Inland Seas Angler
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Highlights of the Annual Lake Committee Meetings

Great Lakes Fishery Commission proceedings, Niagara Falls, Ontario

This third of a series of annual special reports is an extensive summary of Lakes Erie & St. Clair. These lake committee reports are from the annual Lake Committee meetings hosted by the Great Lakes Fishery Commission in March/April 2016. We encourage reproduction with the appropriate credit to the GLSFC and the agencies involved. Our thanks to the staffs of the GLFC, OMNR, USFWS, NYSDEC and Michigan & Ohio DNRs for their contributions to these science documents. Thanks also to the Great Lakes Fishery Commission, its staff, Bob Lamb & Marc Gaden, for their efforts in again convening and hosting the Lower Lake Committee meetings in Niagara Falls, Ontario.

Lake Erie

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Abbreviation	Expansion
CPH	Catch per hectare
CWT	Coded Wire Tag
DFO	Dept. of Fisheries and Oceans
LEBS	Lake Erie Biological Station
LEC	Lake Erie Committee
MDNR	MI Dept. of Natural Resources
DEC	NY Dept. of Environment Conservation
ODNR	Ohio Dept. of Natural Resources
OMNR	ON Ministry Natural Resources
OSU	The Ohio State University
USFWS	U.S. Fish and Wildlife Service
WTG	Walleye Task Group
YAO	Age 1 and older
YOY	Young of the year (age 0)

Lake Erie Walleye and Yellow Perch Catch Levels for 2016

NIAGARA FALLS, ON – The binational Lake Erie Committee, comprising fishery managers from Michigan, New York, Ohio, Ontario, and Pennsylvania, today recommended to a total allowable catch (TAC) of 4.937 million walleye and 9.208 million pounds of yellow perch for 2016. (Walleye are allocated by number of fish; yellow perch are allocated in pounds.) These TAC recommendations represent an increase in allowable catch for walleye from 4.114 million fish last year and a decrease in yellow perch from 10.528 million fish.

The Lake Erie Committee's TAC recommendations are reflective of the status of Lake Erie's fish populations and take into account the goal of consistent harvest from year to year. The individual provincial and state governments adhere to and implement the TAC recommendations in accordance with their respective regulations and management objectives.

TAC recommendations are produced after extensive lakewide biological assessments, analysis, discussions, and consultations with stakeholders. A central mechanism to discuss walleye and yellow perch management in Lake Erie is called the Lake Erie Percid Management Advisory Group, or LEPMAG. Through this process, stakeholder input directly informs the development of harvest strategies.

Walleye

The Lake Erie Committee today recommended a 2016 walleye TAC of 4.937 million fish, a 20% increase from the 2015 TAC of 4.114 million fish. The TAC recommendation for 2016 reflects a stable adult population and a moderate to strong hatch in 2014. The 2011, 2010, 2007, and the 2003 year classes continue to contribute to the stability of the walleye fishery and allow for the increase in TAC from last year.

Each Lake Erie jurisdiction is responsible for implementing its portion of the TAC. The Province of Ontario and the States of Ohio and Michigan share the TAC based on a formula of walleye habitat within each jurisdiction in the western and central basins of the lake. Under a 2016 TAC of 4.937 million fish, Ohio will be allocated 2.523 million fish, Ontario 2.126 million fish, and Michigan 0.288 million fish. Most of the walleye harvest comes from the western portion of Lake Erie and, as such, jurisdictions in the eastern end of the lake are outside the TAC area. Harvest limits in the eastern basin are established separately by Ontario, Pennsylvania, and New York and remain in accordance with lakewide conditions and objectives.

The walleye TAC recommendations are consistent with the Lake Erie Walleye Management Plan, which sets fishery goals and objectives for walleye. The plan is the result of extensive stakeholder and manager input through LEPMAG. In addition, the Walleye Task Group, comprising scientists and field biologists from all Lake Erie jurisdictions, provides scientific advice to the Lake Erie Committee. The committee also takes into account recommendations from LEPMAG and is informed by a model, developed in conjunction with stakeholders and Michigan State University.

Yellow Perch

The Lake Erie Committee remains strongly interested in maintaining stability in harvest while ensuring yellow perch sustainability. Consistent with that primary objective, the Lake Erie Committee recommended a 2016 TAC of 9.208 million pounds of yellow perch, a decrease from last year's allocation of 10.528 million pounds. The decrease in the yellow perch TAC reflects declining abundance in the central eastern basins, coupled with increasing abundance in the western basin. Like the walleye TAC recommendation, the proposed yellow perch TAC is the result of deliberations among the jurisdictions and with stakeholders through the LEPMAG process.

The five jurisdictions on the lake share Lake Erie's yellow perch established under an area-based formula. Under the 2016 TAC recommendation, Ontario will receive 4.385 million pounds, Ohio 3.876 million pounds, Michigan 0.209 million pounds, New York 0.119 million pounds, and Pennsylvania 0.620 million pounds.

The Lake Erie Committee noted that the lakewide yellow perch fishery is performing at long-term trend levels and, thus, the overall TAC reflects a relatively small decrease. The performance, however, is not uniform throughout the lake. In some areas, called "management units," the change in yellow perch abundance (and, hence, allowable harvest) is significantly different in 2016 compared to 2015. The Lake Erie Committee has strived to maintain harvest stability while still responding to specific trends in each management unit. The committee discussed the need to evaluate methods, including population modeling and assessment, for better understanding percid recruitment in the central basin.

The Lake Erie Percid Management Advisory Group (LEPMAG)

The Lake Erie Percid Management Advisory Group was first convened in 2010 and serves as the primary method to incorporate stakeholder needs and objectives into the Lake Erie yellow perch and walleye decision-making process. LEPMAG consists of senior representatives from all provincial and state jurisdictions on the lake, recreational fishers, commercial fishers, and other interested organizations. Through LEPMAG, fishery managers and stakeholders work together to identify the harvest policies for Lake Erie percids that meet the needs of all stakeholders while maintaining stability in the percid fishery. Michigan State University's Quantitative Fisheries Center facilitates the LEPMAG process. Walleye are now being managed under the Walleye Management Plan, which was developed through LEPMAG and formally adopted by the Lake Erie Committee in December, 2015. LEPMAG members are in the process of developing population objectives and harvest strategies for yellow perch in Lake Erie. The objectives and harvest strategies are expected to be completed in the coming years.

The Lake Erie Committee and TACs

The Lake Erie Committee comprises fishery managers from Michigan, New York, Ohio, Ontario and Pennsylvania. The committee's work is facilitated by the Great Lakes Fishery Commission, a Canadian and U.S. agency on the Great Lakes. Each year the committee recommends a TAC for walleye and yellow perch. The TAC represents the number or weight of fish recommended to be caught by sport and commercial fishers without putting the fisheries at risk. The individual agencies implement the recommended total allowable catch. ✧

Walleye Task Group Report, 2016 (LEC)

2015 Fishery Review

The total allowable catch (TAC) in quota area waters of the west and central basins for 2015 was 4.114 million fish. This allocation represented a 2% increase from the 2014 TAC of 4.027 million fish. In the TAC area, the total harvest was 2.522 million fish, or 61% of the quota **(Table 1**). Harvest in the non-TAC area of the eastern basin amounted to 191,606 fish. Lake-wide Walleye harvest was estimated at 2.713 million fish in 2015. Sport fishery (1.325 million fish) and commercial fishery (1.388 million fish) harvest levels reported for 2015 were both below the long-term (1975-2014) means (2.327 and 2.024 million fish, respectively).

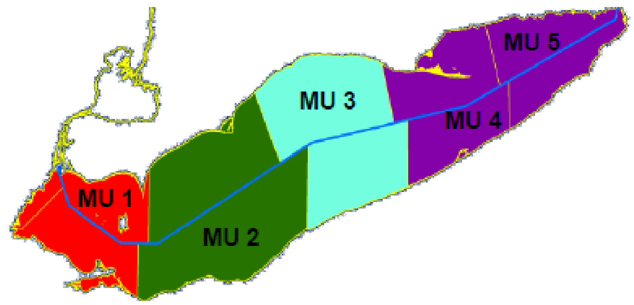

Fig 1- Lake Erie walleye management units

in number of fish	TAC Area (MU-1, MU-2, MU-3)				Non-TAC Area (MU-4 & MU-5)				All Areas
	Michigan	Ohio	Ontario	Total	NY	Penn.	Ontario	Total	Total
TAC	239,846	2,102,665	1,771,488	4,114,000	-	-	-	-	4,114,000
TAC % Share	5.83%	51.11%	43.06%	100.00%	-	-	-	-	100.00%
Harvest	65,740	1,073,263	1,382,600	2,521,603	55,201	46,523	89,882	191,606	2,713,209
Harvest %TAC	27.4%	51.0%	78.0%	61.3%					

Table 1- Summary of walleye harvest by jurisdiction in Lake Erie, 2015

Total commercial Walleye fishery effort increased in 2015 compared to 2014. Commercial gill net effort decreased in MU 1 (5%) but increased in MU's 2, 3 and 4, (47%, 85%, and 212% respectively**, Table 2**). The total commercial effort of 19,637 km of gill net fished was 5% above the long-term average (1975-2014: 18,634 km). Commercial effort was greatest in the west basin, declining eastward through the lake. Across the lake, sport fishery effort in 2015 decreased 2% relative to 2014. Sportfish effort in MU1 increased in Michigan waters by 26%, but decreased in Ohio by 8%. Central basin sportfish effort was mixed, with a 23% increase in Ohio's portion of MU2, but an equivalent decrease of 23% in effort in Ohio's MU3 waters. Sport effort decreased in Pennsylvania (5%) and increased (15%) in New York waters of MUs 4&5 (Table 3). The 2015 Walleye sport effort (2.876 million angler hours) was 55% of the long-term mean.

	Unit 1	Unit 2	Unit 3	Units 4 & 5
Effort (km)	6,980	6,487	5,379	792
change from 2014	-5%	47%	85%	212%

Table 2- Ontario walleye gillnet effort in 2015

	Unit 1 - MI	Unit 1 - OH	Unit 2 - OH	Unit 3 - OH	Units 4&5- PA	Units 4&5- NY
Effort (1000s hrs)	165	1,430	564	341	162	215
change from 2013	26%	-8%	23%	-23%	-5%	15%

Table 3- Summary of sport fishery effort reported in thousands of hours for 2015

Lake-wide catch rates in 2015 decreased for both the sport fishery (fish per hour) and for the commercial fishery (fish per kilometer of net fished). The 2015 catch rate in the sport fishery (0.43 fish/hour) is equal to the long-term average while the catch rate in the commercial fishery (70.7 fish/km gill net) is lower than the long-term average. Compared to 2014, the 2015 sport catch rates by MU decreased in all MU's (10% MU1, 14% MU2, 17% MU3 and 34% MU's 4&5). Gill net catch rates also decreased across all MU's by 12%, 7%, 26% and 38% in MU1, MU2, MU3 and MUs 4&5 respectively. Age distribution of fish in the harvest was dominated by Walleye age 7-and-older (including the 2003 year class) and ages 4 and 5 (2011 and 2010 year classes); lake-wide, age 7-and-older, age 5, and age 4 Walleye comprised 40%, 16%, and 12% of the combined commercial fishery and sport fishery, respectively. The 2013 (age 2), 2012 (age 3) and 2009 (age 6) year classes each represented 5 to 10% of the total harvest in 2015. Age 1 (2014 year class) fish contributed 9% to the total lake-wide harvest.

Catch-at-Age Analysis Population Estimate & Recruitment for 2016 and 2017

Based on the 2016 integrated SCAA model, the 2015 west-central population estimate was 25.604 million age 2 and older Walleye **(Fig 2).** The estimated number of age 7 and older fish (≥2007 year class) in 2015 was 6.178 million fish, and represented 24% of the Walleye (age 2 and older) in the population. The most abundant age group (26%) was age 2, age 4 fish comprise 16%. Using the 2016 integrated SCAA model, the number of age 2 recruits entering the population in 2016 (2014 year-class) and 2017 (2015 year-class) will be 16.538 and 38.233 million Walleye, respectively.

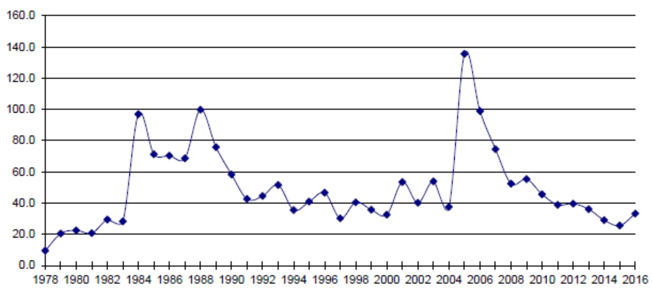

Fig 2- Population estimate of Lake Erie Walleye ages 2 and older from 1978 to 2015, and the projection for 2016 from the integrated SCAA model

2016 Population Abundance

Using the 2016 integrated SCAA model, the projected abundance of Walleye in the west-central population is 33.246 million Walleye **(Table 4).** The most abundant year class (50%) in the population is projected to be age 2 Walleye from the 2014 cohort (16.538 million fish). The next most abundant year class is 2013 (age 3) at 14%. The 2012 (age 4), 2011 (age 5) and 2010 (age 6) year-classes are all expected to contribute proportions to the population ranging from 6%, 8%, and 7%, respectively. Age 7 and older fish are expected to account for 15% of the 2016 population size. The spawning stock biomass (SSB) projected for 2016 is 32.437 million kilograms.

2016 Harvest Strategy and Recommended Allowable Harvest (RAH)

The WTG implemented the Walleye Management Plan (2015- 2019), which includes the integrated Walleye assessment model and a Walleye Harvest Control (HCR) rule. The HCR sets the target fishing rate at 60% Fmsy, with an accompanying limit reference point which will reduce the this target fishing rate beginning at 20% of the unfished spawning stock biomass (20% SSB0). This probabilistic control rule, P-star (P*), of 0.05 was incorporated to ensure that SSB in 2017 is not below the SSBo threshold after fishing in 2016. In addition, there is a limitation of TAC variation from one year to the next of 20% to implement a measure of fishery stability. Using results from the 2016 integrated SCAA model, the harvest policy adopted for 2015, and selectivity values from the current fisheries, a mean RAH of 4.998 million fish was calculated for 2016, with a range of 3.799 to 6.197 million fish **(Table 4).** The TAC range for 2016 based on minimizing variation from the 2015 TAC, plus or minus 20%, would be 3.291 to 4.937 million fish.

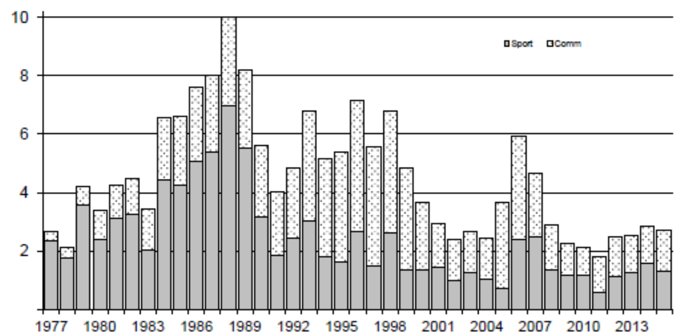

Fig 3- Lake-wide harvest of Lake Erie Walleye by sport and commercial fisheries, 1977-2015

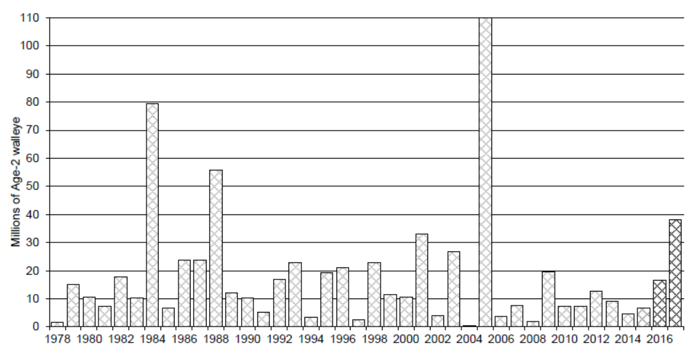

Fig 4- Estimated (1978 – 2015) and projected (2016 and 2017) number of age 2 Walleye in the west-central Lake Erie Walleye population between using the 2016 ADMB statistical catch at age model.

Year		TAC Area (MU-1, MU-2, MU-3) Michigan	Ohio	Ontario [a]	Total	Non-TAC Area (MUs 4&5) NY	Penn.	Ontario	Total	All Areas Total
1980	TAC	261,700	1,558,600	1,154,100	2,974,400				0	2,974,400
	Har	**183,140**	**2,169,800**	**1,049,269**	**3,402,209**				**0**	**3,402,209**
1981	TAC	367,400	2,187,900	1,620,000	4,175,300				0	4,175,300
	Har	**95,147**	**2,942,900**	**1,229,017**	**4,267,064**				**0**	**4,267,064**
1982	TAC	504,100	3,001,700	2,222,700	5,728,500				0	5,728,500
	Har	**194,407**	**3,015,400**	**1,260,852**	**4,470,659**				**0**	**4,470,659**
1983	TAC	572,000	3,406,000	2,522,000	6,500,000				0	6,500,000
	Har	**145,847**	**1,864,200**	**1,416,101**	**3,426,148**				**0**	**3,426,148**
1984	TAC	676,500	4,028,400	2,982,900	7,687,800				0	7,687,800
	Har	**351,169**	**4,055,000**	**2,178,409**	**6,584,578**				**0**	**6,584,578**
1985	TAC	430,700	2,564,400	1,898,800	4,893,900				0	4,893,900
	Har	**460,933**	**3,730,100**	**2,435,627**	**6,626,660**				**0**	**6,626,660**
1986	TAC	660,000	3,930,000	2,910,000	7,500,000				0	7,500,000
	Har	**605,600**	**4,399,400**	**2,617,507**	**7,622,507**				**0**	**7,622,507**
1987	TAC	490,100	2,918,500	2,161,100	5,569,700				0	5,569,700
	Har	**902,500**	**4,433,600**	**2,688,558**	**8,024,658**				**0**	**8,024,658**
1988	TAC	397,500	3,855,000	3,247,500	7,500,000				0	7,500,000
	Har	**1,996,788**	**4,890,367**	**3,054,402**	**9,941,557**	**85,282**			**85,282**	**10,026,839**
1989	TAC	383,000	3,710,000	3,125,000	7,218,000				0	7,218,000
	Har	**1,091,641**	**4,191,711**	**2,793,051**	**8,076,403**	**129,226**			**129,226**	**8,205,629**
1990	TAC	616,000	3,475,500	2,908,500	7,000,000				0	7,000,000
	Har	**747,128**	**2,282,520**	**2,517,922**	**5,547,570**	**47,443**			**47,443**	**5,595,013**
1991	TAC	440,000	2,485,000	2,075,000	5,000,000				0	5,000,000
	Har	**132,118**	**1,577,813**	**2,266,380**	**3,976,311**	**34,137**			**34,137**	**4,010,448**
1992	TAC	329,000	3,187,000	2,685,000	6,201,000				0	6,201,000
	Har	**249,518**	**2,081,919**	**2,497,705**	**4,829,142**	**14,384**			**14,384**	**4,843,526**
1993	TAC	556,500	5,397,000	4,546,500	10,500,000				0	10,500,000
	Har	**270,376**	**2,668,684**	**3,821,386**	**6,760,446**	**40,032**			**40,032**	**6,800,478**
1994	TAC	400,000	4,100,000	3,500,000	8,000,000				0	8,000,000
	Har	**216,038**	**1,468,739**	**3,431,119**	**5,115,896**	**59,345**			**59,345**	**5,175,241**
1995	TAC	477,000	4,626,000	3,897,000	9,000,000				0	9,000,000
	Har	**107,909**	**1,435,188**	**3,813,527**	**5,356,624**	**26,964**			**26,964**	**5,383,588**
1996	TAC	583,000	5,654,000	4,763,000	11,000,000				0	11,000,000
	Har	**174,607**	**2,316,425**	**4,524,639**	**7,015,671**	**38,728**	**89,087**		**127,815**	**7,143,486**
1997	TAC	514,000	4,986,000	4,200,000	9,700,000				0	9,700,000
	Har	**122,400**	**1,248,846**	**4,072,779**	**5,444,025**	**29,395**	**88,682**		**118,077**	**5,562,102**
1998	TAC	546,000	5,294,000	4,460,000	10,300,000				0	10,300,000
	Har	**114,606**	**2,303,911**	**4,173,042**	**6,591,559**	**34,090**	**124,814**	**47,000**	**205,904**	**6,797,463**
1999	TAC	477,000	4,626,000	3,897,000	9,000,000				0	9,000,000
	Har	**140,269**	**1,033,733**	**3,454,250**	**4,628,252**	**23,133**	**89,038**	**87,000**	**199,171**	**4,827,423**
2000	TAC	408,100	3,957,800	3,334,100	7,700,000				0	7,700,000
	Har	**252,280**	**932,297**	**2,287,533**	**3,472,110**	**28,599**	**77,512**	**67,000**	**173,111**	**3,645,221**
2001	TAC	180,200	1,747,600	1,472,200	3,400,000				0	3,400,000
	Har	**159,186**	**1,157,914**	**1,498,816**	**2,815,916**	**14,669**	**52,796**	**39,498**	**106,963**	**2,922,879**
2002	TAC	180,200	1,747,600	1,472,200	3,400,000				0	3,400,000
	Har	**193,515**	**703,000**	**1,436,000**	**2,332,515**	**18,377**	**22,000**	**36,000**	**76,377**	**2,408,892**
2003	TAC	180,200	1,747,600	1,472,200	3,400,000				0	3,400,000
	Har	**128,852**	**1,014,688**	**1,457,014**	**2,600,554**	**27,480**	**43,581**	**32,692**	**103,753**	**2,704,307**
2004	TAC	127,200	1,233,600	1,039,200	2,400,000				0	2,400,000
	Har	**114,958**	**859,366**	**1,419,237**	**2,393,561**	**8,400**	**19,969**	**29,864**	**58,233**	**2,451,794**
2005	TAC	308,195	2,988,910	2,517,895	5,815,000				0	5,815,000
	Har	**37,599**	**610,449**	**2,933,393**	**3,581,441**	**27,370**	**20,316**	**17,394**	**65,080**	**3,646,521**
2006	TAC	523,958	5,081,404	4,280,638	9,886,000				0	9,886,000
	Har	**305,548**	**1,868,520**	**3,494,551**	**5,668,619**	**37,161**	**151,614**	**68,774**	**257,549**	**5,926,168**
2007	TAC	284,080	2,755,040	2,320,880	5,360,000				0	5,360,000
	Har	**165,551**	**2,160,459**	**2,159,965**	**4,485,975**	**29,134**	**116,671**	**37,566**	**183,371**	**4,669,346**
2008	TAC	209,530	1,836,893	1,547,576	3,594,000				0	3,594,000
	Har	**121,072**	**1,082,636**	**1,574,723**	**2,778,431**	**29,017**	**74,250**	**34,906**	**138,173**	**2,916,604**
2009	TAC	142,835	1,252,195	1,054,970	2,450,000				0	2,450,000
	Har	**94,048**	**967,476**	**1,095,500**	**2,157,024**	**13,727**	**42,422**	**27,725**	**83,874**	**2,240,898**
2010	TAC	128,260	1,124,420	947,320	2,200,000				0	2,200,000
	Har	**55,248**	**958,366**	**983,397**	**1,997,011**	**34,552**	**54,056**	**23,324**	**111,932**	**2,108,943**
2011	TAC	170,178	1,491,901	1,256,921	2,919,000				0	2,919,000
	Har	**50,490**	**417,314**	**1,224,057**	**1,691,861**	**31,506**	**45,369**	**28,873**	**105,748**	**1,797,609**
2012	TAC	203,292	1,782,206	1,501,502	3,487,000				0	3,487,000
	Har	**86,658**	**921,390**	**1,355,522**	**2,363,570**	**36,975**	**44,796**	**28,260**	**110,031**	**2,473,601**
2013	TAC	195,655	1,715,252	1,445,094	3,356,000				0	3,356,000
	Har	**54,167**	**1,083,395**	**1,274,945**	**2,412,507**	**34,553**	**60,332**	**30,591**	**125,476**	**2,537,983**
2014	TAC	234,774	2,058,200	1,734,026	4,027,000				0	4,027,000
	Har	**42,142**	**1,303,133**	**1,324,201**	**2,669,476**	**61,982**	**84,843**	**52,675**	**199,500**	**2,868,977**
2015	TAC	239,846	2,102,665	1,771,488	4,114,000				0	4,114,000
	Har	**65,740**	**1,073,263**	**1,382,600**	**2,521,603**	**55,201**	**46,523**	**89,882**	**191,606**	**2,713,209**

Table 4 -Annual Lake Erie walleye total allowable catch (TAC, top) and measured harvest (bottom, bold), 1980 2015

	Sport Fishery															Commercial Fishery				
	Unit 1				Unit 2			Unit 3			Units 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4	
Year	OH	MI	ON[a]	Total	OH	ON[a]	Total	OH	ON[a]	Total	ON[a]	PA	NY	Total	Total	ON	ON	ON	ON	Total
1975	77	4	7	88	10	--	10	--	--	--	--	--	--	0	98	--	--	--	--	0
1976	605	30	50	685	35	--	35	--	--	--	--	--	--	0	720	113	44	--	--	157
1977	2,131	107	69	2,307	37	--	37	--	--	--	--	--	--	0	2,344	235	67	--	--	302
1978	1,550	72	112	1,734	37	--	37	--	--	--	--	--	--	0	1,771	274	60	--	--	334
1979	3,254	162	79	3,495	60	--	60	--	--	--	--	--	--	0	3,555	625	30	--	--	655
1980	2,096	183	57	2,336	49	--	49	24	--	24	--	--	--	0	2,409	953	40	--	--	993
1981	2,857	95	70	3,022	38	--	38	48	--	48	--	--	--	0	3,108	1,037	119	3	--	1,159
1982	2,959	194	49	3,202	49	--	49	8	--	8	--	--	--	0	3,259	1,077	134	2	--	1,213
1983	1,626	146	41	1,813	212	--	212	26	--	26	--	--	--	0	2,051	1,129	167	80	--	1,376
1984	3,089	351	39	3,479	787	--	787	179	--	179	--	--	--	0	4,445	1,639	392	108	--	2,139
1985	3,347	461	57	3,865	294	--	294	89	--	89	--	--	--	0	4,248	1,721	432	225	--	2,378
1986	3,743	606	52	4,401	480	--	480	176	--	176	--	--	--	0	5,057	1,651	558	356	--	2,565
1987	3,751	902	51	4,704	550	--	550	132	--	132	--	--	--	0	5,386	1,611	622	405	--	2,638
1988	3,744	1,997	18	5,759	584	--	584	562	--	562	--	--	85	85	6,990	1,866	762	409	--	3,037
1989	2,891	1,092	14	3,997	867	35	902	434	80	514	--	--	129	129	5,542	1,656	621	386	--	2,663
1990	1,467	747	35	2,249	389	14	403	426	23	449	--	--	47	47	3,148	1,615	529	302	--	2,446
1991	1,104	132	39	1,275	216	24	240	258	44	302	--	--	34	34	1,851	1,446	440	274	--	2,160
1992	1,479	250	20	1,749	338	56	394	265	25	290	--	--	14	14	2,447	1,547	534	316	--	2,397
1993	1,846	270	37	2,153	450	26	476	372	12	384	--	--	40	40	3,053	2,488	762	496	--	3,746
1994	992	216	21	1,229	291	20	311	186	21	207	--	--	59	59	1,806	2,307	630	432	--	3,369
1995	1,161	108	32	1,301	159	7	166	115	27	141	--	--	27	27	1,635	2,578	681	489	--	3,748
1996	1,442	175	17	1,634	645	8	653	229	27	256	--	89	39	128	2,671	2,777	1,107	589	--	4,473
1997	929	122	8	1,059	188	2	190	132	5	138	--	89	29	118	1,505	2,585	928	544	--	4,057
1998	1,790	115	34	1,939	215	5	220	299	5	304	19	125	34	178	2,641	2,497	1,166	462	28	4,153
1999	812	140	34	986	139	5	144	83	5	88	19	89	23	131	1,349	2,461	631	317	68	3,477
2000	674	252	34	961	165	5	170	93	5	98	19	78	29	125	1,354	1,603	444	196	48	2,291
2001	941	160	34	1,135	171	5	176	46	5	51	19	53	15	87	1,449	1,004	310	141	20	1,475
2002	516	194	34	744	141	5	146	46	5	51	19	22	18	59	1,000	937	309	146	17	1,409
2003	715	129	34	878	232	5	237	68	5	73	2	44	27	73	1,261	948	283	182	14	1,427
2004	515	115	34	664	272	2	274	72	0	72	2	20	8	30	1,040	866	334	175	11	1,386
2005	374	38	27	438	110	2	112	126	0	126	2	20	27	49	725	1,878	625	401	15	2,920
2006	1,194	306	27	1,526	503	2	505	170	0	170	2	152	37	191	2,392	2,137	784	545	66	3,532
2007	1,414	166	27	1,607	578	2	580	169	0	169	2	116	29	147	2,502	1,348	450	333	35	2,167
2008	524	121	44	689	333	2	335	225	0	225	2	74	29	105	1,354	954	335	241	35	1,565
2009	553	94	44	691	287	2	288	128	0	128	2	42	14	58	1,166	705	212	135	28	1,079
2010	587	55	44	686	257	2	259	114	0	115	2	54	37	93	1,152	607	184	147	23	962
2011	224	50	44	318	104	2	106	89	0	90	2	45	32	79	593	736	262	181	29	1,208
2012	596	87	44	726	233	2	235	93	0	93	2	45	37	84	1,138	834	285	191	28	1,338
2013	757	54	44	855	190	2	192	136	0	136	2	60	35	97	1,280	737	297	195	31	1,260
2014	909	42	45	996	177	13	190	218	13	231	13	85	62	160	1,577	756	259	238	40	1,292
2015	746	66	45	857	187	13	200	140	13	153	13	47	55	115	1,325	633	354	325	77	1,388
Mean	1,531	264	40	1,834	272	10	278	167	12	176	8	69	37	61	2,327	1,383	432	284	32	2,024

Table 5- Annual harvest (thousands of fish) of Lake Erie walleye by gear, management unit, and agency, 1975 to 2014

	Sport Fishery [a]															Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Units 4 & 5					Unit 1	Unit 2	Unit 3	Units 4&5	
Year	OH	MI	ON[c]	Total	OH	ON[c]	Total	OH	ON[c]	Total	ON[c]	PA	NY	Total	Total	ON	ON	ON	ON	Total
1975	486	30	46	562	61	--	61	--	--	--	--	--	--	0	623	--	--	--	--	--
1976	1,356	84	98	1,538	163	--	163	--	--	--	--	--	--	0	1,701	1,796	1,933	--	--	3,729
1977	2,768	171	130	3,069	151	--	151	--	--	--	--	--	--	0	3,220	4,282	1,572	--	--	5,854
1978	2,880	176	148	3,204	154	--	154	--	--	--	--	--	--	0	3,358	5,253	436	--	--	5,689
1979	4,179	257	97	4,533	169	--	169	--	--	--	--	--	--	0	4,702	5,798	1,798	--	--	7,596
1980	3,938	624	92	4,654	237	--	237	187	--	187	--	--	--	0	5,078	6,229	1,565	--	--	7,794
1981	5,766	447	138	6,351	264	--	264	382	--	382	--	--	--	0	6,997	6,881	2,144	622	--	9,647
1982	5,928	449	108	6,484	223	--	223	114	--	114	--	--	--	0	6,821	10,531	2,913	689	--	14,133
1983	4,168	451	118	4,737	568	--	568	128	--	128	--	--	--	0	5,433	11,205	5,352	5,814	--	22,371
1984	4,077	557	82	4,716	1,322	--	1,322	392	--	392	--	--	--	0	6,430	11,550	6,008	2,438	--	19,996
1985	4,606	926	84	5,616	1,078	--	1,078	464	--	464	--	--	--	0	7,158	7,496	2,800	2,983	--	13,279
1986	6,437	1,840	107	8,384	1,086	--	1,086	538	--	538	--	--	--	0	10,008	7,824	5,637	3,804	--	17,265
1987	6,631	2,193	84	8,908	1,431	--	1,431	472	--	472	--	--	--	0	10,811	6,595	4,243	3,045	--	13,883
1988	7,547	4,362	87	11,996	1,677	--	1,677	1,081	--	1,081	--	--	462	462	15,216	7,495	5,794	3,778	--	17,067
1989	5,246	3,794	81	9,121	1,532	77	1,609	883	205	1,088	--	--	556	556	12,374	7,846	5,514	3,473	--	16,833
1990	4,116	1,803	121	6,040	1,675	33	1,708	869	83	952	--	--	432	432	9,132	9,016	5,829	5,544	--	20,389
1991	3,555	440	144	4,200	1,220	79	1,320	715	155	880	--	--	440	440	6,840	10,418	5,055	3,146	--	18,619
1992	3,955	715	105	4,775	1,169	81	1,249	640	145	786	--	--	299	299	7,109	9,486	6,906	6,043	--	22,435
1993	3,943	691	125	4,759	1,349	70	1,418	1,062	125	1,187	--	--	305	305	7,669	16,283	11,656	7,420	--	35,359
1994	2,808	788	125	3,721	1,025	65	1,090	599	130	729	--	--	355	355	5,894	16,698	9,968	6,459	--	33,125
1995	3,188	277	125	3,589	803	65	868	355	130	485	--	--	259	259	5,201	20,521	12,113	7,850	--	40,484
1996	3,060	521	125	3,706	1,132	65	1,197	495	130	625	--	316	256	572	6,100	19,976	15,685	10,990	--	46,651
1997	2,748	374	88	3,210	864	45	909	492	91	583	--	388	273	661	5,363	15,708	11,588	9,094	--	36,390
1998	3,010	374	103	3,487	635	51	686	409	55	409	217	390	280	670	5,252	19,027	19,397	13,253	818	52,495
1999	2,368	411	--	2,779	603	--	603	323	--	323	--	397	171	568	4,273	21,432	10,955	7,630	1,444	41,461
2000	1,975	540	--	2,516	540	--	540	281	--	281	--	244	177	421	3,757	22,238	11,049	7,896	1,781	43,054
2001	1,952	362	--	2,314	697	--	697	261	--	261	--	241	163	404	3,676	9,372	5,746	5,021	639	20,778
2002	1,393	606	--	1,999	444	--	444	246	--	246	--	130	132	262	2,951	4,431	4,212	4,427	445	13,515
2003	1,719	326	--	2,045	675	--	675	236	--	236	30	159	162	321	3,277	4,476	3,946	3,725	365	12,512
2004	1,257	504	--	1,761	736	27	736	178	7	178	--	88	101	189	2,864	3,875	2,977	2,401	240	9,493
2005	1,180	212	40	1,392	573	--	573	261	--	261	--	109	142	251	2,477	7,083	4,174	4,503	174	15,934
2006	1,757	587	--	2,344	899	--	899	260	--	260	--	239	137	376	3,879	5,689	4,008	3,589	822	14,107
2007	2,076	448	--	2,524	1,147	--	1,147	321	--	321	--	232	135	367	4,358	4,509	2,927	2,665	383	10,484
2008	1,027	392	63	1,419	809	--	809	356	--	356	--	187	156	343	2,927	4,990	3,193	1,909	497	10,590
2009	1,063	310	--	1,373	777	--	777	289	--	289	--	124	100	224	2,663	3,537	2,164	1,746	478	7,925
2010	1,403	226	--	1,629	652	--	652	219	--	219	--	188	140	328	2,828	1,918	1,371	1,401	247	4,937
2011	862	165	--	1,026	346	--	346	217	--	217	--	156	145	301	1,891	2,646	1,884	1,572	489	6,591
2012	1,283	242	--	1,525	560	--	560	182	--	182	--	160	169	329	2,597	4,674	2,480	2,298	352	9,804
2013	1,424	182	--	1,606	503	--	503	236	--	236	--	154	143	297	2,641	3,802	2,774	2,624	304	9,503
2014	1,552	131	101	1,683	459	85	459	441	71	441	70	171	187	358	2,940	7,351	4,426	2,911	254	14,943
2015	1,430	165	--	1,595	564	--	564	341	--	341	--	162	215	377	2,876	6,980	6,487	5,379	792	19,637
Mean	3,017	700	102	3,782	760	62	776	417	111	451	106	214	232	259	5,212	8,973	5,492	4,493	572	18,634

Table 6- Annual fishing effort for Lake Erie walleye by gear, management unit, and agency, 1975 to 2014

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Yellow Perch Task Group Report, 2016 (LEC)

2015 Fisheries Review

The lakewide total allowable catch (TAC) of Yellow Perch in 2015 was 10.528 million lbs. This allocation represented a 5% decrease from a TAC of 11.081 million lbs in 2014. For Yellow Perch assessment and allocation, Lake Erie is partitioned into four management units (Units, or MUs; **Fig 1).** The 2015 TAC allocation by management unit was 1.592, 4.450, 3.962, and 0.524 million pounds for Units 1 through 4, respectively. The lakewide harvest of Yellow Perch in 2015 was 6.918 million pounds, or 65.7% of the total 2015 TAC. This was a 21% decrease from the 2014 harvest of 8.792 million pounds. Harvest from Yellow Perch management units 1 through 4 was 1.122, 2.621, 2.782, and 0.393 million pounds, respectively **(Table 1).** The TAC percentages harvested were 70.5%, 58.9%, 70.2%, and 75.1%, in MUs 1 through 4, respectively. In 2015, Ontario harvested 4.460 million pounds, followed by Ohio (2.190 million lbs.), Michigan (94 thousand lbs.), Pennsylvania (88 thousand lbs.), and New York (86 thousand lbs.).

Targeted gill net effort in Ontario waters in 2015 increased from 2014 by 19.9% in MU1, and by 42.2% in MU2, but decreased slightly from 2014 by 11.9% in MU3, and 12.0% in MU4. U.S. angling effort increased in 2015 from 2014 in MU1 by 12.5%, whereas U.S. angling effort decreased in MU2 (-22.3%), MU3 (-33.7%), and MU4 (-31.0%). U.S. trap net effort in 2015 increased in MU2 (+10.4%), MU3 (+79.5%), and MU4 (+107.0%) compared to 2014. There was no U.S. trap net effort in MU1 in 2015. Fishing effort by jurisdiction and gear type is presented in **Table 2**.

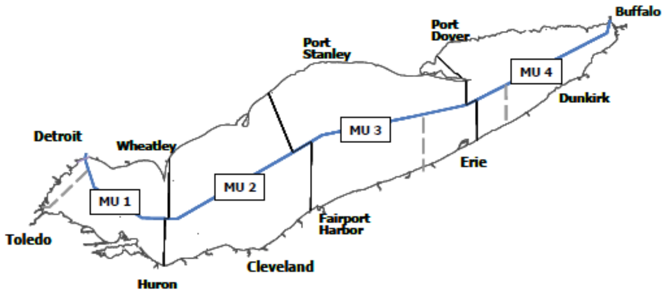


Fig 1- Yellow Perch Management Units (MUs) of Lake Erie

MU	Harvest by jurisdiction (lbs)								Total (lbs)
	Michigan	Ontario	Ohio		Pennsylvania		New York		
	sport	all commercial*	sport	commercial trap net	sport	commercial trap net	sport	commercial trap net	
1	94,225	541,938	485,744	0					1,121,907
2		1,489,433	126,932	1,005,061					2,621,426
3		2,131,211	306,706	266,030	70,704	6,854			2,781,505
4		297,716			10,055	0	64,032	21,503	393,306
Total	94,225	4,460,298	919,382	1,271,091	80,759	6,854	64,032	21,503	6,918,144

Table 1- Lake Erie Yellow Perch harvest by jurisdiction and gear type for 2015

MU	Effort by jurisdiction							
	Michigan	Ontario	Ohio		Pennsylvania		New York	
	sport (angler hours)	commercial (km gill net)*	sport (angler hours)	commercial (trap net lifts)	sport (angler hours)	commercial (trap net lifts)	sport (angler hours)	commercial (trap net lifts)
1	137,246	4,074	659,460	0				
2		9,459	217,637	6,309				
3		5,000	212,226	1,067	70,490	310		
4		1,774			18,638	0	44,029	441
Total	137,246	20,306	1,089,323	7,376	89,128	310	44,029	441

Table 2- Lake Erie Yellow Perch fishing effort by jurisdiction and gear type for 2015

Catch-at-Age Analysis and Recruitment Estimate for 2016

Population size for 1975 to 2015 for each management unit was estimated by statistical catch-at-age analysis (SCAA) using Auto Differentiation Model Builder (ADMB) modeling software. Stock size estimates for 2016 (ages 3 and older) were projected from SCAA estimates of 2015 population size and age-specific survival rates in 2015. Age-2 Yellow Perch recruitment in 2016 was predicted by multi-model averaging of juvenile Yellow Perch survey indices against SCAA abundance estimates of two-year-old Yellow Perch within each management unit. Projected age-2 Yellow Perch recruitment from the 2014 year class was incorporated into the 2016 population estimate along with estimates of ages-3-and-older fish in each Unit, producing the total standing stock of ages-2-and-older fish in 2016 **(Table 3**).

Abundance estimates of ages-2-and-older Yellow Perch in 2016 are projected to increase by 94.7% in MU1, 14.8% in MU2, and 35.7% in MU4, and decrease by 0.5% in MU3, compared to the 2015 abundance estimates. Ages-2-and-older Yellow Perch abundance in 2016 is projected to be 56.096, 47.826, 39.137, and 8.370 million fish in Units 1 through 4, respectively **(Table 3)**. Using mean weight-at-age information from assessment surveys, in 2016 biomass estimates are projected to increase in MU1 (+85.8%) and in MU4 (+1.3%), and decrease in MU2 (-1.2%), MU3 (-14.1%) compared to 2015.

MU	Age	2015 Mean Stock Size (millions fish)	Fishing Mortality (F)	Survival Rate (S)	2016 Mean Stock Size (millions fish)	Mean Weight in Population (kg)	Stock Biomass 2015 (millions kgs)	Stock Biomass 2016 (millions kgs)	Stock Biomass 2016 (millions lbs)
1	2	21.474	0.131	0.588	39.997	0.078	1.696	3.120	6.879
	3	3.763	0.321	0.486	12.627	0.118	0.470	1.486	3.276
	4	0.608	0.369	0.463	1.830	0.142	0.091	0.260	0.573
	5	1.660	0.343	0.476	0.282	0.160	0.257	0.045	0.100
	6+	1.306	0.428	0.437	1.360	0.199	0.273	0.271	0.598
	Total	*28.811*	*0.182*	*0.559*	*56.096*	*0.092*	*2.788*	*5.182*	*11.426*
2	2	9.369	0.199	0.549	27.589	0.090	0.928	2.474	5.455
	3	23.147	0.276	0.509	5.147	0.132	3.079	0.678	1.494
	4	3.497	0.565	0.381	11.774	0.157	0.525	1.845	4.067
	5	2.452	0.612	0.363	1.332	0.193	0.483	0.258	0.568
	6+	3.192	0.672	0.342	1.984	0.257	0.820	0.509	1.123
	Total	*41.657*	*0.322*	*0.486*	*47.826*	*0.120*	*5.834*	*5.763*	*12.707*
3	2	8.141	0.019	0.658	17.507	0.071	0.554	1.237	2.728
	3	9.697	0.164	0.569	5.354	0.114	1.038	0.612	1.350
	4	5.002	0.250	0.522	5.517	0.143	0.690	0.789	1.740
	5	6.133	0.258	0.518	2.611	0.171	1.000	0.447	0.985
	6+	10.345	0.333	0.480	8.147	0.232	2.514	1.893	4.174
	Total	*39.318*	*0.198*	*0.550*	*39.137*	*0.127*	*5.795*	*4.978*	*10.976*
4	2	0.742	0.102	0.605	4.860	0.090	0.077	0.436	0.961
	3	2.143	0.139	0.583	0.449	0.158	0.334	0.071	0.156
	4	0.764	0.147	0.579	1.250	0.213	0.157	0.266	0.587
	5	1.648	0.212	0.542	0.442	0.267	0.445	0.118	0.260
	6+	0.871	0.207	0.545	1.368	0.326	0.306	0.446	0.983
	Total	*6.168*	*0.164*	*0.569*	*8.370*	*0.160*	*1.319*	*1.336*	*2.947*

Table 3- Projection of the 2016 Lake Erie Yellow Perch population

Recommended Allowable Harvest (RAH) for 2016

Standard errors and ranges for population estimates were calculated for each age in 2015, and following estimated survival from catch-at-age, for 2016. RAH *min*, *mean*, and *max* values are based on mean population estimates minus or plus one standard deviation. Proposed target fishing rates for RAHs in 2016 are the same as 2015, and RAH ranges are presented in Table 4 for management units 1 through 4.

MU	Fishing Rate	Recommended Allowable Harvest (millions lbs.) MIN	MEAN	MAX
1	0.670	1.394	2.292	3.209
2	0.670	1.814	2.656	3.504
3	0.700	1.430	2.408	3.390
4	0.300	0.141	0.259	0.384
Total		4.779	7.615	10.487

Table 4- Lake Erie Yellow Perch fishing rates and RAH (in millions of pounds) for 2016 by management unit

	Year	Ontario* Harvest	%	Ohio Harvest	%	Michigan Harvest	%	Pennsylvania Harvest	%	New York Harvest	%	Total Harvest
Unit 1	2000	980,323	47	1,038,687	50	67,010	3	--	--	--	--	2,086,020
	2001	813,066	45	915,641	51	70,910	4	--	--	--	--	1,799,617
	2002	1,454,105	50	1,316,553	45	147,065	5	--	--	--	--	2,917,723
	2003	1,179,667	44	1,406,385	53	84,878	3	--	--	--	--	2,670,930
	2004	1,698,761	59	1,090,669	38	94,732	3	--	--	--	--	2,884,162
	2005	1,513,890	60	965,231	38	49,485	2	--	--	--	--	2,528,606
	2006	1,325,464	54	1,055,378	43	62,854	3	--	--	--	--	2,443,696
	2007	727,678	41	982,677	55	62,815	4	--	--	--	--	1,773,170
	2008	580,050	56	409,705	39	47,934	5	--	--	--	--	1,037,689
	2009	853,137	61	463,564	33	87,319	6	--	--	--	--	1,404,020
	2010	879,358	47	889,512	48	83,725	5	--	--	--	--	1,852,595
	2011	870,802	48	796,447	44	145,960	8	--	--	--	--	1,813,209
	2012	752,872	44	883,245	51	93,291	5	--	--	--	--	1,729,408
	2013	648,884	43	789,088	52	76,994	5	--	--	--	--	1,514,966
	2014	620,667	56	391,361	36	87,511	8	--	--	--	--	1,099,539
	2015	541,938	48	485,744	43	94,225	8	--	--	--	--	1,121,907
Unit 2	2000	1,484,125	56	1,169,333	44	--	--	--	--	--	--	2,653,458
	2001	1,794,275	51	1,747,069	49	--	--	--	--	--	--	3,541,344
	2002	2,190,621	52	1,986,730	48	--	--	--	--	--	--	4,177,351
	2003	2,107,639	50	2,113,285	50	--	--	--	--	--	--	4,220,924
	2004	2,051,473	48	2,246,264	52	--	--	--	--	--	--	4,297,737
	2005	2,666,231	59	1,843,190	41	--	--	--	--	--	--	4,509,421
	2006	3,102,269	69	1,393,732	31	--	--	--	--	--	--	4,496,001
	2007	1,847,139	45	2,244,656	55	--	--	--	--	--	--	4,091,795
	2008	1,990,237	50	2,005,000	50	--	--	--	--	--	--	3,995,237
	2009	2,495,611	58	1,801,978	42	--	--	--	--	--	--	4,297,589
	2010	1,888,876	56	1,457,823	44	--	--	--	--	--	--	3,346,699
	2011	1,665,258	54	1,399,503	46	--	--	--	--	--	--	3,064,761
	2012	1,877,615	50	1,851,846	50	--	--	--	--	--	--	3,729,461
	2013	1,803,684	51	1,721,668	49	--	--	--	--	--	--	3,525,352
	2014	1,679,175	52	1,543,226	48	--	--	--	--	--	--	3,222,401
	2015	1,489,433	57	1,131,993	43	--	--	--	--	--	--	2,621,426
Unit 3	2000	771,646	62	443,250	36	--	--	32,613	3	--	--	1,247,509
	2001	999,450	64	464,811	30	--	--	91,211	6	--	--	1,555,472
	2002	1,192,691	60	640,104	32	--	--	140,821	7	--	--	1,973,616
	2003	1,667,133	72	481,558	21	--	--	177,516	8	--	--	2,326,207
	2004	1,453,419	62	659,447	28	--	--	244,063	10	--	--	2,356,929
	2005	1,771,800	75	457,593	19	--	--	142,028	6	--	--	2,371,421
	2006	3,451,499	90	271,144	7	--	--	106,260	3	--	--	3,828,903
	2007	2,997,101	84	391,285	11	--	--	193,065	5	--	--	3,581,451
	2008	2,200,168	74	629,366	21	--	--	155,014	5	--	--	2,984,548
	2009	2,266,727	74	597,214	20	--	--	190,742	6	--	--	3,054,683
	2010	3,370,099	85	476,808	12	--	--	117,640	3	--	--	3,964,547
	2011	3,366,412	81	636,686	15	--	--	153,233	4	--	--	4,156,331
	2012	3,768,183	81	746,999	16	--	--	161,751	3	--	--	4,676,933
	2013	2,983,539	76	796,307	20	--	--	155,193	4	--	--	3,935,039
	2014	2,668,921	70	979,937	26	--	--	168,690	4	--	--	3,817,548
	2015	2,131,211	77	572,736	21	--	--	77,558	3	--	--	2,781,505
Unit 4	2000	35,686	73	--	--	--	--	10,950	22	2,458	5	49,094
	2001	35,893	60	--	--	--	--	8,337	14	15,319	26	59,549
	2002	87,541	54	--	--	--	--	46,903	29	26,903	17	161,347
	2003	84,772	60	--	--	--	--	39,821	28	16,511	12	141,104
	2004	98,733	49	--	--	--	--	46,344	23	54,862	27	199,939
	2005	195,347	67	--	--	--	--	42,226	15	53,468	18	291,041
	2006	230,226	69	--	--	--	--	57,005	17	48,107	14	335,338
	2007	185,954	78	--	--	--	--	25,859	11	25,935	11	237,748
	2008	240,270	77	--	--	--	--	31,325	10	40,809	13	312,404
	2009	272,579	72	--	--	--	--	37,991	10	70,030	18	380,600
	2010	467,612	89	--	--	--	--	19,989	4	37,730	7	525,331
	2011	468,001	80	--	--	--	--	37,040	6	80,848	14	585,889
	2012	502,778	77	--	--	--	--	41,362	6	106,499	16	650,639
	2013	496,666	72	--	--	--	--	74,277	11	119,869	17	690,812
	2014	485,899	74	--	--	--	--	16,671	3	149,668	23	652,238
	2015	297,716	76	--	--	--	--	10,055	3	85,535	22	393,306
Lakewide Totals	2000	3,271,780	54	2,651,270	44	67,010	1	43,563	<1	2,458	<1	6,036,081
	2001	3,642,684	52	3,127,521	45	70,910	1	99,548	1	15,319	<1	6,955,982
	2002	4,924,958	53	3,943,387	43	147,065	2	187,724	2	26,903	<1	9,230,037
	2003	5,039,211	54	4,001,228	43	84,878	1	217,337	2	16,511	<1	9,359,165
	2004	5,302,386	54	3,996,380	41	94,732	1	290,407	3	54,862	<1	9,738,767
	2005	6,147,268	63	3,266,014	34	49,485	<1	184,254	2	53,468	<1	9,700,489
	2006	8,109,458	73	2,720,254	24	62,854	<1	163,265	1	48,107	<1	11,103,938
	2007	5,757,872	59	3,618,618	37	62,815	<1	218,924	2	25,935	<1	9,684,164
	2008	5,010,725	60	3,044,071	37	47,934	<1	186,339	2	40,809	<1	8,329,878
	2009	5,888,054	64	2,862,756	31	87,319	1	228,733	3	70,030	1	9,136,892
	2010	6,605,945	68	2,824,143	29	83,725	1	137,629	1	37,730	<1	9,689,172
	2011	6,370,473	66	2,832,636	29	145,960	2	190,273	2	80,848	1	9,620,190
	2012	6,901,448	64	3,482,090	32	93,291	1	203,113	2	106,499	1	10,786,441
	2013	5,932,773	61	3,307,063	34.2	76,994	1	229,470	2	119,869	1	9,666,169
	2014	5,454,662	62.0	2,914,524	33.2	87,511	1	185,361	2	149,668	2	8,791,726
	2015	4,460,298	64.5	2,190,473	31.7	94,225	1	87,613	1	85,535	1	6,918,144

Table 5- Lake Erie Yellow Perch harvest in pounds by management unit (Unit) and agency, 2000-2015.

		Unit 1		Unit 2		Unit 3		Unit 4		Lakewide	
Gear	Age	Number	%	Number	%	Number	%	Number	%	Number	%
Gill Nets	1	0	0.0	1,896	0.0	0	0.0	0	0.0	1,896	0.0
	2	372,274	21.5	366,717	7.8	12,797	0.2	48,561	5.7	800,350	5.6
	3	538,766	31.1	2,343,279	49.5	1,402,573	20.3	510,881	59.9	4,795,498	33.7
	4	143,167	8.3	769,787	16.3	1,826,947	26.5	95,248	11.2	2,835,149	19.9
	5	415,099	24.0	696,648	14.7	1,807,831	26.2	160,284	18.8	3,079,862	21.7
	6+	263,068	15.2	552,549	11.7	1,845,035	26.8	38,250	4.5	2,698,903	19.0
	Total	1,732,374	*41.3*	4,730,877	*58.4*	6,895,184	*80.5*	853,225	*83.7*	14,211,659	*65.0*
Trap Nets	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	0	0.0	70,883	2.3	12,379	1.5	0	0.0	83,262	2.1
	3	0	0.0	1,385,769	45.4	352,130	43.9	1,111	2.0	1,739,010	44.5
	4	0	0.0	471,688	15.5	143,583	17.9	3,704	6.7	618,975	15.8
	5	0	0.0	735,254	24.1	167,491	20.9	21,854	39.3	924,599	23.7
	6+	0	0.0	386,168	12.7	126,109	15.7	28,892	52.0	541,169	13.9
	Total	0	*0.0*	3,049,762	*37.6*	801,692	*9.4*	55,561	*5.4*	3,907,015	*17.9*
Sport	1	79,713	3.2	11,823	3.7	8,379	1.0	0	0.0	99,915	2.7
	2	1,563,901	63.5	43,491	13.5	41,973	4.9	1,881	1.7	1,651,246	43.9
	3	567,249	23.0	153,374	47.6	289,111	33.4	9,465	8.6	1,019,199	27.1
	4	74,260	3.0	26,957	8.4	213,109	24.7	9,737	8.8	324,062	8.6
	5	97,565	4.0	41,753	13.0	126,541	14.6	54,822	49.5	320,681	8.5
	6+	80,949	3.3	44,714	13.9	185,252	21.4	34,800	31.4	345,715	9.2
	Total	2,463,636	*58.7*	322,112	*4.0*	864,365	*10.1*	110,706	*10.9*	3,760,818	*17.2*
All Gear	1	79,713	1.9	13,719	0.2	8,379	0.1	0	0.0	101,812	0.5
	2	1,936,175	46.1	481,091	5.9	67,149	0.8	50,442	4.9	2,534,858	11.6
	3	1,106,015	26.4	3,882,422	47.9	2,043,814	23.9	521,458	51.1	7,553,708	34.5
	4	217,426	5.2	1,268,432	15.7	2,183,639	25.5	108,689	10.7	3,778,187	17.3
	5	512,663	12.2	1,473,655	18.2	2,101,863	24.6	236,960	23.2	4,325,142	19.8
	6+	344,017	8.2	983,431	12.1	2,156,396	25.2	101,942	10.0	3,585,787	16.4
	Total	4,196,010	19.2	8,102,751	37.0	8,561,241	39.1	1,019,491	4.7	21,879,492	100.0

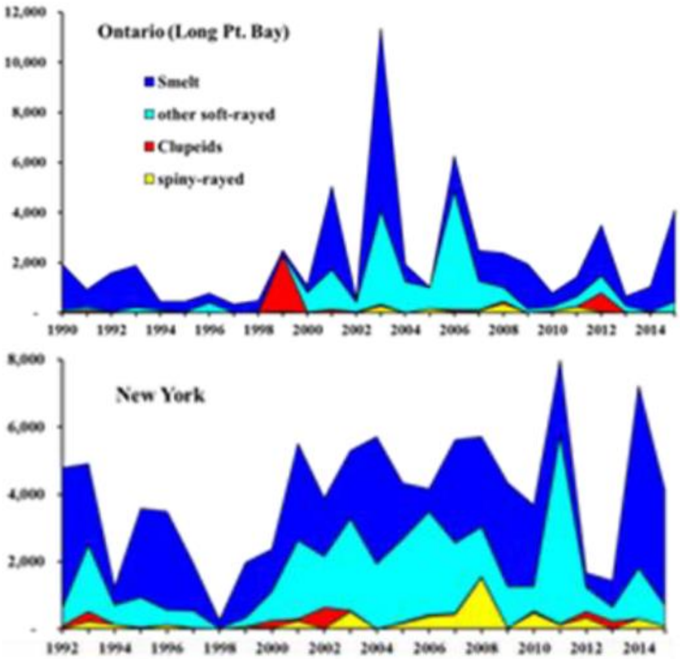
Table 6- Estimated 2015 Lake Erie Yellow Perch harvest by age and numbers of fish by gear and management unit ✧

Forage Task Group, 2016 (LEC)

East Basin Status of Forage

Rainbow Smelt are the principal prey fish species of piscivores in the offshore waters of eastern Lake Erie and the most abundant forage species in most years. In 2015, Rainbow Smelt were the most abundant forage species in Ontario and New York waters of the East Basin. Young-of-the-year density in the Ontario trawl program was the highest since 2003 (3245/ha) and age-1+ density was the highest since 2009 (411/ha). In the New York survey, age-0 density (2856/ha) was down from a record high in 2014 but remained well above average. Yearling-and-older density in New York increased to 575/ha from low numbers in 2014. In Pennsylvania waters, both age-0 (108/ha) and age-1+ (35/ha) densities were much lower than in the other jurisdictions.

The densities of most non-Rainbow Smelt forage species were below average in 2015, including Trout-Perch, White Perch, Alewife and Spottail Shiner. Emerald Shiner catches were generally below average except for age-0 in Ontario. Gizzard Shad density increased to above average levels in Ontario and Pennsylvania. Round Goby density increased in all surveys and was above average in Ontario nearshore surveys. Predator diets were dominated by fish species, primarily Rainbow Smelt and Round Goby. Predator growth remains good. However, over the last 6- or 7- year period, a moderate decreasing trend in size at age is evident among a few age groups of Smallmouth Bass in Ontario. Lake Trout size-at-age remains stable and among the highest observed in the Great Lakes.



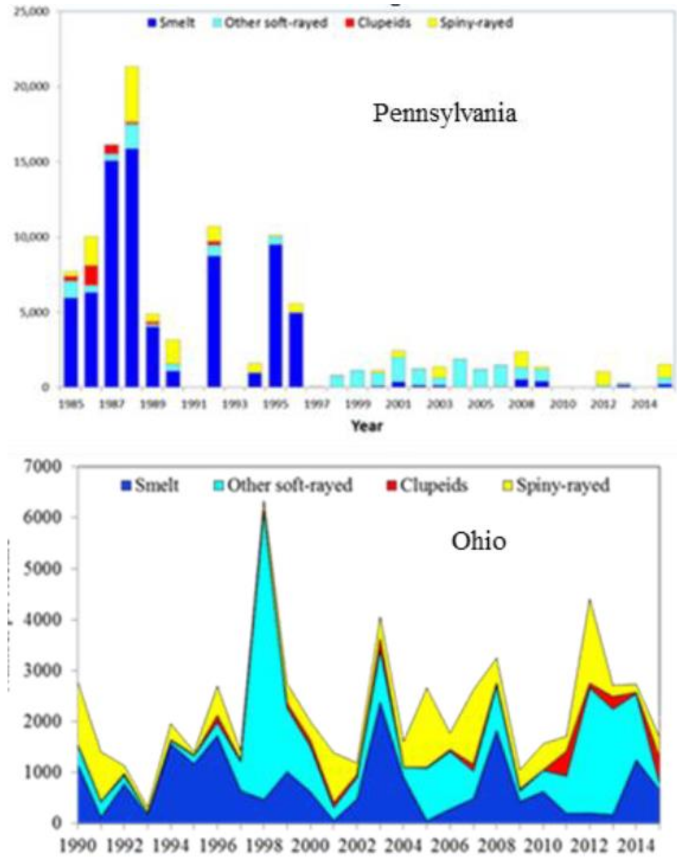
East Basin Forage Abundance

Central Basin Status of Forage

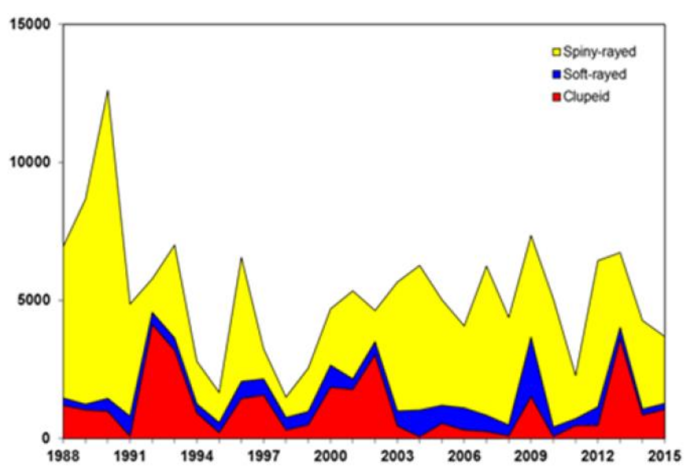
In 2015, overall forage abundance in Ohio waters declined from 2014 and was below the long term average for the 26 year survey. The largest declines were in the Rainbow Smelt and soft-rayed groups (primarily Emerald Shiners). The clupeid and spiny-rayed groups did increase from 2014, but the increase was not enough to offset the sharp declines in Rainbow Smelt and soft-rayed groups in Ohio. In Pennsylvania, Rainbow Smelt were the primary forage species prior to 1998, when Round Goby entered the system and became the primary soft-rayed forage species. Recently, spiny-rayed species, age-0 White Perch and age-0 Yellow Perch have been the most abundant forage group in Pennsylvania. Round Goby age-0 and age-1+, Ohio West indices increased from 2014 and were above average, while Ohio East indices decreased from 2014 and were below average. The Pennsylvania age-0 index was above average, while the age-1+ index was below average. Gizzard Shad indices from 2015 were the highest in the time series in Pennsylvania and Ohio East, and second highest in Ohio West. Adult Walleye diets (by dry weight) were primarily Gizzard Shad and to a lesser extent Emerald Shiner.

West Basin Status of Forage

In 2014, hypolimnetic dissolved oxygen levels for all sampled sites remained above the 2 mg per liter threshold during the August trawling survey. In total, data from 70 sites were used in 2014. Total forage abundance was below average in 2015, the second year of decline. Clupeid catches were highest near Sandusky Bay and Point Pelee. Soft-rayed fish were most abundant near Pelee Island. Spiny-rayed abundance was distributed relatively evenly throughout the basin. Young-of-the-year Yellow Perch (494/ha) decreased relative to 2014, while age-0 Walleye abundance (84/ha) increased sharply; both were well above long-term means. Catches of Round Goby (43.7/ha) increased from 2013, but still represent the fourth lowest abundance since their discovery in 1997.



Central Basin prey density by functional group



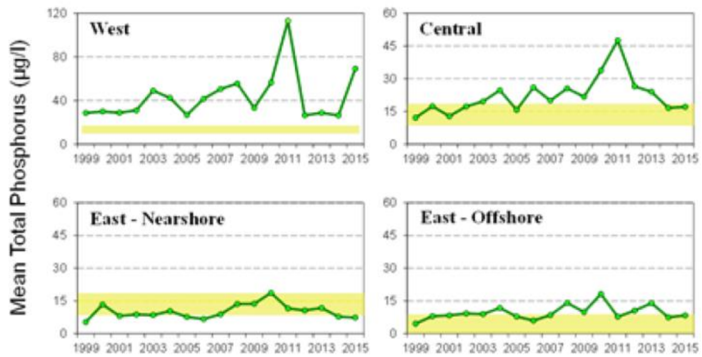
West Basin prey density by functional group

Hydroacoustic Assessments

The Forage Task Group introduced fisheries hydroacoustic technology on Lake Erie to provide a more comprehensive assessment of pelagic forage fish species abundance and distribution. Beginning with surveys of the eastern basin in 1993, coverage was expanded to the central basin in 2000 and western basin in 2004. Recent year basin surveys have been accomplished as independent, approximately concurrent summer-time efforts during the new-moon phase in July. Participation in each basin acoustic survey has been shared among jurisdictional agencies with support from the USGS. In 2015 (new moon on July 16th), the east basin acoustic survey was conducted from July 13 to 16 on 6 of 12 planned transects, the central basin survey from July 13-17, and the west basin survey from July 13-22. Thirteen acoustic transects, 48 temperature and dissolved oxygen profiles and 36 midwater trawls were sampled in total during the 2015 surveys. Hydroacoustic density estimates of age-0 Rainbow Smelt were the largest in the last five years in the central basin. Western basin forage fish density and biomass estimates were high in 2015, averaging 54,309 fish per hectare and 22 kg per hectare. East basin acoustic data collected in 2015 have not been processed or analyzed.

Interagency Lower Trophic Level Monitoring

The lower trophic level monitoring (LTLA) program has measured nine environmental variables at 18 stations around Lake Erie since 1999 to characterize ecosystem change. In 2015, measures of total phosphorus remained above target levels in the western basin but near or within targets in the central and eastern basins. Water transparency was below targets in the western basin but near or within targets elsewhere. Trophic class metrics indicate that the western basin is within eutrophic status, which favors centrarchid species, the central basin is within targeted mesotrophic status, which favors percid production, and the nearshore waters of the eastern basin are borderline mesotrophic/oligotrophic. The offshore eastern basin waters remain near targeted oligotrophic status. Trends across Lake Erie in recent years indicate that overall productivity is slowly declining. Low hypolimnetic dissolved oxygen continues to be an issue in the central basin during the summer months.



Mean total phosphorus in each basin of Lake Erie, 1999-2015. Target trophic ranges are in yellow.

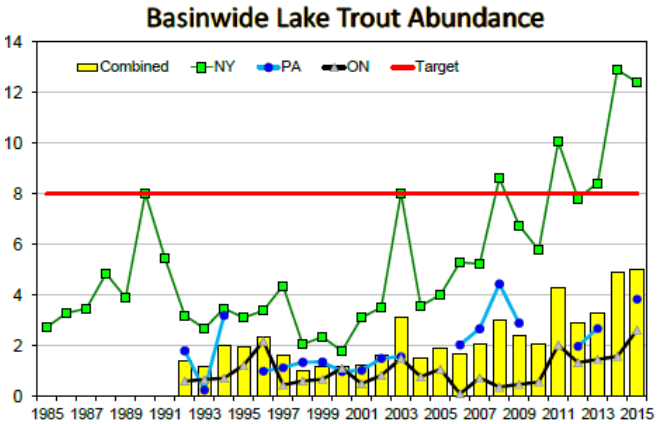
✧

Coldwater Task Group, 2016 (LEC)

Eight charges were addressed by the CWTG during 2015-2016: (1) Lake Trout assessment in the eastern basin; (2) Lake Whitefish fishery assessment and population biology; (3) Burbot fishery assessment and population biology; (4) Participation in Sea Lamprey assessment and control in the Lake Erie watershed; (5) Maintenance of an electronic database of Lake Erie salmonid stocking information; (6) Steelhead fishery assessment and population biology, (7) Development of a Cisco impediments document and (8) Prepare a report addressing the current state of knowledge of Lake Whitefish populations in Lake Erie. The complete report is available at http://www.glfc.org/lakecom/lec/CWTG.htm.

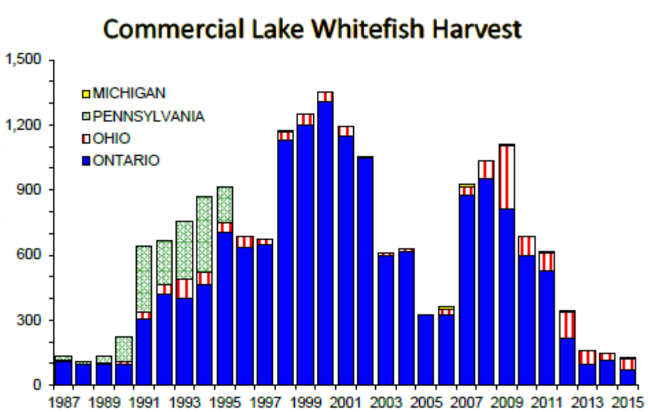
Lake Trout

A total of 847 Lake Trout were collected in 133 unbiased gill net lifts across the eastern basin of Lake Erie in 2015. High Lake Trout catches were recorded in all jurisdictions relative to the time series. Adults ages 5-7 dominated the catches with Lake Trout ages 10 and older only sporadically caught. Basin-wide Lake Trout abundance (weighted by area) was the highest value in the time series at 5.0 fish per lift, but remains below the rehabilitation target of 8.0 fish/lift. The adult (ages 5+) abundance index increased in 2015 to a time series high (3.7 fish/lift) and exceeded the target of 2.0 fish per lift for the second consecutive year. Klondike, Finger Lakes, and Lake Champlain strain Lake Trout comprise the majority of the population. Natural reproduction has not been documented in Lake Erie despite more than 30 years of restoration efforts.



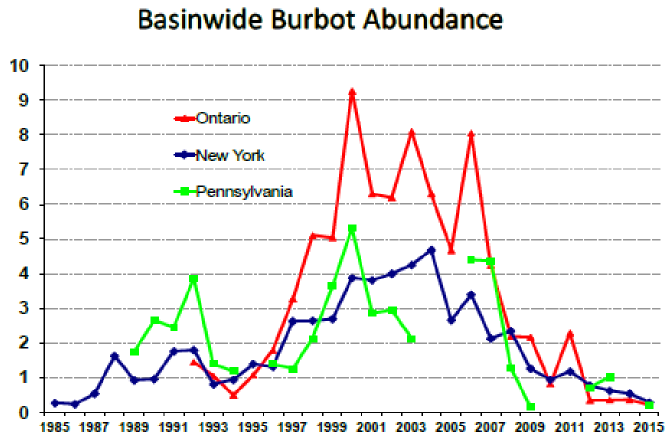
Lake Whitefish

Lake Whitefish harvest in 2015 was 126,243 pounds, distributed among Ontario (56%), Ohio (40%), Pennsylvania (3%) and Michigan (<1%). Catches in 2015 were comparable to low levels observed during the 1980s. Gill net fishery age composition ranged from 5 to 25. The 2003 year class (age 12) comprised the largest fraction (61%) of the Lake Whitefish gill net fishery. Gill net surveys caught Lake Whitefish from age 0 to 26, with age 12 most abundant. Central and east basin bottom trawl surveys caught young-of-the-year and yearling Lake Whitefish in 2015. The magnitude of influence these cohorts will have on the declining Lake Whitefish population is uncertain. Conservative harvest is recommended until Lake Whitefish spawner biomass improves.



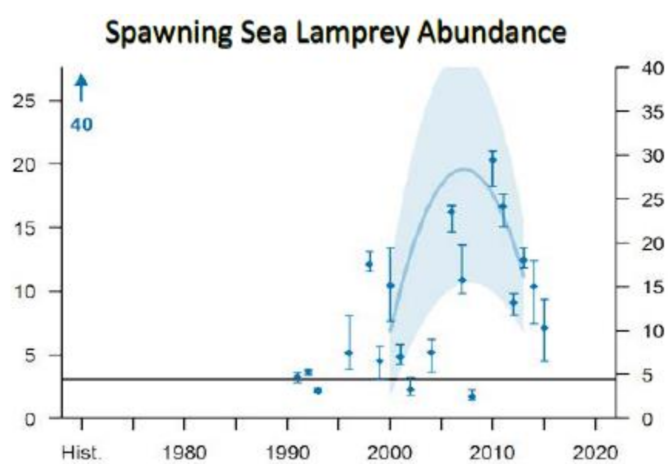
Burbot

Total commercial harvest of Burbot in Lake Erie during 2015 was 2,728 pounds (1,237 kg) of which 57% came in New York by two fishers. Burbot abundance and biomass indices from annual coldwater gillnet assessments remained at low levels in all jurisdictions in 2015, continuing a downward trend since the early-2000s. Agency catch rates during 2015 averaged 0.30 Burbot per lift across all jurisdictions, which represented about a 95% decline in mean catch rates observed during 2000-2004. Burbot ranged in age from 3 to 22 years in 2015. Ongoing low catch rates of Burbot in assessment surveys, the majority (53%) of the population being age-12+, and persistently low recruitment, signal continuing troubles for this population. Round Goby and Rainbow Smelt continue to be the dominant prey items in Burbot diets in eastern Lake Erie population.



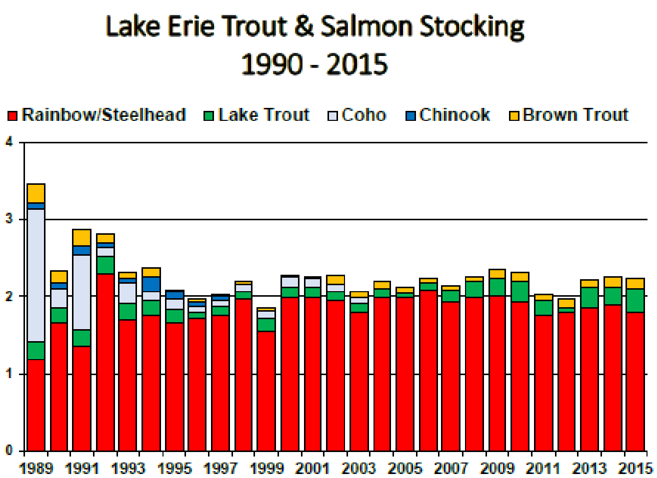
Sea Lamprey

The A1-A3 wounding rate on Lake Trout over 532 mm was 11.5 wounds per 100 fish in 2015. This was a 31% decrease from the 2014 wounding rate but over two times the target rate of five wounds per 100 fish. Wounding rates have been above target for 20 of the past 21 years. Large Lake Trout over 736 mm continue to be the preferred targets for Sea Lamprey; A4 wounding rates on this size group remained very high (98 wounds per 100 fish). The estimated number of spawning adult Sea Lamprey (7,112) was lower than 2014 estimates and the fifth consecutive annual decline. However, it is still well above the target population of 3,039. Comprehensive stream evaluations continued in 2015, including extensive surveys of Lake St. Clair and the Detroit River, to determine the source of the Lake Erie population.



Lake Erie Salmonid Stocking

A total of 2,235,499 salmonids were stocked in Lake Erie in 2015. This was a 1% decrease in the number of yearling salmonids stocked compared to 2014, and was equivalent to the long-term average since 1990. Minor decreases in stocking numbers were observed for Steelhead, but Lake Trout stocking was at its highest stocking effort since directed stocking began in 1982. Although Brown Trout make up only 6% of all trout stockings, the numbers stocked increased 3% from 2014. By species, there were 304,819 yearling Lake Trout stocked in all three basins of Lake Erie; 141,013 Brown Trout stocked in New York and Pennsylvania waters, and 1,789,667 Steelhead/Rainbow Trout stocked across all five jurisdictional waters.



Steelhead

All agencies stocked yearling Steelhead in 2015. The summary of Steelhead stocking in Lake Erie by jurisdictional waters for 2015 is: Pennsylvania (1,079,019; 60%), Ohio (421,740; 24%), New York (153,923; 9%), Michigan (64,735; 4%) and Ontario (70,250; 4%). Steelhead stocking in 2015 (1.790 million) represented a 5% decrease from 2014 and 3% lower than the long-term average. Annual stocking numbers have been consistently in the 1.7-2.0 million fish range since 1993. The summer open lake Steelhead harvest was estimated at 6,460 Steelhead across Steelhead harvest was estimated at 6,460 Steelhead across all US agencies in 2015, essentially equal to 2014 estimates. Estimates for Ontario were not available in 2015. Overall, this harvest was lower than average harvest from 2008-14. Overall open lake catch rates remain near the long-term average, but effort remains minimal. Tributary angler surveys, which is where the majority (>90%) of the targeted fishery effort for Steelhead occurs, found catch rates of 0.32 fish/hour in New York during 2014-15.

Cisco

Cisco, considered extirpated in Lake Erie, have been reported in small numbers (1-7) in 18 of the past 21 years. Of the 47 observations since 1995, all but two were surrendered by commercial fishermen operating in Ontario waters including four surrendered in 2015. None were captured in 2015 in assessment gear. The question arises from these recent captures whether these specimens represent a remnant stock or are transients from Lake Huron. A genetic analysis conducted in the early 2000's using only 9 samples determined those sample fish were most likely from a remnant stock. However, new efforts are underway using genetics, morphometrics, and meristics approaches to characterize these contemporary samples. Preliminary results of this research suggests that the recent samples are unlike historically described Lake Erie cisco and may be a hybridization of deepwater forms similar to what is found in Lake Huron. This research is expected to continue during 2016 with a final determination as to the origin of these contemporary samples. A technical document "Impediments to the Rehabilitation of Cisco in Lake Erie" is expected to be completed in 2016. ✧

Fisheries Research Activities Lake Erie Biological Station, 2015 (USGS)

Executive Summary

In 2015, the U.S. Geological Survey's (USGS) Lake Erie Biological Station (LEBS) successfully completed large vessel surveys in all three of Lake Erie's basins. Lake Erie Biological Station's primary vessel surveys included the Western Basin Forage Fish Assessment and East Harbor Fish Community Assessment as well as contributing to the cooperative multi-agency Central Basin Hydroacoustics Assessment, the Eastern Basin Coldwater Community Assessment, and Lower Trophic Level Assessment. In 2015, LEBS also initiated a Lake Erie Central Basin Trawling survey in response to the need for forage fish data from Management Unit 3.

Our 2015 vessel operations were initiated in early April and continued into late November. During this time, crews of the R/V Muskie and R/V Bowfin deployed 121 bottom trawls covering 83.2 ha of lake-bottom and catching 105,600 fish totaling 4,065 kg during four separate trawl surveys in the western and central basins of Lake Erie. We deployed and lifted 9.5 km of gillnet, which caught an additional 805 fish, 100 (337 kg) of which were the native coldwater predators Lake Trout, Burbot, and Lake Whitefish. We also conducted 317 km of hydroacoustic survey transects, collected 114 lower trophic (i.e. zooplankton and benthos) samples, and obtained 216 water quality observations (e.g., temperature profiles, and water samples).

Abstract
We conducted a biomass-based assessment of the Lake Erie Western Basin fish community using data collected from 2013-2015 Western Basin (spring and autumn) and East Harbor (autumn) bottom trawl surveys. Biomass of total catch per hectare has decreased 68 % since 2013. Declines were observed across all functional groups, but most notable was the decline of Emerald Shiner, which decreased from 25.7 kg/ha in 2013 to <0.1 kg/ha in 2015. White Perch also decreased across all age groups, while Yellow Perch and Walleye have fluctuated, but remained more stable. Despite decreasing trends in biomass, there was little effect on biodiversity, while declines in forage biomass, i.e. Emerald Shiner and age-0 White Perch, increased the mean trophic level of catches. Examination of forage fish to piscivore ratios reflected higher catchability of predators than prey fish in all seasons except the most recent surveys in autumn 2015 when young-of-the-year Gizzard Shad elevated the index. Comparison of condition indices indicated no change in overall health of fishes since spring 2013, and energy density analysis revealed Gizzard Shad and Round Goby to be the most energy dense prey fish.

Introduction
Lake Erie is the most populated of the Great Lakes basins, and as such Lake Erie has undergone dramatic changes concurrent with anthropogenic activities. Stresses such as overexploitation, habitat altercation/destruction (i.e. watershed deforestation, dam construction, deterioration of tributary streams), exotic species invasion, industrial contaminants, and changes in nutrient loading have resulted in significant changes to the fish community since the 1800s, most notably through the decline, collapse, or extirpation of many important native species. In the 1970s, efforts began to improve environmental conditions and rehabiliate the fish community through watershed and fisheries management.

Today, the primary goal of fishery resource managers in Lake Erie is "To secure a balanced, predominantly cool-water fish community…characterized by self-sustaining indigenous and naturalized species that occupy diverse habitats, provide valuable fisheries, and reflect a healthy ecosystem," yet there is little guidance on what fish community characteristics indicate a balanced and healthy Lake Erie ecosystem. The basic metrics with which aquatic ecosystem status is typically monitored are expressed in terms of biomass, while Lake Erie management agencies have traditionally focused on numerical indices of a few economically keystone species (primarily Walleye, Yellow Perch, Lake Trout, and Smallmouth Bass)

2015 Summary
The spring Western Basin survey took place during the week of June 15, and the autumn Western Basin and East Harbor surveys occurred during the weeks of September 14 and October 13, respectively. We trawled a total area of 72.2 hectares (31.2 ha spring, and 41.0 ha autumn), and caught a total fish biomass of 3,905 kg (90,605 fish). Total catches were largest in the spring, totaling 1,900 kg (43,631 fish, 20 species). Autumn Western Basin and East Harbor catches totaled 1,250 kg (18,064 fish, 27 species) and 755 kg (28,910, 23 species), respectively.

Trends in Biomass and Community Composition
Biomass CPH has declined steadily over the past three years by approximately 60 % from 2013 to the 2015 **(Fig 1).** This decrease was not attributed to any single taxon, but was observed across the assemblage and functional groups, including predators, forage fishes (Emerald Shiners, Gizzard Shad, and Rainbow Smelt), and large benthic species (Freshwater Drum, Quillback, Common Carp, and Channel Catfish).

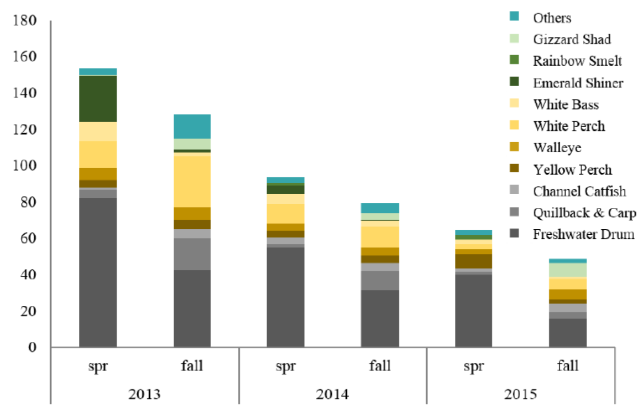


Fig 1- Catch per hectare (CPH) in biomass (kg) of all species captured in western Lake Erie during Western Basin Forage and East Harbor Surveys 2013-2015.

Large benthic species, particularly Freshwater Drum, accounted for approximately 50 percent of the total biomass. Channel Catfish biomass has remained steady, but Common Carp and Freshwater Drum declined by 74 % and 51 %, respectively, from spring 2013 to spring 2015. Although Freshwater Drum catches are generally lower in the autumn, catches fell to the lowest point in the three-year period during autumn of 2015 with a catch rate of 15.6 kg/ha.

Of the predators, moronids (White Perch and White Bass) declined more rapidly than percids (Yellow Perch and Walleye). Average CPH of white perch declined from 7.7 kg/ha in 2013 to 1.4 kg/ha in 2015. During this same period, White Bass also declined from 1.8 to 0.6 kg/ha. While Yellow Perch CPH of all ages pooled did not exhibit a trend, trends were observed among specific age groups. Since 2013, spring catch rates of age-2+ Yellow Perch have declined from 4.1 kg/ha to 1.6 kg/ha, while age-1 Yellow Perch increased during this same period (0.1 kg/ha to 2.4 kg/ha). In 2015, CPH of age-0 Yellow Perch was lowest of the last three years at only 0.29 kg/ha. Similar to Yellow Perch, age-2+ Walleye decreased from 5.3 kg/ha in spring of 2013 to 1.8 kg/ha in spring of 2015. Walleye age-1 and age-0 CPH's have fluctuated but were at a 3-year high in autumn 2015 at 2.4 kg/ha (11 count/ha) and 2.2 kg/ha (69 count/ha), respectively.

The trend that we observed in age-0 Walleye is similar in direction and magnitude to the last three years of data from interagency (ODNR & OMNRF) bottom trawl surveys. In fall 2015, our survey and the combined interagency survey reported numerical indices of 69 and 84 fish/ha, respectively, for age-0 Walleye. For the interagency survey, this was the third highest catch rate of age-0 Walleye since 1988 (WTG 2016). Note that while the units are comparable, the ODNR and OMNRF use different gear, which is not directly comparable to ours. Our previous trawl inter-calibration experiment (LEBS 2013), showed that the USGS gear was more efficient at catching age-0 Walleye (i.e. reported higher catch rates) than ODNR and OMNRF gear, but application of a correction factor was unwarranted because it would inflate the variance of the CPH estimate. Still, our three year data series tracks the interagency data, supporting their evidence of a large 2015 year-class.

The decline of White Perch contributed to an overall decrease in the percentage of non-native species in catch composition over the last three years. Common Carp, Goldfish, and Alewife CPH also declined from 18.8 kg/ha (combined CPH) in autumn 2013 to 2.9 kg/ha in 2015. Alewife were only captured in 2013 (5.5 kg/ha) and were not captured in 2014 and 2015. Rainbow Smelt CPH has increased, and Round Goby CPH has remained stable.

Declines in total catch biomass were in part due to a large decrease in the biomass of important forage species. From spring to autumn of 2013, the mean catch per hectare of Emerald Shiner in the Western Basin decreased from 25.7 kg/ha to <0.1 kg/ha **(Fig. 2).** The greatest decline in mean Emerald Shiner CPH occurred in 2013, when the yearling-and-older (YAO) age class decreased from 25.3 kg/ha (7,753 fish/ha) in the spring, to 1.0 kg/ha (447 fsh/ha) the following autumn. The decline in the Emerald Shiner population may be due in part to the cold winters of 2013-14 and 2014-15 and (or) part of natural population fluctuations.

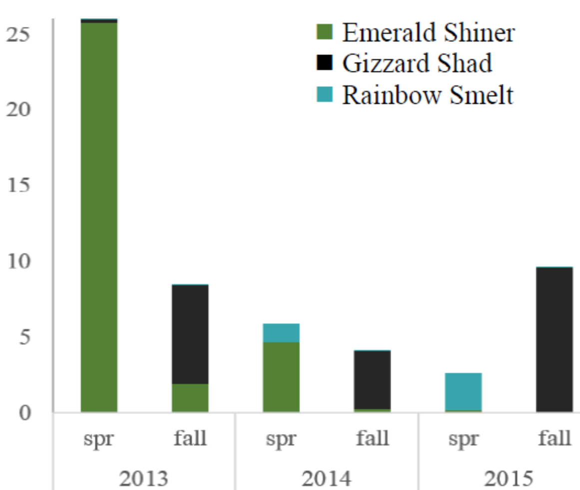


Fig 2- Mean CPH by biomass of three primary forage fishes from 2013-2015.

Comparison of mean forage fish to piscivore biomass ratios indicated higher biomass of predators than prey in bottom trawl catches from spring 2013 to spring 2015**.** To understand whether high piscivore abundance drove declines in forage fish, additional research beyond the scope of this report would have to be conducted. Changes in forage: piscivore ratios can indicate significant changes in species composition. In autumn 2015, large catches of age-0 Gizzard Shad and White Perch along with decreased catches of predator species (age-2+ White Perch, Yellow Perch, and Walleye), reversed the trend and resulted in an average forage:piscivore ratio >1.

Despite decreasing trends in biomass, biodiversity of trawl catches was consistently higher in autumn due to a greater species richness (25 spring, 35 autumn), and the addition of high numbers of age-0 Gizzard Shad and White Perch. Logperch and Goldfish were captured only during autumn surveys. In addition, due to sampling location and proximity to nearshore habitats, East Harbor surveys captured more species (32 spp. 2013-2015) than autumn Western Basin Forage surveys (27 species), including Largemouth Bass, Bluegill, Pumpkinseed, Yellow Bullhead, and White Crappie. The recruitment of age-0 fish to autumn catches lowered mean trophic levels**.** Unlike biodiversity, however, weighted mean trophic level of catches has increased over the last three years (accounting for seasonal differences), which is due primarily to the decline of two lower trophic level groups: Emerald Shiners and age-0 White Perch.

Condition and energy density

Gizzard Shad and Round Goby had the highest caloric density per gram of dry weight. The energy density of Rainbow Smelt was the lowest of the ten species/age groups analyzed (1,285 cal/g), but was similar to values reported in other studies.

Although biomass of bottom trawl catches from western Lake Erie has declined dramatically over the past three years, two- to five-year fluctuations in individual fish populations and total fish biomass are common throughout the Great Lakes.

Diet Analysis of Western Basin Age-2-and-Older Yellow Perch and White Perch

Native Yellow Perch and non-native White Perch are abundant mid-trophic level predators in western Lake Erie. Previous studies have suggested that the establishment of White Perch might have adversely affected the resident fish community. In order to examine possible inter-specific interactions, we evaluated diets of age-2-and-older Yellow Perch and White Perch collected in Lake Erie's western basin during spring and autumn. Evaluation metrics included percent frequency of occurrence and contributions of prey to predator diets by dry weight. Benthic macroinvertebrates contributed most to Yellow Perch and White Perch diets during spring and autumn. Cercopagididae occurrence in Yellow Perch and White Perch diets was low in spring and increased in frequency in autumn. Compiling results from

2015 with data dating back to 2005 revealed increased utilization of zooplankton for both Yellow Perch and White Perch during spring and autumn and decreased utilization of benthic macroinvertebrates and increased utilization of fish prey during autumn for both species.

Frequency of occurrence

The length distribution of subsampled fish with diet contents was similar between species; however, we sampled a few small and larger Yellow Perch during spring and autumn sampling **(Fig 3)**. The proportion of empty stomachs, relative to the number retained, was relatively low in the autumn and spring, and thus, we subsampled the number of sites used for diet analysis in both spring and autumn (N=34 and 37 sites, respectively) by analyzing samples from even numbered sites only **(Fig 1).** Subsampling reduced the amount of labor required while still allowing for diet description across the spatial extent of the survey**.**

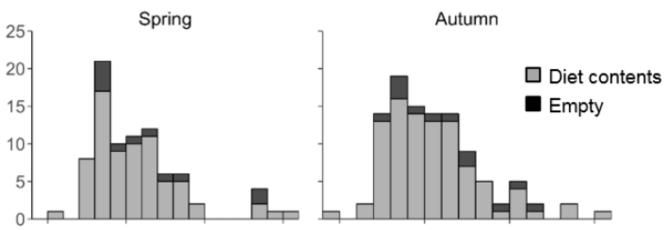


Fig 3- Distribution of age-2+ Yellow Perch sampled for diet analysis during 2015

Spring sampling provided n=84 (after subsampling) age-2+ Yellow Perch diets that were collected from fish ranging between 159-303 mm total length with n=73 (86.9%) of the diets containing prey. In spring 2015, benthic macroinvertebrates were present in a majority of Yellow Perch diets (63.0%) and Ephemeridae (exclusively *Hexagenia* spp.) (45.2%), Dreissenidae (27.4%), and Chironomidae (19.2%) were the most common benthic macroinvertebrates**.** Zooplankton occurred in 49.3 percent of spring Yellow Perch diets with Daphnidae (46.6%) and Leptodoridae (21.9%) occurring most frequently. Fish prey occurred in 8.2 percent of Yellow Perch diets during spring sampling with Round Goby as the most common identifiable fish taxon at 5.5 percent.

During autumn sampling, n=105 (after subsampling) age-2+ Yellow Perch diets were collected from fish ranging from 144-303 mm total length with n=93 (88.6%) diets containing prey. We observed a decline in occurrence of benthic macroinvertebrates (28.0%) and an increase in zooplankton (82.8%) in autumn Yellow Perch diets relative to the spring**.**

Cercopagididae (exclusively *Bythotrephes longimanus*) exhibited a low occurrence in spring (8.2%) and increased frequency in autumn (63.4%). Occurrence of fish prey increased from spring to autumn for Yellow Perch. Fish occurred in 24.7 percent of Yellow Perch diets, and Round Goby was the most common identifiable fish prey type occurring in 3.2 percent of diets**.**

Spring sampling provided n=85 diets from age-2+ White Perch ranging from 170-290 mm total length. A total of n=70 (82.5%) of the White Perch diets contained prey items. In spring, zooplankton was present in 75.7 percent of samples with Daphnidae (68.6%) and Leptodoridae (44.3%) occurring most frequently. Benthic macroinvertebrates occurred in 61.4 percent of spring diets with Ephemeridae (45.7%) being most common. Fish were present in 5.7 percent of White Perch diets with Emerald Shiner (2.9%) being the most frequently observed identifiable fish prey type**.**

During autumn sampling, diets of n=99 age-2+ White Perch were collected from fish ranging from 171-296 mm total length with n=85 (85.9%) diets containing prey items. Zooplankton was the most commonly occurring prey type in autumn (90.6%). Cercopagididae exhibited a low occurrence in spring (11.4%) and increased in autumn (82.4%). We observed a decline in occurrence for benthic macroinvertebrates (20.0%) in White Perch diets in autumn relative to spring diets. Occurrence of fish prey increased from spring to autumn for White Perch. Fish occurred in 25.9 percent of diets, and Yellow Perch was the most common identifiable fish prey occurring in 4.7 percent of diets**.**

Frequency of occurrence of zooplankton was higher for both White Perch and Yellow Perch in 2015 than in 2014**.** Zooplankton occurrence has shown an increasing trend over the past three years for both species in both seasons. Occurrence of benthic macroinvertebrates was lower in spring and autumn 2015 compared to 2014. Occurrence of fish in spring diets remained low (10.4% and 9.4%, respectively) and increased in autumn (42.4% and 65.4%, respectively for Yellow Perch and White Perch). Historically, zooplankton had a low occurrence in diets sampled in autumn, but in 2015 autumn diets zooplankton occurred at higher frequencies (90.6% and 82.8%, respectively for Yellow Perch and White Perch). Benthic macroinvertebrates occurred about half as often as in 2014 across both seasons and species. Occurrence of fish prey in diets has not shown an obvious trend since 2005.

Benthic macroinvertebrates contributed most to age-2+ Yellow Perch diets in spring (53.6%), followed by zooplankton (42.0%) and fish prey (4.4%, **Fig 4).** Dreissenidae (22.7%) and Ephemeridae (22.9%) were the predominant benthic macroinvertebrate contributors by weight in the spring. Daphnidae (35.9%) was the dominant zooplankton taxa, while Round Goby (4.3%) was the most prominent identifiable fish prey in spring Yellow Perch diets.

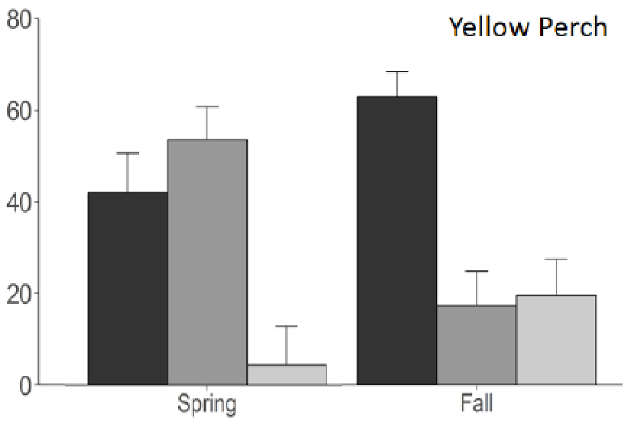


Fig 4- Diet composition (% dry weight) of Age-2+ Yellow Perch by main prey type and season from 2015 bottom trawl samples.

In autumn, zooplankton made the highest contribution to diets (63.0%), followed by fish prey (19.6%) and benthic macroinvertebrates (17.4%) **(Fig 4).** The major zooplankton taxon contributor in autumn was Cercopagididae (51.8%). Gastropoda, Amphipoda, and Dreissenidae accounted for almost 100 % of total benthic macroinvertebrate weight observed in diets. The major identifiable fish prey taxon contributor in autumn was Round Goby (1.5%**).**

Walleye Diets

Bottom trawl surveys conducted by ODNR and OMNR in July and August of 2015 indicated an exceptionally strong year-class of walleye in Lake Erie. Biologists noted protruding stomachs on juvenile walleye during these surveys. High catches of age-0 walleye and low abundance of forage fish (see section 1.0) in USGS trawls prompted us to examine age-0 Walleye diets.

During the USGS autumn Western Basin bottom trawl survey, a sub-sample of age-0 Walleye were collected from n=20 sites. Diet processing methods followed those outlined in Chapter 2.0 of this report. Here, we report diet composition of age-0 Walleye by dry weight.

Of the 99 Walleye analyzed, 28 had empty stomachs. Diets primarily contained fish prey, which constituted 79.1 % of the diet weight on average. Zooplankton was the second highest prey type (11.9%) followed by benthic macroinvertebrates (8.9%). Approximately half (54.8%) of the diet was fish in a heavily digested state, and we were unable to identify these items to species. Of the fish that were identifiable, Emerald Shiner (8.4%) and Gizzard Shad (6.9%) dominated. Cercopagididae was represented exclusively by invasive *Bythotrephes* sp. and was the dominant zooplankton taxon by weight. In the benthic macroinvertebrate prey category, oligochaeta were the most abundant taxon.

Yellow Perch Maturity

In 2015, a sub-sample of 233 Yellow Perch were analyzed for a sexual maturity during our autumn Western Basin Forage Assessment, marking the third year for Yellow Perch maturity data collection. Sample sizes of male and female Yellow Perch were n=110 and n=123, respectively, and total length ranged from 113 to 305 mm total length. Male Yellow Perch started to mature at 120 mm, while the smallest mature female was 125 mm. The total length at which 50 percent of male Yellow Perch were mature was significantly smaller (117 mm, 95% CI: 99-128 mm) than that for females (152 mm, 95% CI: 141-162). Likewise, 90% of male and female Yellow Perch were mature at 145 mm total length (133-153 mm) and 195 mm total length (178-215 mm), respectively. The logistic regression for female Yellow Perch in 2015 is more gradual than in previous years (**Fig 4**), signifying greater variability in maturity status among smaller size classes. Year-to-year comparisons revealed the length at which 50 percent of female Yellow Perch were mature in 2015 was significantly less than in 2014 (**Table 1**). All other comparisons between years were similar.

		2013			2014			2015	
sex	% mature	mm	(95% C.I.)	N	mm	(95% C.I.)	N	mm	(95% C.I.)
Male	50%	97	(86 - 106)	145	104	(91 - 115)	129	117	(99-128)
	90%	146	(131 - 162)		149	(135 - 163)		145	(133-153)
Female	50%	166	(160 - 174)	173	172	(165 - 180)	72	152	(141-162)
	90%	189	(178 - 202)		182	(168 - 194)		195	(178-215)

Table 1- Comparison of Length at Maturity (total length in mm and 95% confidence interval) of Yellow Perch, 2013 - 2015.

Lower Trophic Assessment in the Central Basin of Lake Erie

The Lake Erie Biological Station has participated in the Lower Trophic Level Monitoring program since 2003. The purpose of the program is to monitor and report on nutrient levels and on benthic, algal, and zooplankton communities, which support valuable commercial and recreational fisheries for percids in Lake Erie. We have monitored two stations near Vermilion, OH, one within 1 km of shore, the other approximately 8 km from shoreds. Following 2014 sampling, we detected a potential effect of the Vermilion River on our nearshore station data, hence in 2015 we collected data at an additional nearshore station of similar depth out of the Vermilion River plume to test directly for potential effects. During our 13 years of monitoring, there were no sustained trends in mean surface and bottom water temperatures or mean bottom dissolved oxygen.

At our nearshore site, Secchi depth and total phosphorus varied among years, mean Secchi disk depths decreased, and mean total phosphorus increased with time. Mean Secchi disk depths and total phosphorus typically were not within desired mesotrophic ranges. At our offshore site, mean total phosphorus varied by year, but there was no overall trend. Secchi disk depths did not vary with year and did not have an overall trend. Although mean Secchi disk depths were within the desired range during 6 of 13 years, mean total phosphorus was higher than the desired range 11 of 13 years. Values for Secchi disk depth and phosphorus at our nearshore comparison site were even more strongly influenced by the Vermilion River than the long-term nearshore site, indicating a different comparison site needs to be selected. Our data suggest eutrophic conditions prevail at these sites in central Lake Erie.

Nearshore site

Secchi disk depths varied among years. Mean Secchi disk depths were below target levels for mesotrophic conditions every year except 2003. Secchi disk depth was highest in 2003 and greater than all other years, whereas in 2004, 2006, 2008, and 2012-2015 Secchi disk depths were lower than all other years**.** Since 2011, Secchi disk depths have not increased above 1.7 m; prior to 2012 Secchi disk depths were below 1.7 m only once (2006). Secchi disk depths decreased on average 9.4 cm/yr over the period 2003-2015. Total phosphorus varied by year. Total phosphorus was higher in 2011-2015 than all other years, and in 2005 and 2010 it was lower than all other years **(Fig 5.2A).** For the past 5 years (2011-2015), total phosphorus has been well above target levels. 2015 was the second consecutive inter-annual increase. Total phosphorus increased on average 1.1 µg/l/yr from 2003 through 2015.

Surface temperature and bottom temperature did not vary among years. Surface dissolved oxygen (DO) varied among years**.** Surface DO was higher in 2003 than all other years and in 2004 it was lower than in all other years**.** Bottom DO also varied among years. Bottom DO differences followed the same pattern as surface DO, with 2003 lower than and 2004 higher than all other years. There were no trends in surface or bottom temperature or dissolved oxygen.

East Harbor

Following the 2011 sampling season, the research vessel Musky II, used by the USGS and its predecessor USFWS for sampling young-of-year fishes with bottom trawls since 1961, was decommissioned and replaced with the research vessel Muskie. The change in vessel, accompanied by a change in trawl, required us to assess if and to what degree the change affected indices of fish abundance calculated from trawl samples. We used ANOVA to compare catch per hectare (CPH) of seven species (two native pelagic, three native benthic, and two invasive benthic) in USGS trawls at our long-term East Harbor site in October to CPH from ODNR samples in September at the same sites for the years 2008-2015 to assess differences by agency, period and the agency by period interaction.

The interaction effect provided a test of the gear change effect while controlling for agency gear differences and temporal changes in species abundances. In the USGS gear, we observed a decrease in CPH (by 41-78%) for all 5 benthic species, and a 50 percent increase in one pelagic species following the change in vessel. USGS CPH was consistently lower than ODNR CPH for all species. The agency by period interaction was only significant for Round Goby, indicating disproportionately lower CPH for the USGS vessel. Small sample sizes, high catch variability, and potentially seasonal related differences in capture probability, likely precluded detecting interaction effects for other species. Adding occupancy modeling to an analysis might improve our ability to detect differences.

Mean CPH for USGS samples showed significant change between periods for all species. For Gizzard Shad, CPH with the new vessel/trawl was, on average, 160 % higher. Emerald Shiner CPH was ~50 percent lower. For the 5 benthic species, catches with the new vessel/trawl were between 41 % and 78 % lower.

Mean CPH of all species except Emerald Shiner varied by agency. Additionally, ODNR catches (mean CPH) were consistantly higher than USGS catches. Differences between ODNR and USGS indices were 2 orders of magnitude for White Perch, one order of magnitude for Round Goby and Gizzard Shad, nearly an order of magnitude for Freshwater Drum and Yellow Perch, and four- to seven-fold for Trout-perch and Emerald Shiner. Differences by period were significant for only Trout-perch and Round Goby. The interaction term (period*agency) was significant for only Round Goby, indicating this is the only species for which there was a detectable change in CPH resulting from the new vessel. ✧

Bighead & Silver Carp in the Lake Erie System 2015 Update

- 2015 Targeted Sampling (2,909 sites)
- No Asian carp collected from standard gears: electrofishing, gill nets, trawls, seines, and trap nets
- Sampling by: Fisheries & Oceans CAN (DFO), MDNR, ODNR, OMNRF, & USFWS

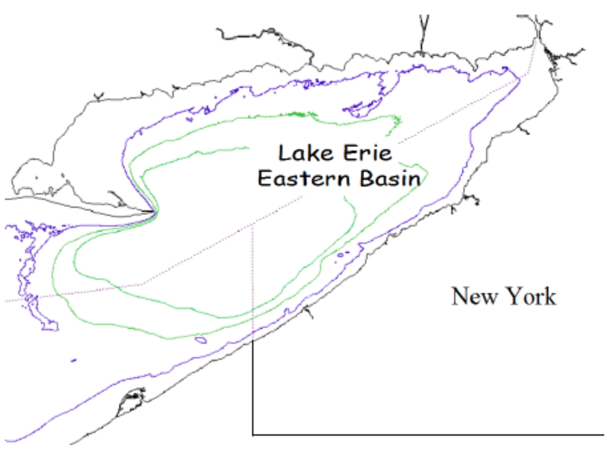
- Four positive eDNA tests for bighead or silver carp in Ontario assessments (Thames R., Colchester harbor)
- No bighead or silver carp were observed in:
  - targeted sampling,
  - agency core fish community assessments, or
  - commercial and recreational fisheries.
- Bighead carp have not been observed since 2000.
- Silver carp have never been observed in the system.
- eDNA results: Three for Bighead Carp and one for Silver Carp (1,997 sites, lakewide)

●Neither species of carp was reported from other monitored fisheries in the Lake Erie system during 2015, including commercial hoop net, pound net, seine, and trawl fisheries, as well as non-Percid recreational fisheries.

●Bi-national studies clearly identify the Lake Erie system as having the highest risk of Asian carp establishment and biological impact of any Great Lake.

●What is the Lake Erie Committee doing about the potential Asian carp threat to Lake Erie fisheries?
The priority is to prevent bighead and silver carp population establishment in the Lake Erie system by focusing on the identification and elimination of outside sources of carps and their pathways of entry, through early surveillance and application of effective control programs where feasible. ✧

New York Lake Erie 2015 Annual Report (DEC)

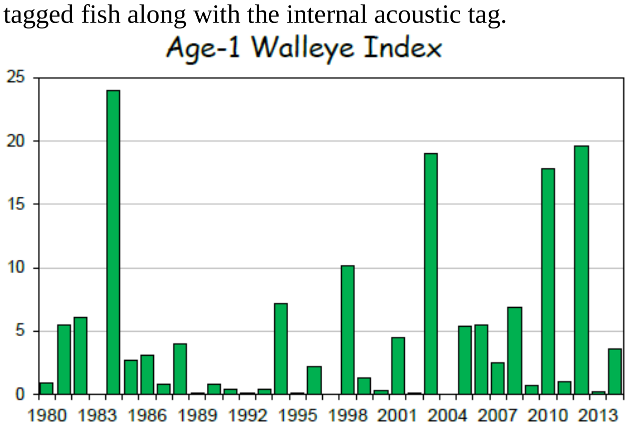


Program Highlights

The New York State Department of Environmental Conservation's Lake Erie Fisheries Research Unit is responsible for research, assessment and fisheries management activities for one of New York's largest and most diverse freshwater fishery resources. A variety of annual programs are designed to improve our understanding of the Lake Erie fish community to guide fisheries management, and safeguard this valuable resource for current and future generations. This document shares just a few of the highlights from the 2015 program year. The complete annual report is available on DEC's website at *http://www.dec.ny.gov/outdoor/32286.html*.

Walleye

Lake Erie's eastern basin walleye resource is composed of local spawning stocks as well as contributions from summertime movements of west basin spawning stocks. Walleye fishing quality in recent years has generally been very good and largely attributable to excellent spawning success observed in 2003, 2010, and 2012. Measures of walleye fishing quality in 2015 were the fifth highest recorded in the 28 year survey. New York's most recent juvenile walleye survey indicates a moderate spawning year in 2014. Overall good recruitment through recent years, especially from 2010 and 2012, suggests adult walleye abundance in the east basin will remain satisfactory for the next several years. The west basin of Lake Erie experienced a high walleye recruitment event in 2015, which should also help to support New York's walleye fishery in the future. A new research initiative that began in 2015 uses acoustic telemetry to study walleye movement and assess the contribution of west basin migrants to the New York walleye fishery. A $100 reward is associated with the return of each tagged fish along with the internal acoustic tag.

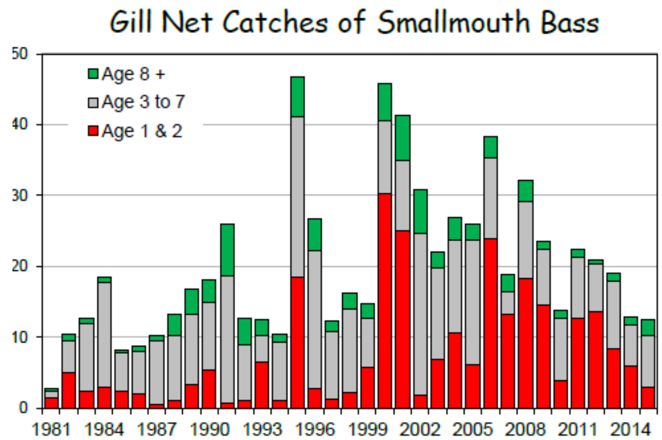


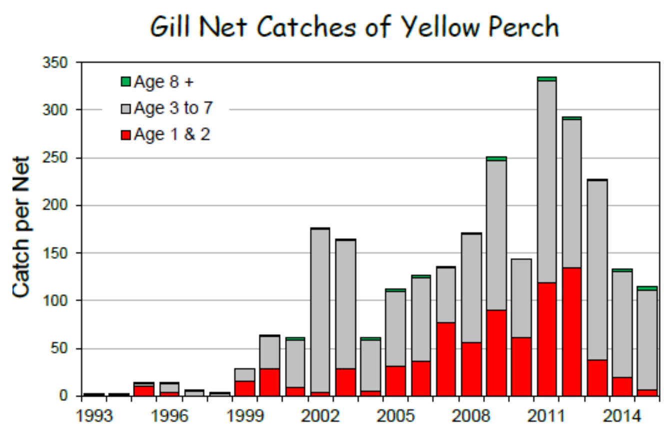
Smallmouth Bass

Lake Erie supports New York's, and perhaps the country's, finest smallmouth bass fishery. Bass fishing quality in 2015 was the fourth highest observed in the 28 year series of monitoring, with the peak observed in 2013. Generally stable spawning success, coupled with very high growth rates and acceptable survival, produce high angler catch rates and frequent encounters with trophy-sized fish. Most recent data indicate a very gradual decline of abundance to near long term average measures. Juvenile abundance measures suggest 2013 produced a below average smallmouth bass year class.

Yellow Perch

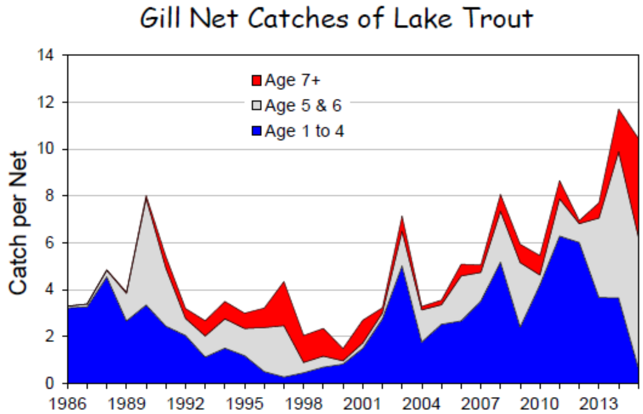
Lake Erie yellow perch populations have experienced wide oscillations in abundance over the last 30 years, from extreme lows in the mid-1990's to an extended recovery that's now lasted well over a decade. A large adult population continues to produce good angler catch rates, especially during spring and fall. Perch fishing quality declined in 2015 following the three highest annual catch rate observations in the time series. Nevertheless, perch fishing quality in 2015 remained the fifth highest measured in the 28 year survey. Declining abundance of juvenile yellow perch resulted in an overall decline in the population over the past four years and appears responsible for the decrease in 2015 fishing quality.





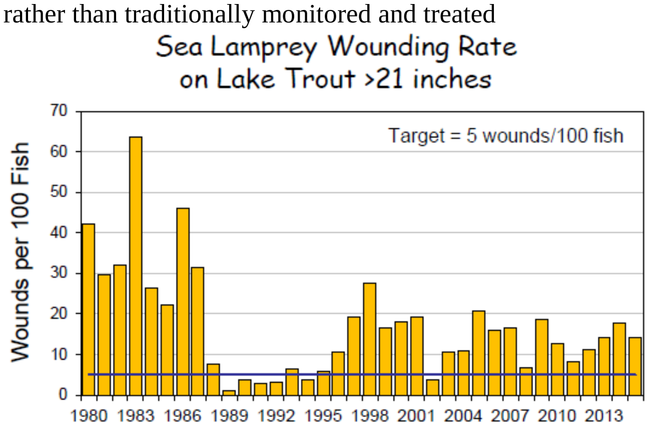
Lake Trout Restoration

Re-establishing a self-sustaining lake trout population in Lake Erie continues to be a major goal of Lake Erie's coldwater program. Lake trout have been stocked since 1978 and annual assessments monitor progress towards restoration objectives. A revised lake trout rehabilitation plan was completed in 2008 and guides current recovery efforts. The overall index of abundance of lake trout in the New York waters of Lake Erie during 2015 was the second highest observed in 30 years. The majority of the catch was comprised of young adult lake trout ages 5-7. All adult fish (age 5 +) were observed at their highest abundance in 2015, but older fish (age 10+) remain scarce. Basinwide estimates surpassed targets for adult abundance for the second consecutive year. However, adult survival for some lake trout strains remains low, mainly due to high sea lamprey predation. Natural reproduction has not yet been detected in Lake Erie, and significant stocking and sea lamprey control efforts must be continued to build and maintain the adult population to levels where natural production is viable. Beginning in 2016 an acoustic telemetry study will help locate spawning habitats used by stocked lake trout.



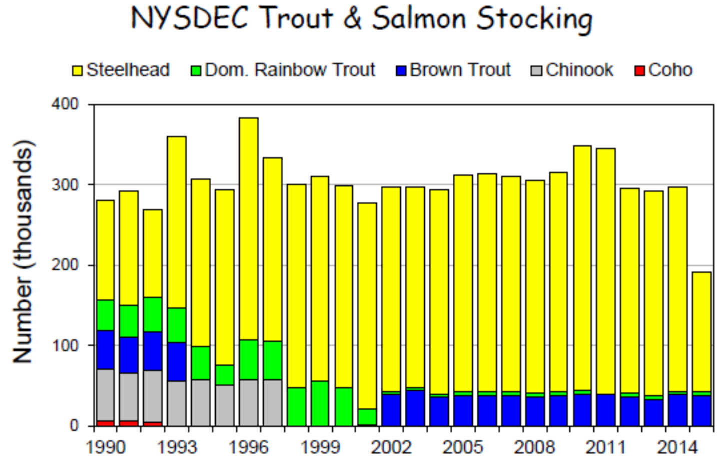
Sea Lamprey

Sea lamprey invaded Lake Erie and the Upper Great Lakes in the 1920s and have played an integral role in the demise of many native coldwater fish populations. Great Lakes Fishery Commission (GLFC) coordinated sea lamprey control in Lake Erie began in 1986 in support of lake trout rehabilitation efforts, and regular treatments are conducted to reduce sea lamprey populations. Annual monitoring undertaken by NYSDEC includes observations of sea lamprey wounds on lake trout and other fish species, and lamprey nest counts on stream sections. Wounding rates on lake trout decreased in 2015 but remain well above targets. Inspections of sportfish species documented sea lamprey wounding on warmwater species as well. GLFC surveys conducted in recent years indicate the largest source of Lake Erie's sea lamprey production may be the St. Clair River rather than traditionally monitored and treated



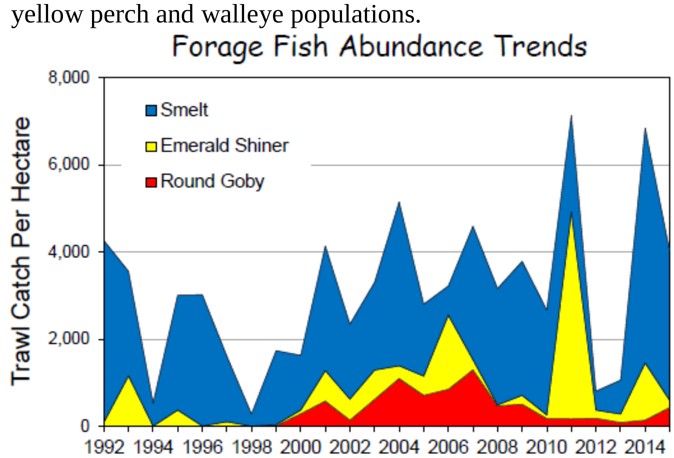
Salmonid Management

New York annually stocks approximately 255,000 steelhead and 35,000 brown trout into Lake Erie and its tributaries to provide recreational opportunities for anglers. Wild reproduction of steelhead also occurs in some tributaries but remains a minor contributor to the overall fishery. A long term annual angler diary program continues to monitor characteristics of the tributary steelhead fishery. Steelhead stocking was below target in 2015 due to a hatchery mortality event. Surplus steelhead were provided by PA and VT to mitigate this shortage. A tributary angler survey conducted in 2014-15 found steelhead catch rates were 0.32 fish/hour, which was similar to the previous 2011-12 survey. A study utilizing two different stocking sizes of steelhead and two different stocking strategies began in 2015, and will to continue through 2018. This research will provide insights on the role of stocking size and location on adult returns.



Prey Fish

The Lake Erie Unit conducts a number of surveys to assess forage fishes and components of the lake's lower trophic levels that further our understanding of factors shaping the fish community. Current surveys include trawling, predator diet studies, and lower food web monitoring. A variety of prey fish surveys beginning over 20 years ago identified rainbow smelt as the dominant component of the open lake forage fish community. Beginning in 2000, there was a notable increase in prey species diversity accompanied by somewhat lower smelt abundance, and in some year's especially high abundances of round gobies and emerald shiners. In recent years overall prey fish abundance has become highly variable with a notable decline of goby abundance in trawl surveys. Overall abundance of forage-sized fishes declined in 2015 but remained at average levels compared to the previous decade. Rainbow smelt were the dominant prey species, especially the young-of-the-year life stage. Trawl catches of round gobies increased for the first time in five years and many sources of information suggest emerald shiners were especially scarce in 2015. Lower trophic monitoring indicates near shore waters are a slightly less productive environment than typically favored by yellow perch and walleye populations.



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Status of the Fisheries in Michigan Waters of Lake Erie and Lake St. Clair, 2015

Highlights for 2015

The purpose of this report is to provide an update on the status of the fisheries in the Great Lakes and connecting waters of Southeast Michigan. Sources of information used in compiling this report include creel surveys, charter boat reports, an angler diary program, the Master Angler program, and commercial fishery records, as well as fisheries survey results.

Some of the highlights described in detail include:

● The 2015 non-charter angler harvest rate for Lake Erie yellow perch was well above the long-term average, while the walleye harvest rate was slightly below the long-term average.

● Michigan non-charter anglers on Lake Erie caught 82,816 walleye and harvested 65,740 of those fish. Anglers reported releasing higher numbers of sub-legal size walleye in 2015 compared to 2014.

● 2015 Lake Erie index gill net catch rates of walleye for Michigan waters were 30% lower than 2014, but yearling catch rates were 88% higher than for 2014 and near the long-term average.

● The Michigan commercial fishery on Lake Erie harvested over 1 million pounds of fish in 2015, with carp, white bass, channel catfish, freshwater drum, and buffalo accounting for 76% of the total harvest.

● Long-term tagging studies on Lake Erie walleye stocks clearly illustrate the important contribution of Lake Erie walleye to the Great Lakes sport fishery of Southeast Michigan, from Port Huron to Toledo.

● A binational creel survey of the Detroit River in 2015 estimated boat anglers spent over 623,000 hours fishing and harvested a total of over 446,000 fish. White bass, walleye, and yellow perch accounted for a total of 97% of the harvest.

● Lake St. Clair continues to be the premier Michigan water for trophy muskellunge and smallmouth bass based on the number of entries recorded in the Master Angler program in 2015.

● Rock bass, smallmouth bass, and channel catfish were the dominant species in the Lake St. Clair trap net survey in 2015. Over 23% of the channel catfish exceeded Master Angler minimum length.

● Trawl surveys on Lake St. Clair continue to document high abundance of yellow perch, but average size is small. Spottail shiner abundance has declined greatly

Fishery Forecast for 2016

Harvestable-size yellow perch abundance in the Michigan waters of Lake Erie is forecasted to increase in 2016, with the strong contributions expected from the 2013 and 2014 year-classes. Anglers can expect to see more small perch in their catch. Abundance of legal-size walleye in Lake Erie is expected to increase in 2016. Michigan anglers will continue to find fewer walleye from the strong 2003 year-class, and the fishery will rely heavily on contributions from the strong 2014 and weaker 2013, 2012, 2011, and 2010 year-classes. This is not surprising, as annual variation in reproductive success of walleye and yellow perch can result in substantial year-to-year changes in their abundance. Muskellunge and smallmouth bass numbers tend to remain more stable from year to year and both species should continue to provide excellent fishing opportunities in 2016, particularly in Lake St. Clair and the Detroit River. Still, since weather conditions can affect sport fishing success as much as fish abundance it is difficult to predict fishing success. Water levels in Lake St. Clair, the connecting rivers, and Lake Erie are forecasted to rise to a point above or near their long-term average in 2016. Thus, anglers may find easier access to some shallow water fishing areas.

Sport Fishery Summary

Information on angler catch rates, effort, and opinion of Michigan's sport fisheries is collected with angler surveys. An angler survey can be conducted on-site where anglers are interviewed or counted while on the water, or off site when anglers are interviewed by mail or telephone. On-site methods, also known as creel surveys, have been used extensively by the MDNR on various Michigan waters to estimate angler effort, harvest, and catch. In Southeast Michigan, on-site creel survey data are collected each year from the non-charter recreational fishery of Lake Erie. Creel surveys are less frequent on the St. Clair-Detroit River System due to budgetary constraints. Charter boat harvest, release, and angling effort are recorded annually by Lake Erie and St. Clair-Detroit River System charter operators, who are required to report this information to the MDNR on a monthly basis.

Another example of an off-site angler survey is an angler diary program, where anglers keep their own records of angling activity and success. A voluntary Sport Fishery Diary Program is used to collect catch and effort data for recreational fishing on Lake St. Clair. The program was initiated by the Ontario Ministry of Natural Resources and Forestry (OMNRF) in 1985 to monitor trends in the muskellunge catch rate for Lake St. Clair. Five years later the program was expanded to include other species. The MDNR became involved in the program in 1993. Since that time, the program has been a cooperative effort between the OMNRF and MDNR to provide annual estimates of catch rates for the major sport fish species in the lake. The MDNR Master Angler Program, established in 1973 to recognize anglers who catch unusually large fish, also provides information on trends in voluntary reports of "trophy" catches throughout the Great Lakes waters of Southeast Michigan.

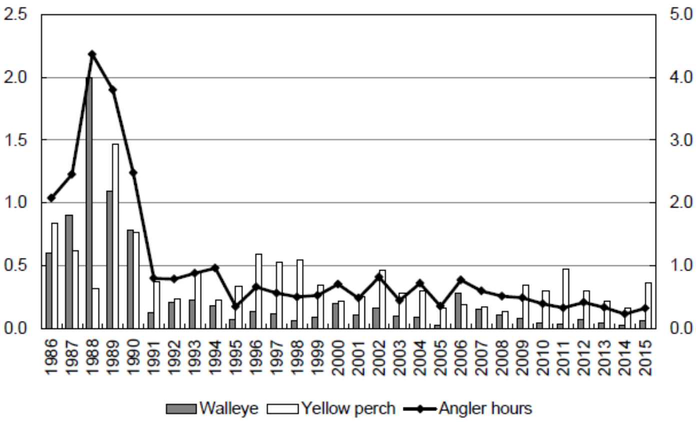


Fig 1-Estimated harvest and effort for Michigan's Lake Erie sport fishery, 1986-2015

Lake Erie non-charter recreational fishery

The annual creel survey conducted by the MDNR during 2015 produced a total harvest estimate of 461,826 fish **(Table 1)** for Michigan's Lake Erie sport fishery (non-charter), representing a substantial increase when compared to harvest in 2014 (222,835 fish). Walleye and yellow perch accounted for 95% of the total harvest, reflecting their continued importance to the sport fishery. Non-charter anglers harvested an estimated 65,740 walleye in Michigan waters of Lake Erie, up substantially from 2014 (34,326 fish). Harvest of bass by Michigan's Lake Erie anglers remained low with an estimate of less than 200 fish harvested. Angler effort in 2015 increased 28% compared to 2014 **(Fig 1).** The walleye harvest rate in 2015 (0.20 fish/angler hour) increased 30% from 2014, and is close to the long-term average of 0.22 fish/angler hour **(Fig 2).** The yellow perch harvest rate (1.12 fish/angler hour) increased 39% in 2015, and remained well above the long-term average of 0.57 fish/angler hour. Trends in angler effort and harvest rates for walleye and yellow perch since the mid-1980's suggest that the level of angler effort on Lake Erie is affected by many factors in addition to harvest rates. Other factors, including weather, prey fish abundance, fishing success on other Great Lakes waters, fuel expenses, and regional economic conditions have likely contributed to the comparatively low level of fishing effort since 1991.

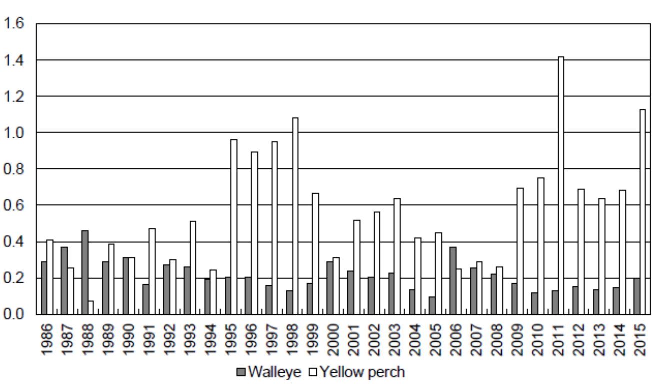


Fig 2-Walleye and yellow perch harvest rates for Michigan's Lake Erie sport fishery, 1986-2015

Biological data were collected from walleye and yellow perch during the 2015 on-site creel survey. One quarter of harvested walleye in 2015 were age-4 representing the 2011 year class **(Fig 3)**. The age-3 ('12) and age-5 ('10) year classes also provided strong contributions to the 2015 harvest, each representing nearly 20% of the total harvest. In contrast to last season, age-10 and older walleye (including the 2003 year-class as 12 year-old fish) accounted for only 11% of the harvest. The average length of walleye harvested in the sport fishery in 2015 was 486 mm (19.1 in.).

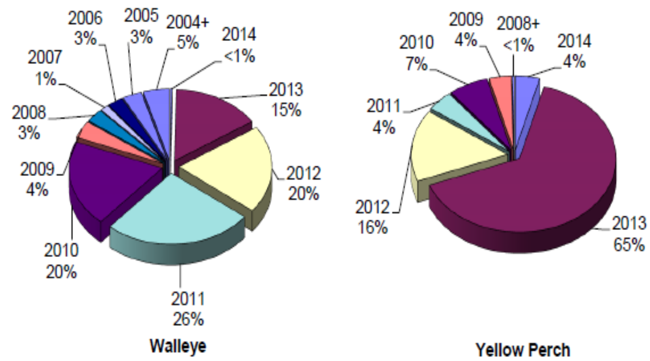


Fig 3-Year-class contribution to Michigan sport harvest for walleye and yellow perch from Lake Erie in 2015

Yellow perch harvest was primarily comprised of age-2 fish (2013 year-class), which accounted for 65% of the total harvest **(Fig 3).** The average length of harvested age-2 yellow perch was 208 mm (8.2 in.). The overall average length of yellow perch harvested in the sport fishery in 2015 was 216 mm (8.5 in.). Observed average length-at-age for yellow perch taken in the Michigan sport fishery decreased for age-4 and age-5 fish in 2015, while average length of age-3 fish remained similar to 2014 (**Fig 4**).

Detroit River non-charter recreational fishery

In 2015 the MDNR conducted a creel survey of the Detroit River in collaboration with the OMNRF and the USGS. This survey is the first characterization of recreational fishing on the Detroit River since 2002-2005. Recreational anglers spent 623,792 hours fishing the Detroit River and harvested a total of 446,593 fish **(Table 2).** White bass were the most commonly harvest fish (224,865 fish) in the Detroit River, representing 50% of the total harvest.

Walleye and yellow perch combined represented 47% of the total harvest. Non-charter anglers harvested a total of 135,319 walleye in 2015, representing a harvest rate of 0.22 fish/angler hour, similar to the harvest rate in Michigan waters of Lake Erie in 2015 (0.20 fish/angler hour). Non-charter recreational anglers harvested an estimated 72,412 yellow perch, a catch rate of 0.12 fish/angler hour.

Catch rates of yellow perch were substantially lower in the Detroit River, when compared to the Michigan waters of Lake Erie in 2015 (1.12 fish/angler hour). Nearly 77,000 legal-sized bass (largemouth and smallmouth combined) were captured in the Detroit River, and 96% were released. Additionally in 2015, a total of 2,120 legal-sized Muskellunge were captured and none were recorded in the harvest.

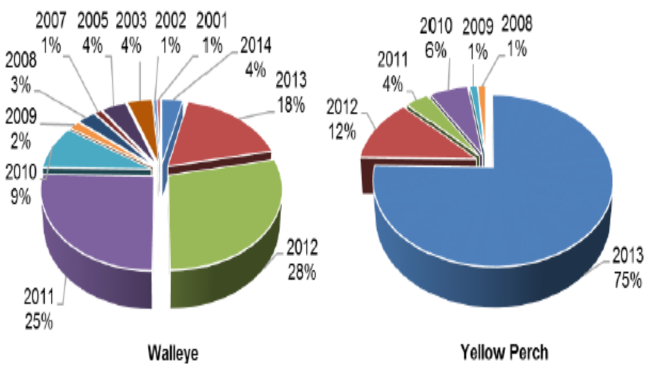


Fig 4-Year-class contribution to Michigan sport harvest for walleye and yellow perch from the Detroit River in 2015

Biological data were collected from walleye and yellow perch during the 2015 Detroit River creel survey. The age composition of harvested walleye was dominated by ages 3 and 4 (2012 and 2011 year-classes), which collectively accounted for 54% of the harvest (Figure 5). Age-10 and older walleye accounted for only 10% of the harvest. The average length of walleye harvested in the Detroit River sport fishery in 2015 was 480 mm (18.9 in.). Three-quarters of yellow perch harvested in the Detroit River were age-2 (2013 year-class) **(Fig 5).** Average length of yellow perch harvested in the sport fishery in 2015 was 217 mm (8.6 in.).

Charter fishery

In 2015, Michigan charter boat operators reported a harvest of 24,491 fish from Lake Erie (Table 3). In combination, walleye (38%) and yellow perch (59%) accounted for 97% of the total harvest. The walleye harvest rate (0.67 fish/angler hour) in 2015 was nearly unchanged from 2014 and remained slightly below the long-term average harvest rate of 0.72 walleye per hour **(Fig 5).** Yellow perch harvest rate (1.06 fish/angler hour) increased 22% from 2014, exceeding the long-term average of 0.63 yellow perch per hour for the 6th consecutive year. The charter boat walleye harvest rate was 3.4 times higher than those estimated for non-charter anglers (0.20 fish/angler hour) in 2015, while the yellow perch charter harvest rate was about 7% less than the rate for non-charter boat anglers (1.13 fish/angler hour).

Beginning in 2010, Michigan charter boat operators were also required to report catch-and-release fishing activity as well as harvest. For Lake Erie, charter operators reported releasing 11,257 fish in 2015 **(Table 3).** About 48% of the released fish were from the “other species” category, which is composed largely of white perch, white bass, freshwater drum, and channel catfish. Lake Erie charter boat operators reported a total catch of 13 muskellunge with 1 fish harvested in 2015.

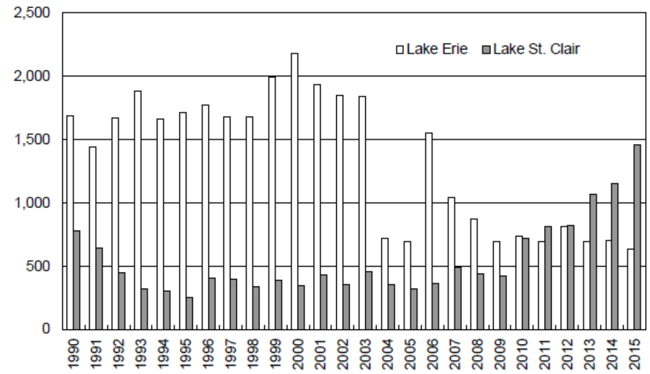


Fig 5-Reported charter boat excursions on Lake Erie and the St. Clair-Detroit River System, 1990-2015

Charter boat anglers reported a harvest of 9,783 fish **(Table 4).** Walleye (50%), yellow perch (23%, and smallmouth bass (22%), made up the bulk of the harvest. In 2015, charter boat harvest rate for walleye was nearly unchanged from 2014, but remained below the long-term average walleye harvest rate of 0.20 walleye per hour**.** Yellow perch harvest rate decreased 38% in 2015 and remained well below the long-term yellow perch harvest rate of 0.51 yellow perch per hour.

Charter operators on the St. Clair-Detroit River System reported releasing 21,335 fish **(Table 4).** Smallmouth bass (76%) and muskellunge (8%) accounted for the majority of the fish caught-and-released. For smallmouth bass, charter operators released 88% of the 18,300 smallmouth bass caught in 2015. Of the 1,747 muskie reported caught, 1 fish was harvested, for a release rate of 99.9%.

The number of reported Michigan charter excursions on Lake Erie decreased 9% in 2015, and remained well below the levels reported prior to 2004 **(Fig 5).** In 2015, charter boat excursions on the St. Clair-Detroit River System increased 27% from 2014. We suspect much of the increase in reported St. Clair System charter excursions since 2010 has been the result of the new reporting requirement for catch-and-release fishing activity. For many years, much of the charter fishing activity on the St. Clair-Detroit River System has been catch-and-release oriented, and was largely unreported.

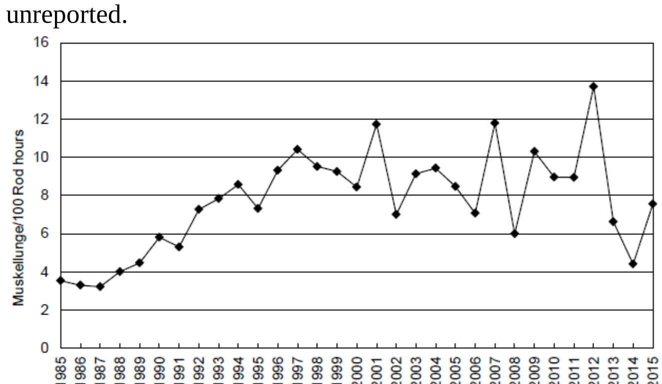


Fig 6-Lake St. Clair muskellunge catch rate from Angler Diary Program, 1985-2015

Sport Fishery Diary and Master Angler programs

Muskie catch rates derived from the Sport Fishery Diary Program on Lake St. Clair improved through the late 1980's and early 1990's, but were more variable in the 2000's. In 2015, the catch rate increased more than 50% from the low level recorded in 2014 **(Fig6).** This rebound in 2015 continues a pattern of increased variability in catch rates over the past 13 years. We suspect this increased variability may be more reflective of the lower number of muskie anglers involved in the diary program, than of actual changes in the muskie population. Overall, angler participation in the diary program has waned and efforts to recruit new participants have not been very successful.

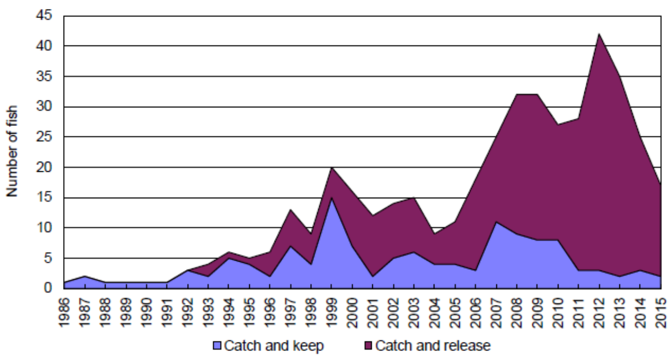


Fig 7-Lake St. Clair smallmouth bass entered in the Michigan DNR Master Angler Program, 1986-2015

For years, the quality of the Lake St. Clair muskie fishery was reflected in the MDNR's Master Angler Program. Lake St. Clair continued to dominate the statewide Master Angler entries for muskie in 2015, with 26 of the 47 total entries originating from the St. Clair System. However, the number of Lake St. Clair muskie Master Angler entries has generally declined since 2000**.** We suspect this is largely a reflection of waning interest in submitting Master Angler entries for muskie less than 50" in length, which has become a local "trophy" benchmark for muskie from the St. Clair-Detroit River System.

By all accounts, the muskie population continues to provide exceptional fishing opportunities. We expect that the following factors will continue to contribute to a strong muskie population and fishery in Lake St. Clair and the connecting waters: 1) a 44" minimum size limit (MSL) for Ontario waters and a 42" MSL with 1 fish per year harvest limit for Michigan waters of the St. Clair System; 2) physical and biological changes in the lake such as clearer water and increased aquatic plant growth resulting in improved habitat for muskie; and, 3) extensive voluntary practice of catch-and-release fishing for muskie in Lake St. Clair by both charter and non-charter anglers.

Statistics from the Master Angler program indicate that Lake St. Clair is one of the premier waterbodies in the state for trophy smallmouth bass. Lake St. Clair accounted for 20% (17 entries) of all smallmouth bass entries statewide in 2015 (catch/keep and catch/release programs combined). No other single waterbody in the state produced more than 2 smallmouth bass entries in 2015. From the early 1990's through 2011, Master Angler smallmouth bass entries from Lake St. Clair exhibited an increasing trend **(Fig 7).** Since 2012, entries have declined. Catch/release entries have outnumbered catch/keep entries for the last 15 years. The strong representation of Lake St. Clair smallmouth bass in the statewide Master Angler Program is likely a reflection of an abundance of trophy-size smallmouth bass in the lake, a high degree of angler effort targeting the species, and widespread practice of catch-and-release among smallmouth bass anglers.

Commercial Fishery Summary

Since 1979 the commercial fishery in Michigan waters of Lake Erie has primarily harvested rough fish species using seines in the shallow embayments along the shoreline. However, a small-mesh trap net license has been active since 2006 resulting in an increased harvest of open water species such as channel catfish, freshwater drum, white bass, and white perch. In 2015, a total of two Michigan commercial fishing licenses were active on Lake Erie. The 2015 commercial harvest included 13 types of fish for a total of 1,025,959 lbs **(Table 5).** In combination, common carp (22%), white bass (17%), channel catfish (14%), freshwater drum (13%), and buffalo (10%) accounted for 76% of the total harvest by weight. The major species in the trap net harvest included white bass, freshwater drum, and quillback. The primary species in the seine harvest included common carp, channel catfish and goldfish. The total value of the 2015 Lake Erie commercial harvest from Michigan waters was estimated at $727,928 **(Table 5).** The 2015 harvest of channel catfish was the highest since 1981 **(Table 6).** The 2015 harvests of goldfish, white perch, and white bass were the second highest reported since 1981. There is no commercial fishing in Michigan waters of the St. Clair-Detroit River System.

Summary of Netting Surveys

In 2014 and 2015, a bottom trawl survey was conducted in the Michigan waters of Lake Erie to measure recruitment of important fish species. Trap nets have been deployed in Anchor Bay of Lake St. Clair each spring since 2002 to sample adult fish populations, while juvenile and forage fish populations in the lake have been assessed with bottom trawls each spring and fall since 1996. A setline survey has been used to monitor the lake sturgeon population in the North Channel of the St. Clair River since 1997; beginning in 2013 the MDNR modified its bottom trawl to increase its success in capturing lake sturgeon in Lake St. Clair.

In 2015, four trap nets were fished from April 27 to May 18 at index net sites in Anchor Bay. The sampling period was characterized by cool and unusually clear water conditions. The trap nets were visible from the surface on nearly every day of the survey. A total of 1,623 fish representing 21 species were captured during the survey. The catch also included a total of 2 mudpuppies. As usual, rock bass were numerically dominant, accounting for 59% of the total catch **(Fig 8).** Other common species in the nets included smallmouth bass (10%), channel catfish (7%), and northern pike (7%).

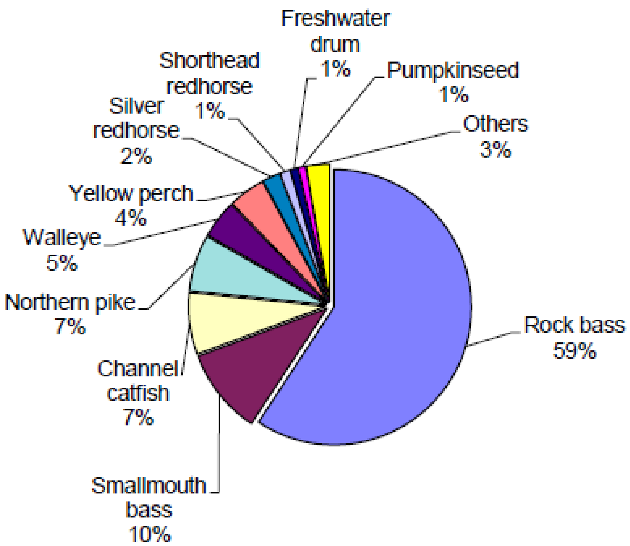


Fig 8-Catch composition for trap nets fished in Lake St. Clair during April - May 2015

Fish Tagging Studies

In 2015, Michigan tagged a total of 153 smallmouth bass with non-reward jaw tags in Anchor Bay of Lake St. Clair. A total of 6 non-reward tags placed on smallmouth bass in 2015 were recovered by anglers for a single-season reporting rate of 3.9%. The 2015 reporting rate marked the second decrease in tag reports in five years and was two-thirds the 6.0% reporting rate observed in 2014. The 2015 tag reporting rate is closest to the 3.1% reporting rate observed in 2010. Walleye captured during the spring trap net survey were not tagged, although two walleyes that were tagged in Lake St. Clair during previous surveys were reported by anglers in 2015.

Since 2002, a total of 5,061 smallmouth bass captured in survey trap nets in Anchor Bay have been tagged and released. In contrast to Lake Erie walleye, smallmouth bass movements are rather localized, with nearly all the smallmouth bass tag recoveries reported to date coming from the Michigan waters of Lake St. Clair. The northernmost smallmouth bass tag recovery has been from the Port Huron area of the St. Clair River, and the southernmost recovery came from the Bolles Harbor area of Lake Erie.

A total of 2,958 lake sturgeon have been tagged and released in the St. Clair River and Lake St. Clair since 1996. To date, 579 tagged lake sturgeon have been recaptured with survey gear or reported by fishermen. A total of 368 tagged sturgeon have been recovered with survey setlines in the North Channel. One was recovered in a survey trap net in Anchor Bay, while 13 have been recaptured in assessment trawls on Lake St. Clair. Sport anglers have reported 161 recoveries, nearly all from the St. Clair River North Channel, except for one reported from Lake Erie, near Huron, Ohio. Twenty-one recoveries have been reported from the Ontario commercial trap net fishery in southern Lake Huron, approximately 70 km (43.5 mi) from the tag site.

Sport Fishing Regulations

The 2016 daily possession limit for walleye fishing in Michigan waters of Lake Erie is 6 fish per day, the Michigan walleye minimum size limit (15") and season (open all year) for Lake Erie waters remain unchanged for 2016. The possession season for smallmouth and largemouth bass fishing in the Michigan portion of the St. Clair River, Lake St. Clair, and the Detroit River is the third Saturday in June (June 18, 2016) thru December 31. The black bass possession season for the Michigan waters of Lake Erie opens on the Saturday before Memorial Day (May 28 in 2016).

The latest information on all of Michigan's fishing regulations, including those of the Great Lakes and its connecting waters in Southeast Michigan, can be found on-line at: https://www.michigan.gov/fishingguide.

Table 1-Estimated harvest of legal-sized fish for Michigan's 2015 Lake Erie non-charter boat fishery

Species	Harvest Rate (fish/hr)	Month Apr	May	Jun	Jul	Aug	Sep	Oct	Season
HARVEST									
Yellow perch	1.1286 (0.5148)	441	278	2,043	57,477	106,555	166,312	37,589	370,695 (74875)
Walleye	0.2001 (0.0938)	11,589	19,513	11,278	21,566	1,712	45	37	65,740 (13647)
Channel catfish	0.0148 (0.0064)	0	2,960	790	802	283	14	0	4,849 (930)
White bass	0.0543 (0.0761)	56	15,497	1,425	707	107	0	35	17,827 (11068)
White perch	0.0049 (0.0078)	0	628	52	169	535	14	216	1,614 (1128)
Freshwater drum	0.0012 (0.0017)	0	116	130	34	85	44	0	409 (247)
Smallmouth bass	0.0006 (0.0011)	0	0	19	78	32	44	14	187 (156)
Other	0.0015 (0.0041)	0	499	0	0	0	0	6	505 (593)
Total Harvest	1.4061	12,086	39,491	15,737	80,833	109,309	166,473	37,897	461,826

Table 3-Total numbers harvested and released, harvest and release per angler hour, harvest per excursion, and fishing effort (angler hours, trips, and charter excursions) reported for charter boats on Lake Erie, 2015.

Species	Per angler hour	Per excursion	Month Apr[1]	May	Jun	Jul	Aug	Sep	Oct[1]	Season
Harvested										
Rainbow trout	0.0001	0.0	0	0	0	1	0	0	0	1
Yellow perch	1.0575	22.6	0	48	22	440	4,576	5,701	3,660	14,447
Walleye	0.6732	14.4	383	2,125	2,210	3,918	487	56	18	9,197
Small. bass	0.0010	0.0	0	4	6	4	0	0	0	14
Muskellunge	0.0001	0.0	0	1	0	0	0	0	0	1
Other	0.0608	1.3	0	394	322	25	76	4	10	831
Released										
Yellow perch	0.3236	6.9	1	7	38	109	1,339	2,200	727	4,421
Walleye	0.0984	2.1	5	251	522	515	41	1	9	1,344
Small. bass	0.0075	0.2	9	36	18	4	10	25	0	102
Muskellunge	0.0009	0.0	5	2	4	1	0	0	0	12
Other	0.3937	8.4	26	3,298	645	464	667	186	92	5,378
Angler hours			759	2,766	2,738	3,966	1,699	1,199	534	13,661
Angler trips			134	523	532	785	327	219	103	2,623
Charter excursions			40	135	127	186	73	50	27	638

[1]March and April values combined; October, November, and December values combined.

Table 2- Estimated harvest, harvest rate, effort, and released catch of legal-sized fish for the 2015 Detroit River non-charter boat fishery.

Species	Harvest rate (fish/hr)	Month Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Season
HARVEST										
White bass	0.3605 (0.3535)	0	4,120	167,212	52,468	792	273	0	0	224,865 (38,146)
Walleye	0.2169 (0.2448)	0	63,456	40,890	11,931	5,633	2,092	10,992	325	135,319 (26,416)
Yellow perch	0.1161 (0.5595)	157	12,113	2,777	3,768	920	2,475	47,155	3,047	72,412 (60,379)
Channel catfish	0.0067 (0.0373)	0	0	0	427	90	2,283	1,328	77	4,205 (4,023)
Smallmouth bass	0.0052 (0.0161)	0	0	0	47	423	709	1,956	96	3,231 (1,737)
Northern pike	0.0004 (0.0023)	0	149	62	60	0	0	0	8	279 (253)
White perch	0.0004 (0.0027)	0	0	0	92	156	0	0	0	248 (289)
Largemouth bass	0.0002 (0.0015)	0	0	0	47	0	0	65	0	112 (160)
Muskellunge	0	0	0	0	0	0	0	0	0	0
Other	0.0162 (0.0861)	0	70	1,389	336	1,888	1,816	392	31	5,922 (9,291)
Total Harvest	0.7159	157	79,908	212,330	69,176	9,902	9,648	61,888	3,584	446,593 (76,451)
EFFORT										
Angler hours		377	215,156	127,549	74,638	54,845	51,227	78,638	21,362	623,792 (107,912)
Angler trips		98	42,228	32,798	17,608	15,204	12,226	20,408	4,988	145,558 (24,998)
RELEASED										
White bass	0.4596 (0.8708)	6	4,319	178,839	97,571	4,684	750	475	24	286,668 (93,965)
Smallmouth bass	0.0854 (0.2573)	0	686	8,590	6,365	6,917	8,218	20,543	1,984	53,303 (27,767)
Largemouth bass	0.0326 (0.1236)	0	43	5,412	2,603	2,170	3,009	5,889	995	20,121 (13,336)
Muskellunge	0.0034 (0.0081)	0	213	83	114	862	254	99	495	2,120 (869)
Northern pike	0.0048 (0.0142)	0	605	1,102	600	68	90	413	94	2,972 (1,529)

Table 4-Total numbers harvested and released, harvest and release per hour, harvest per excursion, and fishing effort (angler hours, trips, and charter excursions) reported for charter boats on the Detroit River, Lake St. Clair, and the St. Clair River, 2015.

Species	Per angler hour	Per excursion	Month							Season
			Apr[1]	May	Jun	Jul	Aug	Sep	Oct[1]	
Harvested										
Yellow perch	0.0702	1.5	0	92	331	226	159	1,022	411	2,241
Walleye	0.1539	3.4	2,590	1,725	328	97	91	65	16	4,912
Small. bass	0.0675	1.5	0	0	127	873	828	295	31	2,154
Muskellunge	0.0000	0.0	0	0	0	0	1	0	0	1
Other	0.0149	0.3	1	383	42	25	22	2	0	475
Released										
Yellow perch	0.0368	0.8	0	0	5	0	246	543	380	1,174
Walleye	0.0155	0.3	385	84	11	2	7	0	5	494
Small. bass	0.5058	11.1	454	4,918	4,000	2,653	2,182	1,144	795	16,146
Muskellunge	0.0547	1.2	15	14	221	391	481	267	357	1,746
Other	0.0556	1.2	37	976	466	63	96	82	55	1,775
Angler hours			5,181	5,279	4,616	5,050	5,039	3,596	3,162	31,923
Angler trips			911	891	705	772	769	558	446	5,052
Charter excursions			231	248	222	219	225	164	151	1,460

[1]March and April values combined; October, November, and December values combined.

Table 5-Commercial harvest (pounds sold) from Michigan waters of Lake Erie in 2015.

Species	Harvest (lbs.)	% of total harvest	Reported market value
Carp	227,946	22%	$84,340
White bass	179,246	17%	$295,756
Channel catfish	144,500	14%	$75,140
Freshwater drum	128,510	13%	$38,553
Buffalo	100,135	10%	$80,108
Goldfish	88,791	9%	$71,033
Quillback carpsucker	76,203	7%	$41,912
White perch	53,245	5%	$24,493
Bullhead	26,396	3%	$15,838
Bowfin	338	0%	$135
Sucker	332	0%	$50
Whitefish	267	0%	$566
Gizzard shad	50	0%	$5
Grand Total	1,025,959	100%	$727,928

✧

Lake Erie phosphorus-reduction targets challenging but achievable

ANN ARBOR—Large-scale changes to agricultural practices will be required to meet the goal of reducing levels of algae-promoting phosphorus in Lake Erie by 40 percent, a new University of Michigan-led, multi-institution computer modeling study concludes.

Last month, the U.S. and Canadian governments called for a 40-percent reduction, from 2008 levels, in phosphorus runoff from farms and other sources into Lake Erie. The nutrient feeds an oxygen-depleted "dead zone" in the lake and toxin-producing algal blooms, including a 2014 event that contaminated the drinking water of more than 400,000 people near Toledo for two days.

The main driver of the harmful algal blooms is elevated phosphorus from watersheds draining to Lake Erie's western basin, particularly from the heavily agricultural Maumee River watershed. About 85 percent of the phosphorus entering Lake Erie from the Maumee River comes from farm fertilizers and manure.

The new study, which integrates results from six modeling teams, was released today by the U-M Water Center. It concludes that meeting the 40-percent reduction target will require widespread use of strong fertilizer-management practices, significant conversion of cropland to grassland and more targeted conservation efforts.

"Our results suggest that for most of the scenarios we tested, it will not be possible to achieve the new target nutrient loads without very significant, large-scale implementation of these agricultural practices," said U-M aquatic ecologist Don Scavia, lead author of the new study and director of the Graham Sustainability Institute, which oversees the Water Center.

"It appears that traditional voluntary, incentive-based conservation programs would have to be implemented at an unprecedented scale or are simply not sufficient to reach these environmental goals, and that new complementary policies and programs are needed." The researchers developed a list of potentially effective cropland management practices after consulting with agricultural and environmental experts. They examined various options for fertilizer application, tillage operations, crop rotations and land conversion.

Various management options were combined to create 12 scenarios that were each tested using six computer models. The watershed models tested the ability of each scenario to achieve the proposed 40 percent phosphorus-reduction target. The scenarios examine both the total amount of phosphorus, known as TP, and the amount of dissolved reactive phosphorus (DRP), the form of the nutrient that is most stimulating to algae.

"The most promising scenarios included widespread use of nutrient management practices—especially subsurface application of phosphorus-based fertilizers—along with substantial conversion of cropland to grassland and extensive use of buffer strips," said study co-author Jay Martin of Ohio State University.

Even so, the researchers determined that seven of the 12 cropland-management scenarios would not meet the goal of a 40-percent reduction in total phosphorus entering western Lake Erie from the Maumee River watershed. One of the five scenarios capable of reaching the TP target (Scenario 6) requires taking nearly 30,000 acres of cropland out of production and putting more than 1.5 million acres under stringent conservation practices. Because the average size of a farm in the Maumee River watershed is 235 acres, this is equivalent to impacting more than 6,300 farms.

One of the scenarios (Scenario 2) that reach the target for dissolved reactive phosphorus requires enhanced nutrient management on all 3.1 million acres of row-crop fields in the watershed, which equates to impacting roughly 13,000 farms. "While there may be a temptation to select one model based on 'superior performance,' there is no one way to evaluate model performance. Instead, we chose to use multiple models because together they represent the range of reasonable representations of the real world," said study co-author Margaret Kalcic, one of the U-M Water Center's lead modelers.

"Research like this is valuable to help inform on-the-ground conservation efforts, such as the 4R Nutrient Stewardship Program currently underway in Ohio. We will only solve this problem with the right mix of land and water management practices, deployed in the right place and amount," said study co-author Scott Sowa of The Nature Conservancy.

Meeting phosphorus-reduction targets has proved difficult elsewhere in the United States. Specific goals for reducing the size of the Gulf of Mexico's oxygen-starved "dead zone" have existed for 15 years, but almost no progress has been made. And water-quality improvement goals for the Chesapeake Bay were in place for decades before some limited progress was made.

The new Lake Erie report is titled "Informing Lake Erie agriculture nutrient management via scenario evaluation." In addition to Scavia, Kalcic, Martin and Sowa, the authors are U-M's Rebecca Logsdon Muenich, Jennifer Read and Yu-Chen Wang; Noel Aloysius and Marie Gildow of Ohio State University; Chelsie Boles, Todd Redder and Joseph DePinto of LimnoTech; Remegio Confesor of Heidelberg University; and Haw Yen of Texas A&M University.

Funding for the study was provided by the Fred A. and Barbara M. Erb Family Foundation. The study findings have been submitted to a peer-reviewed scientific journal for publication. The U-M Water Center addresses critical and emerging regional and national water resource challenges. Its mission is to foster collaborative research that informs the policy and management decisions that affect our waters.

✧

2015 Lakes Erie/Huron Lake Sturgeon Working Group Report

The 2015 Lakes Erie/Huron Lake Sturgeon Working Group Reports, comprised of fisheries biologists from USFWS (multiple offices), U.S. Army Corp of Engineers, the Great Lakes Center at SUNY Buffalo State, New York Department of Environmental Conservation, USGS Great Lakes Science Center, Ontario Ministry of Natural Resources and Forestry (OMNRF, U of Windsor, U of Toledo, Michigan DNR, Ohio DNR and West Virginia U are collectively collaborating in twelve ongoing projects to collect life history and population demographics for the lake sturgeon population in and about Lakes Erie, Huron & St. Clair; and the Maumee, St. Clair, Detroit and Niagara Rivers

Some sample projects:

●Researchers are collecting life history and population demographics for the lake sturgeon population in and about Buffalo Harbor.

●Researchers equipped 9 fish with archival satellite transmitters and surgically implanted acoustic transmitters into 19 fish to analyze coarse- and fine-scale temporo-spatial movement, behavior and habitat use within Buffalo Harbor.

●Researchers are collecting information on age, growth, sex, health and spawning contribution of adult and sub-adult lake sturgeon caught in annual surveys conducted in the Buffalo Harbor and upper Niagara River.

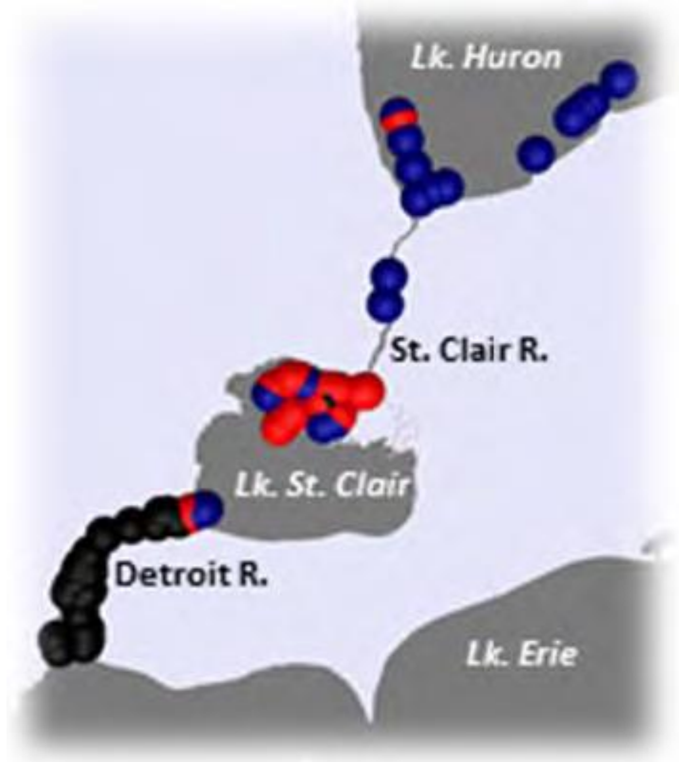
●Two remnant groups of sturgeon are being studied: one in the Detroit River and the other in the upper Niagara River, in order to gain a better understanding of these existing groups of sturgeon as they relate to historical populations and identify other historically important areas that supported the largest commercial fishery of lake sturgeon in the Great Lakes.

●Genetic analysis of the lake sturgeon sampled in the Niagara River and eastern Lake Erie will improve the understanding of the genetic relationship between lake sturgeon from both the upper and lower Niagara River, as well as in comparison to other populations throughout the Great Lakes.

●In order to determine if current habitat quantity and quality are sufficient to support reintroduction, researchers are constructing a spatially explicit habitat suitability index model for spawning adult and age-0 lake sturgeon for the lower Maumee River.

●The Michigan DNR Lake St. Clair Fisheries Research Station (LSCFRS) has been conducting lake sturgeon assessment surveys since 1996 to capture lake sturgeon in the open waters of Lake St. Clair. All sturgeon captured are scanned for PIT tags and untagged fish are PIT tagged prior to release, with data used to obtain growth, genetics, distribution, spawning site, and population demographic information.

●The North Channel of the St. Clair River supports a unique recreational fishery for lake sturgeon. The objectives of this project are to better understand the human dimensions of sturgeon fishing, and to gather firsthand observations of the effect of recreational angling on lake sturgeon caught with conventional fishing equipment.



●Since 2011, a total of 268 adult lake sturgeon have been captured in the Detroit and St. Clair rivers, implanted with highpower acoustic tags with a battery life of 10 years, and then released near the capture site.

●A current study evaluated the use of a portable ultrasound unit to determine sex of lake sturgeon in the St. Clair-Detroit River System. The sex and maturity of 41 female and 107 male lake sturgeon was determined by visually inspecting gametes through a small incision.

●Raw imagery was collected in 2015 and the categorical map will be completed in 2016. Additionally, biometric, age, blood and genetic data for each individual will be used to describe population demographics and health.

●Annually since 2002, researchers have been using setline assessments to obtain information on adult and subadult lake sturgeon, specifically to obtain growth information, genetics, distribution, potential spawning sites, and population demographic information. To date, the Service has tagged 374 lake sturgeon in the Detroit River.

●In an effort to gain a better understanding of lake sturgeon presence and abundance in western Lake Erie, the Ohio DNR and USFWS Alpena FWCO are working with commercial fisherman in Ohio waters of Lake Erie to collect lake sturgeon information.

●The Ontario Ministry of Natural Resources and Forestry (OMNRF) does not conduct annual targeted survey for lake sturgeon on Lake Erie, but does rely on indirect sources of information in order to track lake sturgeon presence and absence over time across the Ontario waters of Lake Erie. This program monitors the abundance, age structure, size, and species composition throughout Lake Erie.

●Understanding how invasive species alter the food web structure in Lake Sturgeon Isotopic signatures in the Huron-Erie Corridor is an effort of USFWS, OMNRF and U of Windsor. The research questions Is there an ontogenetic shift in lake

sturgeon trophic position and how have/are invasive species affecting the trophic position of juvenile and adult lake sturgeon?

●Researchers want to determine whether the lake sturgeon of the St. Clair system and Southern Lake Huron differ morphometrically due to variation in migratory phenotypes, 2) determine if individuals with different migratory phenotypes are reproductively isolated, and 3) determine if migratory and river resident individuals are differentially methylated, indicating epigenetic differences between the two phenotypes. ✧

Sea Lamprey Control in Lake Erie 2015 (USFWS)

The Sea Lamprey is a destructive invasive species in the Great Lakes that contributed to the collapse of Lake Trout and other native species in the mid-20th century and continues to affect efforts to restore and rehabilitate the fish-community. Sea Lampreys attach to large bodied fish and extract blood and body fluids. Approximately half of Sea Lamprey attacks result in the death of their prey and an estimated 18 kg (40 lbs) of fish are killed by every Sea Lamprey that reaches adulthood. The Sea Lamprey Control Program (SLCP) is a critical component of fisheries management in the Great Lakes because it facilitates the rehabilitation of important fish stocks by significantly reducing Sea Lamprey-induced mortality.

Lampricide Control

● Lampricide treatments were completed in 7 tributaries (1 Canada, 6 U.S.).

● Komoka Creek, a tributary to the Thames River and Lake St. Clair was treated for the first time.

● Paint (Clinton River tributary) and Big Sister creeks were treated for the first time.

● Canadaway Creek was treated for the first time since 1986.

● The entire infested distribution on Conneaut Creek was treated including upstream areas that had been excluded in previous treatments to protect other species.

● Crooked Creek was added to the treatment schedule after numerous large larval and metamorphosing Sea Lampreys were found during assessment surveys.

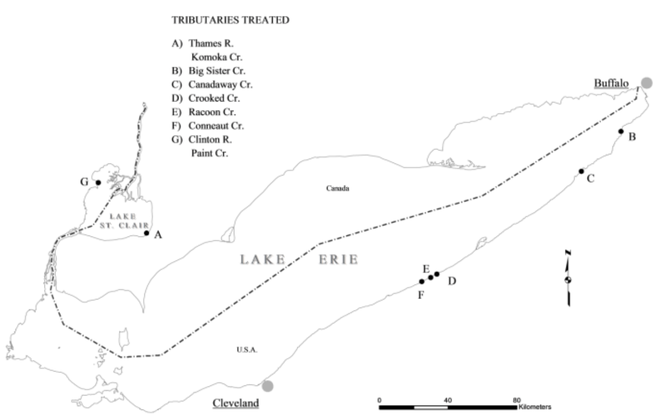


Fig 1- Location of Lake Erie tributaries treated with lampricides (corresponding letters in Table 1) during 2015

Barriers

Field crews visited 139 structures on tributaries to Lake Erie to assess Sea Lamprey blocking potential and to improve the information in the BIPSS database.

Operation and Maintenance

● Routine maintenance, spring start-up, and safety inspections were performed on seven Canadian barriers.

● Repairs or improvements were conducted on three Canadian barriers:

● Little Otter Creek – A water flow deflector was installed at the Sea Lamprey trap entrance in the summer of 2015. Handrails were repaired in fall 2015 to improve safety around the trap.

● Young's Creek – The overhanging lip was extended to prevent a water jet from impinging entrance to the Sea Lamprey trap. Data loggers were relocated to ease future access.

● Forestville Creek - The landowner is being consulted on rehabilitation of the access road, which is planned for 2016.

Ensure Blockage to Sea Lamprey Migration

● Cattaraugus Creek – The USACE, along with project partners Erie County and New York State Department of Environmental Conservation (NYSDEC) have approved the selected plan for the Springville Dam Ecosystem Restoration Project, restoring connectivity to approximately 70 miles of Cattaraugus Creek upstream of the Springville Dam. The selected plan will lower a portion of the existing spillway, but will still serve as a Sea Lamprey barrier. A rock riffle ramp with seasonal trapping and sorting operation is included in the design. Construction is targeted for 2018.

● Consultation to ensure blockage at barriers were conducted with partner agencies for three sites in two streams during 2015.

New Construction

● Grand River – The USACE is the lead agency administering a project to construct a Sea Lamprey barrier to replace a deteriorated structure in Harpersfield, Ohio. Project partners include the Commission, Service, Ohio Department of Natural Resources, and Ashtabula County. The USACE developed several alternatives, including: status quo, onsite rebuild, or rebuild further downstream. The USACE selected an onsite rebuild as the preferred alternative and completed the Detailed Project Report. The USACE District Headquarters approved the release of the DPR and the public review period closed on July 10, 2015. Construction is targeted for 2017.

Assessment of Candidate Streams

● Big Otter Creek – A meeting between the owner of the Black Bridge dam (located in Tillsonburg, Ontario) and Department staff was convened in September of 2015 to discuss a potential retrofit to the rock filled dam to prevent the passage of Sea Lampreys. Design drawings of the existing structure were provided by the owner, who was very positive regarding the proposed work. A detailed engineering study including geotechnical investigation, structural integrity, access road construction, determination of the best retrofit option, and design drawings is planned for 2016.

Fish Community Assessments

● Fish community assessments were conducted on two tributaries to Lake Erie: Clear Creek and Big Creek (Venison Creek). The purpose of this work was to evaluate the condition of fish communities within streams where purpose built Sea Lamprey barriers exist.

Larval Assessment

● Larval assessments were conducted on 65 tributaries (30 Canada, 35 U.S.) and offshore of 1 U.S. tributary.

● Surveys to detect new larval populations were conducted in 38 tributaries (22 Canada, 16 U.S.). No new populations were discovered.

● Post-treatment assessments were conducted in 6 tributaries (1 Canada, 5 U.S.) to determine the effectiveness of lampricide treatments conducted during 2014 and 2015.

● Surveys to evaluate barrier effectiveness were conducted in 14 tributaries (5 Canada, 9 U.S.).

● 2.4 ha of the St. Clair River was surveyed with gB, including the upper river and the three main delta channels. Twenty-four sea lampreys were captured throughout the river with no additional areas of high density detected.

● 1.1 ha of the Detroit River was surveyed with gB by the Department and Service crews. No Sea Lamprey larvae were collected.

● The second of a two year deep-water electrofishing project in WIFN territorial waters on the St. Clair River was completed. No lampreys were collected in 2015 and only 7 Sea Lamprey larvae were collected in 2014.

● Larval Sea Lampreys were found upstream of the Bradley Creek confluence on the Catfish River system. Treatment is scheduled for 2016.

● Larval assessment surveys were conducted in non-wadable lentic and lotic areas using 33.2 kg (active ingredient) of gB.

Juvenile Assessment

Lake Trout marking data for Lake Erie are provided by the NYSDEC, the Pennsylvania Fish and Boat Commission, the U.S. Geological Survey, and Ontario Ministry of Natural Resources and Forestry, and analyzed by the Service's GBFWCO.

End

● The Lake Trout marking data from fall assessments during 2015 have not yet been analyzed as they are submitted in February of the following year (2016).

● Based on standardized fall assessment data, the marking rate during 2014 was 17 A1-A3 marks per 100 Lake Trout >532 mm, up from 16.6 in 2014. The marking rate has been greater than the target for the last 10 years and has been increasing the last 4 years after a 2 year decline from a high of 20 in 2009 **(Fig 2).**

● In cooperation with Walpole Island First Nation, the GLFC and partners completed the first year of an annual index for out-migrating juvenile Sea Lampreys in the St. Clair River (SCR). Nine floating fyke nets were deployed in December, 2015 in the main SCR shipping channel and captured 392 juvenile Sea Lampreys over a period of 33 days.

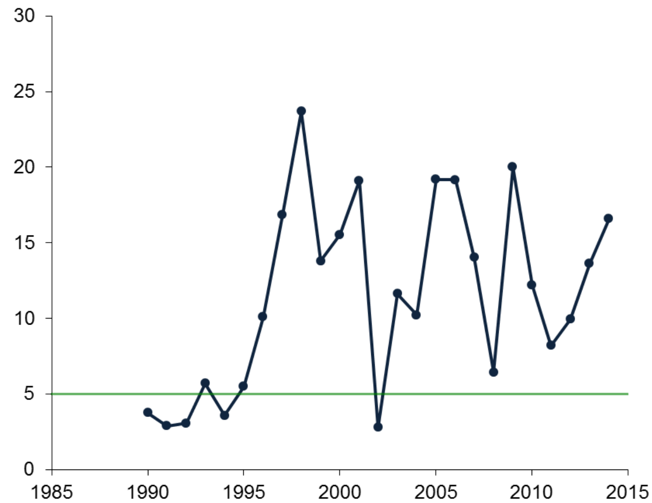


Fig 2- Average number of A1-A3 marks per 100 Lake Trout >532 mm from standardized fall assessments; the horizontal line represents the target of 5 A1-A3 marks per 100 Lake Trout

Adult Assessment

● A total of 2,486 Sea Lampreys were trapped in 5 tributaries during 2015, all of which are index locations. Adult population estimates based on mark-recapture were obtained from all 5 tributaries.

● The index of adult Sea Lamprey abundance was 7,112 (jackknifed range; 4,521-9,341), which was greater than the target of 3,039.

● The adult Sea Lamprey migration was monitored in Cattaraugus Creek through a cooperative agreement with the Seneca Nation Tribe.

● New trap inserts at the Cattaraugus Creek index site were deployed during 2015. Guide rails to aid in trap deployment were installed by Service personnel during fall 2015. ✧