of the strategy to manage impacts on habitat types</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>There is basic understanding of the types and distribution of main habitats in the area of the fishery.</td><td>The nature, distribution and vulnerability of all main habitat types in the fishery are known at a level of detail relevant to the scale and intensity of the fishery.</td><td>The distribution of habitat types is known over their range, with particular attention to the occurrence of vulnerable habitat types.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The distribution of habitats in Lake Erie has been mapped by a large number of surveys that are on-going. The fishery meets SG60 SIa.

The majority of the habitat on which the fishery operates consists of soft bottoms that are of limited vulnerability. The fishery meets SG80 SIa.

Vulnerable habitats such as nursery areas are protected from commercial operations. The fishery meets SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.</td><td>Sufficient data are available to allow the nature of the impacts of the fishery on habitat types to be identified and there is reliable information on the spatial extent of interaction, and the timing and location of use of the fishing gear.</td><td>The physical impacts of the gear on the habitat types have been quantified fully.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Information on the fishing operation, habitat monitoring, VMS, DCRs and log books provide the information for the fishery to satisfy SG60 SIb.

Such information is sufficient to inform managers on the nature of impacts, the spatial extent of interaction and the timing and location relating to the setting, soaking and lifting of the gillnets. The fishery meets SG80 SIb.

Although the physical impacts of the gear on habitat types are considered to be minor, they have not been quantified. The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="3">c</td><td>Guidepost</td><td></td><td>Sufficient data continue to be collected to detect any increase in risk to habitat (e.g. due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).</td><td>Changes in habitat distributions over time are measured.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">The TAC and number of active vessels provide the data needed to detect if there is increase risk to habitat. The fishery meets SG80 SIc.

Because habitat is a determinant of quota allocations for the target species, there has been significant amount of work dedicated to measure habitat description on an ongoing basis. The fishery meets SG 100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Barbiero & Tuchman 2002; Johansson et al 2000; Bolsenga & Herdendorf 1993; Golapan et al. 1998; Tyson 2010; GLEAM; YPTF 2013; Report to the Lake Erie Habitat Task Force 2013; ODW 2013.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">95</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.5.1</td><td colspan="3">The fishery does not cause serious or irreversible harm to the key elements of ecosystem structure and function</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>The fishery is unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>The fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td><td>There is evidence that the fishery is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm.</td></tr>
<tr><td>Met?</td><td></td><td></td><td></td></tr>
<tr><td>Justification</td><td colspan="3">Due to the lack of specific research on the impact of the fishery on key elements of the ecosystem the RBF has been used to score PI 2.5.1 (see section 13.1)</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Environment Canada and US Environmental Protection Agency, 2005; A. Debertin, Unintended consequences of shared fisheries on fish population sustainability: a food-web model approach to sympatric fish species in Lake Erie, www.cfrn-rcrp.ca.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">Converted RBF Score = 80</td></tr>
</table>

PI 2.5.2		There are measures in place to ensure the fishery does not pose a risk of serious or irreversible harm to ecosystem structure and function		
SI		SG 60	SG 80	SG 100
a	Guide post	There are measures in place, if necessary.	There is a partial strategy in place, if necessary.	There is a strategy that consists of a plan, in place.
	Met?	Y	Y	N
	Justification	It is considered highly unlikely that the large mesh fishery could reduce ecosystem structure and function to a point where there would be serious or irreversible harm. The potential risk of impact is reduced by limited entry in the fishery and the quota that covers both the retained and bycatch of Walleye. The fishery meets SG60 SIa. Since there are not any significant ecosystem impacts, a management strategy is not needed (paragraph 7.1.25, MSC FAM v1.3). The fishery meets SG80 SIa. The lack of a strategy consisting of a plan means that SG100 SIa is not met.		
b	Guidepost	The measures take into account potential impacts of the fishery on key elements of the ecosystem.	The partial strategy takes into account available information and is expected to restrain impacts of the fishery on the ecosystem so as to achieve the Ecosystem Outcome 80 level of performance.	The strategy, which consists of a plan, contains measures to address all main impacts of the fishery on the ecosystem, and at least some of these measures are in place. The plan and measures are based on well-understood functional relationships between the fishery and the Components and elements of the ecosystem. This plan provides for development of a full strategy that restrains impacts on the ecosystem to ensure the fishery does not cause serious or irreversible harm.
	Met?	Y	Y	N
	Justification	It is highly unlikely that the large mesh fishery will reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Measures and a partial strategy are not needed and the fishery meets SG60 & SG80 SIb. The lack of a strategy consisting of a plan means that SG100 SIb is not met.		
c	Guidepost	The measures are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries / ecosystems).	The partial strategy is considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries / ecosystems).	The measures are considered likely to work based on prior experience, plausible argument or information directly from the fishery / ecosystems involved.
	Met?	Y	Y	Y
	Justification	Maintenance of the *status quo* would lead the measures and partial strategy to work. The Walleye fishery is considered highly unlikely to reduce ecosystem structure and function to a point where there would be serious or irreversible harm. Since there are currently no significant ecosystem impacts, a management strategy is not deemed necessary at either the SG60 or SG80 level (paragraph 7.1.25, MSC FAM v1.3). The fishery meets SG60 & SG80 SIc. Based on the knowledge of the catch of the target, retained, by-catch and ETP species in the context of work on food webs in other Canadian lakes, it is reasonable to consider that the measures and partial strategy will work. The fishery meets SG100 SIc.		

<table>
<tr><td rowspan="3">d</td><td>Guidepost</td><td></td><td>There is some evidence that the measures comprising the partial strategy are being implemented successfully.</td><td>There is evidence that the measures are being implemented successfully.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Since there are currently no significant ecosystem impacts, it may be considered that the approach adopted is successful. The fishery meets SG80 SId.

However, more research would be required to provide strong evidence that this is the case. A longer time series of information on bycatch in the fishery would be needed to infer the main consequences for the ecosystem. Further, the potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. SG100 SId is not met.</td></tr>
<tr><td colspan="2">References</td><td colspan="3"></td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">85</td></tr>
</table>

PI 2.5.3		There is adequate knowledge of the impacts of the fishery on the ecosystem		
SI		SG 60	SG 80	SG 100
a	Guidepost	Information is adequate to identify the key elements of the ecosystem (e.g., trophic structure and function, community composition, productivity pattern and biodiversity).	Information is adequate to broadly understand the key elements of the ecosystem.	
	Met?	Y	Y	
	Justification	Information on key elements of the ecosystem (main predators, prey and the structure of lower food web) allows the fishery to meet SG60 SIa. This information is adequate to broadly understand the key elements of the ecosystem as: (i) there is continuous monitoring of fish community composition and lower food web levels; (ii) changes in productivity are identified through measurement of nutrient inputs, phytoplankton densities, presence of blooms and levels of hypoxia; and (iii) there is an understanding of the effects of invasive species. The fishery meets SG80 SIa.		
b	Guidepost	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information, *but* have not been investigated in detail.	Main impacts of the fishery on these key ecosystem elements can be inferred from existing information and some have been investigated in detail.	Main interactions between the fishery and these ecosystem elements can be inferred from existing information, and have been investigated.
	Met?	Y	Y	N
	Justification	The main impacts of the fishery may be identified through the work on Ecopath and Ecosim food web models by researchers at OMNR and NOAA that is based on mass balance fluxes and integrates the information available. The fishery meets SG60 & SG80 SI b. Although the auditors are aware that the food web models are capable of identifying the main impacts of fisheries on key ecosystem elements, due to the lack of published information (it is understood that this is in the peer review process) it is not possible to identify if impacts of the walleye gillnet fishery have been investigated in detail. The fishery does not meet SG100 SIb.		
c	Guidepost		The main functions of the Components (i.e., target, Bycatch, Retained and ETP species and Habitats) in the ecosystem are known.	The impacts of the fishery on target, Bycatch, Retained and ETP species are identified and the main functions of these Components in the ecosystem are understood.
	Met?		Y	N
	Justification	Walleye is a main predator in the ecosystem with a trophic level of 4.5. The main retained species are White bass and Lake whitefish that have respective trophic levels of 4.04 and 3.43. The former is a pelagic feeder and the latter feeds on benthic invertebrates and may become increasingly planktivore. The main bycatch species are Gizzard shad, lake trout and Lake sturgeon. Gizzard shad is an invasive planktivorous species with a trophic level of 2.4. Lake trout is a long lived, main predator with a trophic level of 4.3. Lake sturgeon is a benthivore; trophic level 3.3. The latter two are both classified as vulnerable species. The fishery has limited impact on ETP species. There isn't a negative interaction between the fishery and habitat. On the basis of the foregoing, it may be concluded that the fishery meets SG80 SIc. Given the lack of specific analysis on the interaction of the fishery with each of these sub-components, evidence is not sufficient for the fishery to meet SG100 SIc.		
d	Guidepost		Sufficient information is available on the impacts of the fishery on these Components to allow some of the main consequences for the ecosystem to be inferred.	Sufficient information is available on the impacts of the fishery on the Components and elements to allow the main consequences for the ecosystem to be inferred.
	Met?		Y	N

<table>
<tr><td></td><td>Justification</td><td colspan="3">The catch of main retained species in the fishery in the context of their total removal, stock status and knowledge of their main ecosystem function, is considered sufficient to infer some of the fishery's main consequences. The situation is similar for main by-catch species. It is known that the fishery has a limited impact on habitat and ETP species. The fishery meets SG80 SId.

A longer time series of information on by-catch in the fishery would be needed to infer the main consequences for the ecosystem. Further, the potential influence of major environmental stressors (such as invasion, exotic species, climate change and eutrophication) complicates the evaluation of the fishery's main consequences. The fishery does not meet SG100 SId</td></tr>
<tr><td rowspan="3">e</td><td>Guidepost</td><td></td><td>Sufficient data continue to be collected to detect any increase in risk level (e.g., due to changes in the outcome indicator scores or the operation of the fishery or the effectiveness of the measures).</td><td>Information is sufficient to support the development of strategies to manage ecosystem impacts.</td></tr>
<tr><td>Met?</td><td></td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">Information on the scale and intensity of the fishery together with catch data is considered sufficient to detect any increase in the level of risk. The fishery meets SG80 SIe.

It is known that although it is not yet published, the food webs have been modelled and this would support the development of a strategy to manage ecosystem impacts. The fishery meets SG100 SIe.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Lake Erie Lakewide Management Committee, 2008; Government of Canada and the US Environmental Protection Agency, 2008; Campbell et al. 2009.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">85</td></tr>
</table>

PI 3.1.1		The management system exists within an appropriate legal and/or customary framework which ensures that it: Is capable of delivering sustainable fisheries in accordance with MSC Principles 1 and 2; and Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and Incorporates an appropriate dispute resolution framework.		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	There is an effective national legal system and a framework for cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2	There is an effective national legal system and organised and effective cooperation with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2.	There is an effective national legal system and binding procedures governing cooperation with other parties which delivers management outcomes consistent with MSC Principles 1 and 2.
	Met?	Y	Y	Y
	Justification	Lake Erie fisheries fall under the jurisdiction of the U.S. and Canada. In the former, overall management authority is vested in FWS although other Federal agencies may be involved in specific aspects. The Walleye fishery in U.S. waters is entirely recreational; no commercial activity is permitted. In Canada, the only Province involved in the fishery is Ontario. Combining National and Provincial policy on fisheries, habitats and environmental provides the framework for a rigorous management system. GLFC was established to coordinate work to maintain the Great Lake ecosystem. The 1980 JSP was signed by each of the state, provincial, federal, and tribal natural resource agencies in the Great Lakes basin. Individual lake committees, that comprise representatives from each agency, implement the strategic plan. For example, bi-national Fish Community Objectives for each of the Great Lakes specify lake-wide fish community goals and objectives that are achieved through management programs (such as stocking and regulations) developed and implemented by individual jurisdictions. LEC is a bi-national committee of state and provincial fisheries agencies operating under the auspices of GLFC to manage fish communities and fisheries in Lake Erie. LEC uses the JSP as a guide for managing internationally shared resources. The fishery meets SG60 SIa. The GLFC, LEC and associated task groups provide a coherent, logical set of practices or procedures that deliver management outcomes consistent with MSC Principles 1 and 2. The fishery meets SG80 SIa. The setting and allocation of quotas for some species and the work of the compliance committee can be taken as "*binding procedures*" and the fishery meets SG100 SIa.		
b	**Guidepost**	The management system incorporates or is subject by law to a mechanism for the resolution of legal disputes arising within the system.	The management system incorporates or is subject by law to a transparent mechanism for the resolution of legal disputes which is considered to be effective in dealing with most issues and that is appropriate to the context of the fishery.	The management system incorporates or subject by law to a transparent mechanism for the resolution of legal disputes that is appropriate to the context of the fishery and has been tested and proven to be effective.
	Met?	Y	Y	Y
	Justification	At the national and provincial level all laws are open to appeal, initially to the relevant Ministry / Department and up to the Ministerial level and on to the Federal system. GLFC has a dispute resolution mechanism that was strengthened by the JSP. The fishery meets SG60 SIb. There are a number of examples of legal disputes in the Canadian systems. These have covered a range of issues. For example, there is a case history linked to the confirmation of First Nation fishing rights. A dispute over the TAC setting for Walleye led to mediation under the prescribed GLFC procedures. Accordingly, while the agencies look to be proactive in minimizing the risk of disputes by involving stakeholders in the decision making process, parties may seek legal redress. It is concluded that this approach is effective in dealing with most issues and the fishery meets SG80 SIb. The history of cases indicates that the dispute resolution procedure, including being proactive to avoid legal issues, has been tested and proven to be effective. The fishery meets SG100 SIb.		

<table>
<tr><td rowspan="3">d</td><td>Guidepost</td><td>The management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to observe_the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td><td>The management system has a mechanism to formally commit to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>Y</td></tr>
<tr><td>Justification</td><td colspan="3">Management of Lake Erie at the local level is the responsibility of the National and Provincial jurisdictions. In Canada, the Aboriginal Fisheries Strategy (AFS) of 1992 provides the framework for the management of fisheries in compliance with the Sparrow decision. DFO negotiates annual agreements with Aboriginal groups that provide communal food, social and ceremonial fishing opportunities, co-operative management arrangements and economic development opportunities. Commercial communal licences have been provided to Aboriginal groups under the Allocation Transfer Programme (DFO 2003). Taken together, the bi-national, federal, and non-federal management agencies approach the Great Lakes from the same general perspective and with the same goals in mind. One of the aims of Ontario policy is to balance “the interests of stakeholders, including those of sport, commercial, and tribal fisheries, the environmental community, and many others”.

On the basis of the foregoing it is concluded that the management authorities are formally committed to respecting customary rights. However, this is in the context of fitting in with the established management system and those holding customary rights are bound to respect all regulations related to P1 and P2.

The fishery meets SG60, SG80 & SG100 SIc.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">Roseman et al; Isbell, JSP; http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/documents/national_standard_8_cfr.pdf</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">100</td></tr>
</table>

PI 3.1.2		**The management system has effective consultation processes that are open to interested and affected parties.** **The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are generally understood.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for key areas of responsibility and interaction.	Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction.
	Met?	Y	Y	Y
	Justification	A wide range of organisations and individuals are engaged in the large variety of issues relating to Lake Erie; many are specific to fisheries while others deal with other factors that have an influence on fisheries e.g. habitat and ecosystem. The main fishery related players are the State and Province agencies in the U.S. and Canada and the GLFC with its specific committees and groups related to management of Lake Erie. Review of the web sites of the large number of agencies (identified in the main text above) strongly indicates that functions, roles and responsibilities are explicitly defined and well understood for all areas of responsibility and interaction. As stated by Gaden *et al* (2009) "*Despite the large number of jurisdictions, the role of each type of jurisdiction is defined, accepted, and respected, and the management authorities tend to complement, not contradict or duplicate, each other*". The fishery meets SIa at SG60, SG80 and SG100 SIa.		
b	**Guidepost**	The management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information obtained.	The management system includes consultation processes that regularly seek and accept relevant information, including local knowledge. The management system demonstrates consideration of the information and explains how it is used or not used.
	Met?	Y	Y	N
	Justification	Stakeholders have a key role to play in the Lake Erie management process and a wide range of groups represent specific interests. As Haeffer comments on LEPMAG, formed in 2010, it is "*a more formal role for all stakeholders in quota decisions, not governance per se, which is bound by statutes that differ among agencies. Stakeholders have always been able to make recommendations for the LEC to consider when setting quotas. This new effort formalizes this process, ensuring more explicit involvement in understanding the scientific uncertainties, potential policies and outcomes, when making their recommendations… This process has been effective in helping stakeholders understand what it takes to craft policy options amidst competing interests. In similar kinds of processes, participants have become advocates for new data collection procedures and take ownership by volunteering data that they have collected*". As LEC (2014) notes: "*Through LEPMAG, fishery managers and stakeholders work together to identify the harvest policies for Lake Erie percids that meet the needs of all stakeholders while maintaining stability in the percid fishery. MSU'S QFC facilitates the LEPMAG process. Walleye are now being fully managed through the recommendations and population objectives developed through LEPMAG. This will be documented by the LEC as they draft and complete the revised Walleye Management Plan this year. The main focus of LEPMAG will now shift to developing population objectves and harvest strategy development for Yellow perch in Lake Erie*". At the site visit fishers in Ohio and Ontario spoke of the high degree of interaction between themselves and the authorities. The fishery meets SG60 & SG80 SIb. At the site visit, concern was expressed by commercial fishers at the influence of the recreational fishers to the cost of the interests of commercial fishers e.g. the stocking of salmonids and the potential impact on commercial fisheries. The fishery does not meet SG100 SIb.		

c	Guidepost		The consultation process provides opportunity for all interested and affected parties to be involved.	The consultation process provides opportunity and encouragement for all interested and affected parties to be involved, and facilitates their effective engagement.
	Met?		Y	Y
	Justification	The LEPMAG process and the public consultation on the new Ontario fisheries strategy means that the fishery meets SG80 & SG100 SIc.		
References		Gaden *et al* (2009); http://www.glfc.org/aboutus/brief.php#mission; Roseman *et al* 2009; ODNR 2014; Locke; Haeffer; LEC 2014; http://www.cfrn-rcrp.ca/article75; DFO 1999; DFO 2012a; Devitt *et al* 2010; OMNR 2008 (b); http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies		
OVERALL PERFORMANCE INDICATOR SCORE			**90**	

<table>
<tr><td>PI 3.1.3</td><td colspan="4">The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Principles and Criteria, and incorporates the precautionary approach</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Long-term objectives to guide decision-making, consistent with the MSC Principles and Criteria and the precautionary approach, are implicit within management policy</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach are explicit within management policy.</td><td>Clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within and required by management policy.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The JSP, most significantly with the FCOs, and GLWQA provide explicit and clear long term objectives relating to the MSC principles and criteria. These objectives are reinforced in Ontario with the defined goals for Lake Erie in Ryan et al as strengthened by the new draft Provincial Fish Strategy. While these objectives are explicit, no evidence has been presented to show that they are required. The best example of this is management of Lake Trout.

The fishery meets SG60 and SG80 but not SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">GLFC 2007; Ryan et al 2003; GLWQA 1987; Roseman et al; Ohio Coastal Management Program; ODNR 2010; DFO 1999; Strategic Plan for Ontario Fisheries (SPOF I); SPOF II; Our Sustainable Future: A Renewed Call to Action; ntario Biodiversity Strategy, OMNR’s Statement of Environmental Values.</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 3.1.4		**The management system provides economic and social incentives for sustainable fishing and does not operate with subsidies that contribute to unsustainable fishing**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and seeks to ensure that perverse incentives do not arise.	The management system provides for incentives that are consistent with achieving the outcomes expressed by MSC Principles 1 and 2, and explicitly considers incentives in a regular review of management policy or procedures to ensure they do not contribute to unsustainable fishing practices.
	Met?	Y	Y	N
	Justification	MSC CR v1.3 and related guidance state "*this PI gives effect to Criterion P3, A6. When considering if the fishery management system provides for incentives that are consistent with achieving the outcomes expressed by P1 and P2 (SG60 and SG80), the key issue in this part of the SG is to score the system with reference to if it 'opens the door' for the possibility for positive incentives. Does the system have attributes, policies or principles that would tend to incentivise fishers to fish sustainably, that engender a sense of stewardship of the resources? For example, policies that attempt to provide stability and/or security for fishers amid the uncertainties that come with complex and dynamic systems. This may involve, but not be limited to: the system providing for reducing information gaps and uncertainties for fishers; providing for strategic or statutory management planning to give certainty about the rules and goals of management; providing for mechanisms and opportunities to gain support for the management system from fishers; or fishery management system features that encourage collective action while allowing individual choice such that individual decisions are steered towards public good; providing for the clarification of roles, rights and responsibilities of the various stakeholders; engenders a sense of ownership (possibly, but not necessarily, through rights-based measures); providing for a participatory approach to management, research and other relevant processes*". In the Walleye fishery, the quota, the support of OCFA in contributing to research, the amount of research available to stakeholders, LEPMAG and other committee processes related to LEC all provide evidence that the fishery meets SG60 & SG80 SIa. As the management system does not actively and explicitly consider and review management policies and procedures with particular attention paid to the issue of incentives to make sure they are not contributing to unsustainable fishing practices, the fishery does not meet SG100 SIa.		
References		LEC 2005; LEPMAG ToR.		
OVERALL PERFORMANCE INDICATOR SCORE			**80**	

<table>
<tr><td colspan="2">PI 3.2.1</td><td colspan="3">The fishery has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Objectives, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are implicit within the fishery's management system</td><td>Short and long-term objectives, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.</td><td>Well defined and measurable short and long-term objectives, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are explicit within the fishery's management system.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">A large part of the overarching policy for Lake Erie with related short and term objectives are directly linked with the Walleye fisheries, taking into account both commercial and sport activities. The fishery meets SG60 SIa.

Through the FCO and the FMP, together with the terms of reference of the various TGs and related research it can be concluded that short and long term objectives are explicit within the fishery management system. The fishery meets SG80 SIa.

Issues related to retained catch and by catch prevent the fishery meeting SG100 SIa.</td></tr>
<tr><td colspan="2">References</td><td colspan="3">WFMP; Fish Community Goals and Objectives for Lake Erie</td></tr>
<tr><td colspan="3">OVERALL PERFORMANCE INDICATOR SCORE</td><td colspan="2">80</td></tr>
</table>

PI 3.2.2		**The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery under assessment.**		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	There are some decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives.	There are established decision-making processes that result in measures and strategies to achieve the fishery-specific objectives.	
	Met?	Y	Y	
	Justification	The decision making process is well established through the GLFC, LEC, WTG and LEPMAG processes. This leads to the setting of an annual quota that has the aims of meeting the fishery specific objectives related to sustainable long term fisheries. They are leading to the up-dating of the WFMP. The fishery meets SG60 and SG80 SIa.		
b	**Guidepost**	Decision-making processes respond to serious issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions.	Decision-making processes respond to serious and other important issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.	Decision-making processes respond to all issues identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions.
	Met?	Y	Y	N
	Justification	The research programme based on an overall lake objective that recognizes the need for sustainable fishing of the available fish resources in the context of a healthy ecosystem. The work of the TGs indicates that the fishery responds to serious and other important issues. However, there are a number of issues that are not covered e.g. PCM, observers and discards. The fishery meets SG60 and SG80 SIb but not SG100 SIb.		
c	**Guidepost**		Decision-making processes use the precautionary approach and are based on best available information.	
	Met?		Y	
	Justification	A keystone of quota managed Walleye fisheries in the context of the overall approach to management in Lake Erie is the requirement for precaution. This is shown in a large number of reports. The fishery meets SG80 SIc.		
d	**Guidepost**	Some information on fishery performance and management action is generally available on request to stakeholders.	Information on fishery performance and management action is available on request, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.	Formal reporting to all interested stakeholders provides comprehensive information on fishery performance and management actions and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity.
	Met?	Y	Y	N

	Justification	The research programme and associated reporting provides information on the fishery and management action, the most important source being the annual report of the WTG. The fishery meets SG60 SId. LEPMAG provides information on the decision making process and how this is responding to research findings. The fishery meets SG80 SId. The lack of verified information on by catch prevents the fishery meeting SG100 SId.		
e	Guidepost	Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery.	The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges.	The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges.
	Met?	Y	Y	Y
	Justification	In the past, the main court challenges related to consideration by fishers that quotas have been set unfairly. There is no evidence that the management authorities have shown any disprespect for the law and the fishery meets SG60 SIe. The work of the Blue Ribbon panel and the various task groups shows that managers are In response to this, the management approach changed to include greater stakeholder input with the expectation that a greater understanding of the large variety of issues would reduce the potential for conflict. Informed comment by a number of stakeholders and review of the literature indicates that this has proven to be the case – with LEPMAG providing a strong basis for cooperation between stakeholders and managers. The fishery meets SG80 SIe. The introduction of LEPMAG had the specific aim of involving stakeholders in the decision making process and thus proactively avoid legal disputes. Similarly, the joint management by various jursidictions has a similar impact. The fishery meets SG100 SIe.		
References				
OVERALL PERFORMANCE INDICATOR SCORE				**85**

<table>
<tr><td colspan="2">PI 3.2.3</td><td colspan="3">Monitoring, control and surveillance mechanisms ensure the fishery's management measures are enforced and complied with</td></tr>
<tr><td colspan="2">SI</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="3">a</td><td>Guidepost</td><td>Monitoring, control and surveillance mechanisms exist, are implemented in the fishery under assessment and there is a reasonable expectation that they are effective.</td><td>A monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated an ability to enforce relevant management measures, strategies and/or rules.</td><td>A comprehensive monitoring, control and surveillance system has been implemented in the fishery under assessment and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">The commercial fishery for Walleye in Ontario is monitored for compliance by OMNR that works closely with OCFA. At the international level, the GLFC has a Law Enforcement Committee that has detailed terms of reference mainly covering coordination and support between individual agencies. Given the low number of commercial fishing vessels in Ontario fisheries allied with a risk based approach it may be expected that compliance mechanisms will be effective. The fishery meets SG60 SIa.

At the international level the Law Enforcement Committee identifies and evaluates the problems associated with control of illegal fishery activities in the Great Lakes basin, and supports agencies in their resolution. In Ontario the main tools are dockside monitoring, VMS and forensic accounting at the fish plant level in the context of an inter-agency approach and occasional inspections on the lake. While research indicates transgressions in the past there does not appear to have been any significant problems in more recent years. It may be concluded that the system has demonstrated an ability to enforce regulations on TACs, quotas, closed areas and seasons. The fishery meets SG80 SIa.

Given the range of enforcement activities, it may be concluded that it is comprehensive. While there is no evidence to suggest that a consistent ability to enforce relevant management has not demonstrated, the lack of on-water monitoring prevents the fishery meeting SG100 SIa.</td></tr>
<tr><td rowspan="3">b</td><td>Guidepost</td><td>Sanctions to deal with non-compliance exist and there is some evidence that they are applied.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and thought to provide effective deterrence.</td><td>Sanctions to deal with non-compliance exist, are consistently applied and demonstrably provide effective deterrence.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
<tr><td>Justification</td><td colspan="3">Research indicates that there are sanctions (as established by regulations in the respective jurisdictions) and examples given in the main text of the report provides the evidence that they are applied. The fishery meets SG60 SIb.

From the evidence available from the limited number of major infractions it appears that the potential sanctions (high fines, custodial sentences, loss of license, confiscation of gear and and vessel) are applied and function as an effective deterrent. The fishery meets SG80 SIb.

Given the lack of recent court cases it may be concluded that the potential sanctions demonstrably provide an effective deterrent to non-compliance. However, there is not any evidence that the fishers comply with discard regulations in the Ontario fishery.The fishery does not meet SG100 SIb.</td></tr>
<tr><td rowspan="2">c</td><td>Guidepost</td><td>Fishers are generally thought to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery.</td><td>Some evidence exists to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery.</td><td>There is a high degree of confidence that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery.</td></tr>
<tr><td>Met?</td><td>Y</td><td>Y</td><td>N</td></tr>
</table>

	Justification	Fishers provide DCRs to the authorities and the information needed to support resource assessments. The lack of court cases in recent years indicates that the fishers are complying with regulations. The fishery meets SG60 SIc. The lack of court cases is the evidence that fishers comply and the landing data and VMS they provide support effective management of the fishery. The fishery meets SG80 SIc. However, the lack of on-board observers means that there is no evidence that the fishers are recording all discards. The fishery does not meet SG100 SIc.		
d	Guide post		There is no evidence of systematic non-compliance.	
	Met?		Y	
	Justification	Discussions with fishery managers and compliance officers during the site visits and background research did not provide any evidence of systematic non-compliance of fishers with the regulations. Court cases over the past 5 years have been isolated. The fishery meets SG80 SId.		
References		http://www.glfc.org/boardcomm/lawenforce/lawenf.php; http://www.glfc.org/boardcomm/clc/clchome.php#pub; http://www.fishlakeerie.com/news/articles-erie/607.html; http://wikileaks.org/cable/2008/02/08TORONTO58.html; (http://www.goerie.com/article/20120504/NEWS02/305039883/Erie-men-on-trial-on-illegal-fishing-charges;http://www.angelfire.com/la/outdoorspot/page40.html;http://www.mnr.gov.on.ca/en/Business/Enforcement/2ColumnSubPage/STEL01_130158.html); http://blogs.windsorstar.com/2012/05/10/troubled-fishing-vessel-accused-of-illegally-fishing-in-u-s-waters/;http://outdoorcanada.ca/11850/news/ontario-anglers-net-big-fines-for-selling-their-catch; http://www.ecoissues.ca/index.php/Ontario's_Commercial_Fisheries_Policies		
OVERALL PERFORMANCE INDICATOR SCORE			**80**	

PI 3.2.4		The fishery has a research plan that addresses the information needs of management		
SI		SG 60	SG 80	SG 100
a	Guidepost	Research is undertaken, as required, to achieve the objectives consistent with MSC's Principles 1 and 2.	A research plan provides the management system with a strategic approach to research and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.	A comprehensive research plan provides the management system with a coherent and strategic approach to research across P1, P2 and P3, and reliable and timely information sufficient to achieve the objectives consistent with MSC's Principles 1 and 2.
	Met?	Y	Y	N
	Justification	The main vehicle for research is GLFC and the work of the associated LEC and the various task groups. The research priorities identified by GLFC covers a wide range of areas: ecosystem consitions; productivity and yield obejective; near shore habitat objective, western basin objective; central basin objective; eastern basin objective; fish habitat objective; genetic diversity objective; and food web structure objective. These cover objectives consistent with MSC P1 & P2. The fishery meets SG60 SIa. GLFC has responsibility to formulate a coordinated research program between the United States and Canada that has the goals of identifying ways to achieve MSYs for the various stocks and recommend specific management initiatives. Each task group is charged with annual work objectives to meet the overall research programme. This may be considered as a strategic approach with the objective of providing tinely outputs that correspond to identified strategic needs. The fishery meets SG80 SIa. The annual charges to each task group reflect priorities and represent a coherent and strategic approach to research across the three MSC principles. For example, in 2014 STC is charged with producing a Walleye management plan. Where research does not fit with the established theme areas, non-theme research may be financed. However the lack of a specific written research plan required by the MSC standard prevents the fishery meeting SG100 SIa.		
b	Guidepost	Research results are available to interested parties.	Research results are disseminated to all interested parties in a timely fashion.	Research plan and results are disseminated to all interested parties in a timely fashion and are widely and publicly available.
	Met?	Y	Y	Y
	Justification	The results of research are available to all interested parties on the GLFC web site under in the web pages of various task groups. The fishery meets SG60 SIb. Wherever research has implications for the management process the details are presented with the LEPMAG process to guide the decision making process. The fishery meets SG 80 SIb. All interested parties may review individual research plans and outputs in the web site with the annual reports of the various task groups providing the results of research undertaken. However the lack of a specific written research plan required by the MSC standard prevents the fishery meeting SG100 SIa.		
References		GLFC 2009; http://www.glfc.org/research/Erie%20Priorities%202009.pdf;		
OVERALL PERFORMANCE INDICATOR SCORE			80	

PI 3.2.5		There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives There is effective and timely review of the fishery-specific management system		
SI		SG 60	SG 80	SG 100
a	**Guidepost**	The fishery has in place mechanisms to evaluate some parts of the management system.	The fishery has in place mechanisms to evaluate key parts of the management system	The fishery has in place mechanisms to evaluate all parts of the management system.
	Met?	Y	Y	Y
	Justification	The work over the past 15 years, with an up-dated WFMP and progress on the YPFMP provide evidence that the fishery specific management systems for wallyeye and Yellow perch are evaluated to ensure that they meet the defined goals and related objectives. The mechanisms are the work of the various task groups and LEPMAG. The fishery meets all SGs at SIa.		
b	**Guidepost**	The fishery-specific management system is subject to occasional internal review.	The fishery-specific management system is subject to regular internal and occasional external review.	The fishery-specific management system is subject to regular internal and external review.
	Met?	Y	Y	N
	Justification	Over the past 15 years there have been a number of external and internal reviews. Given that Walleye and Yellow perch are important for recreational and sport fishing, it may be concluded that this sector performs the role of external review.; as this is occasional rather than continuous the fishery meets SG80 SIb but not SG100 SIb.		
References		Myers & Bence; LEC 2005; Lester *et al*. 2005; Locke *et al*. 2005; WTG 2013; Auditor Generals 2007 audit		
OVERALL PERFORMANCE INDICATOR SCORE			**90**	

WALLEY - RISK BASED FRAMEWORK OUTPUTS

.:SICA

ator	Risk-causing activities from fishery under assessment	Spatial scale of activity	Temporal scale of activity	Intensity of activities	Relevant subcomponents	Consequence score
: me	• Fishing • Gear loss • Bait collection • Other identified risk-causing activities (please specify)	4	5	3	Species composition	
					Functional group composition	
					Distribution of the community	
					Trophic size/structure	2
worst ario	The main risk causing element for the ecosystem is the fishery removing a top predator. This has implications for the food web as there are a limited number c					
cale of	The fishery takes place in Ontario waters in QZ 1 thru QZ 3 (E&W) which represents more than 31% of the total surface area of the lake but less than 45 %. The					
l scale	The fishery is year round with a total of 65 vessels that do not fish at the same time. The large mesh fishery is not seasonal and it is likely that there is at least s 200 to 300 days per year. The score of 5.					
ity of	The fishery takes place over about 43 % of the lake, but seasonal patterns reflect localised availability that changes according to spawning migrations from basins. Accordingly, fishing intensity varies on a local basis and while it is difficult to characterise, it seems reasonable to conclude that there may be modera at broader spatial scale, or obvious but local detection. In some areas of the lake there will be no activity. The score is 3.					
most onent	The risk from removing a top predator is the potential impact on trophic structure.					
uence	As the fishery takes less than 50 % of the total removals and the gear is selective by size, it is concluded that while there may be a change in mean trophic leve 5%.					

13.2 Appendix 2.2.2 Productivity-Susceptibility Analysis (PSA)

PSA was not used for the RBF

13.3 Appendix 2.3 Walleye - Conditions

Table 58: Walleye: Condition WE1

Condition WE1	**2.1.1**
Performance Indicator	Issues at SG80 a. Main retained species are highly likely to be within biologically based limits (if not, go to SI c below). c. If main retained species are outside the limits there is a partial strategy of demonstrably effective management measures in place such that the fishery does not hinder recovery and rebuilding.
Score	70
Rationale	Issue c. The decline in the Lake whitefish population is shown by fishery and survey indicators. The continued poor recruitment means F must be reduced.
Condition	By the fourth annual surveillance audit, based on Condition WE2 the partial strategy of demonstrably effective management measures will be in place such that the fishery does not hinder the recovery and rebuilding of the Lake whitefish stock.
Milestones	See condition WE2.
Client action plan	This partial strategy for Lake whitefish recovery will involve agencies and stakeholders from multiple Lake Erie Committee (LEC) jurisdictions; therefore it is difficult to guarantee timelines for progress. The LEC is comprised of representatives from the province of Ontario; and, the states of Michigan, Ohio, Pennsylvania and New York. As the basis for meeting Condition WE1, it is proposed that the LEC agencies will work cooperatively and with the Lake whitefish fishery stakeholders to investigate moving forward with a partial management strategy for the recovery of Lake whitefish in Lake Erie. As part of the development of the multi-agency partial management strategy for the recovery of Lake whitefish, it is anticipated that consultations will begin with LEC and their respective stakeholders to examine options for the assessment and management of Lake whitefish. Evidence of these consultations will be provided to the CAB by the first annual audit. It is proposed that the LEC agencies work towards an agreement on the preferred partial strategy for lake whitefish assessment and management. Documentation of the partial strategy, including implementation plans, will be presented to the CAB by the second annual audit. It is proposed that the LEC agencies will implement the partial strategy. Cooperatively, the OCFA and LEC will present the CAB with evidence that an effective suite of management measures will be in place such that the fishery does not hinder the recovery and rebuilding of the Lake whitefish stock by the third and fourth annual audits.
Consultation on condition	As condition YP1.

Table 59: Walleye: Condition WE2

Condition WE2	PI 2.1.2. The fishery does not pose a risk of serious or irreversible harm to the retained species and does not hinder recovery of depleted retained species.
Performance Indicator	Issues at SG80 a. There is a partial strategy in place, if necessary, that is expected to maintain the main retained species at levels which are highly likely to be within biologically based limits, or to ensure the fishery does not hinder their recovery and rebuilding. b. There is some objective basis for confidence that the partial strategy will work, based on some information directly about the fishery and/or species involved. c. There is some evidence that the partial strategy is being implemented successfully.
Score	70
Rationale	SIa. White bass does not have a TAC and catch is not limited. While its harvest may be constrained by the Walleye quota, the lack of a White bass quota means that it is not possible to conclude that the large mesh fishery maintains White bass catch at levels which are highly likely to be within biologically based limits. SIb. Due to the influence of other environmental factors, the partial strategy for Lake whitefish may not work. There is not a partial strategy for White bass. The fishery does not meet SG80 SIb. SIc. There is no evidence that the partial strategy for Lake whitefish is being implemented successfully. The White bass fishery does not have a partial strategy.
Condition	By the fourth annual surveillance audit, there will be a partial strategy in place for managing the catch of Lake whitefish and White bass that is designed to ensure the large mesh fishery does not pose a risk of serious or irreversible harm to them.
Milestones	By the first annual surveillance audit, the client will provide written evidence to the CAB showing that the issue of the by-catch of White bass and Lake whitefish in the large mesh fishery has been reviewed and there has been an options analysis of the management measures needed to ensure such that the fishery does not hinder the recovery and rebuilding of the Lake whitefish stock and may not hinder the recovery and rebuilding of the White bass stock. By the second annual surveillance audit, the client will provide written evidence to the CAB that the required partial strategies have been designed and steps have been taken towards their implementation. By the third annual surveillance audit, the client will provide written evidence to the CAB that the partial strategies are in place and there is some evidence that they are being implemented successfully. By the fourth annual surveillance audit, information about the fishery and/or the species involved will made available to the CAB by the client so that there is some objective basis for confidence that the partial strategy is working. The above provides incremental steps in achieving the condition. Only when the final step is complete will the team be able to provide a revised score. By the fourth audit the required minimum score is 80.
Client action plan	These partial strategies will involve agencies and stakeholders from multiple LEC jurisdictions; therefore, therefore it is difficult to guarantee timelines for progress. It is proposed that the Lake Erie Committee (LEC) agencies will work cooperatively with the Lake whitefish and White bass fishery stakeholders to investigate moving forward with partial management strategies that will ensure that the fisheries do not pose a risk of serious or irreversible harm to Lake whitefish and White bass in Lake Erie. As part of the development of multi-agency partial management strategies for Lake whitefish and White bass, it is proposed that consultations begin to co-operatively examine options for the assessment and management of Lake whitefish and White bass.

	Evidence of these consultations will be provided to the CAB by the first annual audit. It is proposed that the LEC agencies will come to an agreement on the preferred partial strategies for Lake whitefish and White bass assessment and management. Documentation of the partial strategy, including implementation plans, will be presented to the CAB by the second annual audit. It is proposed that the LEC agencies implement the partial strategies for Lake whitefish and White bass. Cooperatively, the OCFA and LEC will present the CAB with evidence that effective management measures will be in place such that the fishery does not pose a risk of serious or irreversible harm to Lake whitefish and White bass in Lake Erie by the third and fourth annual audits.
Consultation on condition	As condition YP1.

Consultation on condition	By e-mail dated November 17, 2014, Jane Graham OCFA executive Director reported various conversations with the entities responsible for implementation of the CAP i.e. LEC, the Ohio commercial fishery, the Ontario Ministry of Natural Resources & Forestry. LEC members include the States of New York, Pennsylvania, Ohio and Michigan, and the Province of Ontario. Responsibilities will be more precisely defined with formal approval after the peer review has been completed and the situation is confirmed and in any case prior to the issue of the public comment draft report.

14 APPENDIX 3. PEER REVIEW REPORTS

Peer Reviewer 1

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	Yes	Conformity Assessment Body Response
Justification: There are some issues with PIs both assessments which would benefit greatly from further clarification (especially as the fisheries are rather complex and the scoring comments rather terse). Subject to these being properly resolved, and it seems likely that they can be on the basis of the information in the report, then the conclusion to certify the fisheries appears justified.		Please note the comments to the specific points raised by the peer reviewer.

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	Yes	Conformity Assessment Body Response
Justification: The requirements of all the conditions follow, as they are required to do, the narrative of the relevant scoring guideposts. The timescales and milestones appear appropriate for all of the conditions.		No comment

Do you think the client action plan is sufficient to close the conditions raised?	Yes	Conformity Assessment Body Response
Justification: The multijurisdictional nature of the fishery makes the client actions necessarily difficult, but the plans in place seem appropriate to deal with the conditions within the specified timescales.		No comment

General Comments on the Assessment Report

None

Performance Indicator Review

The report has separate scoring sections for yellow perch and walleye. Accordingly, Separate sections on 'Performance Indicator Review', 'Other comments' and 'Risk Based Framework' are completed here for each species.

Yellow Perch

Performance Indicator	Has all the relevant information available been used to score this Indicator?	Does the information and/or rationale used to score this Indicator support the given score?	Will the condition(s) raised improve the fishery's performance to the SG80 level?	Justification	Conformity Assessment Body Response
1.1.1	No	No	Yes	For SIb it is not clear what TRP is referred to (SSBmsy, 40%SSB0 or 50%Fmsy). The assessment team appear to have calculated Bmsy themselves, but management appears to use 50%Fmsy. While the biomass is also important to consider, it seems that this PI asks about RPs used for management. For MU1, given 40%SSB0 as a TRP, the case has not been clearly made that the stock is fluctuating around this TRP Is the value for stock status in MU2 correct?	As implied in the guidance to CR1.3 (GCB2.2.2), MSC's intent is to evaluate whether or not SSB is at or above a target level consistent with $SSB_{MSY.}$ For MUs 2-4, the MSC default of $40\%SSB_0$ is interpreted as an SSB consistent with SSB_{MSY} and is used to score SIb. In the case of MU1, given how close (90%) SSB has been to the MSC default, consideration of an SSB_{MSY} estimate from the 2010 YPTG simulation study (confirmed by the client) is also used in the scoring. Taken together, these indicate that recent SSB has varied 90-101% of a level consistent with SSB_{MSY}. SSB is expected to increase in 2016 due to recruitment of a strong 2013 year-class. SSB is also expected to increase with exploitation at the relatively conservative rate of 50% F_{MSY}. These observations indicate that recent SSB is at a level consistent with SSB_{MSY}, scoring SG80, but not to a high degree of certainty, so not meeting SG100. The text and scoring rationale have been amended to reflect these comments. The MU2 information was reviewed and confirmed.

1.1.2	Yes	No		The comments above also apply here. It should be made clear here that the TRP used is consistent with Bmsy.	This is addressed in PI 1.1.1 above. Also, the text and scoring rationale highlight that the implied biomass associated with the 50% F_{MSY} management target is consistent with, and likely exceeds, SSB_{MSY}.
1.1.3				N/A	No comment
1.2.1		Probably		While the conclusion is probably sound, the brevity of the scoring comments do not aid interpretation – e.g. reference to YPMP would be useful here. In the absence of a LRP, it is not clear how the strategy would respond to stock status at very low levels – but it is noted that this issue is addressed in PI 1.2.2.	These are a synposis of the extensive background available in Section 3.1.4 of the report. The latter discusses the YPMG in detail. The drafting style adopted throughout the report is to provide extensive background in the body of the report with synposes of the relevant issues in the scoring rationale. As indicated by the reviewer, this is addressed in PI 1.2.2.
1.2.2	Yes	Yes	Yes		No comment
1.2.3	Yes	Yes			No comment
1.2.4	Yes	Yes			No comment

2.1.1	Yes	No		SIa is scored at 80; for trap net MU1, neither channel catfish not drum seem to have a biologically based limit.These are more appropriately covered in SIc, but this SI does not discuss relevant management measures. The assessment needs to be clear on status re biologically-based limits OR make clear how management does not hinder recovery and rebuilding.	The statement that main retained species do not have biologically base limits is correct as formal quantitative assessments are lacking. Nevertheless outcome can be evaluated from catch rates from commercial harvest and surveys that are used as abundance indices. Interagency surveys showed strong increases in abundance for channel catfish in the early 2000s and increases in commercial fishery catch rates since 2003; thus it can be argued that there is high degree of certainty that the fishery does not pose a risk of serious or irreversible harm. For freshwater drum abundance, YOY survey indices indicate increase in abundance since 2006. Based on this information there are no indications that the species are outside the biological limits for the assessment to cover SIc. As it is recognized in the assessment guidelines, quantitative analysis is often limited in P2 components and so there may be a greater reliance on qualitative interpretations. An 80 score can be achieved because ongoing monitoring provides measurement of continued performance, and history of stability in the fishery provide good evidence for sustainability. Also, these are species with low and localized harvest. In fact since 2009 harvest was taken only in 2010 and 2011 as the yellow perch fishery in MU1 was otherwise closed with catches allocated to the recreational fishery. The text and scoring rationale has been modified to make this clear.

2.1.2	No	No	Yes	Gillnet: The TAC for walleye seems to meet the requirements for a full strategy. Trap net: It should be more clearly described how the management measures mentioned relate to the main retained species (catfish and drum). Specifically, if these do not maintain species at appropriate levels, then it is not clear how SG60 is met; if they do, then it is not clear why SG80 is not met. The report should consistently consider drum – is there a partial strategy or only measures?	There are measures for both main retained species but a strategy is not in place. Measures for both species are closed seasons, area closures and gear regulations, which are general for the yellow perch fishery. These measures control fishing effort, protect nursery areas and minimize catch of juveniles. For channel catfish, an additional measure is minimum landing size. The text has been modified to make this clear
2.1.3	Yes	Yes			No comment
2.2.1	Yes	Yes			No comment
2.2.2	No	No		It would appear appropriate here to explain how fishing practices (as a partial strategy) avoid bycatches such that none are 'main' species.	Discard is prohibited in Ontario. Conditions of licence define by-catch as capture which cannot be legally harvested. All no-harvest permitted species must be reported and landed. In Ohio, fish that cannot be retained should be released live. The text has been modified to make this clear
2.2.3	Yes	Yes	Yes – but see comments	The condition meets the letter of the SGs, but supplementary information on survivorship of released bycatches would make the information gathered much more meaningful.	In principle, the released fish from the trap net gear should all survive as the gear does not injure the catch, contrary to the gillnet for which 80% mortality is assumed.
2.3.1	Yes	Yes		There seems to be inconsistent discussion of ETP species (snuff box mussel and rayed bean mussel) between SIs. Lake sturgeon (endangered in Ontario) should also be clarified re ETP status.	Only snuffbox mussel is potentially affected because of the rayed bean extirpated status. The text has been modified. As explained in the main text and following MSC guidelines, while Lake sturgeon is listed as endangered in Ontario, it is not listed in national legislation and thus not considered a ETP.
2.3.2	Yes	Yes			No comment

2.3.3	Yes	Yes			No comment
2.4.1	No	No		Although fishing is not allowed in the vicinity of the coast, potential damage to vulnerable habitats such as macrophyte beds does not appear to have been considered. While effects on sedimentary habitats are reasonably considered highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm, there is no evidence presented on this beyond expert opinion; a score of 100 does not, therefore, seem to be supported.	Score revised.
2.4.2	Yes	Probably		It is agreed that status quo fishing appears a suitable partial strategy, subject to issue of sensitive habitats discussed above.	See above.
2.4.3	No	No		Again, the lack of discussion of vulnerable habitats (macrophyte beds etc) raises questions over a score of 100 (80 seems to be met).	The information on distribution of habitat types is adequate for 2.4.3. SIa and SIc to be scored at 100. The potential damage that the fisheries can pose to habitat has not been studied and 2.4.3 SIb meets the SG 80.
2.5.1				RBF used.	No comment
2.5.2	No	No		It is noted that the Y/N in the 'Met?' row does not match the scoring comments, but the overall score appears correct. A partial strategy is not described which would support a score of 80; it seems reasonable that status quo fishing would represent a suitable partial stratgey (as for habitats, and SIc), but this needs to be considered and described in the comments. It is assume that 'Measures' in SG100 SG should read 'Strategy'; this is an MSC mistake and it is up to them to comment. If this were 'strategy' then presumably the score would be 80.	Modified.

2.5.3	Yes	Probably		SIb asks in SG100 that interactions have been investigated; this appears to be the case, even if not yet puiblished. Otherwise all scores appear to be supported.	Although the auditors are aware that a food web model has been developed for Lake Erie, there are no publications that show that interactions between the yellow perch fisheries and the food web have been investigated. The text has been modified to make this clear.
3.1.1	Yes	Yes			No comment
3.1.2	Yes	Possibly		For SIb it is not clear why SG100 is not met.	It refers to the concern of commercial fishers that there views are not adequately represented leading to the potential that the information they provide is not used.
3.1.3	Yes	Yes			No comment
3.1.4	Yes	Yes			No comment
3.2.1	No	Probably		It would be helpful to more fully explain how issues over bycatches prevent the fishery meeting SG100.	Clarified in the justification.
3.2.2	Yes	Yes			No comment
3.2.3	Yes	Yes			No comment
3.2.4	Yes	Possibly		While the conclusions appear valid, the difference between SG80 and SG100 is the comprehensive nature of the plan, and inclusion of P3. The presence of a specific research plan is required at SG80 also.	The peer reviewers point is acknowledged. However, given the nature of the a complex Erie fishery and and as allowed for under MSC CR 1.3 CB4.10.3, we differentiated between (MSC CR 1.34.10.1) a strategic approach (at SG80) and a coherent and strategic approach (at SG100) to research within the fishery-specific management system.
3.2.5	Yes	Yes			No comment

Any Other Comments

Comments	Conformity Assessment Body Response
It would be helpful to fully explain the basis of the MUs in terms of separate stock identity. This should usefully be summarised in PI1.1.1 also. Section 7.4.1 item 1 requires changes in traceability before product may be sold as MSC certified, but this is not made clear in section 7.5.1. It is also not clear why the same risks are not present for walleye.	The basis of stock identity is discussed in section 3.1.6. These units form the basis of the biological stocks assumed by the stock assessments and thus the basis of the stock status determinations of PI1.1.1.

For reports using the Risk-Based Framework

Performance Indicator	Does the report clearly explain how the process used to determine risk using the RBF led to the stated outcome? Yes/No	Are the RBF risk scores well-referenced? Yes/No	Justification	Conformity Assessment Body Response
2.5.1	Yes	Not necessarily	It is noted that the RBF meeting was attended by far fewer than the previous consultation meetings. It would be helpful to describe the skills and experience represented by stakeholders at the RBF meeting	**The specific RBF meeting was attended by managers, fishers and processors. Relevant questions were asked at other stakeholder meetings to cover various points.**

Walleye

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification	Conformity Assessment Body Response
1.1.1	Yes	Yes		As for YP, the reference points referred to do not seem to (clearly) correspond with the RPs used by management (60%Fmsy?).	As implied in the guidance to CR1.3 (GCB2.2.2), MSC's intent is to evaluate whether or not SSB is at or above a target level consistent with SSB_{MSY} For MUs 2-4, the MSC default 40%SSB_0 is used as the TRP in the scoring of SIb of PI 1.1.1. In the case of MU1, given how close recent SSB has been to the MSC default (90%), an estimate of SSB_{MSY} from the 2010 YPTG simulation study is also used. These provide a range of SSB consistent with SSB_{MSY}. Consideration is also given to projected trends in SSB. The text and scoring rationale have been modified to make this clear.
1.1.2	Yes	Yes			No comment
1.1.3	-	-			No comment
1.2.1	Yes	Yes		It seem unduly harsh not to consider SG100 met for SIb, given stock status and MSE process.	The concern is that the MSE is very recent (2013) and thus there has not been enough time to evaluate its performance.
1.2.2	Yes	Yes		SIb SG100 should also mention migration to/from Lake Huron?	Text has been added to the SIb scoring rationale on the uncertainty associated with Lake Huron migrants.

1.2.3	Yes	Yes		It is noted that possible subpopulations and migration between lakes would appear relevant to not awarding SG100	Text has been added to the scoring rationale of SIa on the uncertainties associated with inter- and intra-lake movements.
1.2.4	Yes	Yes			No comment
2.1.1	Yes	No	Yes, subject to comments on right.	It is not clear that there are biologically based limits for any of the retained species. It is not clear for lake whitefish that the partial strategy (for this is at least what an annual TAC is), or measures, is/are expected to ensure that the fishery does not hinder recovery and rebuilding – this is the main requirement of this SI.	Biological based limits for Lake whitefish and white bass have not been defined from stock assessments. However, the decline in Lake Erie's lake whitefish population is evident from both fishery and survey indicators. The 2014 CWTG report stated that continued poor recruitment elevates the need for reduced fishing mortality and habitat improvement. Some indicators suggest that mean condition factors have dropped below historic averages and commercial catch rates dropped precipitously from 2011 to 2013. It is ths concluded that the species is not within biological limits. The TAC is expected to ensure that the fishery does not hinder recovery but it requires revision as it is not effectve. The rational has been revised to make these points clear.
2.1.2	No	No	Yes, subject to comments on right.	It does not seem essential to have a catch limit as part of a 'measure/partial strategy' for white bass. For both whitefish and white bass, the key issue seems to be whether the fishery would or would not .	It is essential to have a TAC (based on peer reviewed stock assessment) for White bass as catch is not restricted otherwise. While the stock seems to be within biological levels, it is possible that harvest can increase in response to the market and the status of other species such as Lake whitefish, with it's quota probably allocated to by-catch. The rational has been revised to make the point clear.
2.1.3	Yes	Yes			No comment

2.2.1	No	Possibly		It is open to question whether Ontario legislation, in a state legislated situation, qualifies a species as ETP. It should be clarified whether vulnerable sucker species (which would be classified as main) are included in the catch; if so their status and the effects of catches should be carified here, and a condition raised here or under PI2.2.3 if necessary	The MSC CR definition of ETP species is "National" as recognized by the Canadian rather than Provincial legislation. Given that (i) the two threatened species should be identified separately in the statistics and (ii) the global catch of suckers as a % of the total catch is minimal there is no justification to classify the group as main species. As suckers are not main species they are not considered under SG80. This leads to the recommendation.
2.2.2	Yes	Yes			No comment
2.2.3	Yes	No		See comments under 2.2.1 on suckers.	See comment above.
2.3.1	Yes	Probably		The treatment of unioned mussels should be more properly and consistently evaluated throughout the PI.	Unionids are considered among general and indirect effects. The rational has been revised to make the evaluation consistent
2.3.2	Yes	Yes			No comment
2.3.3	No	Probably		Again, the treatment of unioned mussel needs to be consistent throughout the assessment.	Addressed.
2.4.1	No	Probably		Although fishing is not allowed in the vicinity of the coast, potential damage to vulnerable habitats such as macrophyte beds does not appear to have been considered. While effects on sedimentary habitats are reasonably considered highly unlikely to reduce habitat structure and function to a point where there would be serious or irreversible harm, there is no evidence presented on this beyond expert opinion; a score of 100 does not, therefore, seem to be supported.	On consideration the score has been reduced to 80.

2.4.2	No	Probably		It is agreed that status quo fishing appears a suitable partial strategy, subject to issue of sensitive habitats discussed above.	See above.
2.4.3	No	Probably		Again, the lack of discussion of vulnerable habitats (macrophyte beds etc) raises questions over a score of 95 (80 seems to be met).	The information about habitats is independent of the studies of physical impacts. Habitats are continously assessed because habitat is used for management decitions about quota allocations for walleye, thus includes macrophyte beds that constitute nursery areas. The score of 95 is confirmed
2.5.1		RBF used			No comment.
2.5.2	Yes	No		A partial strategy is not described which would support a score of 80; it seems reasonable that status quo fishing would represent a suitable partial stratgey (as for habitats, and SIc), but this needs to be considered and described in the comments. It is assume that 'Measures' in SG100 SG should read 'Strategy'; this is an MSC mistake and it is up to them to comment. If this were 'strategy' then presumably the score would be 80.	Corrected. Measures and strategy are likely to work based on prior experience and information directly from the fishery and.
2.5.3	Yes	Yes		SIb asks in SG100 that interactions have been investigated; this appears to be the case, even if not yet published. Otherwise all scores appear to be supported.	No comment
3.1.1	Yes	Yes			No comment
3.1.2	Yes	Possibly		For SIb it is again not clear why SG100 is not met.	It refers to the concern of commercial fishers that there views are not adequately represented leading to the potential that the information they provide is not used.

3.1.3	Yes	Yes			No comment
3.1.4	Yes	Yes			No comment
3.2.1	No	Probably		It would be helpful to more fully explain how issues over bycatches prevent the fishery meeting SG100.	Clarified in the justification.
3.2.2	Yes	Yes			No comment
3.2.3	Yes	Yes			No comment
3.2.4	Yes	Possibly		While the conclusions appear valid, the difference between SG80 and SG100 is the comprehensive nature of the plan, and inclusion of P3. The presence of a specific research plan is required at SG80 also. Based on the scoring, the PI score should be 90, not 80.	The peer reviewers point is acknowledged. However, given the nature of the a complex Erie fishery and and as allowed for under MSC CR 1.3 CB4.10.3, we differentiated between (MSC CR 1.34.10.1) a strategic approach (at SG80) and a coherent and strategic approach (at SG100) to research within the fishery-specific management system.
3.2.5	Yes	Yes			No comment

For reports using the Risk-Based Framework

Performance Indicator	Does the report clearly explain how the process used to determine risk using the RBF led to the stated outcome? Yes/No	Are the RBF risk scores well-referenced? Yes/No	Justification	Conformity Assessment Body Response
2.5.1	Yes	Not necessarily	It is noted that the RBF meeting was attended by far fewer than the previous consultation meetings. It would be helpful to describe the skills and experience represented by stakeholders at the RBF meeting	The specific RBF meeting was attended by managers, fishers and processors. Relevant questons were asked at other stakeholder meetings to cover various points.

Peer Reviewer 2

Overall Opinion

Has the assessment team arrived at an appropriate conclusion based on the evidence presented in the assessment report?	**Yes**	**Conformity Assessment Body Response**
Justification: These two lake Erie fisheries occur within a very complex and highly regulated system. The assessment is thorough and supported by a wealth of background and supporting information.		No comment

Do you think the condition(s) raised are appropriately written to achieve the SG80 outcome within the specified timeframe?	**Yes**	**Conformity Assessment Body Response**
Justification: The assessment of the current factors leading to the conditions are justified through the text. For the walleye fishery the conditions are clear and interrelated hence it is self-evident that the client of the fisheries has clear actions to put in place to address both to achieve the SG80 minimum. For the yellow perch, whilst the conditions are justified, they are not as clear in the required action. This opinion comes from the frequent use of the word 'some' within the conditions. The fishery management will have to ensure that its actions to meet the conditions are conscious of the criteria for meeting and exceeding the SG80. The opinion of this peer reviewer is that the wording conveys to the fishery managers the need to explicitly link the measured improvements to the criteria. This may call for some guidance/opinion from the MSC process part way through the actions. It is perhaps worth noting that the more explicit wording used in the appendices reflects better the requirements to meet the conditions		The conditions use the language of the scoring guideposts.

Do you think the client action plan is sufficient to close the conditions raised?	**Yes**	**Conformity Assessment Body Response**
Justification: The actions identified in the plan are progressive and reaslistic. They are also supported by evidence of actions already taking place, namely the Lake Erie Percid Management Advisory Group (LEPMAG) who are currently working toward the development of a lake wide management approach and plan. Furthermore discussions are evidently ongoing between the various organisations and bodies responsible for ensuring the conditions can be met.		No comment

General Comments on the Assessment Report

The assessors have undertaken a very thorough, comprehensive and effective review of a the Walleye and Yellow Perch fisheies in Lake Erie highlighting the ecological, socio-economic and regulatory/policy complexity within which the fisheries have to be assessed.

The following are considered as relatively minor comments but are provided in the cause of clarity for some points that were raised in the mind of this reviewer. The comments are in order of where they came up whilst reading the report (i.e. page number) and their position in the following text does not reflect any greater importance or relevance of the points raised below them:

The strengths and weaknesses were presented together and as such it was not clear what they were. For clarity it would have been useful to put them into sub-headings. For example, invasive species were highlighted yet there was no specific name or number of species stated or any consideration of whether they were a positive or negative addition to the system. By definition you might expect them to be considered negative however in the literature there has been an interchange between the words 'invasives' and 'non-natives' or even 'alien' species. The better agreed technical terminology is invasive non-native species (INNS), to specify those species of a negative presence. Of course many fisheries around the world have benefitted or rely on non-native species, hence the reason why I raise it here as a point for clarification on whether they are considered good or bad for lake Erie.

Conformity Assessment Body Response

Invasive non-native species play a negative role in Lake Erie. The only reason that the ecosystem has been able to accommodate the high number of INNS is because of its high productivity.

It is noted that the stock recruit assessment moved from a gamma model to a Ricker model in 2010. Again for improved clarity it would be useful to indicate why this occurred, the rationale for the move and a statement about the comparability of the data pre-2010 with the post-2010 data. It may be that the assessors do not have this determination available but if there is some reference to this it would help with the contextualizing of the recruitment data.

Conformity Assessment Body Response

The shift from a gamma to a Ricker stock-recruitment relationship in 2010 was primarily due to the desire to reduce the number of parameters estimated in the model. This is important as the simulation runs exploring alternative harvest rates can be time-consuming. YPTG (2010) does not provide a comparison of the gamma and Ricker fits although the latter were no doubt adequate as the working group accepted it as the basis of the current fishing mortality management target reference point.

Owing to the geographical position of the great lakes there a number of potential influences of other factors that are not fishery related (e.g. eutrophication and cascading effects). These are quite rightly highlighted and the improvements that have occurred are implicated in the stock recovery however the link between the perturbation(s) and the timing of the stock recovery is not always clear. This context would have helped in some of the interpretation of the effects (or not) of the fishery

Conformity Assessment Body Response

Noted.

In some places within the text there is quite a reliance on personal communications. There is an expectation when in consultation with those who know the fishery the best not to have direct published evidence but it such pers. comms. would be enhanced if the organization that the person is associated with was indicated.

Conformity Assessment Body Response

See meeting list.

In section 3.1.7 the stock assessment review highlights two models that were used. There is little information on the earlier CAGEAN model, and whilst the ADMB model is the focus, it would have been useful to have the main assumptions of these models explicitly stated to ensure clarity in interpreting the outputs of the models.

Conformity Assessment Body Response

The ADMB 'model' is referring to the software package used. Both the CAGEAN and ADMB – based models are variants of an SCAA model which has evolved significantly over time. The current model, which is that used to inform current management decision and which uses the ADMB software, is a significant advance over the previous versions. The assumptions of the current

yellow perch model are described in detail on section 3.1.7 of the report while that of walleye are described in section 3.2.7.

P93 paragraph before section 1.2.4 Management Strategy, ends abruptly.

Conformity Assessment Body Response

Corrected

With Principle 2 – Ecosystem it was surprising that changes to environmental temperature related to climate change in shallow water ecosystems was not at least mentioned as a potential co-variable factor in the future of the fisheries.

Conformity Assessment Body Response

The effects of changes in temperature related with climate change in Lake Erie have not been studied. It is practically impossible to relate changes in fisheries with increase in temperature (also climate change induced reduction in ice coverage and water levels) when main stressors driving the system are eutrophication and invasive species. There is no information value in stating that changes to temperature will affect the fisheries.

Performance Indicator Review – Yellow Perch

Performance Indicator	Has all the relevant information available been used to score this Indicator? (Yes/No)	Does the information and/or rationale used to score this Indicator support the given score? (Yes/No)	Will the condition(s) raised improve the fishery's performance to the SG80 level? (Yes/No/NA)	Justification	Conformity Assessment Body Response
1.1.1 – Yellow Perch (YP)	Yes	No	n/a	MU 2-4 demonstrate clearly that a 100 score is appropriate. MU1, whilst close to the biomass % required by MSC has been below the required % level on more than one occasion. Hence a score of 90-95% would be more appropriate tp reflect that the whole fishery is not quite at the 100 % level.	The score for MU1 is 90 which is in concurrance with the comments of the reviewer. The scoring rationale of SIb has been redrafted to more clearly state the basis of the SG80 score. This involved a number of considerations including the MSC default TRP of 40%SSB_0 and an estimate of SSB_{MSY} from the 2010 YPTG simulation study as well as projected near-term increasing SSB, which is consistent with a long-term decline in fishing mortality with relatively conservative harvest rates of 50%F_{MSY}.
1.1.2 - YP	Yes	Yes	Yes	The assessment takes into account the level of uncertainty and demonstrably does not meet the SG 80 fully nor the SG100. The score given is cautious but appropriate enough given the evidence. It provides incentive to move the fishery past the SG80 level with appropriate action, as per the conditions.	No comment
1.1.3 -YP	N/A	N/A	N/A		No comment
1.2.1 -YP	Yes	Yes	n/a	Catches have been set in accordance with appropriate advice backed up by regular assessments. The harvest strategy appears to be working although further testing and validation is required.	No comment

1.2.2 -YP	Yes	Yes	Yes	Another fair score given the evidence presented. It provides incentive to move the fishery past the SG80 level with appropriate action, as per the conditions.	No comment
1.2.3 -YP	Yes	Yes	n/a	The score is close to being below 80 owing to the lack of information on discards. With the uncertainty that this introduces there is argument to say that SG80 is not reached. However, the fact that there is clearly a comprehensive catch recording in place across the MUs and QZs the assumption that by-catch is low is reasonable. It would be worth highlighting to the fishery client that this PI is borderline and action to prevent it being assessed below the required level should be advised.	We have scored the fishery according to the evidence available. Any changes would be for review in the annual surveillance audits.
1.2.4 -YP	Yes	Yes	n/a	The stock status assessment is undertaken using standard methods backed up by expert review.	No comment
2.1.1 -YP	Yes	Yes	n/a	The score is close to being below 80 owing to the lack of information across the species retained. With the uncertainty that this introduces there is argument to say that SG80 is not reached as evidenced within the PI 2.1.1 assessment. However, on balance the SG80 is ok as most of the species do not appear to be outside biological limits, based on a comprehensive catch recording in place across the MUs and QZs. It would be worth highlighting to the fishery client that this PI is borderline and action to prevent it being assessed below the required level in future should be advised.	No comment
2.1.2 -YP	Yes	Yes	Yes	This PI has been split between MUs and QZs. This is appropriate as MU1 is evidently not at the same level as the other MUs and QZs.	No comment

2.1.3 -YP	Yes	Yes	n/a	Within this PI the assessment team highlight the significant effort put in to obtaining appropriate data and evidence on which to make the SG assessment. This provides sufficient basis on which to agree the SG80 level however it is evident that the fishery should take into account the associated recommendations to ensure that this level is maintained or exceeded in future.	No comment
2.2.1 -YP	Yes	Yes	n/a	Lack of supporting data means that this score is appropriate and cannot be any higher.	No comment
2.2.2 -YP	Yes	Yes	n/a	Again lack of some supporting data on by-catch limits this score. With the appropriate policing and sanctioning for any fishery that diverts from compliance this score should be maintained.	No comment
2.2.3 -YP	Yes	Yes	Yes	The score for the MUs does not meet the SG80 owing to lack of any quantitative information. The evidence provided in the PI assessment appears to justify the lower score for MUs but the text could be clearer about whether the SG80 SIa has been or has not been met.	Corrected.
2.3.1 -YP	Yes	Yes	n/a	Straightforward and appropriate assessment given the criteria	No comment
2.3.2 -YP	Yes	Yes	n/a	Straightforward and appropriate assessment given the criteria. Conservation designations in place ensure the level of information available	No comment
2.3.3 -YP	Yes	Yes	n/a	Sufficient general and qualitative information to support 80% level but lack of quantitative data limits any higher grading	No comment
2.4.1 -YP	Yes	Yes	n/a	On the basis that these fisheries methods are generally considered low impact on the adjacent habitats the scoring is appropriate	No comment

2.4.2 -YP	Yes	Yes	n/a	The fact that there is no defined strategy in place means that this score inevitably does not meet SG 100. There is however little evidence or expectation that any impact will be expected.	No comment
2.4.3 -YP	Yes	Yes	n/a	The lake habitats are evidently well known. The lack of any measurement of effect on the habitats by the fishery means it does not meet the 100% level	No comment
2.5.1 -YP	Yes	Yes	n/a	See RBF	No comment
2.5.2 -YP	Yes	Yes	n/a	SIb assessment of not meeting the SG100 criteria is not consistent. In the Met? Row the assessment is all 'y' whereas the evidence presented supports the text that SG100 is not met as there is no strategy and associated plan. Hence the score of 85% is agreed but the supporting material needs corrected.	Corrected.
2.5.3 -YP	Yes	Yes	n/a	The evidence base is variable but the arguments presented are defendable and further specific information is due to become available which is expected to support the arguments further.	No comment
3.1.1 -YP	Yes	Yes	n/a	Clearly the fishery operates within a large and comprehensive set of legislation to ensure that this PI will be met.	No comment
3.1.2 -YP	Yes	Yes	n/a	Overall there is a clear and comprehensive consultation process in place, however in practice it is evident that some further stakeholders need to be brought into the consultations	No comment
3.1.3 -YP	Yes	Yes	n/a	The objectives are explicitly clear and long term explicit, however as there is no specific requirement, the SG100 criteria are not met	No comment

3.1.4 -YP	Yes	Yes	n/a	Management system is in place however the the SG100 criteria are not met	No comment
3.2.1 -YP	Yes	Yes	n/a	SG100 not achievable with current issues relating to bycatch, as specified	No comment
3.2.2 -YP	Yes	Yes	n/a	Some aspects suggest an SG 100 but lack of information for verification of bycatch and full response to decision making issues limit the score	No comment
3.2.3 -YP	Yes	Yes	n/a	Fishery looks overall to be under a good fishery management system, but some areas lack the confirmation necessary to achieve higher scores in line with the MSC criteria	No comment
3.2.4 -YP	Yes	Yes	n/a	A plan of research appears to be in place however it lacks a written plan to verify the rationale and planning for overarching and effective research activities	No comment
3.2.5 -YP	Yes	Yes	n/a	Meets the MSC criteria in general for each SG except for the evidence of a well defined and regular review	No comment

Any Other Comments

Comments	Conformity Assessment Body Response
Whilst the fishery occurs within a complex system there are many good activities relating to the management and monitoring of the fishery. The assessment has taken appropriate steps to obtain the evidence required and has made a fair assessment in accordance with the MSC criteria. The conditions specified on the PIs that were scored below 80 are appropriate. It would however be worth noting that a number of the SG80 scores could easily be raised higher, and may well rise as a result of the direct actions within the conditions for other PIs. However, some are also close to borderline. Hence it is recommended that the scores of 80 are highlighted as needing some consideration over the next few years to maintain their scores and ensure they do not reduce.	Such activity would take place at the annual surveillance audits.

Performance Indicator Review – Walleye

Performance Indicator	Has all the relevant information available been used to score this Indicator?	Does the information and/or rationale used to score this Indicator support the given score?	Will the condition(s) raised improve the fishery's performance to the SG80 level?	Justification	Conformity Assessment Body Response
1.1.1 – Walleye (WE)	Yes	Yes	n/a	Biomass data demonstrates that a 100 score is appropriate.	No comment
1.1.2 - WE	Yes	Yes	n/a	Wider ecological considerationof the walleye is not apparent hence SMC SG100 criteria are not currently met	No comment
1.1.3 –WE	N/A	N/A	N/A		No comment
1.2.1 –WE	Yes	Yes	n/a	Catches have been set in accordance with appropriate advice backed up by regular assessments. The harvest strategy appears to be working although it is too soon to determine the full effectivecness hence further evidence should raise the SG level in the future.	No comment
1.2.2 –WE	Yes	Yes	Yes	The assessment cannot rise to the SG100 level owing to the potential for fish movement between MUs hence further analysis would be needed to determine the consequences.	No comment

1.2.3 –WE	Yes	Yes	n/a	The score is close to being below 80 owing to the lack of information on discards. With the uncertainty that this introduces there is argument to say that SG80 is not reached. However, the fact that there is clearly a comprehensive catch recording in place across the MUs and QZs the assumption that by-catch is low and uncertainty is not too variable appears reasonable. It would be worth highlighting to the fishery client that this PI is borderline and action to prevent it being assessed below the required level should be advised.	We have scored the fishery according to the evidence available. Any changes would be for review in the annual surveillance audits.
1.2.4 –WE	Yes	Yes	n/a	The stock status assessment appears to have been thoroughly tested hence the outputs appear robust	No comment
2.1.1 –WE	Yes	Yes	Yes	The score is below 80 owing to the lack of information and the decling status of the lake whitefish. The condition placed on the fishery is clearly necessary in order to address the low score. This condition is linked closely with condition WE2.	No comment
2.1.2 –WE	Yes	Yes	Yes	The score is below 80 owing to a number of factors as specified in the PI assessment. The condition placed on the fishery is clearly necessary in order to address the low score. This condition is linked closely with condition WE1.	No comment
2.1.3 –WE	Yes	Yes	n/a	The criteria require clearly recorded and verifyiable data but this is not evident across the retained species.	No comment
2.2.1 –WE	Yes	Yes	n/a	Lack of supporting data increases uncertainty hence this score is appropriate and cannot be any higher.	No comment

2.2.2 –WE	Yes	Yes	n/a	Again lack of supporting data on by-catch and inconsistent observer coverage limit this score.	No comment
2.2.3 -WE	Yes	Yes	n/a	Inconsistent and inadequate data available mean that the SG100 criteria is not met	No comment
2.3.1 –WE	Yes	Yes	n/a	Appropriate assessment given the criteria as there is no consideration of some aspects relating to impacts on ETP species	No comment
2.3.2 –WE	Yes	Yes	n/a	Appropriate assessment given the criteria. Conservation designations in place ensure the level of information available but there is a lack of quantitative analysis.	No comment
2.3.3 –WE	Yes	Yes	n/a	Sufficient general and qualitative information to support 80% level but lack of quantitative data limits any higher grading	No comment
2.4.1 –WE	Yes	Yes	n/a	On the basis that these fisheries methods are generally considered low impact on the adjacent habitats the scoring is appropriate	No comment
2.4.2 –WE	Yes	Yes	n/a	The fact that there is no defined strategy in place means that this score does not meet SG 100. There is however a low expectation that any impact will be expected.	No comment
2.4.3 –WE	Yes	Yes	n/a	The lake habitats are evidently well known and not deemed vulnerable. The lack of any determination of physcial effect on the habitats by the fishery means it does not meet the 100% level	No comment
2.5.1 –WE	Yes	Yes	n/a	See RBF	No comment
2.5.2 –WE	Yes	Yes	n/a	There is no strategy and associated plan in place, hence the score of 85% is appropriate.	No comment

2.5.3 –WE	Yes	Yes	n/a	The evidence base is variable but the arguments presented are defendable and further specific information is due to become available which is expected to support the arguments further.	No comment
3.1.1 –WE	Yes	Yes	n/a	Clearly the fishery operates within a large and comprehensive set of legislation and compliance enforcing which will ensure.that this PI will be met.	No comment
3.1.2 –WE	Yes	Yes	n/a	Overall there is a clear and comprehensive consultation process in place, however in practice it is evident that some further stakeholders need to be brought into the consultations	A point of view.
3.1.3 –WE	Yes	Yes	n/a	The objectives are clear and long term explicit, however as there is no specific requirement, the SG100 criteria are not met	No comment
3.1.4 –WE	Yes	Yes	n/a	Management system is in place however the the SG100 criteria are not met	No comment
3.2.1 –WE	Yes	Yes	n/a	SG100 not achievable with current issues relating to bycatch, as specified in PI assessment	No comment
3.2.2 –WE	Yes	Yes	n/a	Lack of information for verification of bycatch and full response to decision making issues limit the score	No comment
3.2.3 –WE	Yes	Yes	n/a	Fishery looks overall to be under a comprehensive fishery management system, but some areas lack the confirmation necessary to achieve higher scores in line with the MSC criteria	No comment
3.2.4 –WE	Yes	Yes	n/a	A plan of research appears to be in place however it lacks a written plan to verify the rationale and planning for overarching and effective research activities	No comment

3.2.5 –WE	Yes	Yes	n/a	Meets the MSC criteria in general for each SG except for the evidence of a regular review	No comment

Any Other Comments

Comments	Conformity Assessment Body Response
Whilst the fishery occurs within a complex system there are many good activities relating to the management and monitoring of the fishery. The assessment has taken appropriate steps to obtain the evidence required and has made a fair assessment in accordance with the MSC criteria. The conditions specified on the PIs that were scored below 80 are appropriate. It would however be worth noting that a number of the SG80 scores could easily be raised higher, and may well rise as a result of the direct actions within the conditions for other PIs. However, some are also close to borderline. Hence it is recommended that the scores of 80 are highlighted as needing some consideration over the next few years to maintain their scores and ensure they do not reduce.	We have scored the fishery according to the evidence available. Any changes would be for review in the annual surveillance audits.

For reports using the Risk-Based Framework

Performance Indicator	Does the report clearly explain how the process used to determine risk using the RBF led to the stated outcome?	Are the RBF risk scores well-referenced?	Justification .	Conformity Assessment Body Response
3.2.3 – Yellow Perch	Yes	Yes	The level of information on the spatial use of the lake by the different fisheries appears high. There are only a few, but reasonably justified assumptions presented. Also, the small spatial scale, localized fishing (and seasonality for yellow perch trapping) and apparent ability to enforce regulations on TACs, quotas, closed areas and seasons gives justification.	No comment
3.2.3 - Walleye	Yes	Yes	The level of information on the spatial use of the lake by the different fisheries appears high. There are only a few, but reasonably justified assumptions presented. Also, the small spatial scale, localized fishing and apparent ability to enforce regulations on TACs, quotas, closed areas and seasons gives justification.	No comment

15 APPENDIX 4. STAKEHOLDER SUBMISSIONS

16 APPENDIX 4. SURVEILLANCE FREQUENCY

Table 60: Surveillance Frequency

Criteria	Surveillance Score	Insert Fishery Name & score below	
		WE	YP
1. Default Assessment Tree			
Yes	0		
No	2	2	2
2. Number of Conditions			
Zero Conditions	0		
1-5 Conditions	1	1	1
>5 Conditions	2		
3. Principle Level Scores			
≥ 85	0		
<85	2	2	2
4. Conditions on outcome PIs?			
Yes	2	2	2
No	0		

Table 61: MSC Fishery Surveillance levels

Surveillance score	Surveillance level		Years after certification or re-certification: Year 1	Year 2	Year 3	Year 4
2 or more	Normal surveillance		On-site surveillance audit	On-site surveillance audit	On-site surveillance audit	On-site surveillance audit & recertification visit
1	Remote surveillance	Option 1	Off-site surveillance audit	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit & recertification visit
		Option 2	On-site surveillance audit	Off-site surveillance audit	On-site surveillance audit	
0	Reduced surveillance		Review new information	On-site surveillance audit	Review new information	On-site surveillance audit & recertification visit

Table 62: Fishery Surveillance Plan

Score from CR Table C3	Surveillance Category	Year 1	Year 2	Year 3	Year 4
[e.g. 2 or more]	[e.g Normal Surveillance]	[e.g. On-site surveillance audit]	[e.g. On-site surveillance audit]	[e.g. On-site surveillance audit]	[e.g. On-site surveillance audit & recertification site visit]

17 APPENDIX 5. CLIENT AGREEMENT

Ontario Commercial Fisheries' Association

February 10th, 2014

Mr. Paul Knapman
Intertek Fisheries Certification Ltd.
1801 Hollis Street, Suite 1220
Halifax, Nova Scotia B3J 3N4

Dear Paul:

[redacted]

[redacted]

[redacted]

Yours truly,

[redacted]

[redacted]

18 APPENDIX 6 OBJECTIONS PROCESS