



Inland Seas Angler

# GREAT LAKES BASIN REPORT<sup>©</sup>

## Special Report – Lake Michigan

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## Highlights of the Annual Lake Committee Meetings Great Lakes Fishery Commission proceedings held in Windsor, ON

This first of a series of annual special reports is an extensive summary of the Lake Michigan annual Lake Committee.

These lake committee reports are from the annual Lake Committee meetings hosted by the Great Lakes Fishery Commission of March 2010. We encourage reproduction with the appropriate credit to the GLSFC and for the agencies involved. The other Lake Committee reports will be released shortly.

Our thanks to the USGS Great Lakes Science Center, GLFC, USFWS, and the State DNRs for their contributions to these science documents. While they are abridged and have been edited for brevity, we have submitted extensive information that gives an overview of the status, conditions and prognosis of the Great Lakes and our fish.

We especially thank the following for their assistance in getting us the many electronic documents, graphs, tables and reports: Brian Breidert, IN DNR; Dale Hanson and Mark Holey, USFWS; and Maureen Walsh, Jackie Savino, USGS Great Lakes Science Center; and their respective support staffs.

Thanks also to the Great Lakes Fishery Commission, its staff and Marc Gaden & Chris Goddard, for their efforts in again convening and hosting all the Lake Committee meetings in Windsor, ON.

### Lake Michigan

#### Index of Reports

Status of Lake Michigan Salmonines in 2009 (LMC)	<i>pgs</i>	1 - 3
Salmonid Stocking Totals for Lake Michigan 1976-2009 (FWS)	<i>pgs</i>	3 - 6
Prey Fish Populations in Lake Michigan, 2009, USGS	<i>pgs</i>	6 - 10
Status of Yellow Perch in Lake Michigan (LMC)	<i>pgs</i>	11 - 12
Lake Michigan Technical Committee Annual Report (LMC)	<i>pgs</i>	12 - 13
Lake Trout Working Group Report (FWS)	<i>pgs</i>	13 - 14
Sea Lampreys in Lake Michigan 2009 (FWS)	<i>pgs</i>	15

#### Key

FWS = Fish & Wildlife Service

LMC = Lake Michigan Committee

USGS = U.S. Geological Survey

CPE = Catch per effort

1 kiloton (kt) (1 kt = 1000 metric tons)

### Status of Lake Michigan Salmonines in 2009 (LMC)

#### Introduction

The Fish Community Objective (FCO) for Lake Michigan salmonines specifies establishment of a diverse salmonine community capable of sustaining an annual harvest of 2.7 to 6.8 million kg, of which 20-25% is lake trout. Inherent in this objective is the desire to maintain a salmonine community that has abundant levels of Chinook salmon (i.e., target annual yield of 3.1 million kg) sufficient to suppress alewife populations but not beyond levels where predator consumption would threaten food web integrity.

#### Abundance

Charter fishery catch rates, predicted abundance of age-1 fish, and Michigan's weir returns were utilized to evaluate trends in Chinook salmon abundance in 2009. Chinook salmon are used as the indicator of overall predator abundance because of the availability of data and because of the demand placed on the prey population due to their high consumption rate. Lakewide harvest of Chinook salmon was highest in the late 1980s, declined substantially during 1989-1994, increased steadily from 1995-2005 and remained high through 2007, but dropped substantially in 2008 (**Fig 1**).

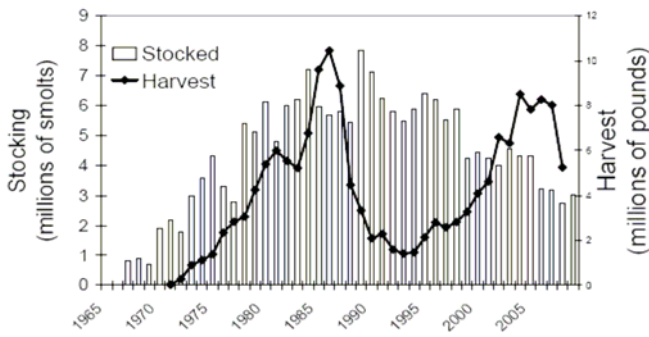


Fig 1 - Chinook salmon stocking and harvest

Similarly, catch rates in the recreational fishery, using Michigan DNRE charter CPE as an index, declined in the late 1980s, were low during 1992-1994, but have been rising since 1995 until 2007-2009 (Fig 2). Charter catch rates declined from 29.7 fish per 100 hours in 2007 to 27.6 in 2008 and 24.7 in 2009. Average catch rate over the entire time series is 14.1±1.7 and ranged from 4.0 – 30.0 fish per 100 hours of fishing. Even though catch rates declined in 2008 and 2009, they are still above the long-term average. Previous SWG reports predicted the observed decline because recreational catch rates had been at all-time high levels during 2006-2007.

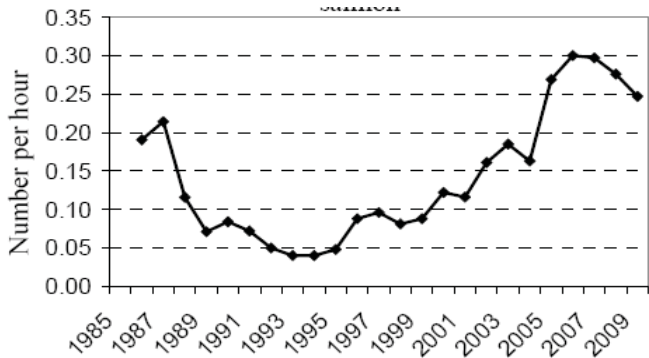


Fig 2 - Fishery (charter) catch rates for Chinook salmon

The abundance of age-1 Chinook salmon showed an increasing trend in the early part of the time series (1992-1996; Fig 3). Since 2005, however, the predicted abundance of age-1 Chinook salmon indicates a decreasing trend (Fig 3). In 2009, the predicted number of age-1 Chinook salmon was below the average of 1,942,140 fish and the lowest in the time series at 745,600 fish.

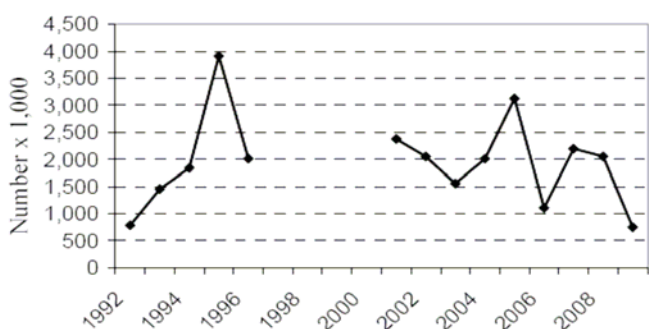


Fig 3 - Number of age-1 Chinook salmon

Weir returns (Fig 4) dropped to 16,369 fish; the second lowest return in the weir time series. The drop in weir returns is due to

lower reductions in Chinook salmon recruitment (see “Reproduction” section below). With the exception of the level I indicator for charter catch rates, all of the Chinook salmon abundance indicators triggered both level I and II red flags.

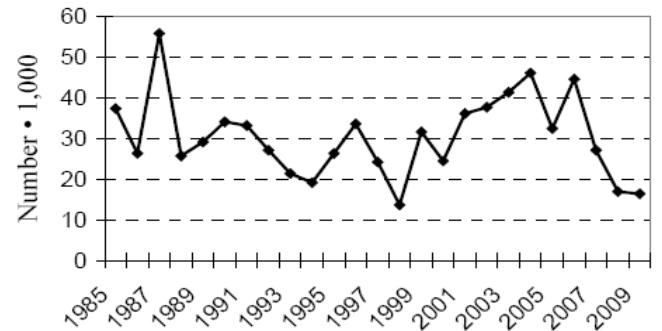


Fig 4 - Michigan Weir Returns

**Reproduction**

Recruitment of naturally-produced Chinook salmon smolts has increased since their introduction in 1967, and now accounts for over 50% of the lake population on average. For example, the percent of wild Chinook salmon for the 2006 and 2007 year-class was 54.0 % and 52.8 %, respectively. However, the percent of wild Chinook salmon dropped to 42.7% for the 2008 year-class (estimated from 2009 collections and unadjusted for marking error). In addition, estimates of total smolt production (estimates of natural reproduction and hatchery stocking combined at 4.8 million smolts) have declined to the lowest value since 1985.

The decline in Chinook salmon smolt production could be due to, in part, stocking reductions aimed at reducing total Chinook salmon abundance to be more in alignment with prey abundance. In addition to stocking reductions, wild smolt production has likely declined from reduced egg production as a function of smaller-sized females in the recent time series.

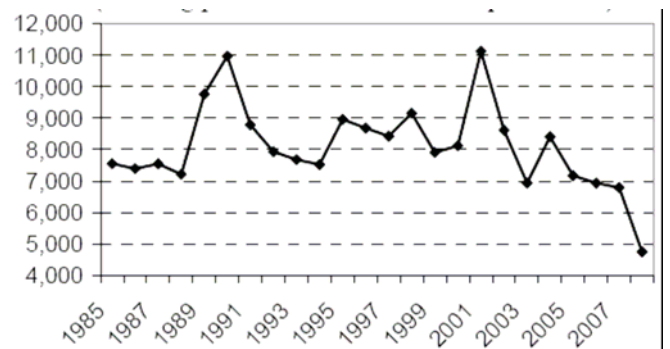


Fig 5 - Total Chinook salmon recruitment (stocking plus estimated wild smolt production)

**Prey fish abundance**

Estimates of forage fish biomass are reported in kilotonnes (kt; 1 kt = 1,000 metric tons) of age-1 and older alewife from bottom trawl surveys and in kt of total alewife biomass from acoustic surveys (Fig 6). Average biomass from bottom trawl surveys is 17.8 kt. Alewife biomass estimated from the bottom trawl increased from 6.0 kt in 2008 to 11.3 kt in 2009. Alewife biomass in 2008, however, was the lowest value in the time series (1985-2009).

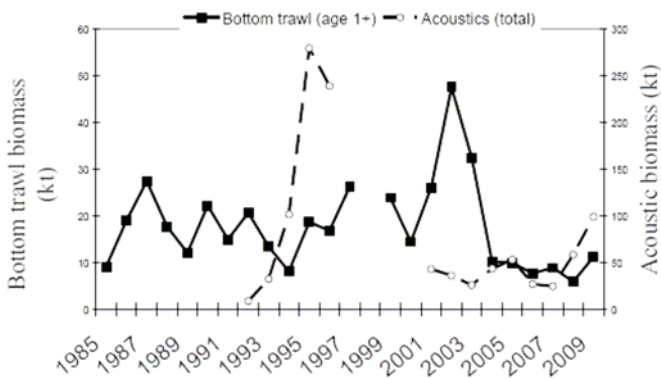


Fig 6 – Lakewide alewife biomass

In contrast, alewife biomass estimated from acoustic surveys in 2009 was 99.2 kt and above the long-term average of 76.9 kt; (Fig 6). Even though the acoustic estimate of alewife biomass was high in 2009, it remains below values recommended in the Planktivore FCO.

These data suggest that the increase in abundance of alewives can be attributed to an increase in older, larger age classes and not from increases in recruitment. The results from the acoustic survey, which is very efficient at sampling younger ages of alewives (ages 0-2), suggests that the abundance of young alewives in 2009 is low. Both bottom trawl and acoustic estimates of alewife biomass triggered level II red flags in 2009.

The increase in coho length may also be impacted by reduced competition with Chinook salmon (Chinook salmon recruitment has been low), which will indirectly affect the predator-prey ratios for coho salmon. In 2009, the average

length of a coho jack continued a several year trend of increasing length and was extremely high (392 mm), suggesting that an abundance of alewives vulnerable to coho predation currently exists in Lake Michigan. However, a level II red flag was triggered because the values were above of the acceptable range.

**Fish health**

Less than 1.5% of the weir-returning Chinook salmon showed any sign of disease in 2009, and no red flags were triggered (Fig 7).

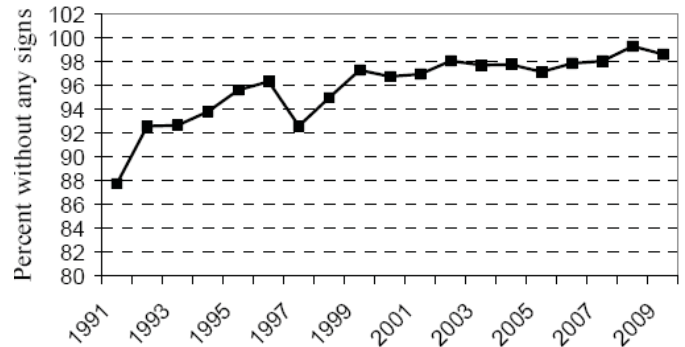


Fig 7 – Visual signs of disease from weirs

**Summary**

Chinook salmon stocking rates were adjusted in 1999 and 2006, through a cooperative process, in an attempt to minimize the risk of a lakewide salmon population crash and its effects on the fishery. These stocking reductions were based on a review of biological indicators from the Salmonid Working Group (SWG) and reflected the consensus of fisheries managers from each agency. ✧

**Salmonid Stocking Totals for Lake Michigan 1976-2009 (FWS)**

Fish community objectives (FCOs) for Lake Michigan call for a diverse salmonid community capable of sustaining annual harvests of 2.7 to 6.8 million kg, of which lake trout comprise 20-25%. Fish stocking is a primary tool used to meet the salmonid FCO and managers must balance stocking rates with declining prey biomass.

**2009 stocking overview:**

The number of salmonids (combined species) stocked in Lake Michigan declined to 11.2 million in 2009, the lowest number in the time series dating back to 1976 (Fig 1, Table 1). Even at this relatively low level, 2009 stocking was similar to last year and is consistent with recent management objectives to reduce predator demands on the Lake Michigan forage base.

In 1999 and again in 2006, Lake Michigan managers enacted a 25% stocking reduction for Chinook salmon in response to decreasing trends in prey-fish biomass. In 2009 3.02 million Chinook were stocked lake-wide, however natural reproduction now accounts for roughly half of the Chinook salmon in Lake Michigan.

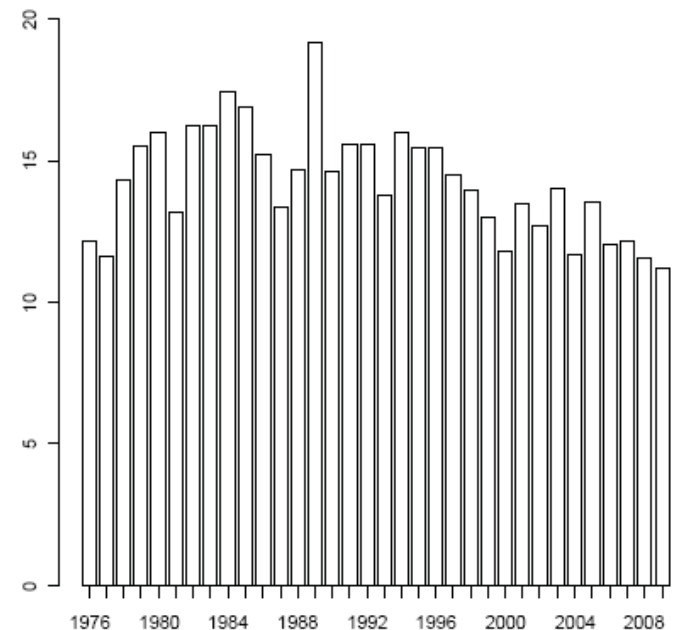


Fig 1 - Millions of salmonids (Chinook, coho, and atlantic salmon, and brook, brown, lake, rainbow, and splake stocked since 1976

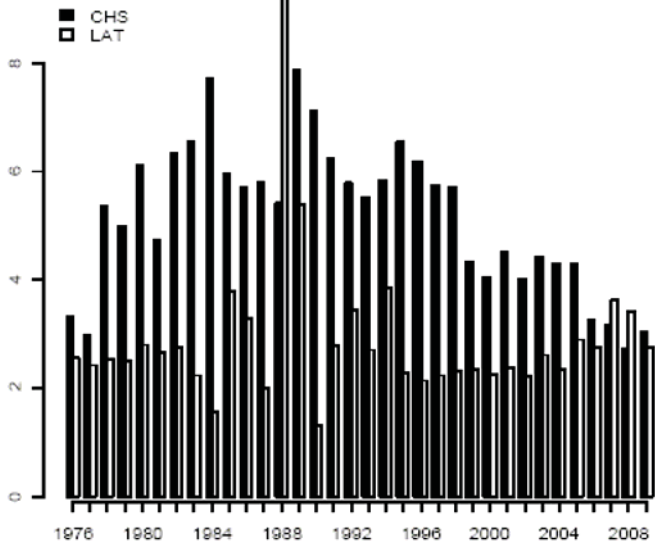


Fig 2 - Numbers of Chinook salmon and lake trout stocked in Lake Michigan, 1976 – 2009

Nearly 2.2 million lake trout yearlings were stocked in first priority areas with an additional 517,000 stocked in second priority sites. When fully implemented the new lake trout rehabilitation plan calls for increasing lake trout stocking rates to 3.2 million yearlings in first priority areas.

Managers recognize the need to balance Chinook salmon and lake trout stocking rates and when ratified the *Lake Trout Implementation Strategy* will dictate lake trout stocking targets and the *Strategy* contains criteria to adjust lake trout stocking targets based on salmon fishery metrics. In recent years the balance between lake trout and Chinook stocking has been roughly equal since 2006 (Fig 2).

More detailed fish stocking information is presented as tables in this report. Numbers of Service stocked lake trout, by statistical district and refuge area are shown in Table 3. Tables 2 – 5 show numbers of salmonids stocked since 1976 in Wisconsin, Illinois, Indiana, and Michigan waters, respectively.

Table 2 - Number of fingerling and yearling salmonids, excluding lake trout, stocked in Wisconsin waters of Lake Michigan, 1976 – 2009.

Year	Brook trout	Brown trout	Chinook salmon	Coho salmon	Lake trout	Rainbow trout	Splake
1976	6,900	298,200	1,190,500	666,800	0	999,600	0
1977	643,400	802,200	912,600	491,300	0	682,900	0
1978	242,600	1,208,100	2,017,100	499,300	0	612,600	0
1979	187,300	959,500	1,963,800	319,900	0	1,211,300	0
1980	184,900	1,046,500	2,429,500	491,900	0	1,136,800	0
1981	199,900	1,014,200	1,848,300	318,500	0	996,600	0
1982	259,000	1,820,700	2,520,700	216,000	49,400	1,041,800	0
1983	300,200	1,554,800	2,791,700	356,500	31,500	1,467,800	0
1984	225,000	1,184,900	2,891,900	551,500	20,400	1,380,800	34,200
1985	307,100	1,170,100	2,740,800	1,044,200	0	415,100	54,500
1986	188,300	882,900	2,377,600	267,200	76,000	782,400	115,000
1987	94,800	836,800	2,263,500	624,400	0	542,200	0
1988	466,500	1,020,900	1,409,300	1,019,900	0	291,300	28,900
1989	150,100	972,700	2,713,900	511,300	0	495,300	0
1990	315,100	1,229,100	2,379,300	498,400	0	460,600	0
1991	326,100	981,500	1,734,600	402,800	0	536,900	147,000
1992	272,400	1,228,600	1,523,100	568,500	0	569,400	43,800
1993	294,100	1,333,300	1,600,100	0	0	679,200	40,000
1994	268,600	1,261,100	1,548,600	457,200	0	798,300	71,700
1995	328,000	1,325,100	1,901,400	722,100	0	553,400	0
1996	167,300	1,301,100	1,727,000	563,600	0	565,900	69,900
1997	114,500	1,279,800	1,917,100	514,700	0	570,000	40,000
1998	407,300	1,242,800	1,591,500	504,900	0	533,100	22,000
1999	190,700	1,181,300	1,308,800	520,200	0	521,400	26,700
2000	44,600	1,056,300	1,010,800	253,700	0	197,900	0
2001	101,500	1,257,600	1,502,600	512,800	0	641,700	54,500
2002	50,400	1,211,800	1,419,300	595,500	0	545,500	28,500
2003	23,900	1,080,500	1,511,200	540,100	0	758,300	22,100
2004	0	1,021,700	1,502,900	484,800	0	430,600	43,900
2005	0	952,100	1,475,500	516,000	0	553,900	16,300
2006	1,000	1,009,300	1,166,200	387,600	0	578,400	80,100
2007	0	1,011,000	1,112,600	610,100	0	714,800	44,300
2008	0	966,300	724,500	282,900	0	536,500	0
2009	0	934,400	995,800	344,500	0	636,300	0
1 year mean	22,100	1,050,100	1,242,100	452,800	0	559,400	29,000

Table 3- Number of fingerling and yearling salmonids, excluding lake trout, stocked in Illinois waters of Lake Michigan, 1976 – 2009.

Year	Brook trout	Brown trout	Chinook salmon	Coho salmon	Lake trout	Rainbow trout
1976	6,400	94,300	142,000	80,300	0	45,300
1977	0	42,200	346,700	102,700	0	276,200
1978	5,000	13,400	611,400	278,800	0	39,800
1979	8,300	1,000	183,100	289,400	0	215,400
1980	19,500	23,800	152,200	39,000	0	112,900
1981	0	65,100	430,600	323,800	0	186,400
1982	0	18,300	793,300	158,700	0	170,000
1983	0	50,900	533,600	0	0	0
1984	0	88,500	537,800	276,800	0	164,700
1985	0	114,700	195,000	304,600	135,500	146,300
1986	0	59,300	215,000	312,200	111,000	151,900
1987	0	88,500	539,100	187,100	25,000	89,000
1988	0	94,700	456,800	297,300	66,500	116,100
1989	0	105,500	650,400	99,700	27,200	110,500
1990	0	0	479,400	302,600	0	0
1991	0	113,900	496,300	312,700	0	133,700
1992	0	100,100	352,700	308,600	0	105,300
1993	0	105,100	364,200	117,800	0	182,100
1994	0	100,500	285,600	328,000	0	74,600
1995	0	98,200	362,700	308,200	0	99,100
1996	0	85,200	365,400	305,600	0	102,100
1997	0	90,100	360,100	302,300	0	91,700
1998	0	100,000	366,200	305,800	0	103,000
1999	0	102,700	304,600	301,600	0	84,700
2000	0	100,000	305,700	302,300	0	100,000
2001	0	72,300	304,000	300,900	0	87,600
2002	0	100,000	305,300	301,000	0	106,500
2003	0	100,000	299,500	244,100	0	126,900
2004	0	70,000	302,700	300,100	0	112,700
2005	0	109,200	295,200	301,000	0	111,400
2006	0	57,600	251,600	304,200	0	105,200
2007	0	100,600	252,300	301,400	0	117,300
2008	0	100,100	254,000	282,200	0	107,000
2009	0	100,200	237,000	300,600	0	102,100
0 year mean	0	90,100	280,700	293,800	0	107,700

Table 1 - Millions of salmonids, fingerling and yearling stages combined, stocked in Lake Michigan between 1976 and 2009

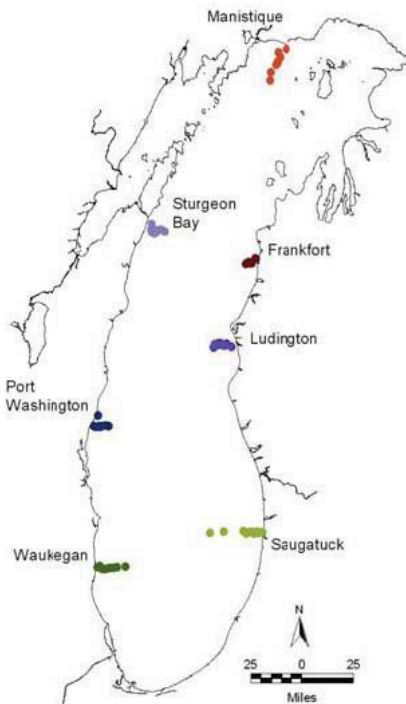
	Atlantic Salmon	Brook Trout	Brown Trout	Chinook Salmon	Coho Salmon	Lake Trout	Rainbow Trout	Splake	Total
1976	0.020	0.075	1.129	3.317	3.196	2.548	1.863	0.000	12.148
1977	0.019	0.643	1.160	2.977	3.087	2.418	1.312	0.000	11.616
1978	0.046	0.248	1.503	5.365	2.685	2.539	1.933	0.000	14.319
1979	0.000	0.196	1.228	4.984	4.044	2.497	2.589	0.000	15.538
1980	0.000	0.204	1.292	6.106	2.943	2.791	2.630	0.000	15.967
1981	0.020	0.208	1.169	4.747	2.451	2.642	1.971	0.000	13.208
1982	0.045	0.259	2.139	6.312	2.181	2.746	2.525	0.000	16.207
1983	0.000	0.300	2.180	6.539	2.364	2.241	2.595	0.000	16.219
1984	0.000	0.233	1.803	7.710	2.954	1.565	3.111	0.034	17.410
1985	0.000	0.307	1.798	5.956	3.181	3.782	1.825	0.054	16.903
1986	0.000	0.197	1.434	5.693	2.291	3.297	2.222	0.115	15.249
1987	0.000	0.117	1.341	5.801	2.305	1.998	1.831	0.018	13.411
1988	0.017	0.466	1.516	5.417	3.210	9.254	1.429	0.104	14.706
1989	0.060	0.150	1.504	7.859	2.334	5.377	1.845	0.088	19.217
1990	0.000	0.400	1.772	7.129	2.380	1.317	1.600	0.050	14.648
1991	0.000	0.326	1.383	6.238	2.471	2.779	1.975	0.396	15.568
1992	0.000	0.272	1.615	5.795	2.712	3.435	1.689	0.099	15.618
1993	0.000	0.294	1.759	5.530	1.709	2.697	1.680	0.141	13.809
1994	0.000	0.269	2.172	5.837	1.497	3.854	2.220	0.166	16.015
1995	0.000	0.328	1.876	6.549	2.401	2.265	1.878	0.151	15.448
1996	0.000	0.180	1.787	6.193	3.112	2.141	1.849	0.201	15.463
1997	0.000	0.115	1.804	5.745	2.620	2.235	1.864	0.155	14.538
1998	0.000	0.408	1.742	5.721	2.059	2.302	1.618	0.097	13.948
1999	0.000	0.191	1.649	4.324	2.765	2.348	1.680	0.077	13.034
2000	0.000	0.045	1.666	4.049	2.499	2.260	1.244	0.079	11.842
2001	0.000	0.102	1.749	4.518	2.765	2.382	1.849	0.131	13.495
2002	0.000	0.050	1.754	4.015	2.690	2.224	1.861	0.126	12.721
2003	0.000	0.024	1.649	4.422	3.124	2.609	2.078	0.104	14.010
2004	0.000	0.001	1.601	4.303	1.687	2.354	1.583	0.122	11.651
2005	0.000	0.000	1.523	4.306	2.561	2.887	2.170	0.099	13.546
2006	0.000	0.001	1.611	3.253	2.430	2.770	1.788	0.166	12.018
2007	0.000	0.000	1.487	3.173	2.269	3.624	2.010	0.125	12.167
2008	0.000	0.005	1.550	2.724	2.029	3.415	1.761	0.087	11.571
2009	0.000	0.000	1.632	3.020	1.746	2.771	2.069	0.000	11.238
10 year mean	0.000	0.023	1.622	3.778	2.380	2.730	1.841	0.104	12.426

Table 4 - Number of fingerling and yearling salmonids, excluding lake trout, stocked in Indiana waters, 1976 – 2009.

Year	Brown trout	Chinook salmon	Coho salmon	Rainbow trout
1976	199,000	38,000	179,500	217,100
1977	109,000	141,400	179,000	47,700
1978	131,000	213,200	105,000	129,700
1979	68,500	530,700	117,500	181,900
1980	116,100	621,400	169,500	69,800
1981	58,100	263,400	102,000	230,400
1982	0	313,100	160,400	247,700
1983	0	238,400	127,600	378,300
1984	0	405,900	156,300	258,800
1985	7,400	761,800	139,000	509,400
1986	0	697,700	132,900	635,700
1987	0	569,200	161,800	511,200
1988	0	879,800	160,400	461,300
1989	0	717,400	40,700	503,500
1990	0	630,200	114,200	538,800
1991	0	694,400	100,000	493,200
1992	0	504,200	100,800	411,800
1993	0	458,600	12,300	315,600
1994	0	537,000	84,400	568,100
1995	0	555,000	169,100	542,000
1996	0	571,600	357,000	577,600
1997	0	422,600	80,800	610,000
1998	0	593,500	148,300	464,000
1999	0	415,400	146,900	551,500
2000	0	417,800	157,700	374,500
2001	0	450,700	157,000	571,400
2002	35,000	253,000	224,800	605,200
2003	40,400	232,400	233,200	592,000
2004	46,200	237,100	236,000	465,200
2005	36,400	251,300	237,000	933,000
2006	42,900	225,100	79,000	491,400
2007	41,100	217,400	231,300	643,500
2008	22,600	215,800	248,700	572,000
2009	23,000	206,700	239,800	602,400
10 year mean	28,800	270,700	204,500	585,100

Table 5 - Number of fingerling and yearling salmonids, excluding lake trout, stocked in Michigan waters of Lake Michigan, 1976 – 2009.

Year	Brook trout	Brown trout	Chinook salmon	Coho Salmon	Lake trout	Rainbow trout	Splake
1976	61,300	537,300	1,946,600	2,269,900	0	600,600	0
1977	0	206,500	1,576,200	2,314,100	0	305,200	0
1978	0	150,000	2,523,600	1,802,000	0	1,150,600	0
1979	0	198,800	2,306,700	3,317,000	75,000	980,800	0
1980	0	105,500	2,902,900	2,243,000	62,000	1,310,600	0
1981	8,000	32,000	2,204,700	1,707,200	453,200	557,700	0
1982	0	300,000	2,685,100	1,645,400	90,000	1,066,100	0
1983	0	574,000	2,975,700	1,880,000	0	748,500	0
1984	8,000	529,600	3,874,200	1,969,400	0	1,307,000	0
1985	0	505,500	2,258,500	1,693,000	0	754,100	0
1986	8,600	491,800	2,402,500	1,579,200	0	651,500	0
1987	22,500	415,900	2,429,000	1,331,300	0	688,400	17,700
1988	0	400,100	2,670,900	1,732,600	0	560,700	75,000
1989	0	425,800	3,777,700	1,682,200	0	735,900	88,000
1990	85,000	542,600	3,659,800	1,464,900	0	600,700	50,000
1991	0	287,800	3,312,300	1,655,400	0	761,100	249,200
1992	0	285,900	3,415,400	1,734,600	0	602,600	55,500
1993	0	320,300	3,107,000	1,578,600	0	502,700	101,000
1994	0	810,700	3,465,800	626,900	0	779,100	94,500
1995	0	452,700	3,729,500	1,201,700	105,600	684,000	150,800
1996	0	400,500	3,529,400	1,885,700	0	603,100	131,500
1997	0	434,000	3,045,100	1,722,200	0	592,300	115,000
1998	0	399,600	3,170,200	1,100,000	0	517,800	75,000
1999	0	364,800	2,295,600	1,796,200	0	522,400	50,700
2000	0	509,800	2,314,500	1,785,200	0	571,900	79,100
2001	0	419,100	2,261,000	1,794,600	0	548,200	76,100
2002	0	406,900	2,037,600	1,569,000	149,900	604,200	97,400
2003	0	428,200	2,379,300	2,106,500	0	600,900	81,500
2004	1,000	463,200	2,260,200	666,500	0	574,100	77,700
2005	0	434,300	2,283,700	1,507,100	0	571,600	82,600
2006	0	500,300	1,609,800	1,658,900	0	612,700	86,200
2007	0	334,400	1,590,900	1,125,900	0	534,100	80,400
2008	5,000	460,900	1,530,000	1,215,100	0	545,900	87,000
2009	0	574,700	1,580,500	861,100	80,600	727,600	0
10 year mean	600	453,200	1,984,800	1,429,000	23,100	589,100	74,800



## Prey Fish Populations in Lake Michigan, 2009, USGS

### Abstract

Lake-wide biomass of alewives in 2009 was estimated at 13.03 kilotonnes (kt) (1 kt = 1000 metric tons), which was more than double the 2008 estimate. Lake-wide biomass of bloater in 2009 was estimated at 6.98 kt, which was nearly three times higher than the 2008 estimate.

Fig 1 - Established sampling locations for GLSC bottom trawls in Lake Michigan

Rainbow smelt lake-wide biomass equaled 1.26 kt in 2009, which was nearly double the 2008 estimate. Deepwater sculpin lake-wide biomass equaled 3.73 kt, which was only 4% lower than the 2008 estimate. Nevertheless, the 2009 estimate was the lowest value in the deepwater sculpin time series. Slimy sculpin lake-wide biomass remained relatively high in 2009 (3.59 kt), increasing 72% over the 2008 level. Ninespine stickleback lake-wide biomass equaled 0.39 kt in 008, which was nearly identical to the 2008 estimate.

The final prey fish, exotic round goby, decreased by 83% between 2008 and 2009, from 3.76 to 0.63 kt. Burbot lake-wide biomass was overestimated by roughly 20%, according to our trawl measurements. For this report, all densities and lake-wide biomasses were calculated using the new relationships derived from the trawl measurements made during June 2009.

## Numeric and Biomass Density

### Alewife

Alewife has remained the most important constituent of salmonine diet in Lake Michigan for the last 35 years. Most of the alewives consumed by salmonines in Lake Michigan are eaten by Chinook salmon. A commercial harvest was established in Wisconsin waters of Lake Michigan in the 1960s to make use of the then extremely abundant alewife that had become a nuisance and health hazard along the lakeshore. There is presently no commercial fishery for alewives in Lake Michigan.

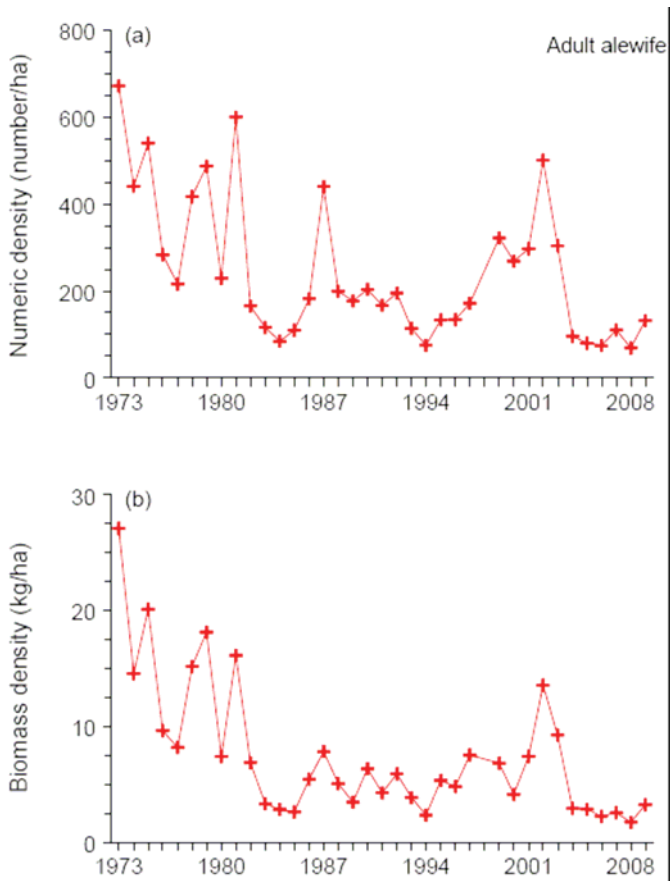


Fig 2 - Density of adult alewives as number (a) and biomass (b) per ha in Lake Michigan, 1973-2009

Adult alewife biomass density increased from 1.7 kg per ha in 2008 to 3.2 kg per ha in 2009 (**Fig 2b**). This increase was likely due to both a slight lessening of the degree of predation on alewives by the Chinook salmon population in the lake and the 2005 year-class of alewives becoming fully recruited to the bottom trawl. The 2005 year-class, although not nearly as strong as the 1998 year-class, appeared to be a relatively large one. In addition, based on angler catch rate, Chinook salmon abundance in Lake Michigan decreased between 2008 and 2009, and this decrease in Chinook salmon abundance may have been of sufficient proportion to significantly reduce the amount of predation on alewives by Chinook salmon. Numeric density of adult alewives increased by nearly a factor of two between 2008 and 2009 (**Fig. 2a**). The overall temporal trends in adult alewife density primarily reflected an increase in

predation by salmonines on alewives during the 1970s and 1980s, followed by relatively high predation maintained by salmonines on alewives from the early 1980s to the present time. There is presently no commercial fishery for alewives in Lake Michigan.

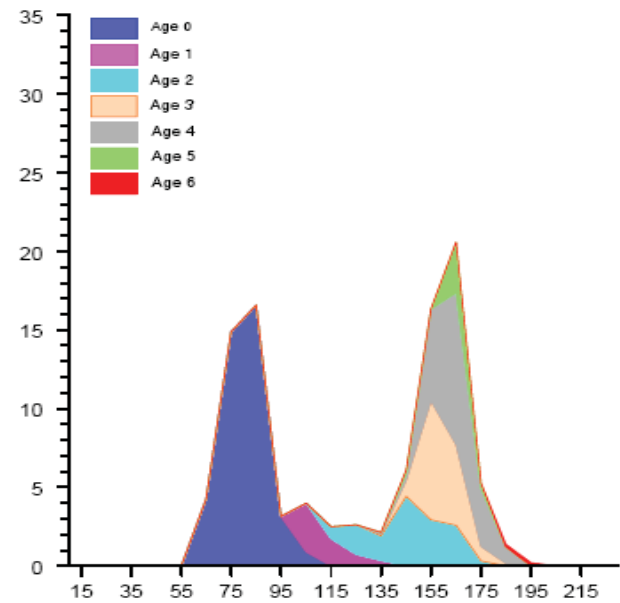


Fig 3 - Age-length distribution of alewives caught in bottom trawls in Lake Michigan, 2009

The catch of adult alewives was dominated by fish of ages 2-4 in 2009 (**Fig 3**). Age-4 (2005 year-class) fish accounted for 34% of the adult catch, by number of fish. Age-2 (2007 year-class) and age-3 (2006 year-class) represented 24% and 25%, respectively, of the adult catch.

### Bloater

Bloaters are eaten by salmonines in Lake Michigan, but are far less prevalent in salmonine diets than alewives. When available, juvenile bloaters have been a substantial component of salmon and nearshore lake trout diets, particularly for intermediate-sized fish. The bloater population in Lake Michigan also supports a valuable commercial fishery. Biomass density of adult bloater increased by more than threefold between 2008 (0.5 kg per ha) and 2009 (1.8 kg per ha) (**Fig 3a**). Similarly, adult bloater numeric density increased from 21 fish per ha in 2008 to 72 fish per ha in 2009. Adult bloater numeric and biomass densities have shown an overall declining trend since 1989 (**Fig 3a**). These declines are attributable to relatively poor recruitment since 1992.

There are signs of modest increases in recruitment in recent years. Numeric density of age-0 bloaters (< 120 mm TL) in 2005, 2008, and 2009 were 34, 27, and 29 fish per ha, respectively (**Fig 4b**). Although these densities pale in comparison to those observed between 1980 and 1990 (mean = 449 fish per ha), they are an order of magnitude greater than all of the other densities since 1992 (mean = 2 fish per ha). The observed increase in adult bloater biomass density between 2008 and 2009 was likely attributable, at least in part, to the 2005 year-class recruiting to the adult population. Bloaters do

not fully recruit to the bottom trawl until age 3 or age 4. The observed increase in adult bloater numeric density between 2008 and 2009 was probably due, at least in part, to the 2008 year-class beginning to recruit to the adult population. Thus, the 2009 bottom trawl data indicated a link between the recent modest increases in age-0 bloater abundance and a subsequent increase in adult bloater abundance.

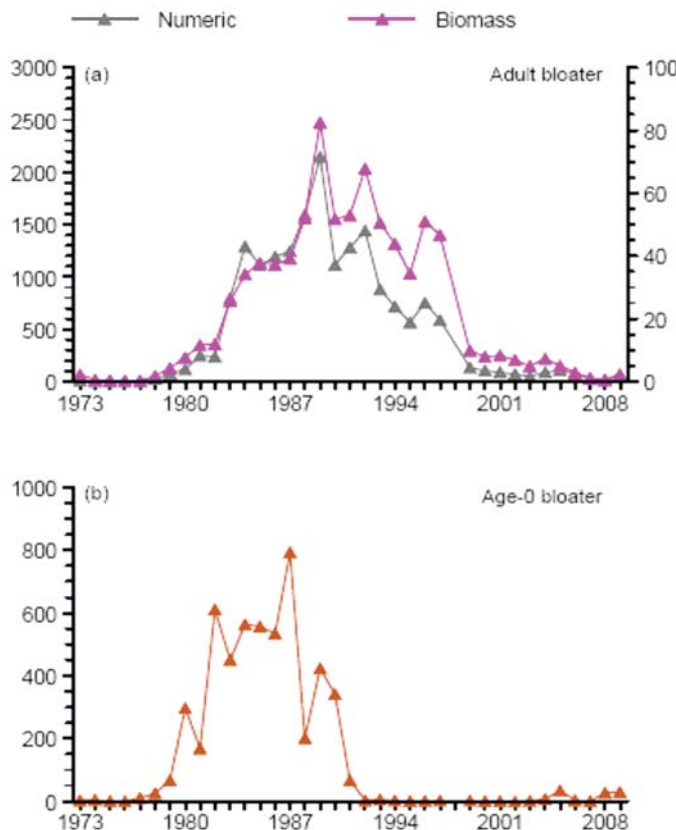


Fig 4 - Panel (a) depicts numeric and biomass density of adult bloater, 1973-2009. Panel (b) depicts numeric density of age-0 bloater, 1973-2009.

The bloater population during 2009 appeared to be very young, as 47% of the trawl catch was represented by age-1 fish and 38% of the catch was represented by age-2 fish. The percentage of age-4 and older bloater in the trawl catch was only 9% in 2009. Given the recent modest increases in recruitment, a young bloater population would be expected. Results from the acoustic survey indicated that bloater biomass decreased between 2008 and 2009. However, this decrease in biomass was a result of a decrease in the size of small bloater. Numeric density actually increased slightly between 2008 and 2009, but juvenile bloaters were very small compared with previous years. A similar pattern has been observed in Lake Huron acoustic and bottom trawl survey results.

### Rainbow smelt

Adult rainbow smelt is an important diet constituent for intermediate-sized lake trout in the nearshore waters of Lake Michigan. Rainbow smelt are not eaten by Lake Michigan salmonines to the same extent as alewives. The rainbow smelt population supports commercial fisheries in Wisconsin and Michigan waters.

Adult rainbow smelt biomass density increased from 0.07 kg per ha in 2008, the year of the lowest adult biomass density for adult rainbow smelt, to 0.30 kg per ha in 2009 (**Fig 57a**). Despite this more than threefold increase between 2008 and 2009, the 2009 level still represented a relatively low value in the time series. Adult rainbow smelt numeric density increased from 8 fish per ha in 2008 to 45 fish per ha in 2009.

Adult rainbow smelt numeric density was highest from 1981 to 1993, but then declined between 1993 and 2001, and has remained at a relatively low density, except in 2005, since 2001. Causes for the decline remain unclear.

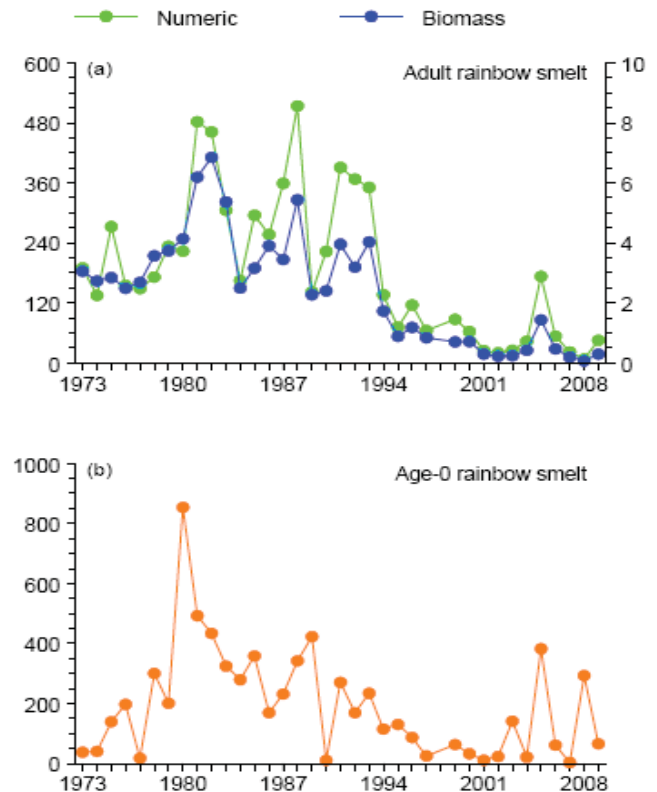


Fig 5 - Panel (a) depicts numeric and biomass density of adult rainbow smelt, 1973-2009. Panel (b) depicts numeric density of age-0 rainbow smelt, 1973-2009.

### Sculpins

From a biomass perspective, the cottid populations in Lake Michigan proper have been dominated by deepwater sculpins, and to a lesser degree, slimy sculpins, Spoonhead sculpins, once fairly common, suffered declines to become rare to absent by the mid 1970s. Spoonhead sculpins are still encountered in Lake Michigan, but in small numbers.

Slimy sculpin is a favored prey of juvenile lake trout in nearshore regions of the lake, but is only a minor part of adult lake trout diets. Deepwater sculpin is an important diet constituent for burbot in Lake Michigan, especially in deeper waters.

Numeric density of deepwater sculpins was only 92 fish per ha in 2009, which was the lowest value in the time series (**Fig 6a**). Likewise, biomass density of deepwater sculpins in Lake

Michigan was only 1.1 kg per ha, the lowest value in the time series. During 1990-2006, both deepwater sculpin biomass density and numeric density trended neither downward nor upward. However, deepwater sculpin catch in our bottom trawls dropped suddenly and drastically during 2007- 2009. Deepwater sculpins have been captured at increasingly greater depths since the 1980s. Therefore, one potential explanation for the recent declines in deepwater sculpin densities is that an increasing proportion of the population is now occupying depths deeper than those sampled by our survey (i.e., 110 m). Furthermore, because the deepwater sculpin occupies deeper depths than any of the other prey fishes of Lake Michigan, a shift to waters deeper than 110 m would seem to be a reasonable explanation for the recent declines in deepwater sculpin densities. Previous analysis of the time series indicated deepwater sculpin density is negatively influenced by alewife (predation on sculpin larvae) and burbot (predation on juvenile and adult sculpin).

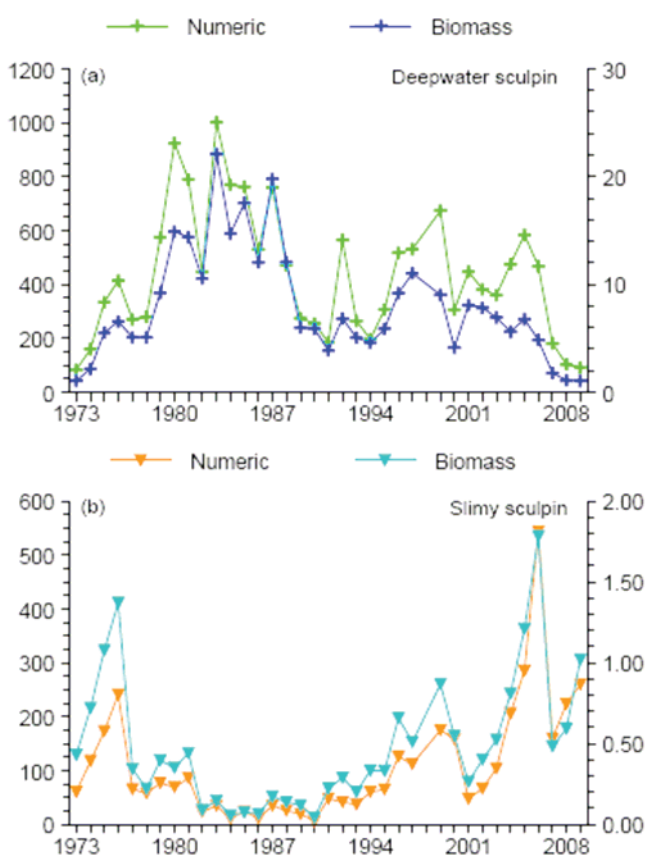


Fig 6 - Numeric and biomass density for deepwater (a) and slimy sculpin (b) in Lake Michigan, 1973-2009

Numeric density of slimy sculpins in Lake Michigan increased from 224 fish per ha in 2008 to 260 fish per ha in 2009, which represented a 16% increase (**Fig 6b**). Biomass density of slimy sculpins increased from 0.59 kg per ha in 2008 to 1.02 kg per ha in 2009, which represented a 72% increase. Overall, slimy sculpin numeric density has generally increased since around 1990, with considerable interannual variation. This increase was likely attributable to greater emphasis on stocking lake trout on offshore reefs beginning in 1986.

### Ninespine stickleback

Two stickleback species occur in Lake Michigan. Ninespine stickleback is native, whereas threespine stickleback is non-native and was first collected in the GLSC bottom trawl survey during 1984. Ninespine stickleback is generally captured in greater densities than the threespine, especially in recent years. Numeric density of ninespine stickleback was only 63 fish per ha in 2009. Similarly, biomass density was only 0.11 kg per ha in 2009. A recent analysis of ninespine stickleback densities in lakes Michigan and Superior revealed that the recent increase in Lake Michigan coincided with the expansion of dreissenid mussels in the lake.

### Round goby

The round goby is an invader from the Black and Caspian seas. Round gobies have been observed in bays and harbors of Lake Michigan since 1993, and were captured by Michigan DNR personnel in the southern main basin of the lake as early as 1997. Round goby numeric density has shown an overall increasing trend during 2003-2009, but with high inter-annual variability (**Fig 7**). Round goby numeric density decreased from 158 fish per ha in 2008 to 25 fish per ha in 2009. Round gobies have now been captured at all transects, at depths ranging 9 to 91 m, and will likely continue to contribute to the diets of Lake Michigan piscivores into the future. Given the importance of round gobies in the diet of burbot, an offshore predator, and in the diets of yellow perch and smallmouth bass, nearshore predators, we may expect round goby abundance in Lake Michigan to level off in the upcoming years as predatory control begins to be exerted.

### Lake-Wide Biomass

A total lake-wide biomass of prey fish available to the bottom trawl in 2009 was 29.62 kilotonnes (kt) (1 kt = 1000 metric tons) (**Fig 7**). Total prey fish biomass was the sum of the population biomass estimates for alewife, bloater, rainbow smelt, deepwater sculpin, slimy sculpin, ninespine stickleback, and round goby. Percentages of the total prey fish biomass (and biomass estimates) for the prey fish species were: alewife 44% (13.03 kt), bloater 24% (6.98 kt), deepwater sculpin 13% (3.73 kt), slimy sculpin 12% (3.59 kt), rainbow smelt 4% (1.26 kt), round goby 2% (0.63 kt), and ninespine stickleback 1% (0.39 kt).

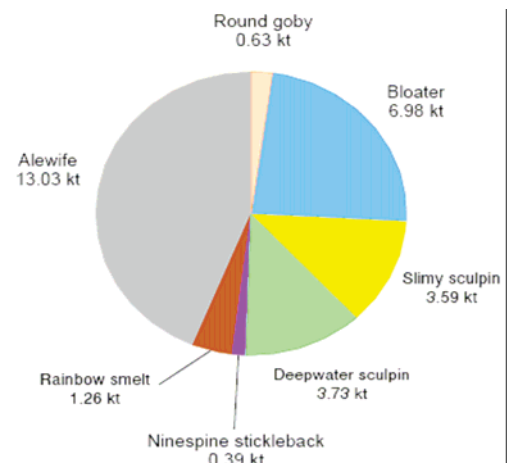


Fig 7 - Estimated lake-wide biomass of prey fishes, 2009, based on the bottom trawl survey

Total prey fish biomass in Lake Michigan has trended downward since 1989. This decline was largely driven by the dramatic decrease in bloater biomass. During 2002-2009, decreases in alewife and deepwater sculpin biomasses also contributed to the continued decrease in total prey fish biomass. Although total prey fish biomass in 2009 (29.62 kt) represented a 52% increase over the total prey fish biomass estimated for 2008 of 19.44 kt, the 2009 estimate of total prey fish biomass was the third lowest value in the time series; only in 2007 and 2008 was total prey fish biomass lower than that estimated for 2009.

### **Burbot**

Burbot and lake trout represent the native top predators in Lake Michigan. Burbot numeric densities had been relatively stable since 2002. Burbot numeric density decreased from 0.31 fish per ha in 2008 to 0.18 fish per ha in 2009, however burbot biomass density actually increased between 2008 and 2009. Continued surveillance will be needed to determine whether burbot abundance has begun a long-term decline.

### **Yellow perch**

The 2005 year-class of yellow perch was the largest ever recorded (**Fig 8**). This huge year-class was likely attributable to a sufficient abundance of female spawners and favorable weather. Numeric density of the 2009 year-class was 38 fish per ha, an indication of a strong year-class.

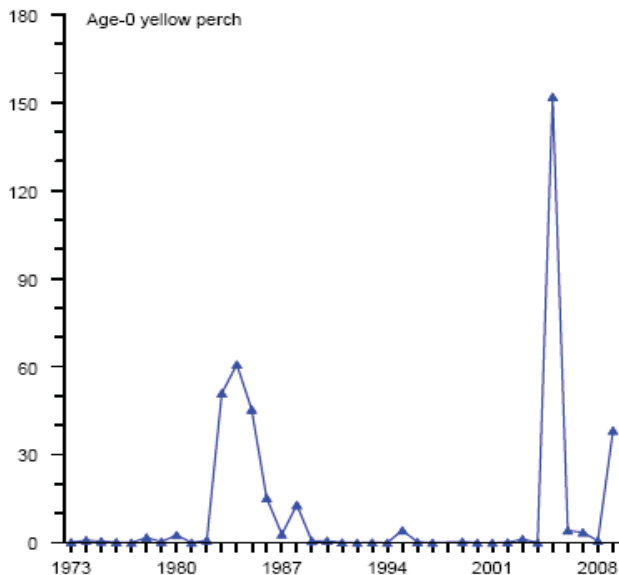


Fig 13 - Numeric density of age-0 yellow perch, 1973-2009

Unlike 2005, when relatively high age-0 yellow perch densities were observed at most transects, nearly all of the age-0 yellow perch caught during 2009 were from the Saugatuck transect. Most researchers believe that the poor yellow perch recruitment during the 1990s and early 2000s was due to a combination of several factors, including poor weather conditions and low abundance of females.

### **Dreissenid mussels**

The first zebra mussel noted in Lake Michigan was found in May 1988 in Indiana Harbor at Gary, Indiana. The quagga mussel is a more recent invader than the zebra mussel. According to the GLSC bottom trawl survey, biomass density of dreissenid mussels was highest in 2007 (**Fig 8**), which followed an exponential like increase between 2004 and 2006. Over this same period of dreissenid mussel increases, prey fish biomass was declining, which led to a dramatic increase in the percentage of dreissenids in the total bottom trawl catch (**Fig 8**).

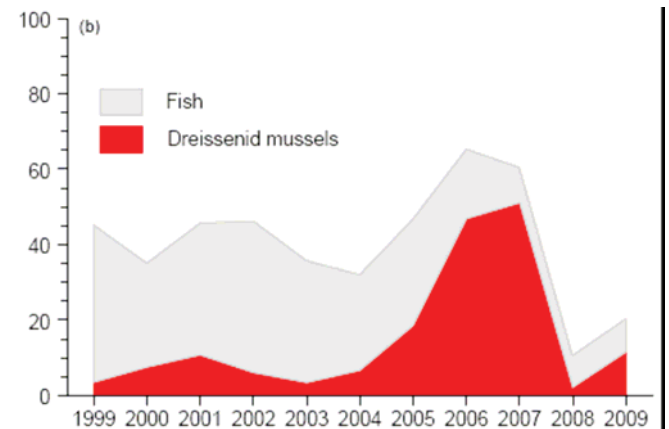


Fig 14 – Biomass of dreissenids and total fish biomass estimated by the bottom trawl between 1999 and 2009

The biomass density of dreissenid mussels in 2009 was 11.58 kg per ha, which was equal to 23% of the peak biomass density estimated for 2007 (**Fig 8**). A comparison of the biomass density of dreissenid mussels (11.58 kg per ha) with biomass density of all of the fish (8.80 kg per ha) caught in the bottom trawl indicated that 43% and 57% of the biomass in Lake Michigan during 2009 estimated from the bottom trawl survey corresponded to fish and dreissenid mussels, respectively (**Fig 8**). Some of the temporal trends in dreissenid mussel biomass density shown in Figure 14a were difficult to explain. The exceptionally high biomass densities recorded in 2006 and 2007 were attributable to the expansion of quagga mussels into deeper (> 60 m) waters of Lake Michigan. However, there was no clear explanation for the drastic drop in dreissenid mussel biomass density between 2007 and 2008. Based on the data from Lake Erie and Lake Ontario, we would expect the quagga mussel population in Lake Michigan to eventually exceed its carrying capacity and then undergo a reduction in abundance.

### **Conclusions and Prognosis**

Our bottom trawl estimate of total prey fish biomass in 2009 was the third lowest in our time series, which began in 1973. The relatively low prey fish biomass estimates for 2007-2009 were probably due to a suite of factors. We can clearly identify two of these factors as: (1) a prolonged period of relatively low bloater year-class strength during 1992-2009, and (2) relatively high predation on alewives by Chinook salmon during the 2000s. ✧

## Status of Yellow Perch in Lake Michigan 2009 (LMC)

### Adult Relative Abundance

This information shows a long-term decline in adult yellow perch abundance. The longer data series show a peak abundance in the mid- 1980s to early 1990s, followed by significant declines through the early 2000s. Increases in catch-per-unit-effort resulting from recruitment of the 1998, 2002, and 2005 year classes are particularly apparent in some data series. (Click on any image or graph and drag to enlarge. These index data show that current abundance remains well below the historically observed abundance of the late 1980s and early 1990s.

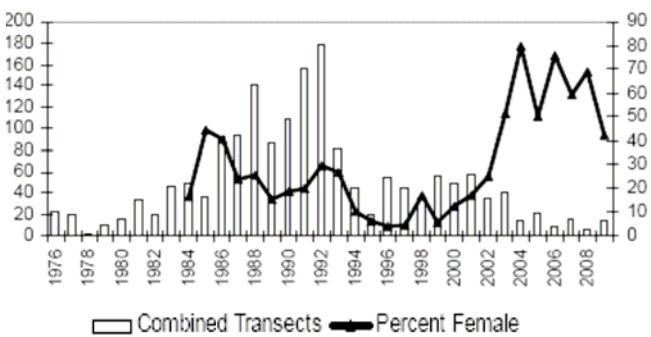


Fig. 1 - Adult yellow perch abundance and percent female in the Illinois waters of Lake Michigan

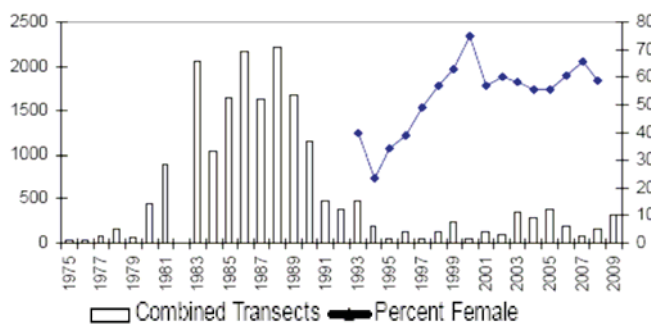


Fig. 2 - Adult yellow perch trawl CPUE and percent female in Indiana waters of Lake Michigan

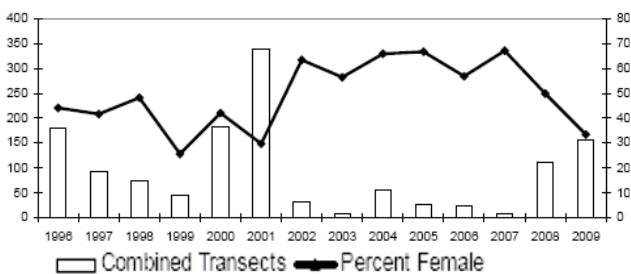


Fig 3 - Adult yellow perch gill net catch-per-unit-effort and percent female in the catch at four Lake Michigan ports (Grand Haven, Saugatuck, South Haven, and St. Joseph, MI)

### Population Age Structure

Yellow perch from the 2005 year class still made up from approximately 25-60% of the adult population in the various state waters. Continued survival of the 1998 year class (age 10) is also apparent in data collected in Illinois and Wisconsin waters of Lake Michigan.

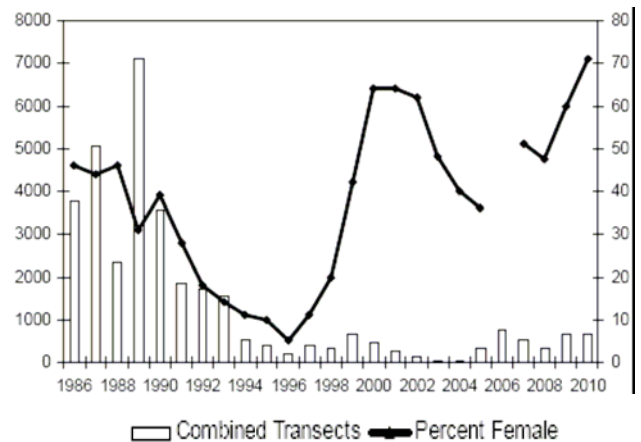


Fig 4 - Adult yellow perch abundance and percent female in the Wisconsin waters of Lake Michigan

### Recruitment

While catch of age-0 yellow perch increased slightly in some areas of southern Lake Michigan, recruitment in 2009 was still relatively low (weak) in most areas of the lake, in comparison to long-term averages.

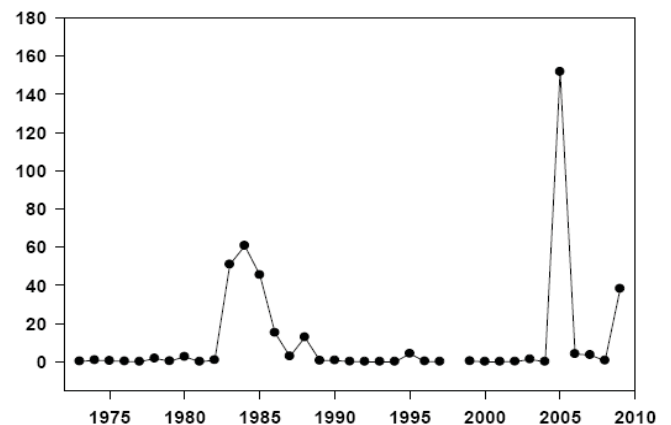


Fig 5 - CPUE of age-0 yellow perch, lakewide

### 2010 Yellow Perch Harvest Restrictions

Sportfishing regulations by state:

#### ► Illinois

July closed to sportfishing for yellow perch (exception: under 16 years of age – 10 fish bag limit)

Daily bag limit 15 fish

#### ► Indiana

- No closed season for yellow perch

- Daily bag limit 15 fish

#### ► Michigan

- No closed season for yellow perch

- Daily bag limit; 35 fish (south of the 45th parallel) / 50 fish (north of 45th parallel and Grand Traverse Bays)

#### ► Wisconsin (Lake Michigan)

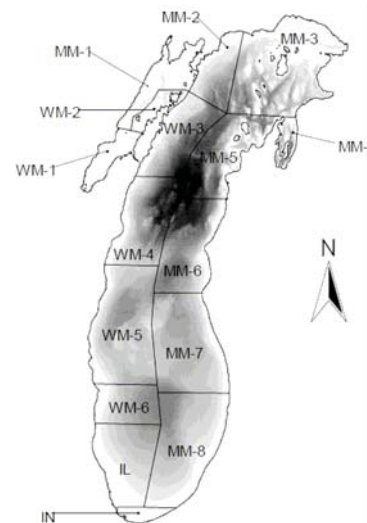
- May 1 through June 15; closed to sportfishing for yellow perch

- Daily bag limit 5 fish

- ▶ Wisconsin (Green Bay)
  - March 16 through May 19; closed to sportfishing for yellow perch
  - Daily bag limit 15 fish

Commercial regulations:

- ▶ Illinois perch fishery remained closed
- ▶ Indiana perch fishery remained closed
- ▶ Michigan does not allow a commercial harvest (outside of 1836 Treaty waters)
- ▶ Wisconsin perch fishery remained closed (outside of Green Bay, where quota for 2010 is 100,000 pounds)

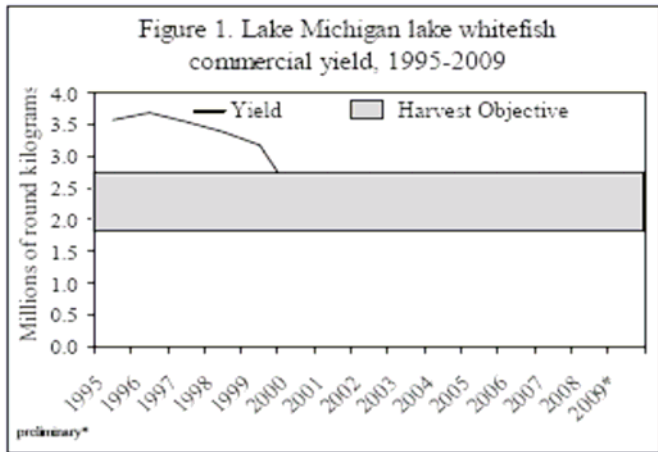


Appendix 1 - Lake Michigan statistical districts

## Lake Michigan Technical Committee Annual Report (LMC)

### Lake Whitefish Harvest Objective

During 1995-2009, the average yield of whitefish from Lake Michigan was approximately 2.6 million kilograms, near the upper range of the target established in the Fish Community Objective (Fig 1). In 2000 yield declined from the 1995-1999 average of 3.5 million kilograms to 2.3 million kilograms.



Yield has remained fairly stable since then and within the harvest objective of 1.8 to 2.7 million kilograms. The commercial yield of Lake Whitefish was 2.44 million kilograms (5.38 million lbs) in 2009, the highest since 2000. Estimates from modeling efforts in the treaty waters of Lake Michigan suggest that most northern stocks experienced strong recruitment over the past decade. The combination of declining fishing mortality and solid recruitment contributed to increased estimates of standing stock biomass throughout most of the 2000s. Although growth may have stabilized from the long-term decline which began in the early 1990s, the potential impacts of lower trophic-level disturbance on growth and

recruitment remain a concern. In many areas, whitefish do not recruit to fishing gear until age six or seven, so future efforts by management agencies should focus on developing better indices of recruitment.

### Lake Sturgeon Task Group

Members of the Task Group continue to implement and evaluate the use of streamside rearing facilities to rehabilitate and reintroduce lake sturgeon populations into Lake Michigan rivers (Table 1). The Little River Band of Ottawa Indians (LRBOI) completed a 6th year of rearing wild collected Manistee River larvae in their streamside facility and releasing them back to the river each fall. Fairly consistent numbers have been released each year and preliminary evaluations indicate this effort is approximately doubling the current annual wild production in this system. The Wisconsin DNR facilities were operated on the Milwaukee River for the fourth consecutive year and on the Kewaunee River for the first year (the previously sited Manitowoc River was permanently relocated to the Kewaunee River in 2009). Over 2000 fingerlings were successfully reared and stocked from each facility during July-September in 2009. This was the first year the target annual stocking goal of 1500 fall fingerlings per river was met. Gametes for these two reintroduction efforts continue to come from Wolf River donors. The Michigan DNRE facilities operated successfully for a 2nd year on the Cedar and Whitefish Rivers. For the first time, gametes were collected and reared from a full complement of families originating from four female and 18 male donors. Success in previous years had been hampered by difficulty collecting eggs from multiple females from the Menominee River so gamete collections were shifted to the Peshtigo River in 2009 where donor fish were more accessible. It is anticipated that stocking will reach target goals in these two rivers in future years.

River Year	ManisteeP <sup>2P</sup>	MilwaukeeP <sup>2P</sup>	KeweenawP <sup>2P</sup> (Manitowoc*)	CedarP <sup>2P</sup>	Whitefish
2009	34	2038	2388	75	198
2008	47	767			
2007	29	158	67*	189	772
2006	89	27			25
2005	51				

Table 1: Number of rearing assisted and newly reintroduced fingerling lake sturgeon stocked into Lake Michigan rivers from streamside rearing facilities

**Research Priorities**

The Lake Michigan Technical Committee decided on these top three research priorities in 2009:

- 1) What are the current species-specific abundances, production, and forage demand of the Lake Michigan salmonine community? And what levels of salmonine production and yield are sustainable without threatening the biological integrity of the Lake Michigan fish community – including consideration for other Fish Community Objectives?
- 2) To what extent does thiamine deficiency complex (TDC) impede lake trout rehabilitation in Lake Michigan?
- 3) What contributions do naturalized fish make to the lakewide salmonine abundances, production, forage demand, and annual yield? Is there an interaction between salmonine stocking rates and naturalized salmonine production? ✧

**Lake Trout Working Group Report (FWS)**

This report provides a brief overview of the status of lake trout populations and restoration efforts in Lake Michigan. It provides a quick, graphical representation of pertinent data, and is structured to review the population objectives articulated in *A Lake Trout Restoration Guide for Lake Michigan*

**Overall Goal:** In targeted rehabilitation areas, reestablish genetically diverse populations of lake trout composed predominately of wild fish able to sustain fisheries.

**Objective 1 (Increase genetic diversity):** Increase the genetic diversity of lake trout by introducing morphotypes adapted to survive and reproduce in deep-water, offshore habitats, while continuing to stock shallow-water morphotypes.

Results: Klondike Reef strain from Lake Superior has been recommended for introduction to deep-water habitats; the LMC has decided that a limited number should be stocked experimentally in the near future. Lean lake trout from Seneca Lake (Finger Lakes, NY), Apostle Islands (Lake Superior), and Lewis Lake (Lake Michigan remnant) have been selected as the primary lean lake trout strains. Additionally, a remnant, nearshore form of lean lake trout from Parry Sound (Lake Huron) is being raised in FWS hatcheries and should be available for stocking in 2013.

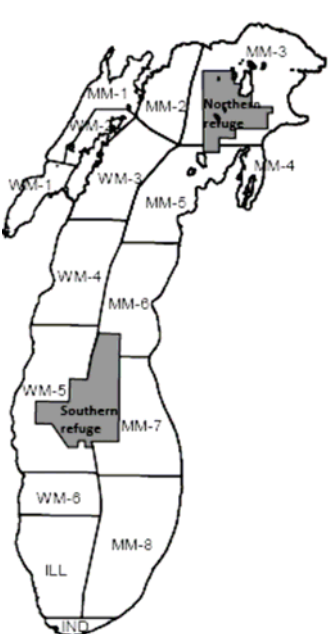


Fig 1 - Statistical districts for lake trout management

**Objective 2 (Increase overall abundance):** By 2014, increase densities of lake trout populations in targeted rehabilitation areas to levels observed in other Great Lakes locations where recruitment of wild fish to the adult population has occurred. To achieve this objective, CPUE in spring assessments should consistently exceed 25 lake trout/1000 feet of graded-mesh (2.0 – 6.0 inch) gill net fished.

Results: Spring gill net assessments in 2009 indicate that overall abundance remain substantially below the target level of 25 lake trout/1000 ft of net (horizontal line) lakewide (**Fig 1**).

**Objective 3 (Increase adult abundance):** By 2020, achieve densities of spawning adult lake trout in targeted rehabilitation areas comparable to those observed in other Great Lakes locations where recruitment of wild fish to the adult population has occurred. To achieve this objective, CPUE in fall assessments should consistently exceed 50 fish/1000 ft of graded-mesh (4.5-6.0 inch) gill net fished.

Results: Of the 14 spawning areas sampled during fall 2009, 8 areas met or exceeded the target (**Fig 2**). In other areas, abundance of adult fish is low and likely inadequate to result in egg deposition rates sufficiently high to overcome impediments to rehabilitation. The lowest spawner abundances were measured at Beaver Island, Boulder Reef, and Gull Island Reef within the Northern Refuge. These low abundances could be attributed, at least in part, to reduced stocking rates during 1995-2008.

**Objective 4 (Build spawning populations):** By 2024, spawning populations in targeted rehabilitation areas stocked prior to 2008 should be at least 25% females and contain 10 or more age groups older than age 7. These milestones should be achieved by 2032 in areas stocked after 2008.

Results: Half of the sites sampled during fall 2009 exceeded the target for female percentage. Most of these were located in the

central or southern portions of Lake Michigan. Age compositions of spawning lake trout at sites sampled during fall 2009 were well below those required to meet restoration targets. Only one site in southern Lake Michigan at the Port of Indiana met the target of 10 or more age-classes older than age 7.

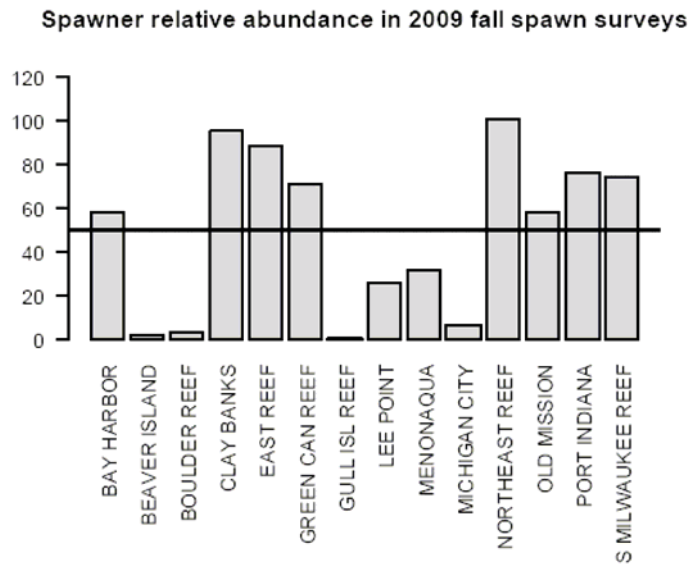


Fig 2 - Abundance of lake trout spawners by location, in fall 2009

**Objective 5 (Detect egg deposition):** By 2021, detect a minimum density of 500 viable eggs/m<sup>2</sup> (eggs with thiamine concentrations > 4 nmol/g) in previously stocked areas. This milestone should be achieved by 2025 in newly stocked areas.

Results: Egg deposition rates remain low in northern Lake Michigan, where the measured densities of lake trout eggs are consistently less than 60 eggs/m<sup>2</sup>.

**Objective 6 (Detect recruitment of wild fish):** Consistent recruitment of wild lake trout in targeted rehabilitation areas should occur as follows: by 2022 detect age-1 fish in bottom trawls, by 2025 detect age-3 fish in spring graded-mesh-gill-net assessments, and by 2028 consistently detect sub-adults.

Results: Less than 3% of lake trout of all ages captured during spring 2009 were those that had no fin clip, which indicates little natural reproduction (Fig 3). Additionally, since 1973, less than 2% of the lake trout captured annually in the USGS fall bottom trawl surveys were unclipped fish.

**Objective 7 (Achieve restoration):** By 2037, 75% or more of the lake trout in deep- and shallow-water habitats should be age-10 and younger and of wild origin.

Results: Populations far from targets.

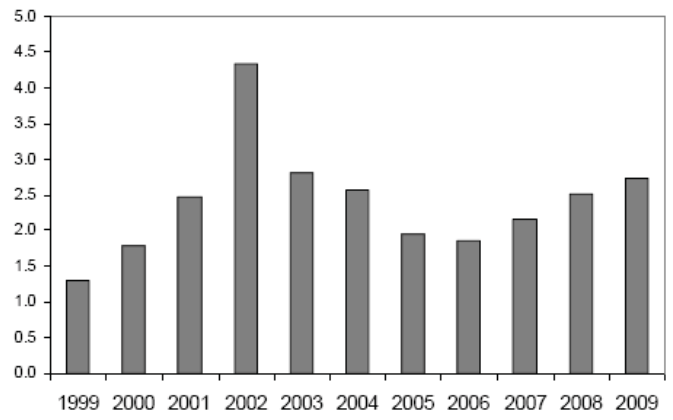


Fig 3 - Percentage of lake trout captured in spring without fin clips. Lack of a fin clip may suggest that the fish was produced in the lake

**Lake trout stocking**

The U. S. Fish and Wildlife Service stocked a total of 2.69 million yearling (14-16 months old) lake trout into Lake Michigan in 2009. Stocking totals for each state jurisdiction were 118,160 in Illinois, 22,267 in Indiana, 1,859,777 in Michigan, and 690,455 in Wisconsin (Fig 4). All yearling fish received a RP fin clip. No lake trout with an AD fin clip and coded wire tags (ADCWT) were stocked into Lake Michigan during 2009.

The stocked yearling lake trout consisted of three strains: Apostle Islands, Lewis Lake, and Seneca Lake. Additionally, 406,000 fall fingerlings of two strains (Apostle Islands and Seneca Lake) were stocked into Indiana (52,160), Michigan (167,052), and Wisconsin (186,788) waters (Fig 4).

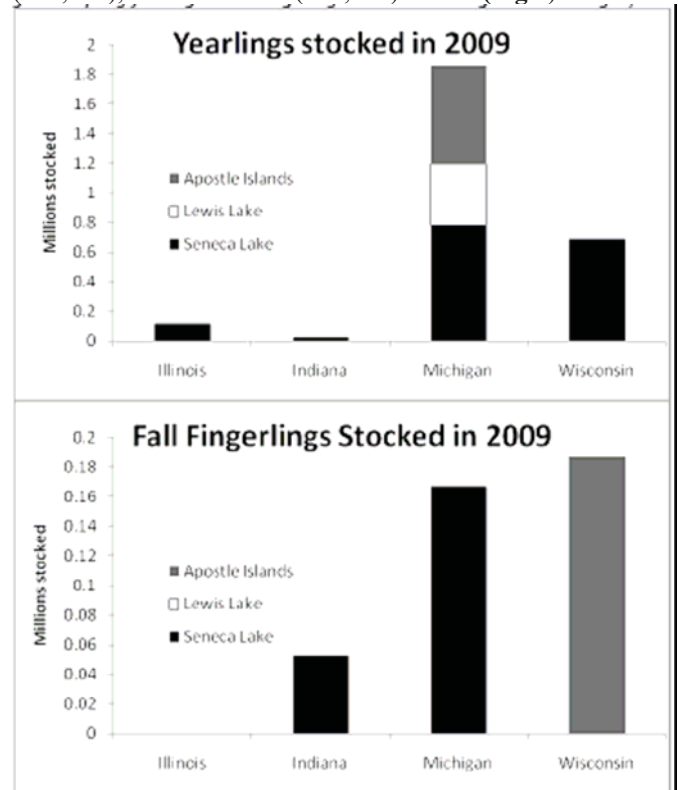


Fig 4 - Spring yearling and fall fingerling lake trout stocking, 2009

## Sea Lampreys in Lake Michigan 2009

Sea lamprey control has the most direct effect on achieving objectives for lake trout and other salmonines.

### Tributary Information

Lake Michigan has 511 tributaries. One hundred twenty-one tributaries have historical records of larval sea lamprey production, and of these, 76 tributaries have been treated with lampricides at least once during 2000-2009. Thirty-eight tributaries are treated on a regular cycle.

### Lampricide Control

Tributaries harboring larval sea lampreys are treated periodically with lampricides to eliminate or reduce larval populations before they recruit to the lake as parasitic juveniles. Service and Department treatment units administer and monitor doses of the lampricide TFM, sometimes augmented with Bayluscide to scheduled tributaries and 3.2% Granular Sea Lamprey Larvicide to scheduled areas. Specialized equipment and techniques are employed to provide concentrations of lampricides that eliminate about 95% of larval sea lampreys and minimize the risk to non-target organisms.

► Lampricide treatments were completed in 25 tributaries and two areas. Of the 25 lampricide treatments of tributaries, 24 included options to improve treatment effectiveness.

► Treatments of the Peshtigo, Oconto, Big Manistee, and Paw Paw rivers were completed at above average discharge.

► Sea lamprey distribution in the mainstream of the Paw Paw River was further upstream than it has ever been historically. The upper segment of the Paw Paw River required six additional application sites.

► The Rogue River, a tributary to the Grand River that is upstream of the Sixth Street Dam in Grand Rapids, was treated for the first time.

### Alternative Controls

#### Barriers

Presently, there are 11 barriers on Lake Michigan that were built or modified to block sea lampreys. Construction projects were initiated, ongoing, or completed on 2 tributaries.

► Manistique River - U.S. Army Corps of Engineers is the lead agency administering this project. The existing Manistique Paper, Inc. dam location has been identified as the most feasible site for a new barrier. Hydrology and hydraulic analysis were completed to determine site suitability and the maximum crest height of the new structures.

► Trail Creek – The U.S. Army Corps is the lead agency administering this project. Construction is planned for this year.

### Assessment

► Larval assessment surveys were conducted on 97 tributaries and offshore of 13 tributaries.

► Surveys to estimate the abundance of larval sea lampreys were conducted in 33 tributaries and offshore of 1 tributary.

► Surveys to detect the presence of new larval sea lamprey populations were conducted in 19 tributaries. A new population was discovered in Mattix Creek and is scheduled to be treated during 2010.

► Post-treatment assessments were conducted in 20 tributaries and 2 lentic area to determine effectiveness of lampricide treatments during 2008 and 2009.

► Surveys to detect barrier effectiveness were conducted in 4 tributaries.

► Surveys to collect larval lampreys for pheromone extraction were conducted in 7 tributaries.

### Spawning-phase

► A total of 19,444 sea lampreys were trapped at 17 sites in 16 tributaries during 2009.

► The estimated population of spawning-phase sea lampreys in Lake Michigan was 59,800, which is within the fish-community objective target range of 57,000.

► Sea lamprey numbers decreased significantly during 2009 after reaching peak abundance during 2007. Populations were less than or within the target range prior to the 2000 spawning year, but had shown a significant trend upward to a peak abundance of 167,126 during 2007.

► A total of 6,971 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Betsie (337), Boardman (105), Carp Lake (303), Manistee (178), Manistique (4,526), Muskegon (294), Peshtigo (881), Pere Marquette (232), and St. Joseph (115) rivers.

► A field-scale management experiment using the sea lamprey mating pheromone was conducted in 10 Great Lakes tributaries, including the Carp Lake, Betsie, and Manistee rivers.

### Parasitic-phase

The target rate for sea lamprey marking on lake trout in Lake Michigan is 5 fresh wounds per 100 fish. ✧