Lake Erie multi-species commercial

4th Surveillance Report (2019)

Conformity Assessment Body (CAB)	SAI Global
Assessment team	Vito Romito, Lead and P2 John Casselman, P1 Bob Allain, P3
Fishery client	Ontario Commercial Fisheries' Association (OCFA)
Assessment Type	4th Surveillance
Report Code	MSC046/SUR04
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1. Contents

2. Glossary

AFS	Aboriginal Fisheries Strategy
DFO	Department of Fisheries and Oceans
BMSY	Biomass at Maximum Sustainable Yield
Bo	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
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
OMNRF	Ontario Ministry of Natural Resources and Forestry
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

3. Executive summary

This report outlines the findings of the 4th annual surveillance of the Lake Erie Multi-species Commercial fishery. This annual surveillance included an off-site surveillance audit (Conference call with Client Group and Science/Management representatives on the 10th October 2019) inclusive of a desktop review of the most current fishery status updates, documented in this 4th surveillance report.

The fishery was originally certified to the MSC standard by Intertek Fisheries Certification (IFC) on the 20th August 2015 after an assessment that commenced on 18th June 2013. In September 2015, Acoura Marine (AM) assumed the IFC fisheries certification portfolio. In January 2016, the client confirmed AM as the CAB contracted for the Lake Erie Multispecies Commercial Fishery (Acoura Marine is now part of Lloyd's Register). SAI Global was confirmed the new CAB for the 4th surveillance and re-assessment of the fishery. The current certificate is valid until August 19th, 2020. The primary focus of this surveillance audit is to assess changes that may have occurred in the previous 12 months, although we note that a number of those were already captured in the 3rd surveillance report (published on the MSC website on the 15th April 2019 by Lloyd's Register, the previous CAB). The surveillance program for this fishery has changed from that previously indicated in the PCDR and the previous surveillance report.

For a more complete picture of the fishery, this 4th surveillance report should be read in conjunction with previous surveillance reports and the Public Certification Report for this fishery assessment which can be found here: https://fisheries.msc.org/en/fisheries/lake-erie-multi-species-commercial/@@assessments

The surveillance audit process was carried out against v. 1.3 of the MSC Standard and MSC Fisheries Certification Process v. 2.1. The key findings from this report can be summarised as follows:

- The fishery has closed the last open Condition (YP2, PI 1.2.2 applicable to UoC 1-7) as per the original timeline described in the original Corrective Action Plan.
- Accordingly, the yellow perch PI 1.2.2 has been re-scored to 90 (from an original conditional score of 75).
- No new conditions have been opened during this surveillance process.
- The fishery remains compliant with and therefore certified to the MSC standard v. 1.3.
- The fishery client has confirmed that a Re-Assessment of this fishery will occur to ensure continued certification.

Principle 1 level score – Original (2015 Certification Report) and revised (4th Surv., 2019) scores per UoC.

	Gillnet				Trapnet		
Principle	QZ1	QZ2	QZ3 E	QZ3 W	MU1	MU2	MU3
P1 – Target Species (original)	81.9	84.4	84.4	84.4	81.9	84.4	84.4
P1 – Target Species (revised 4th Surv.)	**85**	**87.5**	**87.5**	**87.5**	**85**	**87.5**	**87.5**

P2 and P3 scores have not changed since the previous audits carried out by IFC/ later Acoura Marine/ later Lloyd's Register. Refer to the previous surveillance reports for P2 and P3 updated scores.

The fishery remains in scope. No other UoCs are certified or under assessment in Lake Erie and no harmonisation activities are required. Furthermore, no indication was given or suggested during the surveillance audit to suggest that destructive fishing practices or controversial unilateral exemptions were introduced for the fisheries under assessment.

Units of Certification

The scope of the certified fishery and therefore of this surveillance is specified in the Units of Certification (UoC) set out below:

Table 1. Units of Certification for the for the Lake Erie Multi-Species Commercial Fishery.

Unit of Certification 1 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, QZ1
Geographical Area:	Lake Erie: QZ1
Harvest method:	Small mesh gill net
Management System	Department of Fisheries and Oceans (DFO), Canada / Lake Erie Committee (LEC) / Ministry of Natural Resources and Forestry (MNRF), Ontario
Client Group:	Ontario Commercial Fisheries' Association (OCFA)
Unit of Certification 2 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, QZ2
Geographical Area:	Lake Erie: QZ2
Harvest method:	Small mesh gill net
Management System	Department of Fisheries and Oceans (DFO), Canada/ Lake Erie Committee (LEC) / Ministry of Natural Resources and Forestry (MNRF), Ontario
Client Group:	OCFA
Unit of Certification 3 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, QZ3(W)
Geographical Area:	Lake Erie: QZ3 (W)
Harvest method:	Small mesh gill net
Management System	Department of Fisheries and Oceans (DFO), Canada/ Lake Erie Committee (LEC) / Ministry of Natural Resources and Forestry (MNRF), Ontario
Client Group:	OCFA
Unit of Certification 4 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, QZ3 (E)
Geographical Area:	Lake Erie: QZ3 (E)
Harvest method:	Small mesh gill net
Management System	Department of Fisheries and Oceans (DFO), Canada/ Lake Erie Committee (LEC) / Ministry of Natural Resources and Forestry (MNRF), Ontario
Client Group:	OCFA
Unit of Certification 5 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, MU1
Geographical Area:	Lake Erie: MU1
Harvest method:	Small mesh trap net
Management System	US Fisheries & Wildlife Service (FWS) / Lake Erie Committee (LEC) / Ohio Department of Natural Resources (ODNR)
Client Group:	OCFA
Unit of Certification 6 (of 8)	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, MU2
Geographical Area:	Lake Erie: MU2
Harvest method:	Small mesh trap net
Management System	US Fisheries & Wildlife Service (FWS) / Lake Erie Committee (LEC) / Ohio Department of Natural Resources (ODNR)
Client Group:	OCFA
Unit of Certification 7 (of 8)	

Table 1. Units of Certification for the for the Lake Erie Multi-Species Commercial Fishery.	
Species:	Yellow Perch (*Perca flavescens*)
Stock:	Lake Erie Yellow Perch, MU3
Geographical Area:	Lake Erie: MU3
Harvest method:	Small mesh trap net
Management System	US Fisheries & Wildlife Service (FWS) / Lake Erie Committee (LEC) / Ohio Department of Natural Resources (ODNR)
Client Group:	OCFA
Unit of Certification 8 (of 8)	
Species:	Walleye (*Sander vitreus*)
Stock:	Lake Erie Walleye
Geographical Area:	Lake Erie
Harvest method:	Large mesh gill net
Management System	Department of Fisheries and Oceans (DFO), Canada / Lake Erie Committee (LEC) / Ministry of Natural Resources and Forestry (MNRF), Ontario
Client Group:	OCFA

4. Report details

4.1. Surveillance information

Table 2. Surveillance announcement.

1	Fishery name	
	Lake Erie multi-species commercial	
2	Surveillance level and type	
	Off-site surveillance audit. The surveillance program for this fishery has changed from that previously indicated in the PCDR or a previous surveillance report.	
3	Surveillance number	
	1st Surveillance	
	2nd Surveillance	
	3rd Surveillance	
	4th Surveillance	X
	Other (expedited etc)	
4	Team leader	
	Vito Romito, primary responsible for Principle 2 and Traceability Vito has almost 10 years of expertise in fisheries certification and is an ISO14001 Certified Lead Auditor and MSC FCR v.2.0 and FCP v.2.1 approved Fisheries Team Leader for SAI Global with extensive experience in ecosystems effects of fisheries. Vito received a BSc (Honours) in Ecology and a MSc in Tropical Coastal Management from Newcastle University (U.K.), in between which he worked for a year in Tanzania, carrying out comparative biodiversity assessments of pristine and dynamited coral reef ecosystems around the Mafia Island Marine Park. For five years he worked at Global Trust Certification/ later SAI Global as Lead Assessor for all the fishery assessments in Alaska, Iceland and Louisiana. Vito has also carried out several IFFO forage fisheries assessments in Chile, Peru, Europe and other various pre-assessments in Atlantic and Pacific Canada. To date, Vito has headed and conducted dozens of assessments involving 40+ different species including salmonid, groundfish, pelagic, flatfish, crustacean and cephalopod species in Europe, North and South America, and SE Asia. For three years, as a senior fisheries consultant and then manager with RS Standards Ltd., he was involved in the development and testing of a Data Deficient Fisheries framework and v.2.0 fisheries standard for the ASMI Alaska RFM Scheme, and IFFO RS Improver/FIP projects related to South East Asia multispecies bottom trawl fisheries. Vito re-joined the SAI Global Fisheries Team in 2018 and has since been involved in fisheries assessments in the Baltic Sea, Canada, Iceland, Alaska and Louisiana. Vito meets Fishery Team Leader Qualification and Competency Criteria outlined in MSC FCP Annex PC Table PC1. ▪ A degree in a relevant subject. ▪ 3 years' fisheries experience. ▪ Pass MSC's fishery team leader training at least every 5 years. ▪ Review any updates to the MSC Fisheries Program Documents at least annually. ▪ Pass new versions of the online training prior to undertake assessments against the revised MSC Fisheries Standard or certification process. ▪ Pass the Lead Auditor ISO 19011 course. ▪ Have undertaken 2 MSC fishery assessment or surveillance site visits as a team member in the last 5 years. ▪ Experience in applying different types of interviewing and facilitation techniques. Vito holds a BSc in Ecology and a MSc in Tropical Coastal Management from Newcastle University (UK). His studies were focused on fisheries bycatch and impacts of fishing gears/methods on benthic habitats. He completed MSC's Fishery Team Leader training both for FCR v.2.0 and FCP v.2.1, and passed the Lead Auditor ISO 19011 course. Vito has undertaken three MSC fishery surveillance site visits as a team member in the last 5 years.	

Table 2. Surveillance announcement.	
	Vito will be in charge of coordinating the Assessment Team's work and be responsible for the completion of the re-assessment in accordance with FCP v.2.1. In addition to leading the Assessment Team, Vito will be the team's expert on Principle 2 and Traceability. He meets the Principle 2 and Traceability components of the Fishery Team Qualification and Competency Criteria in Annex PC Table PC3: ▪ 3 years more experience in research into, policy analysis for, or management of, fishery impacts on aquatic ecosystems. ▪ Pass MSC's Traceability training module. His studies were focused on fisheries bycatch and impacts of fishing gears and fishing methods on benthic habitats in various part of the world. He has more than three years of experience in the assessment of ecosystem effects of fisheries. He passed the MSC's traceability training. In addition, Vito has a current knowledge of the country, language and local fishery context as well as two assignments in the country or region in which the fishery under assessment is based in the last 10 years. Vito was involved in numerous fisheries projects in North America in the last 5 years, including 3 MSC surveillance audits of Canadian fisheries. He is fluent in English which is the language of harvesters in Lake Erie. Vito does not have any conflicts of interest in relation to the fishery.
5	Team members
	Dr. John Casselman, primary responsible for Principle 1 Dr John Casselman has experience in marine biology going back more than 40 years including as Senior Aquatic Scientist at J.F. MacLaren, Engineers and Environmental Scientists, and as Research Scientist and as Senior Research Scientist at the Ontario Ministry of Natural Resources (OMNR) from 1973 until 2005. He has most recently been involved in analysis of long-term datasets where he demonstrated the significant overriding effects of climate on community dynamics and population abundance, year-class strength, and the role of predator-prey interaction, especially in early life stages. In 2005, Dr Casselman was awarded the Fruetel Memorial Award of the Ontario Ministry of Natural Resources for significant contributions to Ontario's fisheries research, assessment, and management programs. In 2008, he received the Award of Excellence of the 10,000-member American Fisheries Society, the most prestigious award of the 138-year-old society, given annually in recognition of original and outstanding contributions to fisheries science and aquatic biology for lifetime achievements as a researcher, mentor, and leader. John meets the Fishery Team Member Qualification and Competency Criteria outlined in MSC FCP Annex PC Table PC2 as well as qualification and competencies for fish stock assessment and fish stock biology/ecology in Table PC3. ▪ A degree in a relevant subject. ▪ 3 years' fisheries experience. ▪ Pass MSC's fishery team member training at least every 5 years. ▪ Review of updates to MSC Fisheries Program Documents. ▪ 3 years or more experience of applying relevant stock assessment techniques being used by the fishery under assessment. ▪ 3 years or more experience working with the biology and population dynamics of the target species or species with similar biology. John completed a Ph.D. in Zoology (ecology and environmental physiology) at University of Toronto in 1978. John was involved in long-term studies of the cool-water fish communities of the outlet basin of Lake Ontario and the warm-water and cool-water fish communities of the Bay of Quinte. His studies involved long-term trends, year-class strength, and growth dynamics of such species as yellow perch, freshwater drum, and lake whitefish, and he developed stock separation techniques for a number of freshwater species. He has most

Table 2. Surveillance announcement.	
	recently been involved in analysis of long-term datasets and has demonstrated the significant overriding effects of climate on community dynamics and population abundance, year-class strength, and the role of predator-prey interaction, especially in early life stages. John passed MSC's Fishery Team Member training and was involved in the 2nd and the 3rd surveillance audits of the Lake Erie multi-species commercial fishery. He was a P1 team member in the MSC certification of the Waterhen Lake commercial fishery in 2014 and assisted in its 3rd surveillance audit in 2018. In addition, John has current knowledge of the country, language, and local fishery context as well as two assignments in the country or region in which the fishery under assessment is based in the last 10 years. John was involved in long-term studies of the cool-water fish communities of the outlet basin of Lake Ontario and the warm-water and cool-water fish communities of the Bay of Quinte. His studies involved long-term trends, year-class strength, and growth dynamics of such species as yellow perch, freshwater drum, and lake whitefish, and he developed stock separation techniques for a number of freshwater species. He was involved in the 2nd and the 3rd surveillance audits of the Lake Erie multi-species commercial. John's mother tongue is English which is the language of harvesters Lake Erie. John does not have any conflicts of interest in relation to the fishery. **Robert (Bob) Allain, primary responsible for Principle 3** Bob Allain served in Canada's Department of Fisheries and Oceans for 32 years dealing with management, enforcement and policy. While in Government Service, he consulted internationally for the Canadian International Development Agency, the (former) International Centre for Ocean Development, the World Bank, and the Food and Agricultural Organization of the United Nations. He has participated in, and spoken at, international conferences in the United States, Ireland and Australia and has given over 600 media interviews to national and international news agencies while in government service. On behalf of various national (CIDA, ICOD) and international (UNFAO, World Bank) organizations with specific mandates for the advancement of fisheries management and conservation in developing coastal states: Evaluated the effectiveness of national monitoring, control and surveillance (MCS) programs of several West African (CECAF) coastal states; studied opportunities for inter-regional cooperation, and prepared comprehensive conceptual reports for improving the organization and delivery of MCS programs. Evaluated the strengths and weaknesses of national fisheries legislation in respect of foreign and domestic fisheries licensing and revenue systems, enforcement responses and effectiveness, penalties and the conservation of marine species. Bob meets the Team Member Qualification and Competency Criteria outlined in MSC FCP Annex PC Table PC2 as well as Principle 3 components of the Fishery Team Qualification and Competency Criteria outlined in MSC FCP Annex PC Table PC3. ▪ A degree in a relevant subject. ▪ 3 years more experience as a practicing fishery manager and/or fishery/ policy analyst. ▪ Passed MSC's fishery team member training at least every 5 years. ▪ Review of updates to MSC Fisheries Program Documents. ▪ Two assignments in the country or region in which the fishery under assessment is based in the last 10 years. Bob has a Bachelor of Science and is a former senior executive with over 30 years' experience with Canada's Federal Department of Fisheries and Oceans in fisheries management, strategic policy development and analysis, facilitation and conflict resolution, and mentoring. He passed MSC's Fishery Team Member training and was involved in numerous MSC fisheries assessments in Canada in the last 5 years, including in the 3rd surveillance audit of the Lake Erie multi-species commercial. In addition, Bob has a current knowledge of the country, language and local fishery context as well as two assignments in the country or region in which the fishery under assessment is based in the last 10 years.

Table 2. Surveillance announcement.	
	He was involved in the 3rd surveillance audits of the Lake Erie multi-species commercial. Bob's mother tongue is English which is the language of harvesters in Lake Erie. Bob is based in New Brunswick, Canada and was involved in numerous MSC fisheries assessments in Canada and U.S. in the last 5 years. Bob does not have any conflicts of interest in relation to the fishery.
6	Audit time and location
	10th October 2019 off-site surveillance conference call with client group and representatives from relevant management/science agencies.
7	Assessment and review activities
	A two-part conference call (one in the morning and one in the afternoon) was set up on October 10th 2019 with the Client Group, science and management staff from Ontario and Ohio. The following people participated: Lake Erie Management Unit, Ontario Ministry of Natural Resources and Forestry – Brian Locke, Rich Drouin, Michael Thorne. Ohio Department of Natural Resources – Travis Hartman, Lake Erie Program Administrator OCFA – Kevin Reid, Jane Graham Assessment Team Vito Romito, Lead Assessor and P2 Assessor John Casselman, P1 Assessor Bob Allain, P3 Assessor See Section 6.1.1 for Agenda. The rest of the audit was conducted primarily in terms of remote desktop review activities additionally supported by client submissions and clarifications as needed.

5. Background

5.1. Stock Status and Assessment (P1) updates

5.1.1. Background

The MSC-certified Lake Erie multi-species commercial fishery has two target species, yellow perch and walleye. These fisheries were certified in 2015 (Intertek 2015). The yellow perch stock is assessed according to four bi-national management units (MU), 1 to 4. The stock status of yellow perch in this certification met the MSC standard in all MUs. However, some issues prevented the yellow perch fishery from meeting the defined MSC standard for reference points (RP) (PI 1.1.2) and the harvest control rules (HCR) and tools (PI 1.2.2), and this led to conditions on the certification. Condition YP1 was met and removed in 2018, as indicated in the third surveillance audit (Hough et al. 2019) with new exploitation policies and the development of limit reference points (LRP) and target fishing rates. Condition YP2 required the implementation of these new exploitation policies, which occurred in 2019 and will be discussed later. Walleye is an important commercial species in Lake Erie. A major part of the Lake Erie population of walleye is considered to be a single stock. Walleye are caught by large-mesh mid-water gill nets but may also be caught incidentally in small-mesh gear targeting other species. The walleye stock met the MSC standard for all Principle 1 indicators. This fourth surveillance audit considers the status and relevant science around the certification of these two important Lake Erie targeted commercial species.

5.1.2. Yellow Perch

5.1.2.1. Stock Status

The abundance of yellow perch has increased in recent years up to 2019. However, there is evidence, as indicated by model simulations and recommended annual harvest, that there are declines in some MUs (MU1 and MU2), the latter being more pronounced. This led to a lake-wide recommended allowable harvest (RAH), with the extent varying by MU. The mean lake wide RAH in 2019 was 8.412 million pounds, a 13.2% decrease from 2018 (Table 3). This resulted in a 2019 recommended total allowable catch (TAC) of 8.552 million pounds, an overall 18.5% decrease from 2018. The TAC in 2018 in relation to the RAH was +1.7%. Percent of the harvest of yellow perch in relation to the TAC has been declining. The harvest in 2018 was 6.782 million pounds, 65% of the TAC. The 2019 reduction of RAH in MU2 was more extreme than in any other unit. The significance of this will be examined around the RP performance indicators.

Table 3. Lake Erie yellow perch harvest (million pounds), 2017–2019, including relative changes in the mean recommended allowable harvest and total allowable catch. From YPTG (2017, 2018, 2019) and LEC (2017, 2018, 2019b).

	Recommended allowable harvest (RAH)									Harvest	
Year	MU1	MU2	MU3	MU4	Total	Change in RAH (%)	TAC	Change in TAC (%)	TAC relative to RAH (%)	Actual	Relative to TAC (%)
2017	3.874	2.567	2.588	0.303	9.332	+22.5	10.375	+12.8	+10.1	7.789	75.0
2018	3.533	3.150	2.578	0.431	9.691	+3.8	10.498	+1.2	+8.3	6.782	65.0
2019	2.240	1.914	3.374	0.883	8.412	-13.2	8.552	-18.5	+1.7		

Long-term trends in yellow perch spawning stock biomass (SSB – millions of kilograms) for the four Lake Erie MUs indicate that in recent years, this biomass has generally been above the long-term average (Figure 1). The statistical catch-at-age analysis (SCAA), using the Auto Differentiation Model Builder program (ADMB) estimate of the yellow perch SSB in 2019 (Table 4), as reported by the Yellow Perch Task Group (YPTG 2019), showed a marked decrease in MU1 and MU2 compared with 2018 (Table 5). In 2019, the MU 1–4 age 3+ (mature individuals) biomass was 2.796, 4.700, 6.775, and 2.087 million kg, respectively (Table 5, YPTG 2019), compared with the 2018 values of 4.871, 5.355, 4.008, and 1.654 million kg, respectively (Table 5, YPTG 2018). In MU1, the decrease in SSB in 2019 from 2018 was 42.6%, and in MU2 it was 12.2%.

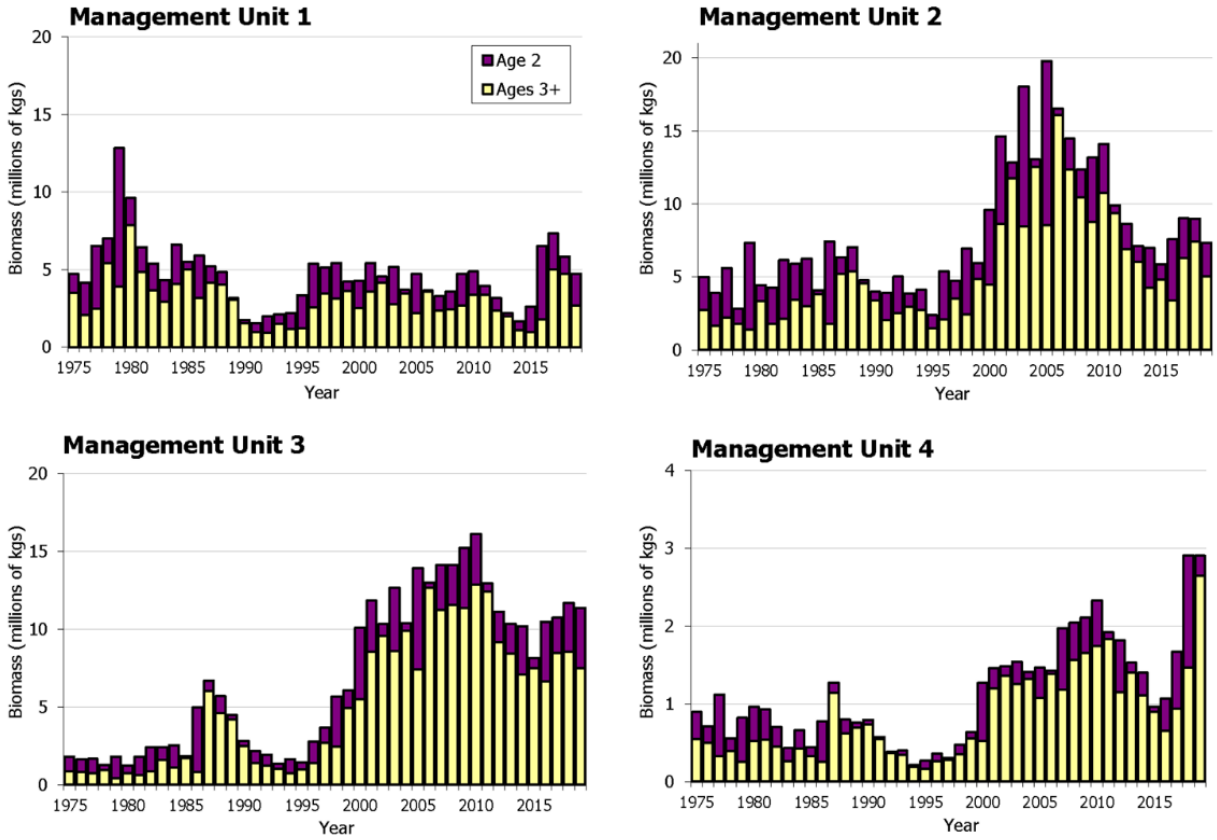


Figure 1. Lake Erie yellow perch biomass (millions kg) estimates by management unit (MU) for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2019 are from the PR ADMB model. From YPTG (2019, Figure 1.10).

Table 4. Parameters of the stocked-recruitment relationship, spawning stock biomass, limit reference points, and target fishing rates for each yellow perch management unit. F_{actual} was reduced from F_{target} because P* > 5%. From YPTG (2019, Table 2.1).

	Spawn/ Recruit Relationship Parameters			Spawning Stock Biomass (Unfished Population)		Spawning Stock Biomass (kgs)		Biomass at MSY (Limit Reference Point)			Fishing Rate			
Unit	log(alpha)	beta	sigma	SSB_0	sd($logSSB_0$)	2019	2020[a]	B_{msy}	$\%SSB_0$	P*	F_{msy}	$\%F_{msy}$	F_{target}	F_{actual} [b]
MU1	2.80	3.85E-07	0.96	5,645,560	0.22	2,795,920	3,171,970	1,585,743	28%	0.54%	2.38	28%	0.666	0.666
MU2	2.42	1.57E-07	0.96	12,378,700	0.19	4,700,430	4,076,090	3,395,611	27%	18.12%	2.06	35%	0.721	0.353
MU3	2.27	1.34E-07	0.96	12,895,400	0.22	6,775,030	7,236,280	3,542,554	27%	0.30%	2.03	32%	0.650	0.650
MU4	2.09	1.07E-06	1.01	1,791,990	0.21	2,087,220	1,791,180	506,007	28%	0.00%	1.46	34%	0.496	0.496

(a) Spawning stock biomass when population is fished at target fishing rate
(b) In MU2 fishing at F_{target} exceeds a 5% probability (P*) that the projected spawning stock biomass will be equal to or less than the limit reference point (B_{msy}), therefore the fishing rate was reduced until the probability was less than 5%.

The spawning stock biomass limit reference (B_{limit}) and the target reference point (B_{target}) performance indicators used in the assessments in 2017 and 2018 were 1.097, 1.693, 0.966, and 0.239 and 2.194, 3.366, 1.931, and 0.479, respectively (Intertek 2015) (Table 5). However, LRPs were changed in 2019 as a result of analyses conducted by the YPTG (2019) (Table 4) and indicated by the new yellow perch exploitation policies announced by the Lake Erie Committee (LEC 2019a). These policies satisfied condition YP1 of the MSC certification (Intertek 2015), providing an analytically based LRP rather than the default 20% unfished spawning stock biomass (SSB_0) previously used. The target reference point (TRP) continues to use the default 40% SSB_0. The new analytically based LRPs using the calculated spawning stock biomass at maximum sustainable yield (B_{msy}) were applied in 2019. For 2019, these MU 1–4 LRPs were 1.585, 3.396, 3.543, and 0.506, respectively (Tables 4 and 5).

Examining the SSB in relation to the RPs, using the age 3+ biomass/B_{limit} ratios for MUs 1–4, indicates that in 2019, compared with 2018 (Hough et al. 2019), there was a reduction across all MUs and most markedly in MU2, which had a LRP of 1.38 (Table 5). This ratio was the lowest of all MUs from 2017 to 2019. The ratio remained relatively high in MU4 at 4.12 but was lower and intermediate in MU1 at 1.75 and in MU3 at 1.92. The latter two had declined from the 2017 and 2018 values and were above 4 (Table 5). Overall, the 2018 ratios were high, similar to 2017 (Adlerstein et al. 2017), in both years ranging generally from 2 to 4. Even though there were decreases in 2019 in all MUs, the LRP ratios were > 1 (Table 5) and the SSBs for all MUs remain above the biomass limit reference points.

The SSB in recent years was examined in relation to the TRPs, using the default 40% SSB_0, which gave MU 1–4 values for 2017 and 2018 of 2.194, 3.386, 1.931, and 0.479 million kg, respectively (Intertek 2015), and the 2019 values of 2.258, 4.931, 5.159, and 0.717 million kg, respectively, calculated from YPTG (2019) (Table 5).

TRP ratios, the age 3+ biomass/B_{target} in all MUs, decreased in 2019 and fell below 1 in MU2, a value of 0.95. Indeed, the 2019 ratios in all cases were lower than in 2017 and 2018 (Table 5). Although stock status appears to be declining, it remains above the TRP in all MUs except MU2, which is slightly below but oscillating around 1 over the past few years, given the value of 1.94 in 2015 and 0.98 in 2016. There may be some concern around the status of yellow perch in MU2; however, this is being addressed by the YPTG and LEC, and precautionary management measures are being taken around fishing rates to protect its sustainability. This will be discussed in the following section on management.

Long-term standardized recruitment indices exist for Lake Erie yellow perch, associated with inter-agency trawling of western Lake Erie (YPTG 2019). The 31-year (1998–2018) young-of-the-year catch index provided by Ontario and Ohio indicates that from 2014 to 2018, yellow perch young-of-the-year recruitment has been relatively strong (Figure 2). The strongest recruitment for the period occurred in 1996, higher than in 2003, while the 2018-year class was third strongest for the period (Figure 2). If mortality of the 2018-year class remains low, it may be important in building and sustaining the yellow perch population and fishery.

Fishing mortality in 2019 is projected to be fairly high compared with 2017 and 2018 in MUs 1, 3, and 4 (Table 5). F_{target} was reduced in MU2 from 0.721 to 0.353 because the MU2 fishing at F_{target} exceeded the 5% probability (P*) that the projected SSB would be equal to or less than the LRP (B_{msy}) (Table 4). The fish mortality target reference points (FTR) (50% F_{msy}) for MU 1–4 were 0.67, 0.67, 0.70, and 0.30, respectively (Intertek 2015) but for 2019 were 1.19, 1.03, 1.02, and 0.73 (Tables 4 and 5).

The age 3+ F/F_{target} ratios in 2019 for MUs 1–4 were 0.56, 0.34, 0.64, and 0.68, respectively, all higher than 2018 but, compared with 2017, lower in MUs 1 and 2 and higher in MUs 3 and 4 (Table 5). The exploitation rates for all MUs were higher in 2018 than in 2017 but lower than in 2016 (Figure 3).

Table 5. Performance indicators applying the harvest control rules for yellow perch by management unit in Lake Erie, indicating limit reference points and target reference points and ratios, as well as fishing mortality reference points and ratios. Mean spawning stock biomass and fishing mortality from YPTG (2017, 2018, 2019); harvest control rules from Intertek (2015), LEC (2019a), and YPTG (2019).

	Management Unit			
Year	MU1	MU2	MU3	MU4
Spawning stock biomass (SSB – millions kg)				
2017	5.099	3.996	4.478	1.164
2018	4.871	5.355	4.008	1.654
2019	2.796	4.700	6.775	2.087
Limit reference point (2017–2018) (default 20% SSB_0)	*1.097*	*1.693*	*0.966*	*0.239*
Limit reference point (2019) (calculated SSB_{msy})	*1.585*	*3.396*	*3.543*	*0.506*
Limit reference point ratio				
2017	4.65	2.36	4.64	4.87
2018	4.44	3.16	4.15	6.92
2019	1.75	1.38	1.92	4.12
Target reference point (default 40% SSB_0)				
(2017–2018)	*2.194*	*3.366*	*1.931*	*0.479*
(2019)	*2.258*	*4.931*	*5.159*	*0.717*
Target reference point ratio				
2017	2.32	1.19	2.32	2.43
2018	2.22	1.59	2.08	3.45
2019	1.24	0.95	1.31	2.91
Fishing mortality				
2017	0.447	0.386	0.277	0.160
2018	0.348	0.194	0.216	0.072
2019	0.666	0.353	0.650	0.496
Fishing mortality reference point (50% F_{msy})				
(2017–2018)	*0.67*	*0.67*	*0.70*	*0.30*
(2019)	*1.19*	*1.03*	*1.02*	*0.73*
Fishing mortality reference point ratio				
2017	0.67	0.58	0.40	0.53
2018	0.52	0.29	0.31	0.24
2019	0.56	0.34	0.64	0.68

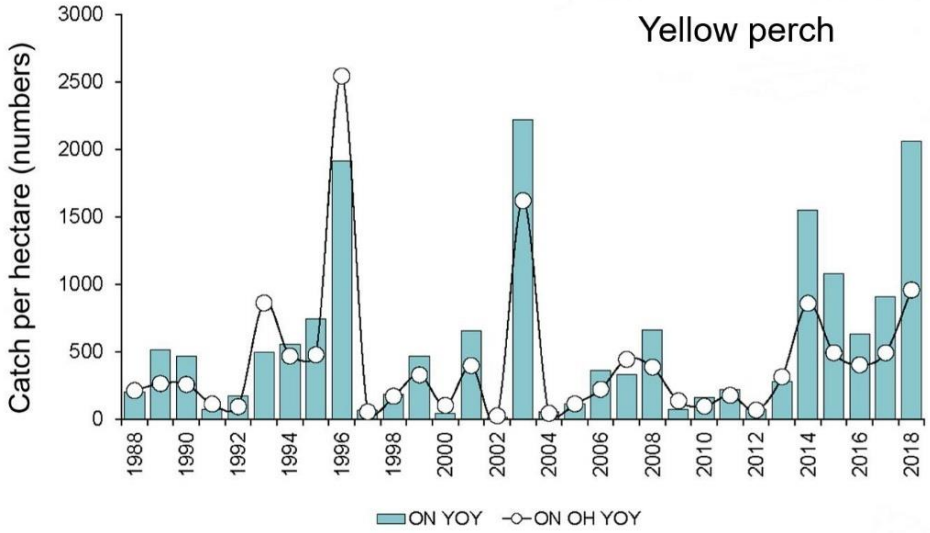


Figure 2. Number of young-of-the-year yellow perch caught per hectare during interagency trawling (1988–2018) in western Lake Erie. Young-of-the-year catches are provided for Ontario and Ohio, with data from Lake Erie Management Unit (2018), Draft Annual Report 2018 and illustrated from OCFA Annual Convention 2019 (OMNRF 2019, PowerPoint slide deck).

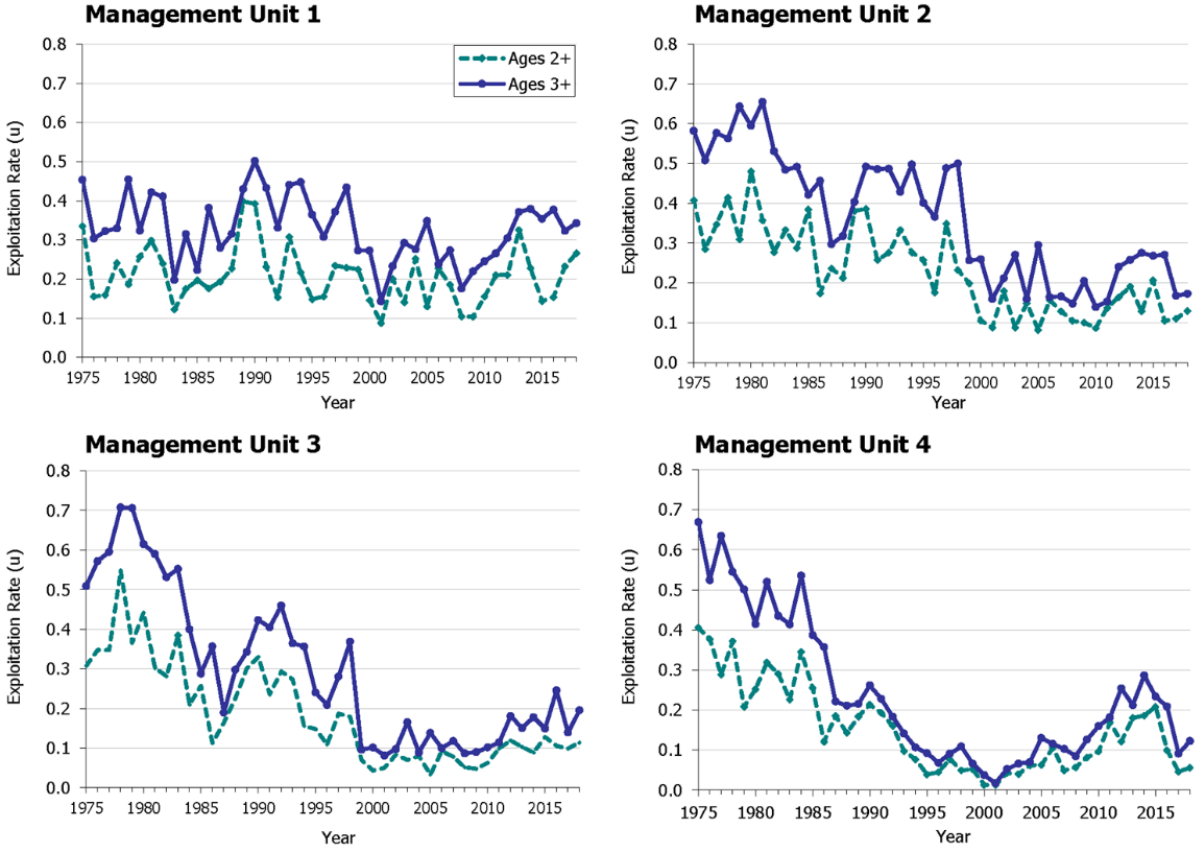


Figure 3. Lake Erie yellow perch exploitation rate (u) estimates by management unit (MU) for ages 2+ (dashed line) and 3+ (solid line). Estimates derived from the PR ADMB model; from YPTG (2019, Figure 1.12).

Stock, biomass, and fishing mortality trends indicate that the original PI 1.1.1 scores remain appropriate. In all MUs, there is certainty that the biomass remains above B_{limit}. The degree of certainty is somewhat less for MU2 since the TRP ratios are the lowest of the other MUs for the past 4 years – 0.98 for 2016, 1.19 for 2017, 1.59 for 2018, and 0.95 for 2019.

5.1.2.2. Management

Management of the Lake Erie yellow perch population and fishery has been actively reviewed in recent years. We provide here a summary of this, which led to the establishment of new exploitation policies in 2019. From 2015 to 2018, the Lake Erie Percid Management Advisory Group (LEPMAG), facilitated by the Quantitative Fishery Center (QFC) at Michigan State University, reviewed the existing YPTG assessment models and data sources and, as part of a Yellow Perch Management Strategy Evaluation (MSE), discussed these with stakeholders. For example, in 2016, the LEPMAG initiated discussion with stakeholders on the performance metrics (e.g., number of fish per rod hour, commercial harvest in pounds, status of SSB) to evaluate the performance of the harvest strategy.

These discussions led to updated assessment models and new harvest exploitation strategies, with a consequently revised draft of the Lake Erie Yellow Perch Management Plan (YPMP). This plan will supersede the previous draft plan (YPTG 2007). Revisions to the assessment models were extensive in involving various staff of the QFC (Dr. Reilly, Dr. Syslo, and Mark Dufour), who facilitated a MSE. From 2016 to 2018, considerable progress was made with the evaluation. This progress was documented in the third surveillance audit (Hough et al. 2019), including a detailed slide deck of the MSC scenario survey. This all led to the LEC, in February 12, 2019, announcing the new analytically based yellow perch exploitation policies and the upcoming YPMP (LEC 2019a). The development of this policy and the new HCR satisfied and removed the first yellow perch condition (YP1) (Hough et al. 2019). The LEC recommendation emphasized that the LEC would implement these new exploitation policies in 2019, indicating that they are committed to manage for a stable and long-term sustainable yellow perch fishery in Lake Erie. Removal of the second condition (YP2) requires evidence that they were implemented in 2019. This was accomplished and will be detailed subsequently.

The original HCRs for yellow perch described in Intertek (2015) were used up to 2019 to provide management with values for RAH. The YPTG used a YPTG model to calculate the RAH allocations up to 2019. The HCRs were based on default limit and TRPs of 20% and 40% SSB_0. In 2019, the Lake Erie Committee (LEC) and the LEPMAG determined new HCRs for yellow perch, which will form the foundation of the upcoming YPMP for the next 5 years. As indicated, these resulted from a re-examination of the earlier draft YPMP (YPTG 2007), which was conducted in conjunction with analyses and simulations performed by the QFC and an associated MSE. In 2019, the LEPMAG determined and announced new HCRs and exploitation policies for yellow perch (LEC 2019a). They are composed of:

- target fishing mortality as a percent of the fishing mortality at maximum sustainable yield (F_{msy}). F_{msy} will remain constant for the duration of the YPMP (a 5-year period).
- limit reference point of the biomass at maximum sustainable yield (B_{msy}).
- a probabilistic risk tolerance level of P* = 0.05 (P-star) for all MUs.
- a limit on the maximum change in TAC of ± 20%.

Target fishing rates and LRPs were estimated by using the SCAA model results. Estimating reference points and recommending allowable harvest involves three steps. First, the estimated recruitment and SSB from the SCAA model are entered into the ADMB model, which estimates a Ricker stock recruitment relationship and the abundance of the non-fished spawning stock biomass (SSB_0). In the second step, maturity weight and age, along with the parameters of the stock recruitment relationship are entered into an R-based model. This model estimates F_{msy} and B_{msy} for the HCR. Finally, F_{msy} and F_{target} as a percent of F_{msy} and B_{msy} as a percent of SSB_0 are entered into the PR ADMB model to estimate the RAH in each MU. The results for 2019 SSB_0, B_{msy}, F_{msy}, and F_{target} are provided in Table 4. The LRPs as a percent of the SSB_0 in 2019 for MUs 1–4 were 28%, 27%, 27%, and 28%, respectively. The target fishing rates (F_{target}) for MUs 1–4 were 0.667 and 0.721, 0.650 and 0.496, respectively, but the MU2 fishing rate exceeded the 5% P* probability that the projected SSB would be equal to or less than the LRP (B_{msy}). The P* was 18.12% (Table 4). The fishing rate for MU2 was reduced such that the probability was < 5%, providing an F_{actual} of 0.353 from the F_{target} of 0.721 (Table 4) (YPTG 2019).

In 2019, the mean total RAH for Lake Erie is 8.412 million pounds, a reduction of 13.2% from the previous year (Table 3). The LEC recommended a TAC of 8.552 million pounds, a reduction of 18.5% from 2018. The 2019 RAH in MU1 and MU2 were reduced considerably from 2018 – 36.5% and 39.2%, respectively. An increase in harvest in MU3 of 30.9% and the relatively small harvest in MU4 of 104.9% were recommended. The total TAC was set slightly higher, at 8.552 million lb (Table 3).

Given the implementation of the new exploitation policies and HCRs (Table 4) (LEC 2019a), as well as the considerable progress made in developing the new YPMP, the outlook for the status of Lake Erie yellow perch remains optimistic. The implementation in 2019 of these new exploitation policies and HCRs satisfies the second yellow perch condition, YP2, that was placed on the 2015 MSC certification.

5.1.2.3. Supporting Information

The new exploitation policies outlined in February 2019 (LEC 2019a) are the result of an extensive review and a major development of a new YPMP. This plan, which is currently in draft and under final review, is fundamental to an explanation of the development and use of updated yellow perch catch-at-age models and analytically based new HCRs, which resulted from the LEPMAG yellow perch MSE process. This draft plan and its planned adoption by the LEPMAG will be discussed during a webinar planned for mid-December 2019. The LEPMAG is composed of the LEC Standing Technical Committee, QFC, and stakeholder groups from all Lake Erie jurisdictions. This group addresses stakeholder objectives, modelling concerns, and exploitation policies for Lake Erie percids. In 2018, the LEPMAG, with the assistance of the QFC, completed the development of a new statistical catch model, referred to as Peterson-Reilly, or PR model, which replaces the formerly used YPTG model and, using this new model along with a MSE tool, evaluated current and alternative harvest strategies for yellow perch in Lake Erie.

The original YPTG model used harvest and effort data from commercial gill net, commercial trap net, and recreational fisheries (YPTG 2018). Survey catch at age for age 2 and older fish from gill net and trawl surveys were also included. The YPTG model incorporated commercial gill-net selectivity derived from index gill-net data, involving back-calculation of length at age and weightings based on monthly distribution of harvest at age. The Ontario Partnership gill-net index catch rates were adjusted for selectivity bias associated with mesh size configuration with an assumed selectivity of 1 for all age groups. Commercial gill-net catchability coefficients based on seasonal distribution of harvest and relative catch rates were also used. The YPTG model used catchability blocks for each type of harvest gear and constant catchability for surveys (YPTG 2018).

The PR model, which is currently being used, uses the same data sources as the YPTG model, with the addition of age 0 and age 1 recruitment data (YPTG 2018). The PR model estimates selectivity for all ages in the fishery and surveys. Since survey selectivities are estimated in this model, Ontario Partnership catch rates are not adjusted for selectivity bias. Catchabilities for all fisheries and surveys vary as a random walk. The model is fit to total catch and proportions at age (multinomial age composition) as separate datasets. The PR model is run as a three-step process. In the first step, an ADMB model without recruitment data is run iteratively until the maximum effective sample size for the multinomial age composition stabilizes and does not change by more than 1 or 2 units. Second, age 2 abundance estimates from the first model are added to age 0 and age 1 recruitment data in a multi-model inference (MMI) R-based model to determine parameters for estimating recruitment. Surveys are not weighted equally in the models; the surveys that are more highly correlated with ADMB age 2 estimates are weighted more heavily and have greater influence on the recruitment predictions. In the third step, the age 0 and age 1 recruitment data are added to the ADMB model along with the MMI coefficients from step two. This allows the model to estimate age 2 recruitment for each year class available in the recruitment data and adds this as a dataset in the objective function. This model is then run iteratively until the maximum effective sample size for the multinomial age composition stabilizes.

The YPTG used the YPTG model to make recommendations in 2017 and 2018 (YPTG 2017, 2018), and the PR model was used in 2019. The task group previously discussed the merits of using the PR model relative to the

YPTG model in terms of model fit and performance presented at LEPMAG meetings, and while the task group generally felt the PR model provided advantages relative to the YPTG models, a formal harvest policy risk assessment, management strategy evaluation, had yet to be completed using the PR models (YPTG 2017). This was conducted during 2018–2019 and is an important part of the development of the new YPMP. Application of the PR model is an integral part of the current draft YPMP under review (announcement of webinar).

The stock sizes of age 2 and older yellow perch in 2019 were estimated from the SCAA model (YPTG 2019, Table 1.7). The stock size estimates for 2018 were lower than those projected last year in MUs 2 and 3 and higher than projected in MUs 1 and 4 (YPTG 2018). Abundance estimates of age 2 and older yellow perch in 2019 are projected to decrease by 3% in MU1, 1% in MU2, and 25% in MU4 and increase by 13% in MU3, compared with the 2018 abundance estimates (YPTG 2019). Model estimates of abundance for age 3 and older yellow perch for 2019 are projected to decrease from the 2018 estimate by 38% and 23% in MUs 1 and 2, respectively, and increase by 1% and 90% in MUs 3 and 4, respectively. Lake-wide abundance of yellow perch in 2019 is projected to be 183.7 million fish, an increase of 2% over 2018. This follows that in 2018, the lake-wide abundance estimate was projected to be 186.4 million fish, a decrease of 16% from 2017 (YPTG 2018). As a function of the population estimates, a mean weighted age from fisheries-independent surveys, total biomass estimates of age 2 and older yellow perch in 2019 are projected to decrease 19% in MU1, 18% in MU2, and 3% in MU3 and be approximately the same in MU4 (-0.1%) compared with the 2018 estimates (YPTG 2019).

In 2018 and 2019, the YPTG examined all age 0 and age 1 recruitment indices used in the MMI model to improve model stability and transparency. The YPTG determined that some of the indices that had been used in the model should be removed because of potential bias or changes in survey design. Surveys removed from the model included: 1) MU4 Long Point Bay summer gill net age 1 survey. This survey had a change in survey design in 2018 and was no longer a continuous time series. 2) MU2 and MU3, Ohio summer trawl survey age 0 and age 1 were removed because of hypoxia during the survey. A complete list of the surveys that were included, along with those that have been excluded, are detailed in the YPTG 2019 report (YPTG 2019, Appendix Table 4). Indices have been added; for example, in 2018, the New York gill net age 1 recruitment index was added to the MU4 model. Additional central basin recruitment indices were examined but not included at that time (YPTG 2018).

5.1.3. Walleye

5.1.3.1. Stock Status

Walleye abundance in Lake Erie has increased substantially in recent years. This has led to a continued increase in lake-wide recommended allowable harvest. The RAH in 2019 was 8.683 million kg, a slight decrease of 1.4% from the 8.809 million kg in 2018 (Table 6). The RAH in 2018 had increased 26.5% over 2017 and 29.4% over 2016. The TAC in each of the past 3 years has been increased by 20% and in 2019 was 8.531 million kg, 1.8% below the RAH. Harvest relative to the TAC in recent years has been relatively high and in 2018 was 6.271 million kg, which was 88.2% of the TAC (Table 6). The outlook for the future status of Lake Erie walleye is very optimistic; abundance is high. However, the very high abundance of walleye might affect the yellow perch and the associated fishery.

Table 6. Lake Erie walleye spawning-stock biomass and recommended allowable harvest (RAH) and total allowable catch (TAC) (millions kg), including relative changes in these, 2017–2019. Includes biomass limit reference points (LRP) and target reference points (TRP) and ratios, as well as fishing mortality and associated reference points and ratios. From WTG (2017, 2018, 2019) and LEC (2017, 2018, 2019b).

															Harvest	
Year	SSB_0	SSB	LRP 20% SSB_0	LRP ratio	TRP 40%SSB_0	TRP ratio	F	60% F_{MSY}	F ratio	Total RAH	Change in RAH (%)	TAC	Change in TAC (%)	TAC relative to RAH (%)	Actual	Relative to TAC (%)
2017	61.613	37.583	12.335	3.05	24.670	1.52	0.097	0.289	0.336	6.965	+39.4	5.924	+20.0	-14.9	4.913	81.9
2018	60.774	44.958	12.155	3.70	24.310	1.85	0.097	0.323	0.297	8.809	+26.5	7.109	+20.0	-19.3	6.271	88.2
2019	60.918	49.774	12.184	4.09	24.368	2.04	0.129	0.334	0.386	8.683	-1.4	8.531	+20.0	-1.8		

In 2019, the WTG (2018) reports the latest status of the west-central (MUs 1–3) Lake Erie walleye stock, which is the basis of the UoA. Using the SCAA analysis (Intertek 2015), total (age 2+) population numbers in 2018 were scaled upwards across the assessment time series (1980–2018), with changes being the most prominent since the mid-2000s (Scott et al. 2016). Abundance of walleye age 2 and older in the west and central basins of Lake Erie has increased in recent years (Figure 4). Based on the 2019 integrated SCAA model, the 2018 west-central population (MU1, MU3) was estimated at 49.849 million walleye age 2 and older (Figure 4). Based on the integrated model, the number of age 2 recruits entering the population in 2019 (2017 year class) and 2020 (2018 year class) was estimated to be 13.514 and 94.071 million walleye, respectively (WTG 2019) (Figure 5). The 2019 projected abundance of age 2 and older walleye in the west-central population is estimated to be 45.338 million fish (Figure 4).

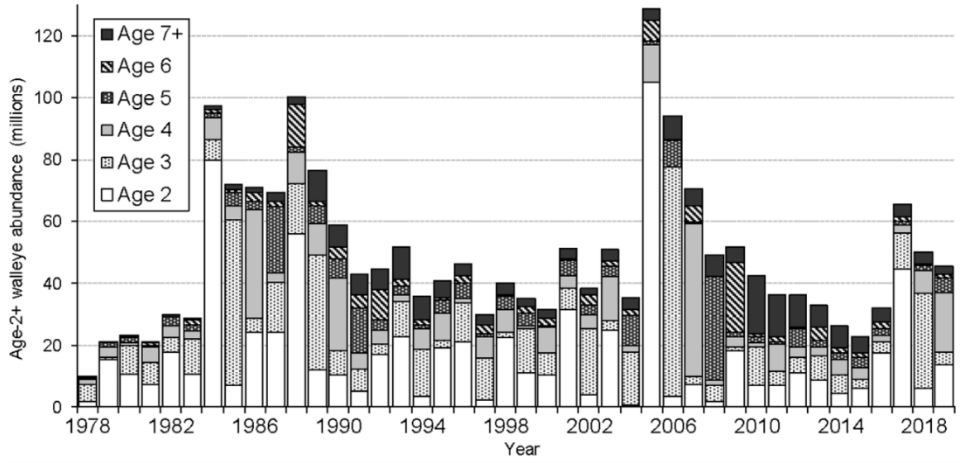


Figure 4. Abundance of walleye age 2 and older in the west and central basins of Lake Erie 1978–2019. Estimated from the latest ADMB integrated model run; statistical catch-at-age model; from WTG (2019, Figure 7 and data from Table 8).

This scaling has resulted in an upward modification of the SSB RPs. The SSB_0s from 2017 to 2019 were estimated to be 61.673, 60.774, and 60.918 million kg, respectively, and the SSBs were 37.583, 44.958, and 49.774 million kg, respectively (Table 6). The LRP, using the MSC default 20% SSB_0, from 2017 to 2019 were 12.335, 12.115, and 12.184, respectively, and the MSC default TRPs of 40% SSB_0 from 2017 to 2019 remained very similar: 24.670, 24.310, and 24.365, respectively. The LRP ratios for the three years were considerably >1, increasing from 3.05 in 2017 to 3.70 in 2018 to 4.09 in 2019. Likewise, the TRP ratios were >1, increasing from 1.52 in 2017 to 1.85 in 2018 to 2.04 in 2019 (Table 6). Table 6 summarizes data provided in the WTG annual reports (2017, 2018, and 2019). The WTG in 2019 determined that the probability of the 2020 SSB being less than 20% SSB_0 (B_{limit}) was 0.000%, which is the same as the probability determined in 2018. Thus, the probabilistic control rule (P*) to reduce target fishing rate and conserve the spawning stock biomass was not invoked during the 2019 determination of RAH (WTG 2019).

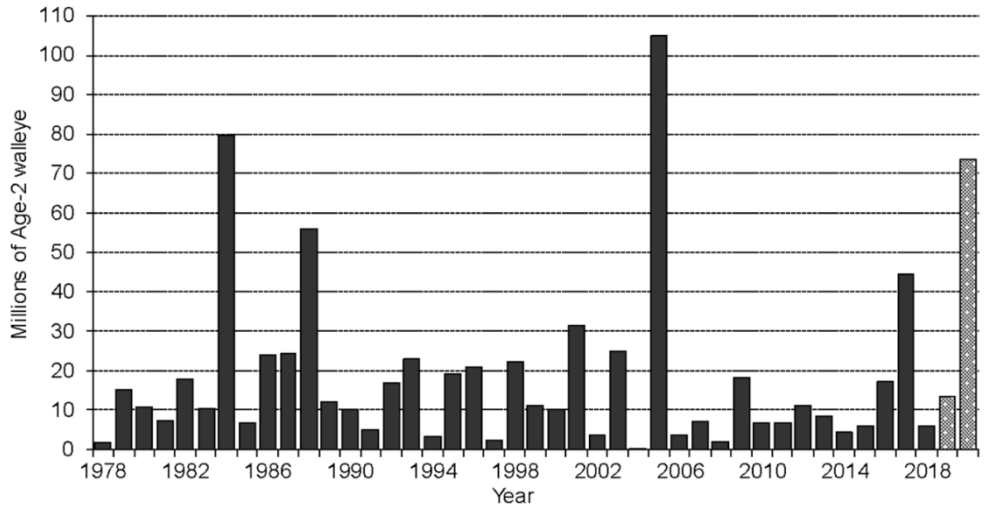


Figure 5. Estimated (1978–2018) and projected (2019 and 2020) number of age 2 walleye in the west-central Lake Erie population from the latest ADMB integrated model run; from WTG (2019, Figure 8).

Furthermore, recruitment of the 2018-year class is relatively strong (Figure 6), suggesting that the SSB will continue to increase in the coming years. In fact, the 2018-year class is exceptionally large, the strongest in the past 31 years, far surpassing the next strongest year class of 2003. However, it remains to be determined whether the strength of the 2018-year class will persist.

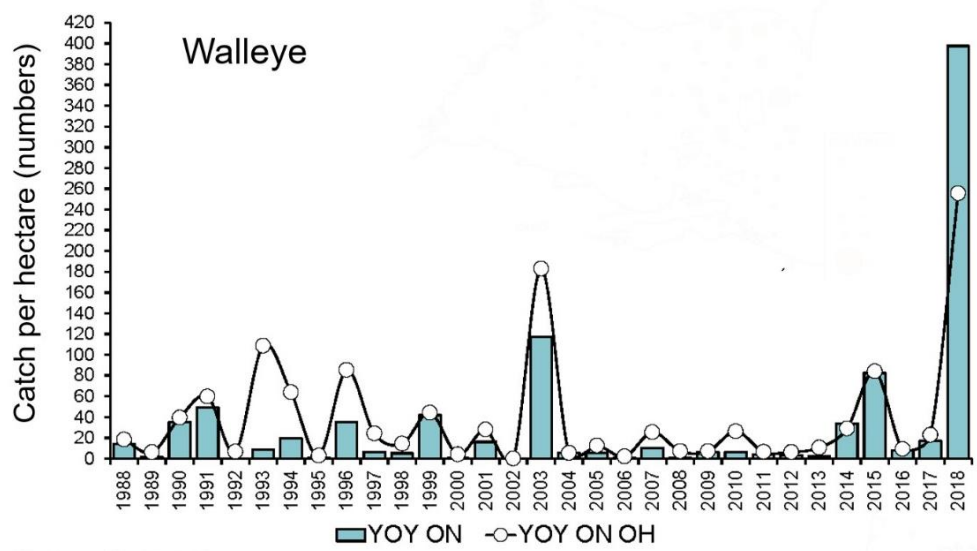


Figure 6. Number of young-of-the-year walleye caught per hectare during interagency trawling (1988–2018) in western Lake Erie. Young-of-the-year catches are provided for Ontario and Ohio, with data from Lake Erie Management Unit, Draft Annual Report 2018 and illustrated from OCFA Annual Convention 2019, OMNRF PowerPoint slide deck.

F_{msy} decreased in 2017 compared with the 2016 assessment, from 0.530 (WTG 2017) to 0.481 (WTG 2016a), but increased in 2018 to 0.538 (WTG 2018) and again in 2019 to 0.556 (Table 6) (WTC 2019). The 60% F_{msy} target fishing mortality increased slightly from 2017 to 2019: 0.289, 0.323, and 0.334, respectively (Table 6). Age 2+ fishing mortality increased markedly in 2018 after 2 years of decline and is the highest seen since 2000 and slightly greater than in 2015, when it was also high (Figure 7). On a relative scale, the fishing mortality/60%F_{msy} target ratio was 0.336 in 2017, the same as in 2016 and slightly lower in 2018 at 0.297 but appreciably higher in 2019 at 0.386, the highest ratio since 2015 but still low (Table 6).

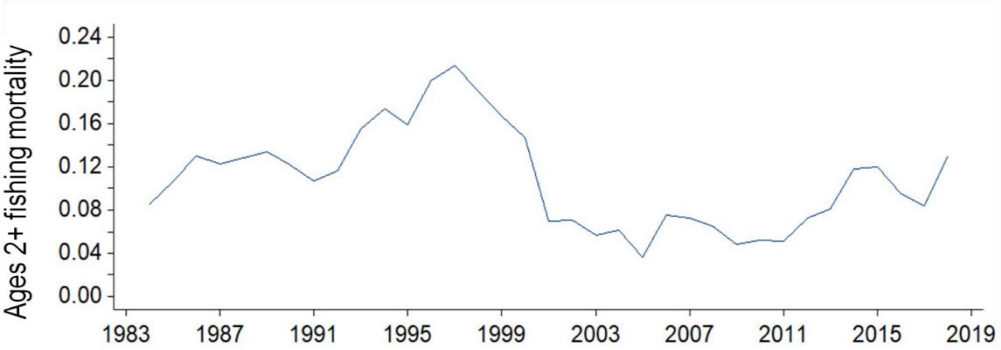


Figure 7. Comparison of walleye ages 2+ Lake Erie west-central fishing mortality (F) 1984–2018 assessed by the Walleye Task Group, 2019; data from respective assessments; from WTG (2019, Table 8).

Overall, the most recent assessment (WTG 2019) indicates an increase in stock status, with SSB well above the B_{limit} and B_{target} reference points. Even though fishing mortality appeared to have increased from 2011 to 2015, there was a slight decrease in 2016 and 2017 (Figure 7) but an appreciable increase in 2018, although it is still well below the target of the management plan.

5.1.3.2. Management

The HCRs described in Intertek (2015) were incorporated into the 2015–2019 WMP (Kayle et al. 2015) and are no longer considered as interim. Informed by the assessment analysis, they were the basis of harvest advice from 2016 to 2018.

The WTG continues to apply the HCR as identified in the Lake Erie WMP 2015–2019 (Kayle 2015):

- Target fishing mortality of 60% of the maximum sustainable yield (60%F_{msy}).
- Threshold limit reference point of 20% of the unfished spawning stock biomass (20%SSB_0).
- Probabilistic control rule, P-star, P*= 0.05.
- A limitation on the annual change in TAC of ± 20%.

The LEPMAG developed and updated the walleye model, which the WTG began using in 2013. The model includes 1) estimating selectivity for all ages without the assumptions of known selectivity at age; 2) integrating age 0 trawl-survey data in the model; 3) a multinomial distribution for age composition; and 4) time-varying catchability using a random walk for fishery and survey data, including the age 0 trawl survey. Instantaneous natural mortality (*M*) is assumed to be constant (0.32) among years and ages (ages 2 through 7 and older). Abundances at age were derived from estimated parameters by using an exponential survival equation.

The WTG used results from the 2019 integrated SCAA model to estimate an abundance of 45.338 million age 2 and older walleye in 2019 and the harvest control policy described above to calculate a RAH for 2019 of 8.683 million walleye (Table 6) (WTG 2019). The target fishing rate (60%F_{msy} = 0.334) in the harvest policy was applied since the probability of the projected spawner biomass in 2020 (56.410. million kg) falling below the limit reference point (20%SSB_0 = 12.184 million kg) after fishing at 60%F_{msy} in 2019 was less than 5% ($P < 0.05$). Thus, the probabilistic control rule (P*) to reduce target fishing rate and conserve spawner biomass was not invoked during the 2019 determination of the RAH (WTG 2019). In addition to the RAH, the HCR adopted by LEPMAG limits the annual change in TAC to ± 20% of the previous year's TAC. According to this rule, the maximum change in TAC would be plus or minus 20% of the 2018 TAC of 7.109 million fish, and the range in 2019 TAC calculated by the WTG for LEC consideration would be from 6.504 million fish to 8.531 million fish, with the upper being chosen (Table 6) (WTG 2019).

The 2015–2019 WMP (Kayle et al. 2015), which was published after the MSC assessment (Intertek 2015), is a significant revision of the original 2005 plan. This plan outlines the management structure, fishery objectives, and on-going harvest strategy. The strategy was based on significant effort on an MSE prior to release of the

plan. The MSE and WMP greatly benefited from stakeholder input during development, and this continues. The WMP also includes an ongoing review process, with an evaluation of the plan performed in 2018. At that time, the LEC determined that no change to the WMP was required, so it was announced that the plan would be extended for 5 years, to 2024, and a performance evaluation would be conducted then. The LEC considered that the plan was working well, and recruitment of the species was strong as a result of the 2014 and 2015 year classes, and now the 2018 year class also appears to be large (Figure 6). The fishery is performing well, and current research, described later, will contribute new information, which will be completed and incorporated into the next plan. The LEC will continue to monitor data trends to ensure ongoing sustainability of the walleye population and associated fisheries.

5.1.3.3. Supporting Information

The most recent WTG assessment updated the previous SCAA analyses (Intertek 2015), with no major changes (WTG 2019). In 2019, the WTG addressed the second major charge from the LEC STC to improve the working knowledge through research into Lake Erie walleye population assessment model estimating and forecasting by addressing specific topics involving 1) movement, migrations, and spatial ecology; 2) stock structure; 3) recruitment; 4) natural mortality; 5) habitat association; and 6) dataset management (WTG 2019). A brief description of these and a progress update on these ongoing initiatives follows. As indicated, new insights for improving walleye stock assessment will be integrated into the next WMP.

- **Movements, migration, and spatial ecology.** Since 2011, WTG members have collaborated in numerous Great Lakes acoustic telemetry studies across Lake Erie. These involved seven walleye studies and 3,000 acoustically tagged fish. Objectives vary, but generally all focus on aspects of the following: 1) determining movements of various walleye spawning populations; 2) examining spawning-site fidelity and estimating mortality rates; 3) characterizing harvest of both recreational and commercial fisheries. All projects used the GLATOS network, and the data generated will address long-standing charges, particularly related to eastern-basin walleye.
- **Stock structure.** A major gap in information around walleye stock structure involves understanding the interaction between western- and eastern-basin stocks. The specific goals of these initiatives are to 1) document occupancy and migration rates among spawning stocks; 2) understand the relationship of spawning stocks to lake-wide fisheries; 3) understand the contribution of different stocks to fishery-independent indices of abundance. Acoustic telemetry will play an important role, but other complementary studies are underway, employing genetics and otolith microstructure.
- **Recruitment.** Multiple walleye stocks exist in Lake Erie, with stock productivity decreasing from west to east. Migrations and mixing among stocks make it difficult to evaluate individual stock productivity. For example, adult walleye spawning in the western basin in spring migrate to the cooler waters of the central and eastern basins in summer and return to spawn in the western basin the following spring. Juveniles in the western and eastern basins are believed to disperse during spring and summer. However, it is not known whether their movements are similar to those of adults. Standardized gill netting has been conducted since 2011 to better understand basin-specific densities of yearling walleye. Some of the details around these index netting programs are documented in WTG (2019). In 2018, yearling walleye catches occurred lake-wide where index nets were fished, but densities were very low along the north shore of the eastern basin. Other specific trends were observed, which will require further analysis. Currently, the young-of-the-year index from the inter-agency western basin bottom-trawl survey is integrated with the SCAA model to estimate age 2 walleye abundance and to forecast recruitment. The bottom-trawl survey is considered to be a robust recruitment predictor, although inclusion of additional young-of-the-year and yearling indices to form a composite recruitment index could supplement recruitment estimates. However, two factors limit this integration. First, yearling indices are not available far enough in advance, and secondly, spatial, temporal, and gear-type variability exist in walleye young-of-the-year and yearling indices. The WTG will continue to update the dataset of the recruitment indices, but composite walleye recruitment indices will not be presented until concerns related to data transformations, missing years, and recent

index-gear configurations are addressed. The WTG will continue to evaluate recruitment-estimation approaches for their eventual adoption into future Lake Erie walleye management plans.

- **Natural mortality (*M*).** The WTG is charged with improving the SCAA model, and this involves evaluating alternative estimates of natural mortality by using a structured approach. Over the years, a number of Lake Erie studies have addressed this problem. References to publications associated with these can be found in WTG (2019) and are very generally described here. For example, the current SCAA model assumes that natural mortality is 0.32, or 27%, annually. This was derived from jaw-tagging studies begun in 1978 and continuing for decades. Various methods have been used to test reporting rates and tag loss. The estimated natural mortality for eastern basin walleye, using the inter-agency walleye tag data and the program MARK, was estimated to be M = 0.22. Natural mortality was found to decline with age and vary regionally with various movement scenarios. Analysis of walleye PIT-tag data produced M = 0.29. Integrated tag catch-at-age analysis (ITCAAN) models, using inter-agency walleye tagging data from Lake Erie and connecting waters, estimated natural mortality to be 0.15 in the western basin and 0.31 in the eastern basin. Recent Bayesian analyses show that time and age varying estimates provided the best model fit. Acoustic telemetry studies monitoring walleye throughout Lake Erie and connecting waters offer a unique approach for estimating survival and mortality. With expanding acoustic tagging, future analyses of these data should provide valuable insights concerning natural mortality of walleye in Lake Erie. These studies and associated decision analyses will provide important additional insights for parameterizing walleye catch-at-age models.
- **Habitat associations.** Understanding walleye habitat associations is important in establishing walleye fishery quotas. They are currently based on a presumed preferred bottom depth of < 13 m. However, there is limited evidence to support this. Acoustically tagged walleye associated with two ongoing GLATOS projects are being used to investigate bottom depth preference of walleye throughout their seasonal lake-wide migrations. Data from more than 1,000 individuals for 5 years are being examined to determine bottom depth preference associated with such variables as stock, sex, and age in the western and eastern basins. Seasonal variability is being found. Shallow water, < 6 m deep, is preferred during the spawning period and deeper water >13 m during summer and fall, with winter preferences in the moderate depth range of 7–13 m. Stock differences may exist; however, the studies highlight that for approximately half the year, walleye live in areas not previously defined as walleye habitat by using a preferred bottom depth of < 13 m. These ongoing insights will better define walleye habitat for future management of the species in Lake Erie.
- **Dataset management.** WTG members currently manage and maintain several fishery-dependent (harvest) and fishery-independent (population) assessment survey data series collected by the various agencies. These long-term databases are very important for trends and status evaluations, for estimating population size and abundance, for using SCAA analysis, and for the decision-making process regarding RAH. Maintenance and updating of these datasets is an important and ongoing role of the WTG.

5.1.4. Stock Assessment, Status and Management Summary

In 2019, the target species, yellow perch and walleye, remain well managed in Lake Erie as shown by specific evidence that these populations and the associated fisheries are sustainable and that the HCRs are being applied appropriately and met. A recent perspective on Lake Erie by Zhang et al. (2018) provides additional insights in a publication entitled ‘Failure to detect ecological and evolutionary effects of harvest on exploited fish populations in a managed fisheries ecosystem’, reviewing evidence that effective fisheries management is capable of rebuilding and/or maintaining sustainable populations and fisheries.

5.2. Ecosystem (P2) Updates

No significant changes in ecosystem effects were indicated that would impact the current P2 scores of the fishery beyond the updates shown below. P2 and PI level scores updated last in the 3rd Surveillance activities are maintained.

5.2.1. Updates on retained and bycatch species

Updated species catch profiles to 2018 have been provided by the client for all the UoCs in the assessment. As for previous years, these include data on all retained/released species in the yellow perch small mesh (<89mm) gill net fishery (QZ1, QZ2, QZ3-W, QZ3-E), the walleye large mesh (> or =89mm) fishery and the Ohio yellow perch (MU1, MU2 and MU3) trap net fishery. The retained and bycatch species associated with the yellow perch and walleye fisheries remain consistent with those identified and assessed in the original 2015 certification report (Intertek, 2015).

Update on previously closed conditions

Update on P2 conditions closed in the previous (3rd) surveillance to ensure the reason for closure is still valid.

Condition YP3 was closed during the 3rd surveillance activities, requesting a partial strategy to manage main retained species: channel catfish and freshwater drum. A Productivity Susceptibility Analysis (PSA) was carried out for both species during the 2nd surveillance activities resulting in a low risk and a PSA- derived MSC score of >80. Updated data for 2018 was provided. The 2018 MU1 catch of freshwater drum was 5.09% (and 5.12% in 2017) while the catch of channel catfish was 8.01% (4.28% in 2017). As specified in the previous (3rd) surveillance report: "*MSC CR v1.3 was not specific as to when a partial strategy 'does not hinder recovery or rebuilding'. This has been clarified in CR v2.0 (s. SA3.4.6 d. and guidance) to include circumstances where the combined catch by all MSC UoAs with the species as a 'main' component relative to the total catch is not influential in hindering recovery in a marginal sense – taken as <30% of the total catch. As the catches of both FWD and CC in the small-mesh YP-directed fishery are far below 30%, the partial strategy of status quo fishing activity, including the various management measures employed in the fishery, is considered sufficient.*" This evaluation is still considered valid, based on available catch data.

Condition YP4 was closed during the 3rd Surveillance activities and originally requested that by the third annual audit, data disaggregated by MU be provided showing the amount of each species released as a proportion of total catch. This was done. Updated disaggregated information for 2018 for MU1, MU2 and MU3 was also provided by the client as part of this 4th surveillance. The discarded catch is largely consistent between 2017 and 2018 and almost all released bycatch makes up less than 1% of the total catch. The most significant data was that for released channel catfish averaging 3.41% in 2017-18. The other significant released species is white perch averaging 2.84% in 2017-18 in MU1. As an invasive species, white perch is not assessed. Furthermore, as highlighted in the 3rd surveillance report, post-release survivorship has been shown to be very good for most of these freshwater species.

Condition WE1 on the status and management of the retained lake whitefish in the large mesh walleye fishery was closed during the 3rd Surveillance activities. The percentage of lake whitefish catch in 2018 continues to be very low and was estimated at 0.4% of the total large mesh catch effort. This is still consistent with last year findings. As shown below, the Lake Whitefish spawning stock biomass (SSB) estimate for 2017 provided by the client group showed a projected increase in between 2018 and 2020 and a biomass above selected reference points.

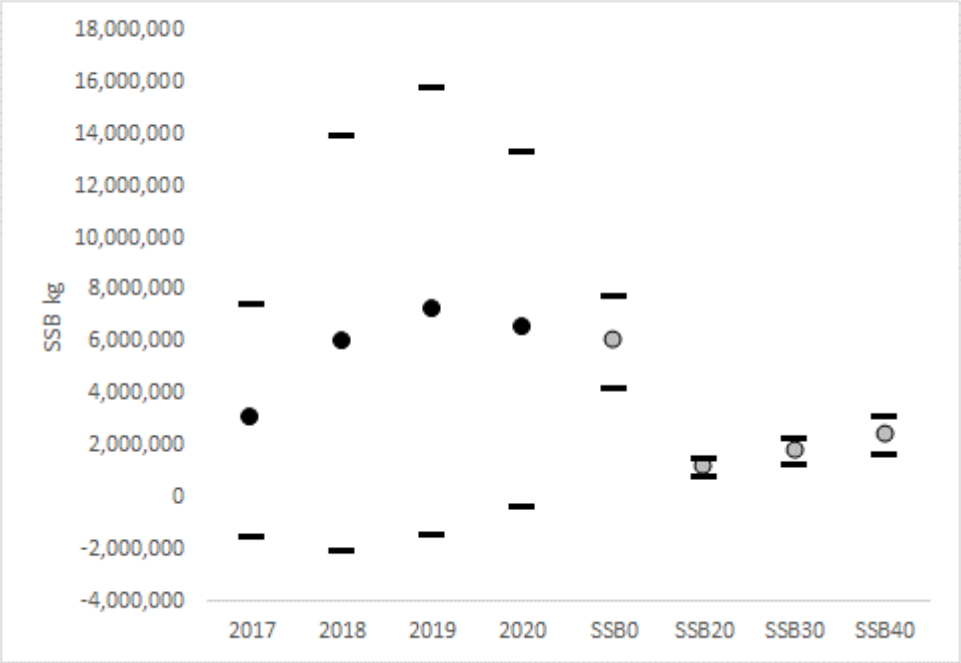


Figure 8. Lake Whitefish spawning stock biomass (SSB) estimate for 2017 and projections for 2018-2020 (black dots) assessed using a statistical catch-at-age (SCA) model built in Auto Differentiation Model Builder (ADMB Project, 2015) modified from the WTG SCA model used between 2001 and 2014 (Walleye Task Group, 2001). Limit reference points (grey dots) shown for unfished spawning stock biomass (SSB_0), and for 20%, 30%, and 40% of SSB_0. 95% confidence limits are presented about the estimates. Data provided by the Client.

Condition WE2 on the partial strategy implementation for lake whitefish and white bass in the large mesh walleye fishery was closed during the 3rd Surveillance activities. Together with a range of management measures in place considered suitable for the management of these species, evidence was provided to show that both lake whitefish and white bass were considered highly likely to be within biological limits (Lake Whitefish and White Bass stock assessment report provided by the Client). Lake whitefish catch in 2018 was 0.4% of the total, while white bass catch was 16.77% of the large mesh effort.

5.2.2. ETP Species updates

5.2.2.1. Catches

No catches of Lake chubsucker and Spotted Gar were recorded in the UoCs in question in 2018, based on catch information (derived from Daily Catch Reports) provided to the team by the Client.

5.2.2.2. Management

Ontario - Proposed Revisions to the Canadian Endangered Species Act

In January 2019[1], the government launched a consultation on how best to update the Endangered Species Act to improve the effectiveness of the program for species at risk by ensuring Ontario's endangered and threatened species protections include advice and species' classifications from an independent scientific committee and modern approaches to enforcement and compliance; species and habitat protections; and recovery planning.

[1] https://ero.ontario.ca/notice/013-5033

On April 18, 2019, the Ministry of Environment, Conservation and Parks (MECP) posted a summary of proposed amendments to Ontario's Endangered Species Act, 2007 (Act)[2]. The proposed amendments follow the transfer of the administration of the Act from the Ministry of Natural Resources and Forestry (MNRF) to the MECP effected by Order-in-Council on October 22, 2018. The proposed changes include[3]:

- enhancing government oversight and enforcement powers to ensure compliance with the act;
- improving transparent notification of new species' listings;
- appropriate consultation with academics, communities, organizations and Indigenous peoples across Ontario on species at risk recovery planning; and
- creating new tools to streamline processes, reduce duplication and ensure costs incurred by clients are directed towards actions that will improve outcomes for the species or its habitat.

The proposed changes follow under the following five categories:

1. Assessing species at risk and listing them on the Species at Risk in Ontario List
2. Defining and implementing species and habitat protections
3. Developing species at risk recovery policies
4. Issuing *Endangered Species Act* permits and agreements, and developing regulatory exemptions
5. Enforcing the *Endangered Species Act*

Ohio - Revisions to the US Endangered Species Act (ESA)

In 2017, the US Fish and Wildlife Service and NOAA Fisheries sought public input on how the federal government could improve upon the regulatory framework. As a result of this process, they received substantial input from a wide range of stakeholders on modernizing the implementation of the Endangered Species Act (ESA) in order to improve collaboration, efficiency, and effectiveness. As a result of this, the U.S. FWS and NOAA Fisheries have jointly announced revisions to regulations that implement portions of the ESA, as part of the August 2019 Trump Administration move to modify application of the ESA.

Firstly, the agencies are finalizing changes to some of the parameters under which other federal agencies must consult with the Service and NOAA Fisheries to ensure their actions do not jeopardize the continued existence of listed species, or destroy or adversely modify critical habitat. The agencies are also finalizing various measures to clarify and improve some of the standards under which listings, delisting, and reclassifications, and critical habitat designations are made.

Additionally, the Service is changing its approach to applying protections to threatened species to align its practice with NOAA Fisheries so the two agencies are consistent in their application of this provision of the ESA. The Service is removing its blanket rule under section 4(d) of the ESA that automatically conveys the same protections for threatened species as for endangered species[4]. This change will not affect the protections for species currently listed as threatened but will have an effect on future Threatened status listings since species will be listed on a species by species basis. Another change to the ESA deals with the removal of language explicitly prohibiting the consideration of the economic impacts of listing a species. However, FWS has stated will continue to rely only on the best available science when determining whether a species should be listed[5]. A number of environmental groups have filed a lawsuit to stop the changes, and several state attorneys general have done the same [6] [7]. The revised ESA became active on the 26th September of 2019.

These policy revisions do not appear to be likely to result in significant changes of ETP species management in either Ontario or Ohio.

[2] https://www.lexology.com/library/detail.aspx?g=14728bbb-d7fd-4d1c-9189-1c82f158ad72
[3] https://ero.ontario.ca/notice/013-5033
[4] https://www.fws.gov/endangered/improving_ESA/regulation-revisions.html
[5] https://www.nature.com/articles/d41586-019-02439-1
[6] https://www.nature.com/articles/d41586-019-02439-1
[7] https://news.stanford.edu/2019/09/26/endangered-species-act-changes/

5.2.3. Habitat updates

The Lake Erie Habitat Task Group (HTG) published their annual report in March 2019[8]. In the document they discuss recent work that entailed a three-step approach to systematically derive Priority Management Areas (PMAs) important to Lake Erie. In Step one, information on functional habitats by life stage and stock for all desired fish species was collected from technical experts around Lake Erie resulting in the creation of Habitat Actions (HA). Desirable fish species included yellow perch and walleye but also several other species commonly caught in the lake. Limiting habitat components were identified within each function habitat, their status (impeded or not), sources of impediments and proposed habitat actions with estimates time to implement, if applicable. Step two involved prioritization criteria while step three used a three-stage scoring process to identify PMAs. PMA scoring identified 12 functional habitats as very high priority (>90%), and 15 high priority PMAs (75-90%), illustrated below.

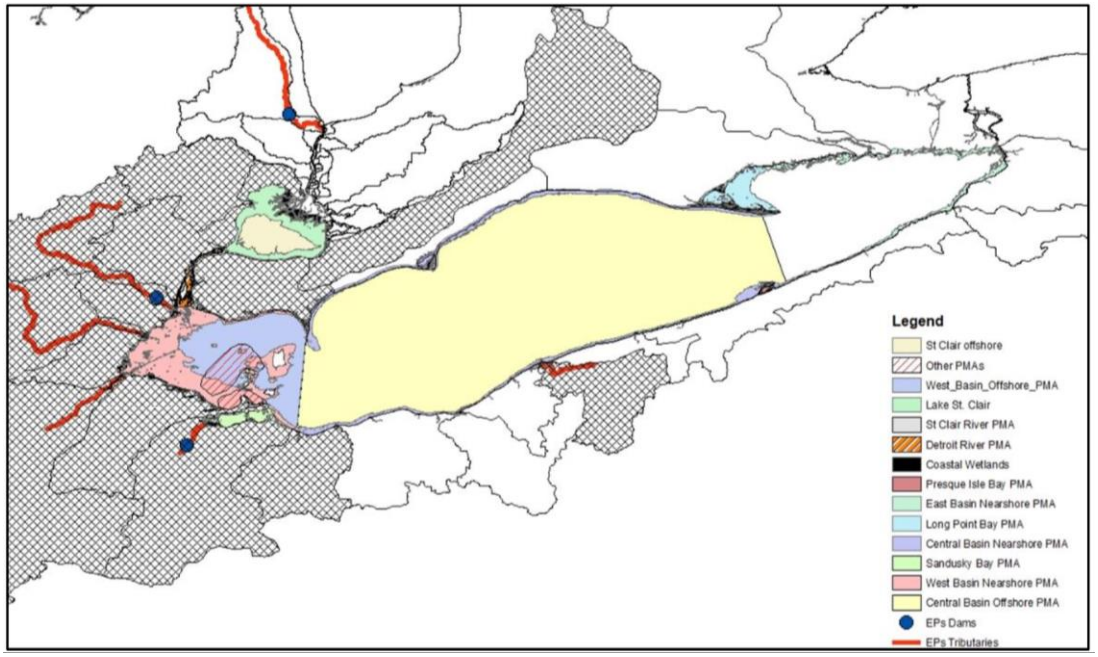


Figure 9. A map of very high and high priority PMAs in the Lake Erie Basin based on the PMA scoring.

The PMAs is set to guide fisheries value in strategic plans such as the lake wide action plan and is being used in the development of the 2019-2023 Lake Erie-Lakewide Action Management Plan (LAMP)[9], which itself was up for public review and comment until the 26th of August 2019.[10]

The HTG and Great Lakes Aquatic Habitat Framework (GLAHF) will collaboratively explore ways to transition the PMA dataset into a geospatial framework. This will increase the power of the approach by minimizing effects the weighting of information in well studied Functional Habitats and improve the accessibility of the data for fisheries biologist, managers and other environmental organizations by enabling better data visualization.

There are several other habitat related projects that take part in Lake Erie where the HTG tends to be central or a partner of. Details for these projects can be found in the yearly HTG reports. The 2019 HTG report includes project overviews for 9 different habitat and research projects underway or completed in medium to high PMAs across the Lake Erie basin[11]. These projects are:

[8] http://www.glfc.org/pubs/lake_committees/erie/HTG_docs/annual_reports/HTG_AnnualReport2018.pdf
[9] https://binational.net/wp-content/uploads/2019/06/Draft-Lake-Erie-LAMP-061819-English.pdf
[10] https://binational.net/2019/06/27/2019-erie-lamp-paap/
[11] http://sealamprey.info/pubs/lake_committees/erie/HTG_docs/annual_reports/HTG_ExecutiveSummary2019.pdf

- Reef Restoration and Maturation in the St. Clair-Detroit River System, Michigan-Ontario
- Biological and Habitat Assessment of the Lower Rouge River, Michigan
- Clinton River Mouth Ecosystem Restoration Project, Michigan
- Henry Ford Estate Dam fish passage to the Rouge River, Michigan
- Celeron and Stony Islands Habitat Restoration, Michigan
- Removal of the Ballville Dam on the Sandusky River, Ohio
- Maumee River Sturgeon Restoration, Ohio
- Remediating the effects of the Dunnville Dam on the Grand River, Ontario
- Niagara River Habitat Restoration Projects, New York

For Lake Erie, a Basin and Lake-Wide Habitat-Related Project Inventory is also available for viewing at: http://www.glfc.org/pubs/lake_committees/erie/spatial_inventory/basin_lake.html

A recent habitat related project is the current Lake Erie Lake Trout Movement project (code LELTM) with project duration spanning from March 2016 to December 2021[12]. This is summarised here. The Lake Erie Fish Community Goals and Objectives state that "the goal for the eastern basin is a balanced cold-water community with Lake Trout as the dominant predator." Native Lake Trout stocks were extirpated from Lake Erie approximately 50 years ago and restoration efforts have been ongoing since the mid-1980s. The Lake Erie Committee's "Strategic Plan for the Rehabilitation of Lake Trout" identifies three strategies for reaching the management objectives: 1) increasing stocking rates of yearlings, 2) maintaining Sea Lamprey abundances to prescribed levels, and 3) identifying potential Lake Trout spawning habitat. The first two strategies are addressed on an annual basis by the management agencies; however, the ability to address the third strategy has lagged. From 2006 to 2011, members of the Lake Erie Habitat Task Group combined efforts to conduct high resolution substrate mapping and underwater photography of potential Lake Trout spawning reefs within the eastern basin. This effort resulted in substrate classifications, bathymetry measures, and measures of connectivity to potential nursery areas. While this information indicated that potential spawning habitat existed in the eastern basin, the authors highlighted that movement data would provide the connection needed between spawning habitat and Lake Trout use. Lake Erie's existing acoustic receiver infrastructure presents an exceptional low-cost opportunity to detect Lake Trout movements during the spawning season as well as through all seasons. Thus, this project will also inform seasonal inter-basin movements of Lake Trout. Anecdotal evidence surprisingly suggests that the western basin reefs and the Detroit River historically provided important spawning habitat for Lake Erie Lake Trout. Whether mature feral hatchery lake trout migrate to these areas during the spawning season is unknown. Lastly, an understanding of western basin versus eastern basin reef occupancy during spawning times will help inform potential stocking locations in the future. The ability to rehabilitate Lake Erie Lake Trout is hindered until more information on spawning habitat occupancy and seasonal movements are quantified.

5.2.4. Ecosystem Updates

5.2.4.1. Recent Ecosystem Monitoring Activities

Long-term, basin-wide monitoring programs for habitats and species are conducted by federal, state, provincial agencies and their partners. The Lake Erie Biodiversity Conservation Strategy provided a health assessment of eight conservation features that represent the lake's biological health (Pearsall et al. 2012).

A summary of recent survey indexes are provided below, as reported in the Report of the Lake Erie Forage Task Group, 2019 [13].

[12] https://glatos.glos.us/home/project/LELTM
[13] http://www.glfc.org/pubs/lake_committees/erie/FTG_docs/annual_reports/FTG_report_2019.pdf

5.2.4.2. LTL Monitoring

The lower trophic level monitoring (LTLA) program has measured nine environmental variables at 18 stations around Lake Erie since 1999 to characterize ecosystem trends.

The Trophic State Index, which is a combination of phosphorus levels, water transparency, and Chl a measures, indicate that the western basin is slightly above the targeted mesotrophic status, the central basin is within targeted mesotrophic status, which favors percid production, and both the nearshore and offshore waters of the eastern basin are oligotrophic (Figure 10). Trends across Lake Erie in recent years indicate that overall productivity has slowly declined since 2010. Low hypolimnetic dissolved oxygen continues to be an issue in the central basin during the summer months.

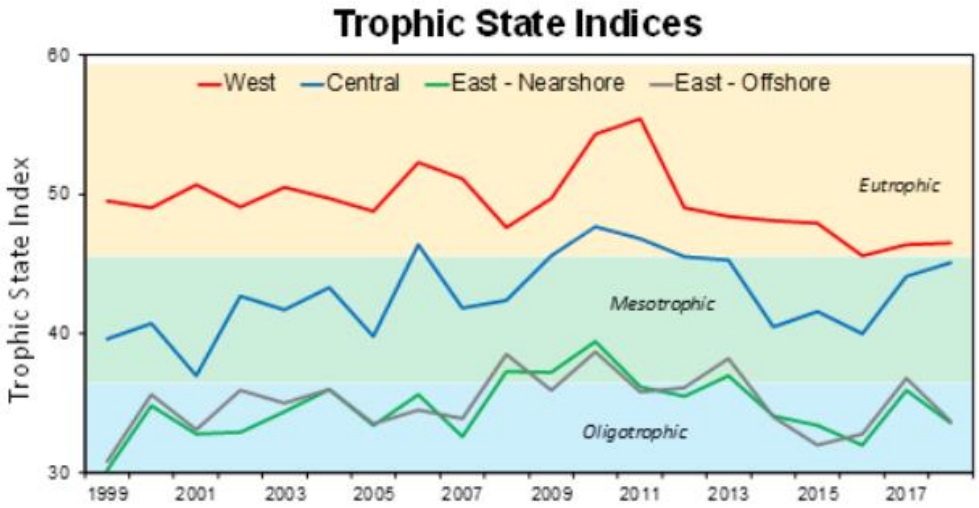
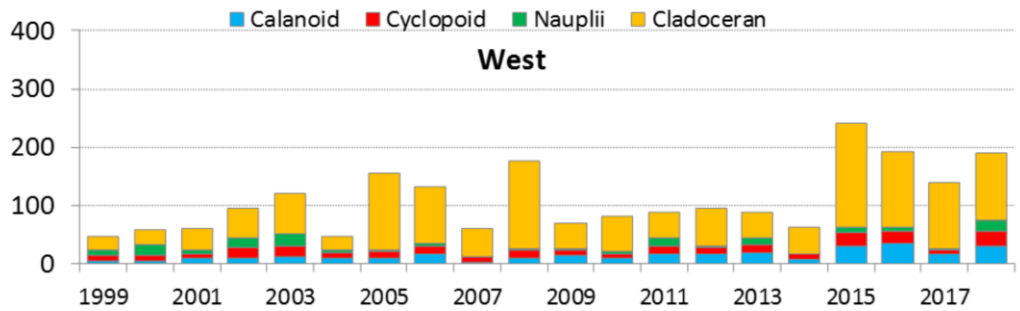


Figure 10. Trophic State Indices of Lake Erie 1999-2018.

5.2.4.3. Zooplankton Biomass in Lake Erie

Mean zooplankton biomass varies among basins and years. In the west basin, the 2018 average biomass was 190.8 mg/m3, which was the third highest value in the time series and well above the long-term mean of 105.9 mg/m3. Cladocerans (small crustaceans commonly called water fleas) provide the bulk of the biomass of zooplankton in the west basin although increases in both calanoid and cyclopoid copepods have been observed in recent years. In the central basin, the 2018 mean zooplankton biomass was 94.6 mg/m3, which was less than the long-term mean biomass (129.4 mg/m3).

Zooplankton biomass in the central basin has been stable over the past five years. Looking at larger trends, there appeared to be a gradient of high zooplankton biomass in the west and lower biomass in the east from 2000 to 2007. From 2009 through 2013, zooplankton biomass increased in the central and east basins, but shifted back to the west basin in 2015 with declines observed in the central and east basins. Cladocerans are typically more dominant in the west basin zooplankton community and decline to the east while calanoid and cyclopoid copepods tend to be higher in biomass in the central and east basins (Figure 11).



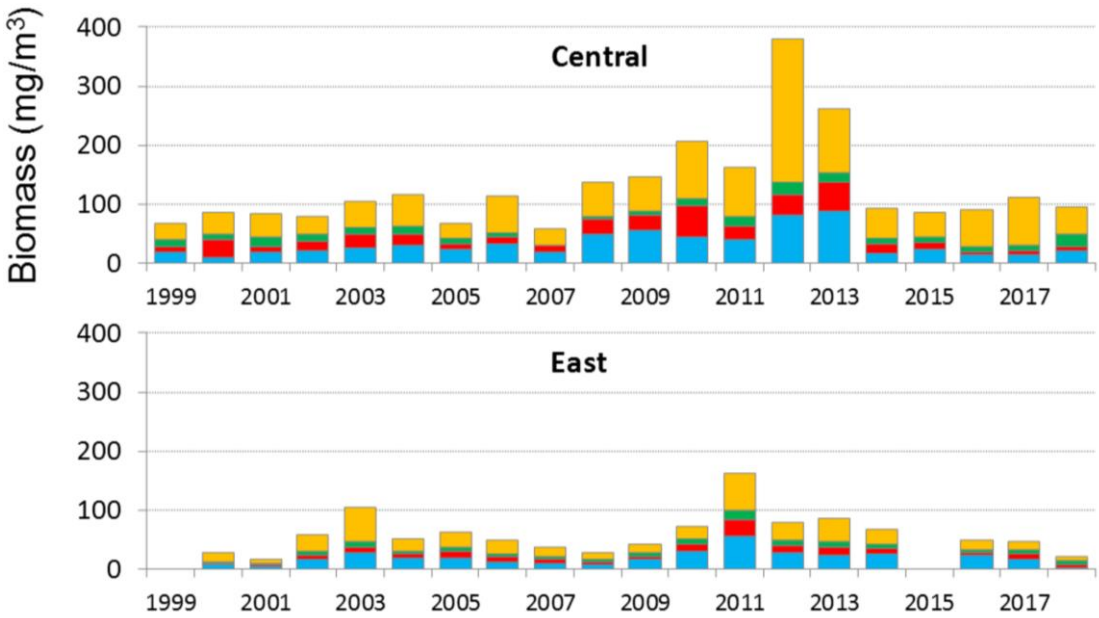


Figure 11. Mean zooplankton biomass (mg/m3) by major taxonomic group by basin, 1999 through 2018. There is no data for 1999 and 2015 in the east basin. West basin includes stations 3 through 6, central basin stations 7 through 12, and east basin stations 15 through 18. Data excludes rotifers and veligers. Harpacticoid zooplankton comprise a miniscule biomass for most years and are not included in the graph.

Additional information on the status of forage species across Lake Erie's East, Central and Western Basin is available in the Lake Erie Forage Task Group report, 2019 [14].

5.2.4.4. 2019 Lake Erie Cooperative Science and Monitoring Initiative (CSMI)

Each year, one of the Great Lakes is the focus of a binational cooperative science effort called the Cooperative Science and Monitoring Initiative (CSMI). In 2019, Lake Erie was the focus of the CSMI field year[15]. The priority science and information needs identified for this intensive field year include understanding of: drivers of eutrophication and harmful and nuisance algal blooms; distribution of critical habitats for species; distribution of contaminants in air, water, sediment and the food web; and the role of storm events on beach water quality. These priorities were developed during a series of meetings and workshops held in 2017 that brought together U.S. and Canadian Lake Erie experts from research and management organizations.

5.2.4.5. Food web dynamics

Ives et al. 2018[16] highlighted that for the past century, Great Lakes fishery management has undergone a slow evolution from single species towards an ecosystem-level focus (e.g., Guthrie, 2017). Evidence of changes include investment, since 2002, in an international coordinated science and monitoring initiative program (e.g., Richardson, Warren, Nielson, & Horvatin, 2012) to focus on whole food-web sampling of each Great Lake on a rotational cycle, incorporation of fish and fish habitat into the 2012 GLWQA, and the ongoing development by Great Lakes fishery managers of ecosystem objectives to complement fish community objectives (http://www.glfc.org/joint-strategic-plan-committees.php). While managers recognise that the lower food web responds more rapidly to environmental and anthropogenic modifiers and precedes—sometimes by a decade—shifts in top predators, there continues to be a need for both a systematic means of interpreting and tools for acting on such food-web changes (e.g., trophic cascades, nutrient loadings, or shifting production among habitats).

[14] http://www.glfc.org/pubs/lake_committees/erie/FTG_docs/annual_reports/FTG_report_2019.pdf
[15] https://binational.net/wp-content/uploads/2019/03/LE_LAMP_AR_2018_final.pdf
[16] https://onlinelibrary.wiley.com/doi/full/10.1111/fwb.13203

Traditionally, Laurentian Great Lakes fishery management issues and associated levers have often been evaluated and implemented from a top-down perspective, focusing on stocking and harvest policy. By contrast, from a water quality perspective, the reverse is true; water quality managers often focused on nutrient input effects on chemical composition of the lakes. These top-down and bottom-up approaches have yet to merge to form a more holistic view of the health of the Great Lakes ecosystem. Ives et al. 2018 explains that for example, during the early 2000s, the Lake Erie Committee explored establishing a harvest strategy for yellow perch using a suite of ecosystem-state indicators. This effort ultimately was not adopted by the Committee due to a lack of explicit linkage between lower food-web dynamics, ecosystem state indicators, and fishery production, and difficulties in easily communicating these linkages to stakeholders.

The Ives et al. 2018 synthesised conceptual model essentially provides resource managers a tool to more systematically interpret how lower food-web dynamics influence harvestable fish populations, and vice versa, and to act accordingly such that sustainable resource practices can be achieved[17].

5.2.4.6. Ecosystem Models

Zhang et. al. 2019[18], modified an Ecopath with Ecosim (EwE) food web model[19] to assess the impacts of three aquatic invasive species on the Lake Erie foodweb, Eurasian ruffe *Gymnocephalus cernua*, killer shrimp *Dikerogammarus villosus*, and golden mussel *Limnoperna fortune*. Their findings highlighted that while all three species may induce negative effects if introduced to Lake Erie, golden mussels may pose the highest risk of impact for Lake Erie's food web.

5.2.4.7. Lake Erie status and trends for habitat and species

In 2019, a summary of the Lake Erie status and trends for habitat and species was provided by the State of Great Lake indicator (ECCC and U.S. EPA 2019)[20]. The condition of Lake Erie's habitats and species indicators is variable, ranging from "poor" to "good", with varying trends from "deteriorating" to "improving" (Table 7).

Table 7. Summary of the Lake Erie status and trends for habitat and species by the State of Great Lake indicator (ECCC and U.S. EPA 2019).

FEATURE	INDICATOR	STATUS	TREND
Coastal Wetlands	Plants	POOR	UNCHANGING
	Birds	FAIR	UNCHANGING
	Amphibians	POOR	UNCHANGING
Native Migratory Fish	Lake Sturgeon	POOR	IMPROVING
	Walleye	GOOD	UNCHANGING
	Aquatic Habitat Connectivity	FAIR	IMPROVING
Open Water Species	Zooplankton	GOOD	UNCHANGING
	Prey fish	POOR	DETERIORATING
	Lake Trout	FAIR	IMPROVING
Native Migratory Birds	Colonial Nesting Water Birds	FAIR	UNCHANGING

For further details please refer to the 2019-2023 LAMP report.

[17] https://onlinelibrary.wiley.com/doi/full/10.1111/fwb.13203
[18] https://link.springer.com/article/10.1007/s10530-019-01929-7
[19] https://www.tandfonline.com/doi/full/10.1080/00028487.2015.1069211
[20] https://binational.net/wp-content/uploads/2019/06/Draft-Lake-Erie-LAMP-061819-English.pdf

5.2.4.8. Lake Erie Lakewide Action and Management Plan (LAMP) 2019-2023

The LAMP is a binational, five-year ecosystem-based strategy for restoring and protecting the water quality of Lake Erie and the St. Clair-Detroit River System. The latest LAMP was published in 2019 and has objective for the Lake until 2023[21].

The Lake Erie LAMP fulfills a United States and Canadian commitment under the 2012 Great Lakes Water Quality Agreement (the Agreement) to assess ecosystem conditions, identify environmental threats and appropriate actions to address these threats, and set priorities for research and monitoring. The Agreement recognizes that the best approach to restore the Lake Erie ecosystem and improve water quality is for the two countries to adopt common objectives, implement cooperative programs, and collaborate to address environmental threats.

The Lake Erie Partnership actively works to ensure that management actions identified in this LAMP are complementary to other international management efforts established under various binational treaties, agreements, and programs (e.g. International Joint Commission Activities, Water Withdrawals Management, fishery management with the Great Lakes Fishery Commission and its LEC) which also work within the Lake Erie ecosystem.

Objective 5 of the Lake Erie LAMP fulfills the Great Lakes Water Quality Agreement by setting a goal to support healthy and productive wetlands and other habitat to sustain resilient populations of native species.

5.2.4.9. Diet studies

Ontario is currently carrying out a diet study relating to the Lake Erie foodweb with results expected in 2020 (Kevin Reid, OCFA, pers. comm., September 2019).

5.2.4.10. Ecosystem Updates Summary

Overall, no significant changes in ecosystem effects were indicated that would impact the current P2 scores of the fishery beyond the updates shown below.

[21] https://binational.net/wp-content/uploads/2019/06/Draft-Lake-Erie-LAMP-061819-English.pdf

5.3. Management System (P3) Updates

The information included in the following sections represents previously unreported information as well as reported changes to the overall management system for the fishery since the 3rd surveillance audit. The information was provided by representatives of the client group and by individuals with organizations that have responsibilities for the management of the multispecies commercial fishery in both Ontario and Ohio, and was compiled based on a Client Document Checklist that was prepared in advance of the off-site surveillance conference call on 10th October. The Assessment Team also collected relevant information that was housed on various government and public websites.

5.3.1. Consultation and Engagement – Update

Organizations involved with the management of Lake Erie's fisheries and ecosystems regularly interacted with stakeholders and the general public via meetings, conferences, roundtables and open houses. A number of stakeholder meetings were held or were scheduled following the publication of the 3rd surveillance audit report. These sessions are of great importance in that they afford interested parties the opportunity to convey and receive information on a broad suite of programs and activities of relevance to Lake Erie's fisheries and ecosystems, to build and sustain professional relationships, to consider the need for or impacts associated with changes to the legal and management system for the fisheries, to solicit feedback on the performance of the fisheries, and to resolve potential disputes.

Table 8 includes a list of the various meeting venues that were announced on the sponsoring host's website. The list is not necessarily inclusive of all scheduled meetings.

Table 8. Consultations and engagements with stakeholders and the public.

Dates	Forums	Locations
April 11	State of Lake Erie meeting	Hamburg, NY
June 12	Quarterly meeting of Ohio Lake Erie Commission	Cleveland, OH
June 17 - 19	Great Lakes Public Forum	Milwaukee, WI
June 18	Public meeting - International Joint Commission	Milwaukee, WI
July 10, August 8, September 11 and October 9	Open houses - Ohio Wildlife Council	Various
June - October	Public roundtables and meetings - International Joint Commission	Various
September 11	Great Lakes Areas of Concern Conference	Cleveland, OH
September 18	Quarterly meeting of Ohio Lake Erie Commission	Lorain, OH
October 9 - 11	Annual meeting – Great Lakes Commission	Québec City, QC
October 29	Semi-annual meeting – Council of Lakes Committee (closed)	Romulus, MI

5.3.2. Enforcement – Update

Ontario's commercial fishery regulations are enforced by a corps of Conservation Officers whose appointment and authorities are set out in Sections 86 to 96 of the *Fish and Wildlife Conservation Act, 1997.* Their responsibilities are supported by a third-party group of Port Observers who oversee the offloading of catches at designated ports.

In Ohio, the ORC stipulates that the Director of Natural Resources may appoint Natural Resources Officers (also known as Wildlife Officers) for purposes of custodial or patrol service on lands and waters owned, controlled, maintained, or administered by the Department of Natural Resources under Chapters 1503, 1517, 1546, and 1547 of the ORC. The authorities of the state's Wildlife Officers are defined at Chapter 1531.13 of the Code and further outlined in the Law Enforcement Operations Manual of the ODNR's Division of Wildlife (Sections 1 and 2)[22]. The division includes a Lake Erie Enforcement Unit (Section 3-3) which is also responsible for the issuance and management of the lake's commercial fishing trap net licences (Section 10).

[22] ODNR Commercial Fishing Law Digest:
http://wildlife.ohiodnr.gov/portals/wildlife/pdfs/publications/laws%20&%20regs/Pub%205501%20Law%20Ops%20Manual.pdf

Monitoring, control and surveillance (MCS) outputs for Ontario's Lake Erie Yellow Perch and Walleye fisheries for the period from 1st January to 31st July 2019 are reported in Table 9. Updated MCS data for Ohio's Yellow Perch commercial fishery will be available shortly after the end of the fishing season.

Table 9. MCS enforcement statistics for Yellow Perch and Walleye Fisheries - January to July 2019, where available. Source: Ontario data provided by client group in consultation with ODNRF.

Data Fields	Canada Yellow Perch + Walleye			U.S. Yellow Perch		
(indicate by "X" where data are not available)	2018	2019	Total	2018	2019	Total
No. of Commercial Fishing Licences Issued	252	274*	526	18		
No. of Vessel Fishing Days	9,025	4,208	13,233	1,114		
No. of At-sea Inspections	32			6		
No. of Dockside Inspections	1,885	2,183	4,068	100		
No. of At-sea Patrol Days	13			101		
No. of Air Hours on Patrol	X			37		
No. of Observer Sea Days	X			0		

Notes: (*) Some Ontario commercial licences include both Walleye and Yellow Perch (double counting).

A discussion of the performance of the MCS programs in Ontario and Ohio during the off-site conference call indicated that the Lake Erie's certified commercial fisheries continued to comply with the requirements of the management system; moreover, managers indicated that there was no evidence of systematic non-compliance. **The team intends to undertake a more detailed analysis of the outcomes of the MCS program when the re-assessment of the fisheries is conducted in early 2020.**

5.3.3. Relevant changes to Legislation and Regulations

5.3.3.1. Province of Ontario

The legal framework upon which the Ontario Yellow Perch and Walleye commercial fisheries are managed was described at the time of the initial assessment and subsequent annual surveillance audits.
According to information placed on the website of the Office of the Premier of Ontario on 31st December 2018, no legislative and regulatory changes were envisaged with respect to Ontario's commercial fisheries in 2019.[23]

Ontario's *Fish and Wildlife Conservation Act, 1997, S.O. 1997, c. 41*[24] continues to operate as the primary statute for the management of the province's commercial fisheries. Specifically,

- Sections 60 - 79 cover the administration of the province's Commercial fishing licencing activities including: (i) issuance, (ii) conditions on issuance and fishing, (iii) transfers, (iv) refusals to issue, (v) cancellation, and (vi) appeal hearing.
- Sections 86 - 96 cover the appointment of Conservation Officers and their assigned powers including: (i) powers of inspection of conveyance and places, and entry, (ii) search, (iii) seizure and forfeiture, and (iv) arrest without warrant, and
- Sections 96 - 110 deal with offences and penalties relative to unauthorized commercial fishing and are to be interpreted in conjunction with the *Provincial Offences Act* in the case of court-ordered licence suspension and/or cancellation.

While of no immediate relevance to the current regulatory system for the commercial fisheries managed by Ontario, the team further noted that the Federal *Fisheries Act* was modernized and received royal assent over the summer. The *Act* has general application to all inland and coastal waters, (as well as to the Canadian portions of the Great Lakes) where the management of the commercial fisheries has been formally delegated to provincial governments including Ontario. The amended *Act* includes a number of new provisions aimed at

[23] https://news.ontario.ca/opo/en/2018/12/regulations-and-statutes-coming-into-force-january-1-2019.html
[7] https://www.ontario.ca/laws/statute/97f41#BK100

strengthening the protection of fish and fish habitat, enhancing marine protection and habitat restoration, and strengthening the role of Indigenous people in project reviews, monitoring and policy development.

Ontario Commercial Licence Conditions

The licence conditions for the 2019 commercial Yellow Perch and Walleye certified fisheries for Gillnets and Trawls are described in a 14th December 2018 document issued by the MNRF.[25] While the conditions are identical to those that were issued for the 2018 fishing season, several key conditions that inform the management system were not included in the 3rd surveillance audit report. A more complete listing is presented below. Excluded conditions include those which pertain to the numerous closed areas and times, and the handling and packaging of landed species prior to landing.

- While engaged in fishing, the licencee or designate shall submit an accurate and complete Daily Catch Report (DCR) prior to landing any fish, even when no fish are caught;
- Any no harvest permitted species, SARO species or wildlife species that are caught and are still alive must be released in a manner which causes the least harm to the fish or wildlife;
- The licencee or designate shall not fish in an area other than that which is described on the face of this licence;
- The vessel(s) named on this licence is/are the only vessel(s) that shall be used for commercial fishing, transporting or possession of commercial fish taken under the authority of this licence;
- The licencee or designate shall accurately maintain, on a daily basis, a bound log book with entries for each day's fishing activities. This shall include: the complete coordinates, in latitude and longitude, for the start and end of each continuous series of nets set and lifted; the dates on which nets are set and lifted; and the length of each net fished;
- The logbook shall be kept on the vessel at all times and made available for inspection by a Port Observer or a Conservation Officer upon request;
- A licencee or designate licenced to use gill nets shall not fish for any species of fish or set, lift or possess a gill net with a mesh size less than 57 millimeters (2.25 inches) in extension measure as defined in these conditions (for Walleye, 89 mm or 3.5 inches);
- All fish on a vessel used for commercial fishing or transporting commercially caught fish shall be in round form;
- All fish shall be landed at designated ports between the specified hours for the ports, except as otherwise authorized by a Port Observer or Conservation Officer;
- When a red flag is displayed at the designated port, the licencee/designate shall report to the Port Observer, Conservation Officer or Observer for sampling, weight verification and/or a vessel inspection;
- When a white flag is displayed at the designated port, the licencee/designate shall proceed to his/her normal place of unloading and wait for a Port Observer, Conservation Officer or Observer for inspection or sampling;
- All fish, with the exception of fish destined for discard, shall be iced immediately upon being removed from nets and placed in receptacles;
- This licence is valid for an assigned quantity of fish by species as listed in the Appendix "C" assigned to this licence. Any fish harvested in excess of quota must be covered off by a transfer of quota from the same quota area sufficient to cover the excess quantity of fish or be subject to the following provisions. There will be no transfers of any quota between quota areas unless authorized in writing by the Lake Manager on a species by species basis;
- Over quota harvest by species at the end of the initial quota period, on the day quota was exceeded, will be subtracted from the final quota allocation for which this licence is valid. Additional Walleye over quota must be covered by a transfer prior to May 1st;
- All transfer of quota must take place by January 31st following the year in which this licence is valid;

[25] Document is entitled: *Lake Erie Commercial Food Fishing Licence Conditions for the Year 2019 - Appendix B.*

- Licencees must make restitution to the Crown for over quota harvest incurred in the current fishing year. Final allocation will not be issued for the next year if restitution has not been made to the Crown;
- With the exception of nets set between March 15th and December 15th fishing with gill nets in any part of Lake Erie during the periods January 1st to March 31st and December 15th to December 31st will be subject to the following conditions:
- a GPS tracking device (vessel monitoring system [VMS]) must be installed on each vessel engaged in fishing operations and remain functional from the time the vessel leaves the harbour until its' return to port on each day fishing,
- each vessel must be covered by a valid service contract with a service provider that captures the output from the GPS tracking device in real time and archives data,
- you must provide internet access codes to the Ministry to access the data captured by the service provider,
- the vessel captain shall ensure that the GPS transponder (antenna), the unit itself (black box), or its power supply is not rendered inoperable, damaged or interfered with,
- if you or a designate receives a communication from a Conservation Officer or Ministry official that the vessel monitoring system on their vessel is not functioning, and upon direction from a Conservation Officer or Ministry official, the vessel must cease all fishing activities and immediately return to the port from which it left and have the VMS unit repaired by a qualified technician employed by the equipment supplier before conducting further fishing activities or leaving port for any other reason unless authorized by a Conservation Officer or Ministry official; and
- A licencee or designate shall immediately report any lost or stolen net(s) to a Conservation Officer.

5.3.3.2. State of Ohio

The Ohio Revised Code (ORC)[26] and Ohio Administrative Code (OAC)[27] contain the details of the State's Regulations. Regulations may be changed by the legislature and/or the Chief of the Division of Wildlife with the approval of the Ohio Wildlife Council, an eight-member board created in 1994 and whose responsibilities and authorities are set out at Chapter 1531.03 of the ORC.[28] Of note, the Council is required to hold public meetings on a quarterly basis for the purpose of establishing seasons, bag limits, size, species, methods of taking, and possession, and for advising on policies of the division and the planning, development, and institution of programs and policies of the division. The Council met on 9th October to vote on the proposed regulatory changes for 2020. The team was informed that no regulatory changes were adopted for the state's commercial fisheries for 2020.

A planned regulatory review of the state's commercial fisheries provisions is listed at Chapter 1501:31-3 of the OAC (Table 10). Of these, three have been identified for review by the legislature in March 2020.

Table 10. OAC regulatory review of commercial fisheries measures

Sub-Chapter	Description	Previous Review Date	Next Review Date
01	Commercial fishing seasons	July 19, 2016	July 19, 2021
02	Legal length and weight of certain fish	July 19, 2016	July 19, 2021
03	Limited entry of commercial fishermen; commercial fishing licences	July 19, 2016	July 19, 2021
04	Prohibited places and times for using nets in Lake Erie	August 18, 2014	March 1, 2020
06	Vessel monitoring system and electronic catch reporting system	July 19, 2016	July 19, 2021
07	Marking of fishing devices	August 18, 2014	March 1, 2020
08	Time for landing fish	July 19, 2016	July 19, 2021

[26] http://codes.ohio.gov/orc/
[27] http://codes.ohio.gov/oac/
[28] Refer to footnote 8.

Table 10. OAC regulatory review of commercial fisheries measures			
09	Commercial fish catch reports	August 18, 2014	March 1, 2020
10	Limitations on size of mesh of fishing devices	July 19, 2016	July 19, 2021
12	Quota management system for Lake Erie fishes	September 6, 2018	September 26, 2023
13	Quota species	July 19, 2016	July 19, 2021
14	Yellow perch sales and purchases records	July 19, 2016	July 19, 2021

A useful summary of the regulations in respect of the state's commercial fisheries is published in a ODNR document entitled *Commercial Fishing Law Digest.*[29]

In response to various questions raised by the Assessment Team, an ODNR representative indicated that the state was considering modifying the definition of Lake Erie's management units (MUs). These MUs are formally defined for sport fishing purposes, but do not exactly match the 10-minute grid system used by the Yellow Perch Task Group for commercial catch reporting. The proposed change will not affect Ohio's trap net catch reporting or quota allocation but would simply align the OAC definition of Lake Erie MUs with the convention that has always been utilized for trap net catch reporting and quota allocation. The Ohio trap net industry has been consulted and the ODNR's Division of Wildlife is developing a proposal to standardize the MU definitions for angling and trap netting.

Stakeholders and the general public are informed of any proposed OAC rule changes on the Division's website.[30]

Ohio Commercial Licence Conditions

The management measures in respect of Ohio's 2019 commercial Yellow Perch small mesh trap net fishery are described in the previously-cited document *Commercial Fishing Law Digest.* They are reported here in greater detail than was reported at the 3rd surveillance audit. Additional relevant measures that are included in the OAC also have been added.

- Season: It shall be unlawful for any person to take or attempt to take Yellow Perch (*Perca flavescens*) with any commercial fishing device in the Lake Erie Fishing District except from May 1 to December 10 of each year;
- Limited entry: Only persons holding a license in reserve or licensed to fish in the previous season or holders of a transferred license will be licensed to fish, provided they have complied with Chapters 1531 and 1533 of the ORC and the OAC in the previous fishing seasons;
- Gear markings: (i) the backs of all trap nets must measure not less than 1/4 inch or more than four inches stretched mesh, (ii) a commercial orange uphaul buoy must be attached to each net; (iii) numbered tags issued by the Division of Wildlife must be attached by the licensee to the uphaul buoy line within 36 inches of the uphaul buoy; (iv) each trap net set singly, or the first and last net in a string of nets, in Lake Erie must display one red flag on the inshore end and two flags on the offshore end;
- Closed areas and times (partial description): (i) 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; (ii) no person may 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, (iii) it is unlawful to set a net or trotline on a reef at any time; and (iv) no fishing device may be lifted, pulled, hauled, set, or have fish removed from it from one-half hour after sunset to one-half hour before sunrise;
- Monitoring and catch reporting: (i) all vessels engaged in trapnetting must have an operating vessel monitoring system aboard approved by the chief of the Division of Wildlife, (ii) trap net licensees shall keep an accurate daily record of their catch on an electronic catch reporting system as established by the

[29] https://wildlife.ohiodnr.gov/portals/wildlife/pdfs/publications/laws%20&%20regs/pub002.pdf
[30] http://wildlife.ohiodnr.gov/Portals/wildlife/pdfs/stay%20informed/CSI/RULE%20PROPOSALS%20SUMMARY%202019%20Summer%20Fall%202.pdf

chief of the Division of Wildlife; (iii) an estimated weight of all quota species of fish taken by trap net shall be entered into an electronic catch reporting system immediately after each net is lifted, (iv) all of the estimated weights entered into the electronic catch reporting system shall be electronically transmitted after lifting the last net, or at least one half hour prior to landing at the dock listed on the license;

- 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;
- It is unlawful for any person to sell, buy, offer for sale, possess, or transport for sale fish which have a length or weight limit in any form other than round, headed and gutted, or filleted;
- Commercial fish minimum sizes: 8 1/2 in (in the round); 5 5/8 in (fillet); 6 7/8 in (headless); and
- All fish taken or caught from Ohio waters shall be brought into an Ohio port for inspection. No person shall ship, carry, transport, or cause to be transported any fish taken or caught from Ohio waters directly to a point outside the state (ORC Chapter 1533.63).

5.3.4. Changes to the Management Regime

There were no reported changes to the long-term objectives of the management system, the fishery-specific short-term objectives, and the decision-making processes since the 3rd surveillance audit.

5.3.4.1. Yellow Perch Management Plan

Work on revisions to the plan continued to progress following the 3rd surveillance audit report. In a 23rd July 2019 email to LEPMAG representatives[31], it was noted that updated Yellow Perch catch-at-age models were implemented in 2018, new harvest control rules were developed using the MSE process in 2019, and the Standing Technical Committee continued to meet to develop an updated Management Plan with a final draft expected to be provided for Lake Erie Percid Management Advisory Group (LEPMAG) review by late October. The Lake Erie Committee (LEC) has proposed to schedule a webinar in mid-December with LEPMAG members that is intended to result in the adoption and implementation of the plan for the 2020 fishing season.

5.3.4.2. TACs and allocations - Yellow Perch[32]

TAC decisions are reflective of the status of Lake Erie's fish populations and take into account the goal of consistent and sustainable harvest each year. The allocations are determined by the LEC after extensive, lakewide biological assessments, analyses, discussions, and consultations with stakeholders, including advice provided by the LEPMAG. The individual state and provincial governments implement the Total Allowable Catch (TAC) in their jurisdiction in accordance with their respective regulations and management objectives.

In March 2019, based on a Management Strategy Evaluation (MSE), the LEC set a TAC for 2019 of 8.552 million pounds of Yellow Perch, a decrease in each of the three western most management units from the 2018 level of 10.498 million pounds.

The annual TAC continued to be allocated across the five jurisdictions of Lake Erie under an area-based formula that uses GIS applications of jurisdictional surface area of waters within each Management Unit (MU). Table 11 provides a comparison of the allocation of Yellow Perch by MU in 2018 and 2019, while Table 12 illustrates how the 2019 TAC was allocated across the MUs and jurisdictions.

The data in million of pounds were provided by the OCFA from a LEC slide deck that was included in the OCFA's submission to the Assessment Team.

Table 11. 2019 Yellow perch TAC (million of pounds) by Management Unit (MU)

Management Unit (MU)	2018 TAC	2019 TAC
MU -1	3.031	2.425

[31] LEC-issued email from Travis Hartman as part of the OCFA's submission to the Assessment Team.
[32] LEC Press Release 29/3/2019 : http://www.glfc.org/pubs/pressrel/LEC%20news%20release%202019_FINAL.pdf

MU-2	3.237	2.208
MU-3	3.776	3.374
MU-4	0.454	0.545
Total	10.498	8.552

Table 12. 2019 Yellow perch TAC (million of pounds) by Management Unit (MU) and Jurisdiction

Jurisdiction	Management Unit				
	MU-1	MU-2	MU-3	MU-4	Total
Ontario	0.984	1.007	1.765	0.316	4.072
Ohio	1.220	1.201	1.093		3.514
Michigan	0.221				0.221
Pennsylvania			0.516	0.060	0.576
New York				0.169	0.169
Total	2.425	2.208	3.374	0.545	8.552

5.3.4.3. Walleye Management Plan[33]

As reported at the time of the 3rd surveillance audit, the LEC decided that the Walleye Management Plan (WMP) would be extended another five years, to 2024 following a review of available data and consultations with Lake Erie stakeholders.[34] In so doing, the evaluation of the plan's performance was also deferred to 2024 based on the following factors:

- The current WMP is working well with harvest policy adapting to annual fluctuations in Walleye abundance;
- Recruitment of strong year classes in 2014 and 2015 and moderate recruitment in 2017, minimize the risk to the Walleye fishery;
- The Walleye sport and commercial fisheries are performing very well;
- To allow LEC agencies to continue to shift effort towards completion of the development of a Yellow Perch Management Plan;
- To allow for the completion of current research over the next 4 years that will contribute new information for incorporation into the next WMP including:
- The extent of the east basin stock contribution;
- Migration rates from west to east basin;
- Composition of mixed stock fisheries; and
- Refinement of estimates of natural mortality (M).

5.3.4.4. TACs and allocations - Walleye[35]

The LEC set the 2019 Walleye TAC at 8.531 million fish, a 20% increase over the 2018 TAC of 7.109 million fish. The increased TAC is a reflection of positive recruitment during the previous few years and increases in population biomass. Ontario, Ohio and Michigan continued to share the TAC based on a formula of walleye habitat within each jurisdiction in the western and central basins of the lake (Table 13). While jurisdictions in the eastern end of the lake are outside of the TAC area, harvest limits there are set consistent with lakewide objectives.

Table 13. 2019 Walleye TAC (million of fish) by Jurisdiction

Jurisdiction	2018 TAC	2019 TAC
Ohio	3.634	4.360
Ontario	3.061	3.673

[33] http://www.glfc.org/pubs/lake_committees/erie/LEC_docs/position_statements/walleye_managment_plan.pdf
[34] http://www.glfc.org/pubs/lake_committees/erie/LEC_docs/other_docs/2018%20LEC%20Announcement%20WMP%205%20year_final.pdf
[35] Refer to footnote 11.

Table 13. 2019 Walleye TAC (million of fish) by Jurisdiction		
Michigan	0.414	0.497
Total	7.109	8.531

As in previous years, the Walleye TAC was established based on extensive discussions among scientists, managers, and stakeholders. The Walleye Task Group met regularly to share data and reach consensus on biological and population abundance estimates. The LEC's Walleye Management Plan, which incorporates suggestions from the LEPMAG, continued to serve as the foundation for the LEC's discussions and TAC decisions.

5.3.5. Personnel involved in science, management or industry

No changes in key personnel involved in science, management or industry were communicated to the assessment team.

5.3.6. Performance Indicators

As a result of the information acquired by or provided to the Assessment Team for the 4th surveillance audit, the team has determined that the information continues to support the scores assigned by the previous Assessment Team at the 3rd surveillance audit in respect of the PIs for Principle 3. Accordingly, the assigned PI-level scores are maintained.

5.4. Traceability

No changes in traceability or risks associated with it have occurred since the previous (3rd) surveillance activities.

5.5. Version details

This surveillance report used on the following versions of fisheries program documents:

Table 14. Fisheries program documents versions.	
Document	Version number
MSC Fisheries Certification Process	Version 2.1
MSC Fisheries Standard	Version 1.3
MSC General Certification Requirements	Version 2.3 and 2.4
MSC Reporting Template	Version 2.01

6. Results

6.1. Surveillance results overview

6.1.1. Summary of conditions

No new conditions were assigned during this surveillance activities and the last open condition (i.e. YP2) was closed on target.

Table 15. Summary of conditions.

Condition number	Condition	Performance Indicator (PI)	Status	PI original score	PI revised score
YP2 UoC 1-7	By the fourth annual surveillance audit, the following SG80 SI must be met: well- defined HCRs are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as LRPs are approached.	1.2.2	Closed, on target, at surveillance 4.	PI score from most recent assessment = 75	PI score after this surveillance = **90**

Table 16. Principle 1 – Original (2015 Certification Report) and revised (4th Surv., 2019) scores per UoC

	Gillnet				Trapnet		
Principle	QZ1	QZ2	QZ3 E	QZ3 W	MU1	MU2	MU3
P1 – Target Species (original)	81.9	84.4	84.4	84.4	81.9	84.4	84.4
P1 – Target Species (revised 4th Surv.)	**85**	**87.5**	**87.5**	**87.5**	**85**	**87.5**	**87.5**

P2 and P3 scores have not changed since the previous audits carried out by IFC/ later Acoura Marine/ later Lloyd's Register. Refer to the previous surveillance reports for P2 and P3 updated scores.

6.1.2. Total Allowable Catch (TAC) and catch data

Table 17. Total Allowable Catch (TAC) and catch data by UoA.

Yellow Perch UoC 1 and UoC 5				
TAC	Year (Most recent fishing year)	2018	Amount	10,498,000 lbs.
UoA share of TAC	Year (Most recent fishing year)	2018	Amount	3,031,000 lbs.
UoC 1 share of TAC	Year (Most recent fishing year)	2018	Amount	1,231,000 lbs.
UoC 5 share of TAC	Year (Most recent fishing year)	2018	Amount	1,525,000 lbs.
Total green weight catch in UoC 1	Year (Most recent fishing year)	2018	Amount	1,248,042 lbs.
	Year (second most recent)	2017	Amount	1,271,282 lbs.
Total green weight catch in UoC 5	Year (Most recent fishing year)	2018	Amount	439,720 lbs.
	Year (second most recent)	2017	Amount	447,263 lbs
Yellow Perch UoC 2 and UoC 6				
TAC	Year (Most recent fishing year)	2018	Amount	10,498,000 lbs.
UoA share of TAC	Year (Most recent fishing year)	2018	Amount	3,237,000 lbs.
UoC 2 share of TAC	Year (Most recent fishing year)	2018	Amount	1,476,000 lbs.
UoC 6 share of TAC	Year (Most recent fishing year)	2018	Amount	1,761,000 lbs.
Total green weight catch in UoC 2	Year (Most recent fishing year)	2018	Amount	1,203,738 lbs.
	Year (second most recent)	2017	Amount	1,434,716 lbs.
Total green weight catch in UoC 6	Year (Most recent fishing year)	2018	Amount	528,234 lbs
	Year (second most recent)	2017	Amount	590,447 lbs.

Table 17. Total Allowable Catch (TAC) and catch data by UoA.				
Yellow Perch UoC 3 and UoC 7				
TAC	Year (Most recent fishing year)	2018	Amount	10,498,000 lbs.
UoA (MU3) share of TAC	Year (Most recent fishing year)	2018	Amount	3,776,000 lbs.
UoC 3 share of TAC	Year (Most recent fishing year)	2018	Amount	1,975,000 lbs.
UoC 7 share of TAC	Year (Most recent fishing year)	2018	Amount	1,223,000 lbs.
Total green weight catch in UoC 3	Year (Most recent fishing year)	2018	Amount	1,743,212 lbs.
	Year (second most recent)	2017	Amount	1,964,728 lbs.
Total green weight catch in UoC 7	Year (Most recent fishing year)	2018	Amount	439,233lbs.
	Year (second most recent)	2017	Amount	449,979 lbs
Yellow Perch UoC 4				
TAC	Year (Most recent fishing year)	2018	Amount	10,498,000 lbs.
UoA (MU4) share of TAC	Year (Most recent fishing year)	2018	Amount	454,000 lbs.
UoC 4 share of TAC	Year (Most recent fishing year)	2018	Amount	263,000 lbs.
Total green weight catch in UoC 4	Year (Most recent fishing year)	2018	Amount	272,067 lbs.
	Year (second most recent)	2017	Amount	177,475 lbs.
Walleye UoC 8 (QZ1, QZ2, QZ3-W)				
TAC	Year (Most recent fishing year)	2018	Amount	7,109,000 (# of fish)
UoA share of TAC	Year (Most recent fishing year)	2018	Amount	7,109,000 (# of fish)
UoC 8 share of TAC	Year (Most recent fishing year)	2018	Amount	2,989,135 (# of fish)
Total green weight catch in UoC 8	Year (Most recent fishing year)	2018	Amount	6,934,794 lbs.
	Year (second most recent)	2017	Amount	6,370,707 lbs.

6.1.3. Recommendations - revised

At the 3rd surveillance audit, the previous Assessment Team included two recommendations that were aimed at strengthening the outcomes of two P3 PIs. A discussion of the recommendations at the 10th October conference call resulted in a refinement of the recommendations' context and purpose.

A. Discussions with Commercial Fish Harvesters and other parties

The audit team is well aware of the consultation and engagement processes that inform the work of Lake Erie's major committees, sub-committees and working groups (i.e. LEC, LEPMAG, TGs) and more broadly (i.e. GLFC). These fora are well-established, inclusive and effective in addressing the P3 requirements for consultation and engagement, dispute resolution, decision-making, and monitoring and evaluation of the performance of the management system of the fisheries. The team is equally aware that, at the more local level, the OCFA and government agencies have a collaborative working arrangement in place that facilitates exchanges with commercial fish harvesters and other parties on a variety of subjects (i.e. FMZ 19 for Ontario, and the equivalent for Ohio's trapnet fishery).

The team's consideration of how these local level discussions and the manner in which they may relate to the aforementioned P3 Indicators (including some linkages to P1 and P2) would be facilitated if the meetings' proceedings were available. While the reporting format itself is a matter for the parties to decide, including how the proceedings are communicated, the team suggests that, at a minimum, the content of the discussions should allow for a good understanding of the subject matters that are discussed, and that any necessary follow-up actions be described. **The team recommends that the OCFA and the Ontario and Ohio government agencies collaborate in addressing this matter at their earliest convenience.**

B. Monitoring and Management Performance Evaluation - MCS

PI 3.2.4 requires that ''the management system has a process of monitoring and evaluating management performance, appropriate to the cultural context, scale and intensity of the fishery. '' At each Scoring Guidepost (SG) for this PI, relevant parts of the fishery-specific system include monitoring, control and surveillance (MCS) activities. The PI extends beyond the management system to include any monitoring systems associated with P1 and P2.

The Compliance and Enforcement component of the MSC Standard (PI 3.2.3) requires that '' there must be a monitoring, control and surveillance (MCS) system in place as evidence that fishers comply with the requirements of the management system and there is no evidence of systematic non-compliance.'' The scope of the MCS system extends beyond the actual fishing operations to include the requirements of MPAs and measures to protect habitat, ecosystems, marine mammals, and species-at-risk.

Both PIs are assessed corroboratively by matching the MCS-generated statistics on enforcement inputs and outcomes (PI 3.2.3) against the program's objectives and benchmarks (PI 3.2.4). **In this regard, the team recommends that a meeting be organized with law enforcement officials during the forthcoming re-assessment site visits.**

C. Recording of Sucker species

Removals can be significant for some sucker populations but information to determine the status of species in the group as main bycatch is missing. The re-assessment 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 species identification and consideration in future annual audits.

6.2. Conditions

Table 18. Condition YP2: UoC 1-7	
Performance Indicator	**1.2.2**
Score	**75**
Justification	Issues at SG80 a. Well-defined HCRs are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as LRPs are approached. b. The selection of the HCRs takes into account the main uncertainties. c. Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the harvest control rules **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% SSB0 is approached.**
Condition	By the fourth annual surveillance audit, the following SG80 SI must be met: well- defined HCRs are in place that are consistent with the harvest strategy and ensure that the exploitation rate is reduced as LRPs 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 that links observed changes in indicators to changes in annual TACs. The required minimum score is 75. At the second annual audit, the client will present the CAB with evidence that the explicit algorithm or decision rule that links observed changes in indicators to changes in annual TACs has been proposed. The required minimum score is 75. At the third annual audit, the client will present the CAB with evidence that the explicit algorithm or decision rule that links observed changes in indicators to changes in annual TACs has been defined. The required minimum score is 75. At the fourth annual audit, the client will present the CAB with evidence to show that the explicit algorithm or decision rule that links observed changes in indicators to changes in annual TACs has been implemented and used in determining the TAC for the following year. The required minimum score is 80.
Consultation on condition	The Lake Erie Committee was involved with OCFA in the development and implementing the Action Plan to close this condition.
Progress on Condition [Year 1]	Progress on this condition is behind schedule. If completion of the MSE deliberations takes place as planned in mid-2017 and before the 2nd surveillance audit, the 1st and 2nd milestones will be met. If the new YPMP is implemented in late 2017, the 3rd and possibly 4th milestones will be met, closing the condition ahead of schedule. At this stage, we do not consider it necessary to change the milestone schedule.
Progress on Condition [Year 2]	Progress on this condition is behind schedule. Given the complexity of this condition in the context of the management processes involved, we consider that the originally defined milestones for year 1 and year 2 were unduly optimistic and did not take into account the management process. On that basis, and as allowed under MSC CR V2.0 Para 17.23.13.1b, the milestone for year 2 should be applied to year 3 while being modified to take into account the previously defined year 3 milestone. The original milestone for year 4 should be retained. At the third annual audit, the client will present the CAB with evidence that the explicit algorithm or decision rule that links observed changes in indicators to changes in annual TACs has been proposed and defined. The required minimum score is 75.

	At the fourth annual audit, the client will present the CAB with evidence to show that the explicit algorithm or decision rule that links observed changes in indicators to changes in annual TACs has been implemented and used in determining the TAC for the following year. The required minimum score is 80.
Progress on Condition [Year 3]	The milestone for the 3rd Surveillance Audit is for the client to provide the CAB with evidence that an explicit algorithm or decision rule has been defined that links observed changes and indicators to annual TACs. Considerable progress has been made, as indicated in condition YP1, that is fundamental to satisfying this YP2 condition. An extensive review of the YPMP has been the focus of discussions by stakeholder members of LEPMAG, facilitated by the QFC in recent years. A management strategy evaluation and scenario survey (Appendix 4.1.5) have been conducted (see minutes of annual meetings, Appendix 4.1). Collaborative efforts have resulted in the development of a new yellow perch assessment model (Peterson-Riley – PR) as well as advice on fishery-based performance metrics, and recommendations for LRPs were developed, along with exploitation rates, that will form the basis for the next five years of yellow perch management through the new yellow perch management plan. These were detailed in the February 12, 2019, yellow perch exploitation policies announcement by the Lake Erie Committee. LRPs and target fishing rate RPs, along with exploitation policies, are provided (Hough et al. 2019, Appendix 4.1.6 announcement by Lake Erie Committee). During the 3rd SA conference call, it was indicated that a draft of the yellow perch management plan is in preparation and will be available early summer 2019. New policies that are analytically based, along with the new Peterson-Riley assessment model for determining recommended allowable harvests, now exist and will be implemented beginning in March 2019 (Lake Erie Committee 2019a).
Progress on Condition [Year 4]	Collaborative efforts by the LEPMAG and QFC have resulted in the development of a new yellow perch assessment model (Peterson-Riley – PR), as well as advice on fishery-based performance metrics and recommendations for new harvest policies. Limit reference points were developed, along with exploitation rates, that will form the basis for the next five years of yellow perch management through the new yellow perch management plan under review (Announcement LEPMAG review of draft YPMP 2019 webinar, planned for December 2019). The new exploitation policies were detailed in the February 12, 2019, yellow perch exploitation policies announcement by the Lake Erie Committee (LEC 2019a). The new biomass limit reference points are as follows: MU1 – 29% SSB_0 (B_{msy}), MU2 – 28% SSB_0 (B_{msy}), MU3 – 28% SSB_0 (B_{msy}), and MU4 – 27% SSB_0 (B_{msy}) with target fishing rate reference points as follows: MU1 – F = 0.77, MU2 – F = 0.70, MU3 – F = 0.79, MU4 – F = 0.40. The Lake Erie Committee indicated that the new policies, which are analytically based, would be implemented beginning in March 2019 (LEC 2019a). The 2019 Yellow Perch Task Group report provided evidence that these new harvest control rules established in 2018 were applied to determine fishing rates and set recommended allowable catch and TAC in 2019 (YPTG 2019, Table 2.1; see Tables 3 and 4, this surveillance audit). This provides concrete evidence that the explicit algorithm or decision rule that links observed changes in indicators to changes in TAC have been implemented in determining the TAC for the following year. This satisfies the fourth and final milestone associated with condition YP2. The condition is closed.
Status	Progress on meeting this condition is on target, all associated milestones have been completed, and conditions have been satisfied. The new yellow perch exploitation policies announced by the Lake Erie Committee (LEC 2019a, see Hough et al. 2019, 3rd surveillance audit, Appendix 4.1.6) have been explicitly incorporated into the advice for setting the 2019 yellow perch TAC for Lake Erie Requirements of SG80 have now been met, and the PI 1.2.2 for yellow perch has been rescored (Section 4.4). This condition is closed at surveillance audit 4.
Additional information	No additional information required.

6.3. Client Action Plan

There were no updates to the Client Action Plan.

6.4. Re-scoring Performance Indicators

Original text that is still applicable is in **black** while original old text that is no longer applicable has been ~~struck through and greyed out~~. New evidence from this 4th surveillance is identified in **blue**.

PI 1.2.2		There are well defined and effective harvest control rules (HCRs) in place		
Scoring Issue		SG 60	SG 80	SG 100
a	HCRs design and application			
	Guide post	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?	**Management Unit 1 Yes** **Management Unit 2 Yes** **Management Unit 3 Yes** **Management Unit 4 Yes**	**Management Unit 1 Yes** **Management Unit 2 Yes** **Management Unit 3 Yes** **Management Unit 4 Yes**	

Rationale

The suite of management modes in the early draft YPMP (YPTG 2007) and the explicit HCR with a 50% FMSY target harvest rate are evidence of the general requirement to reduce exploitation as abundance declines to a critically low level.

The new HCR created by the LEC in 2019 resulted from a re-examination of the earlier draft YPMP (YPTG 2007), which was conducted in conjunction with analyses and simulations performed by the QFC and an associated MSE. In 2019, the LEPMAG determined and announced new HCRs and exploitation policies for yellow perch (LEC 2019a). They are composed of:

- target fishing mortality as a percent of the fishing mortality at maximum sustainable yield (F_{msy}). F_{msy} will remain constant for the duration of the YPMP (a 5-year period).
- limit reference point of the biomass at maximum sustainable yield (B_{msy}).
- a probabilistic risk tolerance level of P* = 0.05 (P-star) for all MUs.
- a limit on the maximum change in TAC of ± 20%.

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% SSB0 is approached. No MU meets SG80 SIa.~~

Collaborative efforts by the LEPMAG and QFC have resulted in the development of a new yellow perch assessment model (Peterson-Riley – PR), as well as advice on fishery-based performance metrics and recommendations for new harvest policies. Limit reference points were developed, along with exploitation rates, that will form the basis for the next five years of yellow perch management through the new yellow perch management plan under review (Announcement LEPMAG review of draft YPMP 2019 webinar, planned for December 2019). The new exploitation policies were detailed in the February 12, 2019, yellow perch exploitation policies announcement by the Lake Erie Committee (LEC 2019a). The new biomass limit reference points are as follows: MU1 – 29% SSB_0 (B_{msy}), MU2 – 28% SSB_0 (B_{msy}), MU3 – 28% SSB_0 (B_{msy}), and MU4 – 27% SSB_0 (B_{msy}) with target fishing rate reference points as follows: MU1 – F = 0.77, MU2 – F = 0.70, MU3 – F = 0.79, MU4 – F = 0.40.

The Lake Erie Committee indicated that the new policies, which are analytically based, would be implemented beginning in March 2019 (LEC 2019a). The 2019 Yellow Perch Task Group report provided evidence that these new

PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place

harvest control rules established in 2018 were applied to determine fishing rates and set recommended allowable catch and TAC in 2019 (YPTG 2019, Table 2.1; see Tables 3 and 4, this surveillance audit). This provides concrete evidence that the explicit algorithm or decision rule that links observed changes in indicators to changes in TAC have been implemented in determining the TAC for the following year.

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. **SG 80 is met.**

b	HCRs robustness to uncertainty							
	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?			**Management Unit 1**	**Yes**	**Management Unit 1**	**No**	
				Management Unit 2	**Yes**	**Management Unit 2**	**No**	
				Management Unit 3	**Yes**	**Management Unit 3**	**No**	
				Management Unit 4	**Yes**	**Management Unit 4**	**No**	

Rationale

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	HCRs evaluation							
	Guide post	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?	**Management Unit 1**	**Yes**	**Management Unit 1**	**Yes**	**Management Unit 1**	**Yes**	
		Management Unit 2	**Yes**	**Management Unit 2**	**Yes**	**Management Unit 2**	**Yes**	
		Management Unit 3	**Yes**	**Management Unit 3**	**Yes**	**Management Unit 3**	**Yes**	
		Management Unit 4	**Yes**	**Management Unit 4**	**Yes**	**Management Unit 4**	**Yes**	

Rationale

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 scientific 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.

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PI 1.2.2	There are well defined and effective harvest control rules (HCRs) in place

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Individual scoring elements		Applicable SGs met per individual scoring element			Scoring element scores
		SG60	SG80	SG100	
1	Management Unit 1	2 of 2	3 of 3	1 of 2	**90**
2	Management Unit 2	2 of 2	3 of 3	1 of 2	**90**
3	Management Unit 3	2 of 2	3 of 3	1 of 2	**90**
4	Management Unit 4	2 of 2	3 of 3	1 of 2	**90**
Overall Performance Indicator score		Applicable SGs/elements met			Overall score
		SG60	SG80	SG100	
		2 of 2	3 of 3	1 of 2	**90**
Condition number (if relevant)					

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ODNR Law Enforcement Operations Manual:
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8. Appendices

8.1. Evaluation processes and techniques

8.1.1. Site visits

A two-part conference call (one in the morning and one in the afternoon) was set up on October 10th, 2019 with the Client Group, science and management staff from Ontario and Ohio. The following people participated:

Lake Erie Management Unit, Ontario Ministry of Natural Resources and Forestry – Brian Locke, Rich Drouin, Michael Thorne.
Ohio Department of Natural Resources – Travis Hartman, Lake Erie Program Administrator
OCFA – Kevin Reid, Jane Graham

Assessment Team:
Vito Romito, Lead and P2 Assessor
John Casselman, P1 Assessor
Bob Allain, P3 Assessor

Meeting Agenda

INTRODUCTION

- Confidentiality statement by SAIG
- Introduction to 4th surveillance assessment audit (Attendees, affiliations and responsibilities, objectives of audit)
- MSC certification process and timelines
- Stakeholder interest in the fishery
- Updates or changes with the Units of Assessment and Certification?
- Updates or changes affecting traceability (mainly risk of mixing certified and non-certified product, and if that occurs, how are risks mitigated?)
- Confirmation that destructive fishing practices or controversial unilateral exemptions have not been introduced.

PRINCIPLE 1 – Sustainable Target Fish Stocks

- Changes/Updates to scientific base of information including stock assessment
- Updated YP Management Plan
- Yellow perch TAC in MU2 - discussions and decisions
- Resulting stock status update (including yellow perch and walleye recruitment indices)
- Condition YP2 (PI 1.2.2) update

PRINCIPLE 2 – Environmental Impacts of Fishing

Retained species, Non-target catches, ETPs, Habitat and Ecosystem

- Updates/significant changes on bycatch profile (specifically updates on retained species status, management measures implemented, bycatch monitoring and information to ensure the reason for closing these conditions during surveillance 3 still apply) including specifically updates on lake whitefish, white bass, channel catfish, freshwater drum, white perch, smelt, lake sturgeon, lake trout and suckers.
- Updates on invasive species classification (e.g. white perch). Invasive species (retained/bycatch).
- Update on relevant ongoing studies and any new studies on Lake Erie's fish post-release survivorship.
- Any changes in ETP species designation under SARA and (US) ESA regulations of relevance to Lake Erie's fisheries?
- Any recent updates regarding ETP Species interactions with Lake Erie's Yellow perch and Walleye fisheries (e.g. Lake Chubsucker and Spotted Gar)?
- Any updates on habitat related studies for the fisheries under assessment (e.g. trapnet anchors, else)?
- Any recent habitat surveys of GIS maps?
- Ecosystem effects of the fishery other updates, new information (e.g. foodwebs, multispecies dynamics)

PRINCIPLE 3 – Effective Management

- Changes in management
- Changes of regulations
- Changes in key personnel
- Enforcement and Compliance update

OTHER POINTS

- ACDR, Re-Assessment Plan, and On-Site visits
- Next steps
- AOB

8.1.2. Stakeholder participation

All existing stakeholders from the Stakeholder list provided by the previous CAB were contacted and updated of all assessment steps as part of the MSC process. Although stakeholders had ample opportunity to either contribute to the surveillance via information submission, individual conference calls or by participating in the October 10th conference call with the Client Group, science and management staff, no stakeholder submitted information or showed interest in participating in this surveillance audit.

8.2. Stakeholder input

No additional stakeholder input has been received during the 4th surveillance activities aside from the information submitted by the Client Group for the audit.

8.3. Revised surveillance program

Not Applicable. The next step is a full re-assessment of the fishery.

The surveillance program for this fishery has changed from that previously indicated in the 3rd surveillance audit announcement and report. However, please note that the surveillance level has not changed since what was indicated in the 3rd surveillance audit announcement and report (Level 1).

As the surveillance program for this fishery has changed from that previously indicated in the 3rd surveillance report, the following is presented below:

1. A rationale for any deviations from carrying out the surveillance audit before or after the anniversary date of certification.
2. A completed revised fishery surveillance program.

Table 19. Surveillance Level Rationale.

Year	Surveillance activity	Number of auditors	Rationale
4	Off-site audit	3 auditors off-site	Although the surveillance level has not changed from that previously indicated in the 3rd surveillance audit announcement and report, the 4th surveillance audit was scheduled to be on-site in combination with the re-assessment site visit. SAI Global proposes to conduct a 4th surveillance audit off-site. From client action plan it can be deduced that information needed to verify progress towards outstanding condition on 1.2.2 HCRs can be provided remotely in year 4. SAI Global is confident that all information about the fishery can be collected remotely. Therefore, the audit will be conducted with 3 auditors off-site (via conference calls).

Table 20. Timing of surveillance audits.

Year	Anniversary date of certificate	Proposed date of surveillance audit	Rationale
4	20th August 2019	9th-11th October 2019	To avoid conducting the 4th surveillance not to close form the 3rd surveillance audit that was completed in April 2019. Also due to key stakeholders' availability.

Table 21. Fishery surveillance program.

Surveillance level	Year 1	Year 2	Year 3	Year 4
Level 1	On-site surveillance audit	Off-site surveillance audit	Off-site surveillance audit	Off-site surveillance audit & re-certification site visit

9. Template information and copyright

This document was drafted using the 'MSC Surveillance Reporting Template v2.01'. Note amendments have been made to formatting in order to comply with SAI Global's corporate identity; however, content and structure follow that of the original template.

Template version control		
Version	Date of publication	Description of amendment
1.0	08 October 2014	Date of issue
2.0	17 December 2018	Release alongside Fisheries Certification Process v2.1
2.01	28 March 2019	Minor document change for usability

A controlled document list of MSC program documents is available on the MSC website (msc.org)

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