Lake Michigan Management Reports - 2013

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

Great Lakes spotted musky. Photo by Dave Rowe.

CONTENTS

INTRODUCTION AND OVERVIEW

Bill Horns

These reports summarize some of the studies and stock assessment activities conducted by the Lake Michigan Fisheries Team during 2012. They provide specific information about sport and commercial fisheries, and describe trends in some of the major fish populations. For further information contact one of the authors (see final page) or visit http://dnr.wi.gov/topic/Fishing/lakemichigan/index.html.

Overview

The Lake Michigan Fisheries Team is charged with implementing the Lake Michigan Integrated Fisheries Management Plan[1] and coordinating the Lake Michigan Fisheries Program for the Department of Natural Resources. Our management of Lake Michigan fisheries is conducted in partnership with other state, federal, and tribal agencies, and in consultation with the public, particularly sport and commercial fishers. Major issues of shared inter-jurisdictional concern are resolved by the Lake Michigan Committee[2], which includes representatives of Michigan, Indiana, Illinois, Wisconsin, and the Chippewa Ottawa Resource Authority.

These studies and assessments take place in the context of continuous ecosystem change, driven by the proliferation of nonnative species. The rapid decline of alewives and the collapse of the chinook salmon fishery in Lake Huron in the past decade have focused our attention on the central issue of what levels of salmon and trout stocking are compatible with sustaining an adequate forage base to support our salmon and trout fisheries. Annual forage surveys conducted by the US Geological Survey along with indices of salmon abundance and size-at-age described in reports here allow us to assess the health of that part of our recreational fishing program. The Wisconsin contribution to the lakewide stocking program in the past year is summarized below. Our salmon and trout stocking program costs between $3.0M and $3.5M annually, and is sustained by roughly equal contributions from Salmon Stamp revenues and from other license fees[3].

Fish stocked in Wisconsin waters during fall of 2012 as fingerlings and spring of 2013 as yearlings (except chinooks, which are stocked as spring fingerlings).

species	strain	fall 2012	spring 2013
brown trout	Seeforellen (feral)		387,372
	Wild Rose (domestic)	103,962	221,979
chinook salmon			802,061
coho salmon			383,339
lake sturgeon		1,446	
rainbow trout	Chambers Creek (steelhead)		138,066
	Ganaraska (steelhead)		142,389
	Arlee (nearshore)		130,464
walleye			0
muskellunge	Great Lakes Spotted	5,129	

[1] Lake Michigan Fisheries Team. 2004. Lake Michigan Integrated Fisheries Management Plan, 2003-2013. Administrative Report No. 56, Wisconsin Department of Natural Resources.

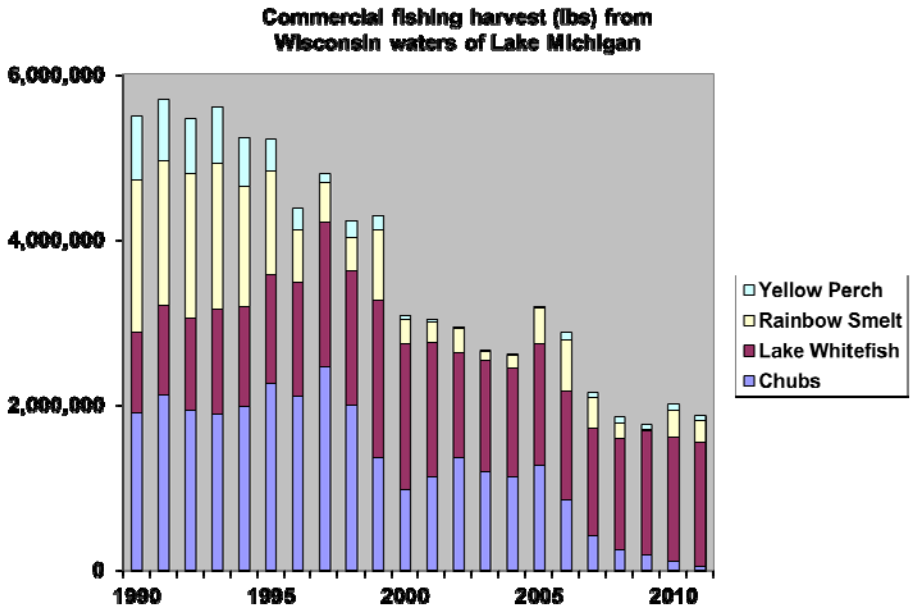
[2] Inter-jurisdictional fisheries governance on the Great Lakes is guided by *A Joint Strategic Plan for Management of Great Lakes Fisheries*, to which all state, federal, and tribal fisheries agencies on the Great Lakes are signatories.

[3] Bureau of Fisheries Management. 2012. Great Lakes Trout and Salmon Stamp Revenue and Expenditures Report, Fiscal Years 2007-2012. Administrative Report No. 72, WDNR.

In cooperation with other agencies around the Lake and with the help of interested citizens and the Quantitative Fisheries Center at Michigan State University, we reviewed the lakewide salmon and trout stocking program and significantly reduced chinook salmon stocking in 2013.

Reports describing the management of cool water species are also contained in this document. Cool water species such as walleye, yellow perch, northern pike, muskellunge and smallmouth bass can be found in many of our larger Lake Michigan tributary streams as well as in Green Bay. Most are self-sustaining, but in some cases stocking is required to maintain the fishery. Some species like yellow perch have undergone large population swings, while others such as walleye and smallmouth bass in Green Bay have shown steadily increasing in numbers.

Several of the reports here describe aspects of our commercial fisheries for yellow perch, bloater chub, lake whitefish, and rainbow smelt. The number of active commercial fishing licenses has fallen below 60 and as the following chart illustrates, commercial harvests of all species except lake whitefish have declined over the past 20 years.



Report highlights

The recreational fishery in 2012 was marked by a sharp increase in chinook salmon harvest along with a decline in coho salmon harvest (see "Sportfishing Effort and Harvest"). We continued to operate three spawning facilities (see "Weir Harvest") and exceeded egg collection quotas for chinook and coho salmon and for steelhead. Chinook size-at-age was markedly smaller in 2012 than in 2011. We are still unable to propagate Skamania steelhead, but were able to meet our total steelhead egg quotas from returning Chambers Creek and Ganaraska spawners. Green Bay yellow perch continue to produce significant numbers of young-of-year (YOY) fish, but survival to fishable sizes remains poor, resulting in continued disappointing commercial and sport harvests (see "Green Bay Yellow Perch"). In Lake Michigan, the reproduction by yellow perch is more spotty, with 2005 producing the last reasonable year class (see "Lake Michigan Yellow Perch"), as reflected by the numbers of age-3 yellow perch collected in annual winter graded-mesh gill netting. The future of the southern Green Bay/lower Fox River walleye stock and sport fishery appears to be

promising, with substantial year classes documented in 2008, 2009, and 2010 (see "Walleye in Southern Green Bay"). Stocking of Great Lakes spotted musky resumed in 2010, 2011, and 2012, following three years in which only 640 yearlings were stocked, and we believe the population is increasing (see "Great Lakes Muskellunge"). The brown trout fishery has changed greatly in recent years. While fishing in southern ports, especially Milwaukee has been exceptional, the harvest in Green Bay has declined steadily over the past dozen years. In 2010 we initiated a revised stocking program for Green Bay in which fall fingerling stocking has been sharply reduced and yearlings are being stocked off shore to avoid nearshore predators (see "Green Bay Brown Trout Management"). The Menominee River is the only river open to fishing for lake sturgeon, with a catch-and-release season in September. That fishery is jointly managed with Michigan. We continue to monitor and protect smaller spawning populations in other Green Bay streams and to stock fall fingerlings reared in streamside rearing facilities on the Milwaukee and Kewaunee Rivers (see "Lake Sturgeon"). The bloater chub population has declined dramatically since the early 1990's, with commercial harvests in 2012 falling below 15,000 pounds, the lowest levels since we started recording harvests in 1979 (see "Commercial Chub Fishery and Chub Stocks"). Lake whitefish provide the bright spot in the commercial fishing industry (see "Lake Whitefish"). Both commercial and recreational harvests of whitefish remain high, although size-at-age remains at low levels, with individual fish not reaching fishable size until age seven.

SPORTFISHING EFFORT AND HARVEST

Brad Eggold and Jeff Zinuticz

Wisconsin's Lake Michigan open water fishing effort was 2,525,586 hours during 2012, 4.78% below the five-year average of 2,652,354 (Table 1). Effort was below the five-year average for all the fishery types with moored boat effort (-15.23%) and stream effort (-16.51%) showing the greatest declines.

Wisconsin Lake Michigan trout and salmon anglers had a very successful season in 2012. Overall harvest was up, with 590,210 salmonids harvested; the harvest rate also increased to 0.2337, fish per hour (Table 3). Chinook comprised the majority of the catch, with a harvest of 390,385. Fishing for Coho salmon was steady in 2012, with 73,395 fish harvested. Fishing for Coho salmon was much shorter in duration than most years with harvest starting in March and ending in early May from Kenosha to Door County. The unusually warm winter and spring jump started Lake Michigan fishing in 2012 with Chinook salmon being harvested as early as April; fishing for other species such as Brown trout and steelhead began early as well and held steady through the Spring and Summer.

The open-water Yellow Perch harvest was 158,095 fish (Table 2), a decrease from 2011. The majority of the catch was comprised of the 2005 and 2008 year classes.

Walleye harvest was estimated at 79,332 fish, an increase from 2011. The Northern Pike catch was slightly lower in 2012 with 2,726 fish caught. Smallmouth Bass harvest was 8,735 fish, a slight decrease from 2011.

For more summaries, check out Wisconsin's Lake Michigan website at:
http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2012 and percent change from the 5-year average (2007-2012).

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2012	1,387,552	324,573	318,457	162,209	144,685	188,110	**2,525586**
% change	-4.07%	-15.23%	10.55%	-0.79%	-1.02%	-16.51%	**-4.78%**

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2012

SPECIES	RAMP	MOORED	CHARTE	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	36,071			544	334	240	**73,395**
Chinook	171,859	83,423	115,757	3,625	3,209	12,512	**390,385**
Rainbow trout	31,225	17,242	23,521	1,064	544	2,355	**75,981**
Brown trout	10,216	1,748	2,381	3,771	2,769	452	**21,337**
Brook trout	0	0	18	0	0	0	**18**
Lake trout	12,543	5,228	11,260	19	44	0	**29,094**
Northern pike	2,414	0	0	26	86	200	**2,726**
Smallmouth	2,964	4,069	0	547	284	871	**8,735**
Yellow perch	115,368	28,256	0	3,255	5,721	5,495	**158,095**
Walleye	68,360	6,632	0	0	18	4,322	**79,332**
TOTAL	**451,050**	**160,965**	**174,776**	**12,851**	**13,009**	**26,447**	**839,098**

Table 3. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1997-2012.

Species	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	(SINCE 1986)
Brook Trout	299	159	574	199	263	144	126	1	18	17	62	13	27	0	26	18	39,040
Brown Trout	43,224	27,371	37,187	40,966	26,421	35,220	23,654	20,918	27,489	17,769	37,947	23,763	15,792	13,029	9,936	21,337	1,048,159
Rainbow Trout	94,470	110,888	84,248	71,829	72,854	74,031	48,548	25,529	48,490	48,420	62,249	41,552	46,529	49,121	75,442	75,981	1,874,831
Chinook Salmon	130,152	136,653	157,934	136,379	191,378	275,454	317,619	360,991	418,918	398,905	431,143	256,796	214,621	315,294	169,752	390,385	6,308,548
Coho Salmon	138,423	59,203	56,297	87,927	47,474	102,313	50,625	76,944	59,244	56,136	94,677	25,453	42,690	42,445	157,367	73,395	2,186,158
Lake Trout	57,954	82,247	39,819	31,151	40,408	39,865	23,881	14,209	14,139	10,638	19,281	12,763	14,946	17,483	17,788	29,094	1,295,459
TOTAL	**464,522**	**416,521**	**376,059**	**368,451**	**378,798**	**527,027**	**464,453**	**498,592**	**568,298**	**531,885**	**645,359**	**360,340**	**334,605**	**437,372**	**430,311**	**590,210**	**12,752,195**
Harvest Per Hour	0.1619	0.1451	0.1331	0.1614	0.1382	0.1789	0.1719	0.1904	0.2036	0.1916	0.2108	0.1443	0.1171	0.1539	0.1693	0.2337	0.1476

Table 4. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1997-2012.

Fisheries Type	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	(SINCE 1986)
Ramp	190,976	155,953	141,903	170,081	156,470	236,241	196,235	195,953	241,535	197,833	254,231	115,698	113,446	161,917	172,438	261,944	4,943,554
Moored	129,332	141,538	100,078	68,872	85,435	110,094	111,148	130,418	149,845	128,666	164,286	92,635	91,986	127,356	103,547	122,008	3,363,222
Charter	94,556	84,867	73,622	91,665	76,868	106,631	100,037	123,995	137,922	152,749	173,250	110,481	91,333	117,004	121,043	174,776	2,945,179
Pier	5,002	4,200	4,614	4,402	7,327	10,629	8,464	11,329	9,284	8,835	15,440	6,487	7,975	8,203	4,432	9,023	323,271
Shore	16,726	8,997	12,685	13,971	18,308	20,111	14,995	11,175	8,557	13,472	16,394	10,191	8,519	6,398	8,544	6,900	405,483
Stream	27,930	20,966	43,157	19,460	34,390	43,321	33,574	25,722	21,155	30,330	21,758	24,848	21,346	16,494	20,307	15,559	771,486
TOTAL	**464,522**	**416,521**	**376,059**	**368,451**	**378,798**	**527,027**	**464,453**	**498,592**	**568,298**	**531,885**	**645,359**	**360,340**	**334,605**	**437,372**	**430,311**	**590,210**	**12,752,195**

* Totals represent total number of salmonids harvested from 1986 – 2012.

WEIR HARVEST

Nick Legler and Cheryl Masterson

The Wisconsin Department of Natural Resources (WDNR) operates three salmonine egg collection stations on Lake Michigan tributaries. The Strawberry Creek Weir (SCW), which has been in operation since the early 1970's, is located on Strawberry Creek in Door County near Sturgeon Bay and is the primary egg collection facility for chinook salmon *Oncorhynchus tshawytscha*. The Buzz Besadny Anadromous Fisheries Facility (BAFF) has been in operation since 1990 and is located on the Kewaunee River in Kewaunee County. BAFF is a co-primary egg collection station for two strains of steelhead *O. mykiss*, and coho salmon *O. kisutch.* BAFF also serves as a backup for chinook salmon egg collection. The Root River Steelhead facility (RRSF) has been in operation since 1994 and is located on the Root River in Racine County. RRSF is a co-primary egg collection station for the two strains of steelhead, and coho, and serves as a backup for chinook salmon egg collection.

Historically, RRSF and BAFF began operating in late summer when the Skamania strain of steelhead appeared in the rivers. Skamania brood stock were collected at the weirs and overwintered at the Kettle Moraine Springs Hatchery until they were ready to spawn the following January/February. However, since 2007 VHS concerns have prompted the disease protocol which prohibits the transfer of live adult fish from the weir to the hatcheries. Therefore, we no longer collect Skamania at RRSF or BAFF and have consequently discontinued stocking that strain until a viable alternative source arises.

Total numbers of fish returning as reported here cannot necessarily be interpreted strictly as the absolute number of fish returning to Wisconsin weirs. Returns can vary depending upon several variables including the timeframe the weir was operated during a particular season, whether fish were passed upstream, and the number of smolts previously released at these sites. The salmonine egg harvest quota varies from one year to the next for each species or strain based on the projected needs of WDNR hatcheries and egg requests from other agencies. In 2012, all Lake Michigan salmon and trout egg quotas for Wisconsin waters were met.

Strawberry Creek Weir

Over 1.2 million Chinook eggs were collected at the Strawberry Creek weir in Sturgeon Bay during the fall of 2012 and a total of 2,553 Chinooks were processed for eggs and/or for biological data (Table 1). Data collected were lengths, weights, gender, lamprey scars, and fin clips. Snouts were also collected from adipose clipped Chinooks for Coded Wire Tag (CWT) analysis and tissues were collected from a subsample for health testing. Sufficient numbers of eggs were collected from Strawberry Creek to meet hatchery production goals, but some challenges had to be overcome. Low water levels made conditions difficult for Chinooks to swim into Strawberry Creek during 2012. As usual, a pump and pipeline were used to supplement water flow into Strawberry Creek. Additionally, since water levels were so low, a channel was dredged at the creek's mouth on October 5. Despite these efforts, relatively few Chinooks returned up Strawberry Creek, most likely due to the low water. However, it rained almost continuously on October 13-14 and subsequently on October 22 over 1,500 Chinooks were processed at Strawberry Creek. Data from Strawberry Creek have been entered and evaluated. One particularly important result is that the average weight of an age-3 female Chinook salmon at the Strawberry Creek weir during 2012 was only 5,411 grams and this is the second lowest weight on record since 1985 (Figure 1).

Table 1. Strawberry Creek Chinook egg collection summary for year 2012

Date	Eggs Collected	Chinooks Processed
Thurs Oct 4, 2012	500,000*	489
Mon Oct 8, 2012	294,635**	250
Mon Oct 15, 2012	132,736**	162
Mon Oct 22, 2012	276,405**	1,552

*336,862 collected for Wild Rose and about 200,000 collected for Kettle Moraine

** Eggs collected for Wild Rose.

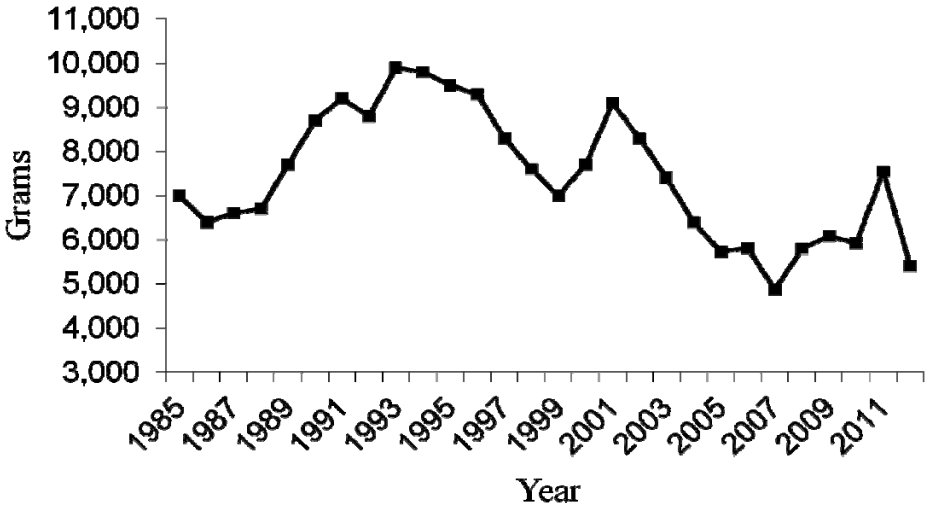


Figure 1. Average weight of age-3 female Chinook salmon collected at the Strawberry Creek weir in Sturgeon Bay.

Besadny Anadromous Fisheries Facility

A total of 709 steelhead were processed at the Besadny Anadromous Fishery Facility (BAFF) on the Kewaunee River during the spring of 2012, including 212 Chambers Creek, 178 Ganaraska and 319 other/unknown strains. These steelhead were processed at BAFF on March 20, 22, 28 and April 4. Data collected were lengths, weights, gender, lamprey scars and fin clips. Eggs and fish health samples were also collected (from Ganaraska and Chambers Creek strains only) by hatchery and fish health personnel.

A total of 2,663 Chinook and Coho salmon were processed at BAFF during the fall of 2012, including 1,365 Chinooks and 1,298 Coho. These fish were processed between October 6, 2012 and November 14, 2012. Data collected were lengths, weights, gender, lamprey scars and fin clips. Coded wire tags were also collected from adipose clipped Chinooks. Eggs and fish health samples were collected from Coho. BAFF serves as a 'back-up' egg collection facility for Chinook salmon. A 'back-up' Chinook salmon egg-take was conducted at BAFF on October 16th but these 'back-up' eggs ultimately were not needed since egg quotas were met at Strawberry Creek.

Root River Steelhead Facility

Spring 2012: The Root River Steelhead Facility (RRSF) was in operation for three processing dates during the spring 2012 migration. We captured and processed 232 steelhead between March 12 and April 2. This was the lowest spring return to RRSF since the facility opened in the fall of 1994. The number of fish captured at RRSF is a small subset of the 2012 steelhead run in the Root River. We do not stop every fish in the river, as they are able to move upstream past the facility before it is operational in early spring, and some fish are able to bypass the facility during the sampling season when the river is at high flows. Therefore, any comparison to past year's processing numbers will not provide a meaningful measure of the overall return of steelhead back to the Root River. In conjunction with the Besadny Anadromous Fisheries Facility in Kewaunee, we met our egg collection quotas for Chambers Creek and Ganaraska strains of steelhead. Our biological sampling goals were fulfilled, and fish health sampling was conducted. The Spring 2012 RRSF steelhead effort is summarized below.

Captured	Spawned	Eggs Taken	Passed Upstream
232	156 total (66 Chambers and 90 Ganaraska)	187,000 Chambers 177,000 Ganaraska	113

Fall 2012: The Root River Steelhead Facility (RRSF) was in operation for 10 processing days during the Fall 2012 fish migration. We were able to capture and process 2,831 fish between September 17 and November 15. Due to extremely low flows in the Root River, the facility was run only sporadically until October 12 and was actively capturing fish for a total of 46 days during the fall season. Our egg-take and biological sampling goals were met, and coho health inspections were conducted. The number of fish captured at RRSF is a subset of the Fall 2012 migration in the Root River. With a later fall processing season, Chinooks and steelhead are able to migrate upriver past the facility before we start capturing fish, resulting in lower numbers handled at the facility. In addition, during the coho salmon spawning run, many coho are able to get past the dam by jumping over the stop logs. Therefore, any comparison to past year's processing numbers will not provide a meaningful measure of the overall return of salmonids back to the Root River. The Fall 2012 Root River effort is summarized below.

	Captured	Spawned	Eggs taken	Passed Upstream
Chinook	1,830	0	0	1,462
Coho	849	452	402,000*	659
Rainbow	18	0	0	16
Brown	134	0	0	112
Totals	2,831	452	402,000	2,249

*An additional 729,000 coho eggs were obtained at the Kewaunee facility for a total of 1.13 million.

GREEN BAY YELLOW PERCH

Tammie Paoli

This report summarizes assessments and monitoring of yellow perch in southern Green Bay completed in 2012. Yellow perch abundance in Green Bay increased steadily through the 1980's. The estimated total biomass of yearling and older yellow perch rose from under 1 million pounds in 1978 to nearly 9 million pounds in 1987. The population growth was fueled by the production of strong year classes in 1982, 1985, 1986, and 1988. Following the late 1980's, yellow perch abundance began to decline and the biomass estimate dropped to between 500 and 600 thousand pounds by 2002. The decline in the population during the 1990's and early 2000's can be attributed to poor recruitment. From 1988 to 2002, only two reasonably strong year classes (1991 and 1998) appeared during summer trawling surveys (Figure 1). More recent summer trawling surveys, however, show improved recruitment. Surveys from 2002 to 2012 indicate reasonably strong year classes (Figure 1).

Spawning assessment

The spring spawning assessment continued for the 35th year on Green Bay near Little Tail Point. Double-ended fyke nets were set at three standard locations on April 2-3, 2012 and fished until April 19, 2012. On that date, 85% of mature females sampled were ripe or spent which triggered the removal of the nets for a total effort of 50 net nights. Water temperatures reached 50F on April 7, but fluctuated between 46F and 55F until April 29, after which temperatures remained above 50F for the remainder of the spring. Due to a mild winter and early ice-out, peak spawning activity occurred about two weeks earlier than a typical year.

Aging structures from immature females, mature females, and males were collected from 10 fish per 10 mm group when possible. All fish species were counted and lengths were taken from 500 yellow perch per sex and maturity category and incorporated into the age expansion. Fish under 100 mm were considered yearlings and were counted (n=6,210). Age-2 (2010 year class) males comprised 79% of the total males over 100 mm sampled (n=258) with a mean length of 139 mm, or 5.5 inches. Of the mature females sampled (n=181), a majority (48%) were age-2 with a mean length of 163 mm, or 6.4 inches, while 43% of mature females were age-3 with a mean length of 190 mm, or 7.5 inches. Younger females (ages 2 and 3), continue to contribute significantly to the spawning population in southern Green Bay. Besides yellow perch, spottail shiners (n=816) dominated the catch, followed by trout perch (n=628), emerald shiners (n=581), and brown bullhead (n=384). The presence of lake whitefish (n=27) in the spring netting survey was unusual since that species is not typically seen in the spring netting survey.

Water temperature

A StowAway TidbiT® templogger (Onset Computer Corporation) was deployed on March 15, 2012 near Little Tail Point to record water temperature every 30 min until August 16, 2012. May 2011 water temperatures averaged 62.5F. The 10-year May average (2003-2012) for this location is 57.6F.

Beach seining

Fifteen index sites along the west and east shores of Green Bay were sampled twice between June 19-27, 2012, and at twelve index sites between July 10-17, 2012 using a beach seine (25ft x 6ft, ¼-in delta mesh with 6x6x6ft bag). At each site, two 50ft hauls were pulled in perpendicular to shore. The number of YOY retained and escaped from the seine bag when it was placed in a tub was recorded. Catch per effort (CPE) was calculated as the mean number of YOY yellow perch per 100ft seine haul. YOY yellow perch were captured at all 15 sites (mean CPE=30) during the June sampling and at all sites in July (mean CPE=27). The 13-year average CPE is 83. The site with the highest abundance in 2012 was Little Tail (CPE=239).

Mean length of YOY yellow perch during the late June survey period was 42 mm (range: 26-62 mm). By late July, mean length of YOY was 57 mm (range: 43-84 mm). The wide range of lengths may be the result

of several pulses of hatches. As expected, escapement rates decreased with larger fish and all YOY ≥ 50 mm were retained in the seine bag. Because many YOY had not yet reached a size where they were effectively captured, our CPE values are probably underestimated. However, a seine with a smaller mesh is difficult to pull in areas with cladophora, which was abundant in several locations in 2012.

A total of twenty-eight fish species were identified during the survey. Bullhead YOY dominated the catches followed by yellow perch YOY, banded killifish, round goby, and white perch YOY. Of interest were 25 smallmouth bass (Suamico, Red Banks, Little Sturgeon) and 2 largemouth bass YOY (Little Sturgeon). In 2011, 6 smallmouth and 7 largemouth bass were captured. Additionally, 57 alewife YOY were captured at Bay Beach, the southernmost site. In 2011, 75 alewife were captured. While black bass and alewife are occasionally captured in seining surveys, the 2011 and 2012 surveys suggest strong year classes for those species in Green Bay.

Trawling survey

Annual late summer trawl surveys continued for the 35th year to monitor trends in yellow perch abundance. Trawling was conducted at 77 index sites at 12 locations: 45 shallow sites (established in 1978-1980) and at 32 deep water sites (added in 1988) using a 25-ft semi-balloon trawl with 1½-in stretch mesh on the body, 1¼-in stretch mesh on the cod end, and a cod end liner with ½-in stretch mesh. The net was towed for 5 minutes at a speed of 2.8 knots, for a total distance of approximately 0.25 miles. Hauls were made during daylight hours on the RV Coregonus. At each of the 12 locations, 100 YOY yellow perch were measured. Mean length of YOY was 75 mm (range: 56-112 mm). This average is 7 mm larger than YOY collected in 2011 trawling surveys. YOY captured in the southern bay were generally larger than YOY from the northern study sites, presumably due to an earlier hatch, warmer water temperatures, and more productive waters. However, timing of the survey could also be a factor, since the northern sites are surveyed a week or so before the southern sites.

The average number of yellow perch collected per trawl hour was adjusted based on the amount of habitat that standard and deep sites represent, creating a weighted area average value. The trawling surveys indicated that 2012 produced a strong year class with the relative abundance of YOY yellow perch (1082/hr), ranking as the 9th highest since the deep water sites were added in 1988 (Figure 1). The 2012 year class strength was nearly identical to the 2011 cohort (1084/hr), with the main difference being faster growth of 2012 YOY. In both years, greatest abundance of YOY was at Pensaukee (PEN) followed by Little Tail Point (LIT).

While the trawling surveys are designed to assess YOY distribution and abundance, yearling and older yellow perch are also measured, weighed, sexed, and aged. Abundance of age-1 and older fish decreased at index sites from 401/hr in 2011 to 38/hr in 2012. A majority (54%) of the age-1 and older fish captured were yearlings (2011 year class) with a mean length of 136 mm (range: 102-179 mm) followed by age-2 (43%) with a mean length of 155 mm (range: 114-224 mm). The high representation of age-2 fish is indicative of the large 2010 year class. Other common species in decreasing order of abundance captured at shallow sites were gizzard shad, alewife YOY, round goby, and white perch YOY. Deep water sites were dominated by alewife YOY, adult alewife, whitefish YOY, and round goby.

Of particular note was the high CPE of alewife YOY, recorded as high as 3196/hr off the Little Suamico River (OLSR). Two other sites in southern Green Bay, Green Bay Entrance Light Deep (GBELD) and Little Tail Point (LIT), had the next highest abundances of alewife YOY. Alewife catches have not been at these levels in Green Bay since the 1990s.

At each of the 12 locations, a temperature and dissolved oxygen profile is taken along with a secchi disk reading. Water clarity was highest at the northernmost locations and generally decreased in the southern bay, ranging from 5.1 m at Little River Deep (LRD) to 0.4 m at Longtail Point (LOT). Mussels caught in the trawl are weighed to the nearest pound and are visually inspected for the relative composition of zebra and quagga mussels. From 1999 to 2011, zebra mussels comprised most of the dreissenid mussels incidentally

caught in the trawling survey. However, 2012 was the first year that quagga mussels dominated the dreissenid mussels caught.

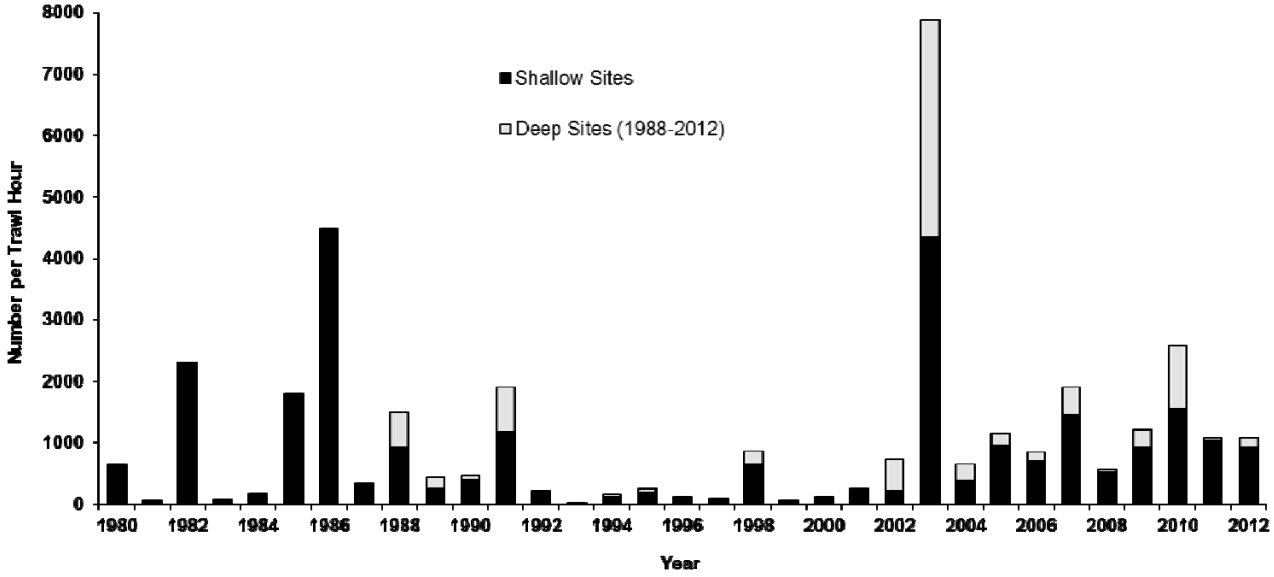


Figure 1. Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2012.

Sport harvest

Sport fishing harvest is estimated from an annual creel survey. Fish obtained through that survey were used to describe the age and size composition of the catch. Open water harvest of yellow perch in 2012 was 148,980 (29,752 lbs) compared to 254,942 fish (67,729 lbs) in 2011 (Figure 2). The majority of the open water harvest (38%) was by boat anglers launching at ramps at Door and Kewaunee Counties, followed by boat anglers launching in Brown (26%) and Oconto County (11%). The remaining 25% of harvest was by pier, shore, or stream anglers, or by anglers who responded to the moored boat survey. These are fairly similar proportions to the 2011 harvest. The open water harvest rate (0.17/hr) at catch rate (0.33/hr) of yellow perch in 2012 fell from 0.25/hr and 0.53/hr, respectively, in 2011. A majority (62%) of the open water harvest was from the 2010 year class, while the 2009 year class comprised 17%. The mean length of open-water harvested yellow perch was 7.8 inches (n = 607), compared to 8.3 inches in 2011.

Winter harvest is influenced largely by ice conditions, daily bag limits, angler effort, and abundance of adult perch. Since the creel survey began in 1986, angler harvest of yellow perch during winter months has ranged from 2 million fish in 1990 to 6,930 in 2002 (Figure 2). Winter harvest of yellow perch in 2012 (9,767 fish; 2,165 lbs.) was significantly lower than in 2011 (62,829 fish; 13,817 lbs.), and well below the 15-year harvest average for Green Bay (50,391 fish). The low harvest is likely due to a mild winter and poor ice conditions in 2012. Many traditional perch fishing spots had open water all winter. Harvest rate for anglers targeting yellow perch was similar in 2012 (0.66/hr) and 2011 (0.60/hr). The mean length of yellow perch harvested through the ice was 8.0 inches compared to 7.9 inches in 2011.

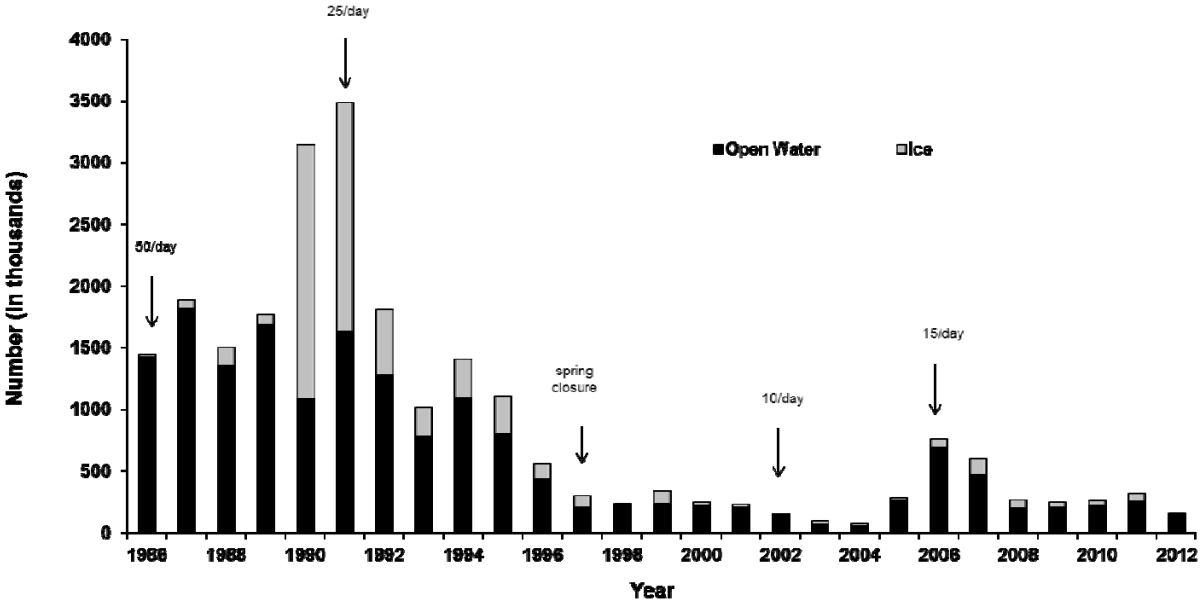


Figure 2. Estimated sport harvest of yellow perch in Green Bay from 1986 to 2012. Regulation changes indicated by arrows.

Commercial harvest

The annual commercial harvest was reported by commercial fishermen who are required to weigh their harvest daily. Fish sampled by WDNR at commercial landings were used to describe the age and size composition of the catch. Since 1983, the yellow perch commercial harvest in Green Bay has been managed under a quota system. The zone 1 (Green Bay) quota has ranged over the past decade from 20,000 pounds to a high of 475,000 pounds.

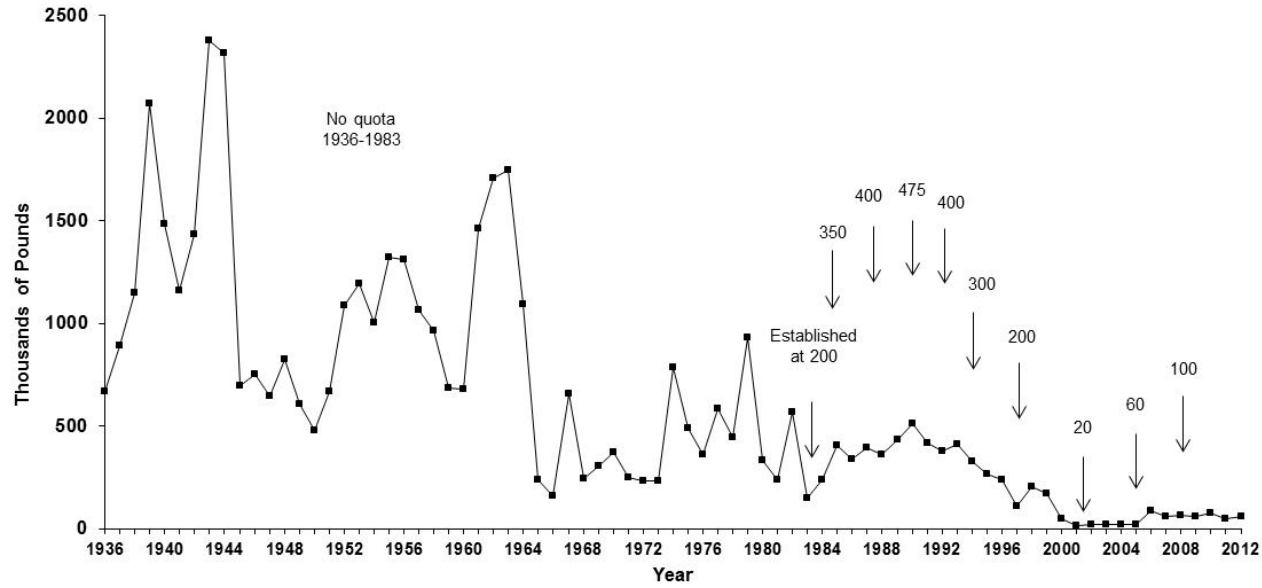


Figure 3. Commercial harvest of yellow perch in Green Bay from 1936 to 2012. Total allowable commercial harvest changes (thousands of pounds) indicated by arrows.

In 2012, commercial fishers harvested a total of 57,845 pounds (175,199 fish) of yellow perch using gill nets and drop nets, compared to 49,465 pounds in 2011 (Figure 3). The total allowable commercial harvest has remained at 100,000 pounds since 2008. The harvest rate (CPE) for gill nets in 2012 was 23 pounds per 1000 ft fished, similar to 2011 (22 pounds/1000 ft). Drop net CPE rose to 30 pounds per net in 2012 (Figure 4), but drop nets comprised only 182 pounds of the total catch. Age-2 perch (2010 year class) made up 63% of the total commercial harvest in 2012, while age-3 (2009 year class) comprised 27%. Presently, WDNR has a policy of allocating yellow perch harvest equally between the sport and commercial fishery over the long term (Figure 5) while protecting the resource from overfishing. The average ratio of estimated sport to commercial harvest in Green Bay from 1996 through 2012, by number, was 54% sport and 46% commercial harvest.

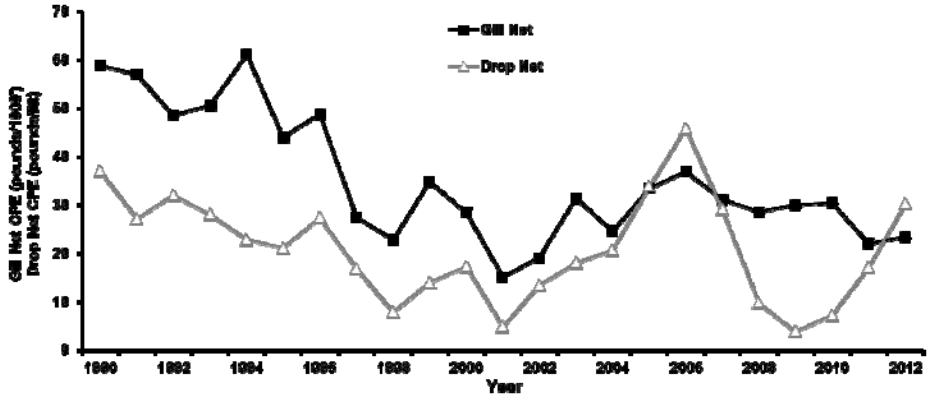


Figure 4. Gill net and drop net catch per unit effort (CPE) of all licensed yellow perch commercial fishers in Green Bay waters, 1990 – 2012. Gill net CPE is in pounds of yellow perch harvested per 1,000 feet lifted. Drop net CPE is in pounds of yellow perch harvested per pot lifted.

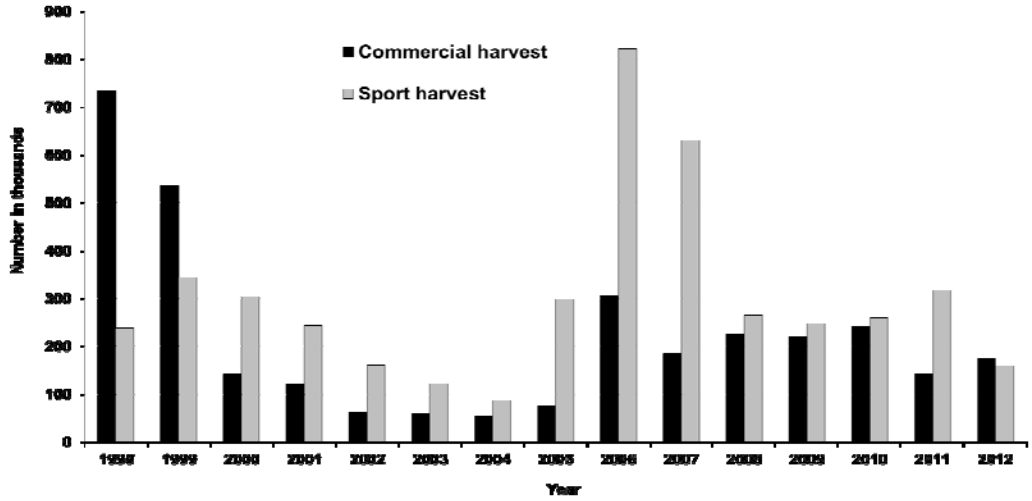


Figure 5. Commercial harvest and estimated sport harvest (open water and ice combined) by numbers in Green Bay from 1998 to 2012.

Discussion and Management Actions

An unusually early spring and warm May water temperatures likely contributed to the strong 2012 year class of yellow perch on Green Bay. The relative abundance of YOY yellow perch (1082/hr) ranks as the 9th highest since 1988.

In summary, yellow perch recruitment has been steady for the last decade, with peak year classes occurring in 2003, 2005, and 2010. Even with excellent recruitment occurring in Green Bay, commercial and sport harvest has leveled off over the last four years and has not exhibited increases as expected.

One possible explanation for lower than expected harvest levels may be because fewer yellow perch are surviving to age one and beyond. WDNR will continue to work with USDA Wildlife Services to achieve the goals for managed double-crested cormorant colonies set forth in the Environmental Assessment "Reducing Double-crested Cormorant Damage in Wisconsin" [a]. In addition, WDNR will continue to monitor the status of the yellow perch fishery and adjust commercial harvest limits and sport bag limits if several years of recruitment failures occur.

[a] USDA (United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services). 2009. Final Environmental Assessment: Reducing Double-crested Cormorant Damage in Wisconsin. 732 Lois Dr., Sun Prairie, WI.
http://www.fws.gov/midwest/MidwestBird/documents/WIeaFinal.pdf

LAKE MICHIGAN YELLOW PERCH

Pradeep Hirethota

This report is a summary of the status of young and adult perch in Lake Michigan assessed through several annual surveys in Wisconsin waters during 2012-13.

Young-of-the-year Assessment

An annual survey of YOY yellow perch along the Lake Michigan shoreline was conducted from 8/20/2012 to 9/6/2012. We used a standard 25-foot beach seine which was pulled by two persons in shallow nearshore waters of Lake Michigan. In general, each pull consisted of a 100-foot sweep either parallel to the beach or perpendicular to the beach along piers and jetty's depending on the depth and feasibility of seining. At each station, two 100-foot pulls were conducted – one a parallel and the other perpendicular. Fourteen stations were sampled from Sheboygan to Kenosha. Seining conditions were generally good excepting at a few stations in 2012 summer. Some stations (Bender Park, McKinley beach, and Port Washington beach) were infested with cladophora during much of the season making it difficult to seine. A total of 19 species of fish were captured (Table 1). Young-of-the-year and juvenile alewife dominated the catch followed by Spottail shiner and round goby.

A total of 4,900 ft of seine hauls were conducted at fourteen sites capturing 24 YOY yellow perch yielding a catch per effort (CPE) of 0.5 YOY yellow perch per 100 foot seine haul. Most of the young perch were caught in Sheboygan and Milwaukee sites. While the CPE is very low in 2012 survey (Figure 1), the average size of YOY yellow perch was greater (62.4mm) compared to the previous year. This is probably due to early warming of spring water temperature. Generally the YOY yellow perch ranged from 45mm to 89mm in 2012 survey.

Two index stations, Shoop Park (Racine Co.) and Doctors Park (Milwaukee Co.), were selected for setting micromesh gill net. The nets were set in nearshore waters using an inflatable boat on a calm day at depths ranging from 5 to 10 feet and fished overnight. We used a 100-foot long and 5- foot deep monofilament net made of 12mm stretch mesh. Each lift consisted of two gangs of 100 ft of net (200ft total) at each station. A total of ten species of fish were captured in these nets with Spottail shiner dominating the catch. Only one YOY yellow perch was caught at Doctors Park location. The catch per 100 ft of gillnet was only 0.1 YOY yellow perch (CPE=0.1) (Figure 2). The conditions were ideal for sampling. The nets were clogged with cladophora at Doctors Park. The water was very clear in Shoop Park, and the temperature ranged from 60 ^{0}F to 64 ^{0}F. The increased water clarity may have pushed young perch to deeper water.

Spawning Assessment

This assessment has been conducted since 1990 on the Green Can Reef and in the Milwaukee Harbor (Table 2). The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. In spring 2012, we took two samples on May 23rd and may 30th with a total effort of 2,000 ft of gillnet. Each box of 500 ft gillnet consisted of 2, 2.5, 2.75, 3.0 and 3.25 inch stretch mesh (100 ft each panel). The bottom water temperature ranged from 45.8 ^{0}F to 53.9 ^{0}F. A total of 147 adult yellow perch – 112 male and 35 female - were caught in two lifts. The majority of females caught were spent. Perhaps the early warming up of spring water temperature accelerated the peak spawning time. This year we caught very few yellow perch in the spawning assessment. Male perch generally dominate the catch during the spawning season. However, in the second lift we caught only eight male

and eight female perch. There was a lot of cladophora attached to the nets, especially in the second lift. The general health of perch and appearance of gonad looked normal. Research samples were provided to UW School of Freshwater Science for further analysis on gonadal development. Age analysis of a subsample of fish revealed that 2005 year-class (age 7 yellow perch) was the dominant year-class (Figure 3).

Yellow perch egg deposition survey was conducted by the WDNR dive team on June 4th, 2012. The divers surveyed an area of 18,029 square meters at depth ranging from 35-55ft. They counted 37 egg masses resulting in 2.05 egg mass per 1000 square meters (Figure 4).

Graded Mesh Gill Net Assessment

The WDNR conducts standardized graded mesh gill net assessments annually in winter months, in grids 1901 and 1902 off Milwaukee. The mesh sizes used in these assessments run from 1 to 3.25 inches stretch mesh with 1/4 inch increment. In November-December 2012, we conducted the survey taking five lifts with a total effort of 22,400 ft gillnet (28 boxes of 800 ft. each). Samples were taken on 11/29/12, 12/5/12, 12/11/12, 12/12/12 and 12/17/12 at depths ranging from 14ft to 95ft.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1998 through 2013. The data show variability in catch rates by calendar year. These data show very low CPEs of younger fish and higher CPEs of older fish until 1998 (dominated by male perch). However, data on age and size distribution of yellow perch from 1999 onward represented smaller and younger perch in significant proportions, essentially from 1998 year-class (Table 3). The 1998 year-class perch comprised the major portion of the population for a number of years, until the 2005 year-class emerged.

In our 2013 winter graded mesh assessment we documented multiple year classes. However, the total number of yellow perch caught during the entire survey was only 79, which is extremely low. The 2005 year-class yellow perch (age 8) emerged as a dominant group (39%) (Figure 5). Only a few less than 4 year-old perch were caught.

Since 2000 the sex ratio of the yellow perch population was shifted toward predominantly female and lasted until 2002. This trend was reversed again since 2003 with greater number of males, except for 2007. But recently the female proportion has increased markedly with 71% in 2010, 76% in 2011, 77% in 2012, and 76% in 2013. The data from 2008-2012 spawning assessment also indicated a decreased number male perch in the population. An absence of commercial harvest in Lake Michigan certainly has helped decrease the impact on fast growing larger female perch in the fishery, allowing them to spawn multiple years.

Harvest

In September 1996, the commercial yellow perch fishery was closed in the Wisconsin waters of Lake Michigan. Hence, the information on commercial harvest is limited up to 1995 catches. Sport harvest is monitored by a contact creel survey. The sport bag limit has been reduced to five fish per day since September 1996, which is reflected in the total harvest (Table 4). Our creel survey data on the sport caught yellow perch in 2009 indicated that the sport harvest was more than doubled compared to 2008 harvest. The overall harvest in Lake Michigan increased from 20,000 perch in 2008 to 51,000 in 2009. The sport harvest remained the same in 2010 at 51,000 fish while there was a dramatic decline in the sport harvest in 2011 (67% drop) with only 17,000 fish. It further declined to a record low 9,000 perch in

2012. In general, the lakeshore counties – Milwaukee, Racine and Kenosha accounted for most of the sport harvest. The main reason for the decline was probably poor recruitment combined with poor weather conditions. Yellow perch are fully recruited to the fishery at age 3. The 3-year-old yellow perch continue to be at very low numbers since the early 1990s (Figure 6).

The 2005 year-class yellow perch recruited to the fishery as 3-year-old fish continued to dominate the sport catch in 2011 replacing the 1998 year-class. In 2011 sport harvest, the 6-year-old 2005 year-class yellow perch comprised 34% of the catch followed by 2007 (20%), 2006 (16%) and 2003 (15%) year-classes. Recent data from the winter graded mesh assessment also indicated a strong 2005 year-class in the population which may continue to support a good sport fishery in the years to come. Unfortunately we did not receive sufficient number of anal spine samples in our creel survey during 2012 in order to examine proportion of various year-class perch in the sport harvest.

Management Actions

All yellow perch assessments and harvest data from the Wisconsin waters of Lake Michigan show weak year classes beginning with the 1990 year class. However, in recent years, the 1998 year-class was the strongest year-class supporting the fishery. Recent data indicate that the2002, 2003, 2005, 2006, 2007 and 2010 year-classes comprise substantial numbers in the population. 2005 year-class has emerged as a dominant year-class in recent years replacing the 1998 year-class perch. These observations are consistent with data collected by other agencies throughout the lake. Effective September 1996 commercial fishing was closed in the Wisconsin waters of Lake Michigan and daily sport bag limit was reduced to 5 fish. Effective May 2002, the sport fishery for Lake Michigan yellow perch is closed from May 1 to June 15. These rule changes are implemented to benefit perch population recovery by reducing impact on spawning stocks, and allowing mature adults to spawn multiple years in their life time. Presence of multiple year-classes in the spawning population as well as in the sport harvest is a positive change. However, the overall number and biomass of yellow perch population in the lake is declining further. The current regulation will remain in effect until a detailed analysis is complete on the status of yellow perch population.

Table 1. Number of fish caught in beach seining effort (Lake Michigan shoreline from Kenosha to Sheboygan) from 8/20/2012 to 9/6/2012.

alewife (YOY)	25,132	longnose dace	177
gizzard shad	2	black bullhead	302
bloater chub	6	banded killifish	101
rainbow smelt	4	ninespine stickleback	1
common carp	2	rock bass	4
common shiner	123	bluegill sunfish	110
spottail shiner	1,385	smallmouth bass	6
sand shiner	121	largemouth bass	14
bluntnose minnow	5	yellow perch (YOY)	24
fathead minnow	17	round goby	615

.

Table 2. Yellow perch spawning assessment in Milwaukee waters (Green Can Reef) of Lake Michigan

Year	Total	Males	Females	Sex-unknown	% Females	Total effort[1]
1995	1,272	1,233	39	0	3	17,000[2]
1996	4,674	4,584	90	0	2	14,400
1997	14,474	14,417	46	11	0.32	5,000[3]
1998	4,514	4,283	231	0	5.1	24,600[4]
1999	5,867	5,635	232	0	4	9,200
2000	855	722	133	0	15.5	3,700
2001	1,431	993	438	0	31	5,400
2002	1,812	1,645	167	0	9.2	2,500
2003	1,609	1,583	26	0	1.6	1,700
2004	1,143	997	144	0	12.6	2,100
2005	1,271	1,207	64	0	5	2,000
2006	1,741	1,580	161	0	9	2,500
2007	2,132	2,076	56	0	3	2,000
2008	326	209	117	0	35.9	4,000
2009	629	465	164	0	26	3,500
2010	616	486	130	0	21	3,000
2011	635	200	435	0	68.5	7,000
2012	147	112	35	0	24	2,000

[1] effort = length of gill net in feet
[2] includes 7,000 feet of standard 2 1/2" mesh commercial gill net
[3] in addition to this 5,000' of commercial gill net, double-ended fyke nets were used
[4] in addition, 11 lifts of contracted commercial trap net and 4 lifts of fyke nets were used

Table 3. Catch per Effort (fish/1000ft./night), and the percent of each sex, of yellow perch caught in standardized assessment graded mesh gill net sets conducted in January each year.

Age	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	42	323	1	0	2	3	0	3	40	3	2	6	0	2	12
3	2	57	65	243	4	0	1	61	29	24	159	50	43	0	1	9
4	6	215	9	20	118	0	0	12	249	60	7	282	56	15	5	3
5	29	93	27	2	4	33	1	0	37	204	46	6	287	13	7	0
6	35	57	2	2	3	0	27	11	0	31	120	59	33	56	10	9
7	20	45	0	1	1	0	1	226	23	4	16	139	52	3	59	9
8	43	63	8	2	0	0	0	6	417	20	7	18	94	18	3	33
9	110	44	9	1	0	0	0	0	7	113	7	12	8	14	8	3
10	60	33	11	1	0	0	0	0	0	0	69	5	26	3	9	9
11	15	9	1	1	1	0	0	0	0	0	1	78	0	4	0	9
12	4	7	0	0	1	1	1	2	0	0	0	2	63	0	0	3
13	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
%M	80	58	36	36	38	52	60	64	53	48	51	40	29	24	23	24
%F	20	42	64	64	62	48	40	36	47	52	49	60	71	76	77	76

Note: Aging of yellow perch changed from scales to spines starting in 2000 to be consistent with Green Bay methodology.

Table 4. Reported commercial and sport yellow perch harvest from Lake Michigan, excluding Green Bay. Sport harvest data since 1989 includes moored boat catch.

Year	Commercial harvest (lbs)	Sport harvest (no.)
1995	128,000	214,000
1996	15,000[a]	41,000[b]
1997	Closed	27,000[b]
1998	Closed	36,000[b]
1999	Closed	23,000[b]
2000	Closed	16,000[b]
2001	Closed	121,000[b]
2002	Closed	88,000[b]
2003	Closed	66,000[b]
2004	Closed	42,000[b]
2005	Closed	33,000[b]
2006	Closed	68,000[b]
2007	Closed	66,000[b]
2008	Closed	20,000[b]
2009	Closed	51,000[b]
2010	Closed	51,000[b]
2011	Closed	17,000[b]
2012	Closed	9,000[b]

[a] commercial yellow perch fishery was closed effective September 1996
[b] sport bag limit was reduced to 5/day effective September 1996

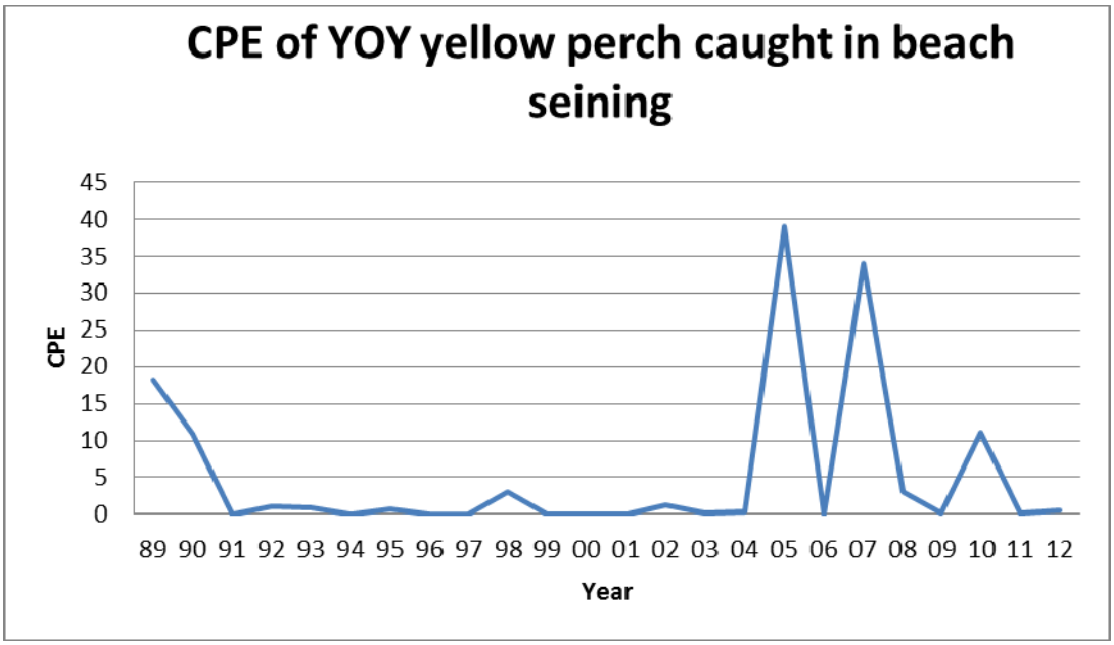


Figure 1. CPE (fish/100') of YOY yellow perch in summer beach seining, WDNR.

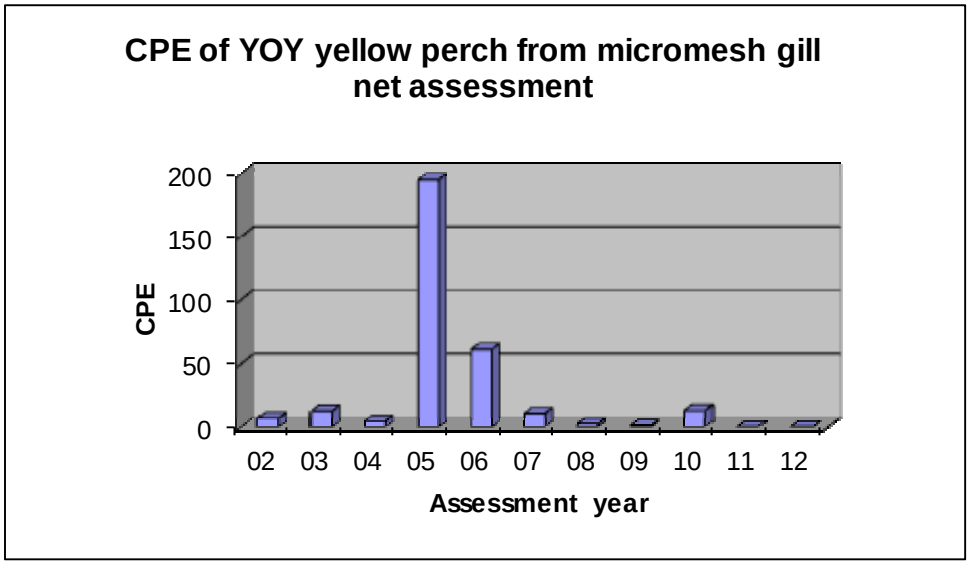


Figure 2. Catch per effort of young-of-the-year yellow perch captured in the micromesh gill net, WDNR, 2012.

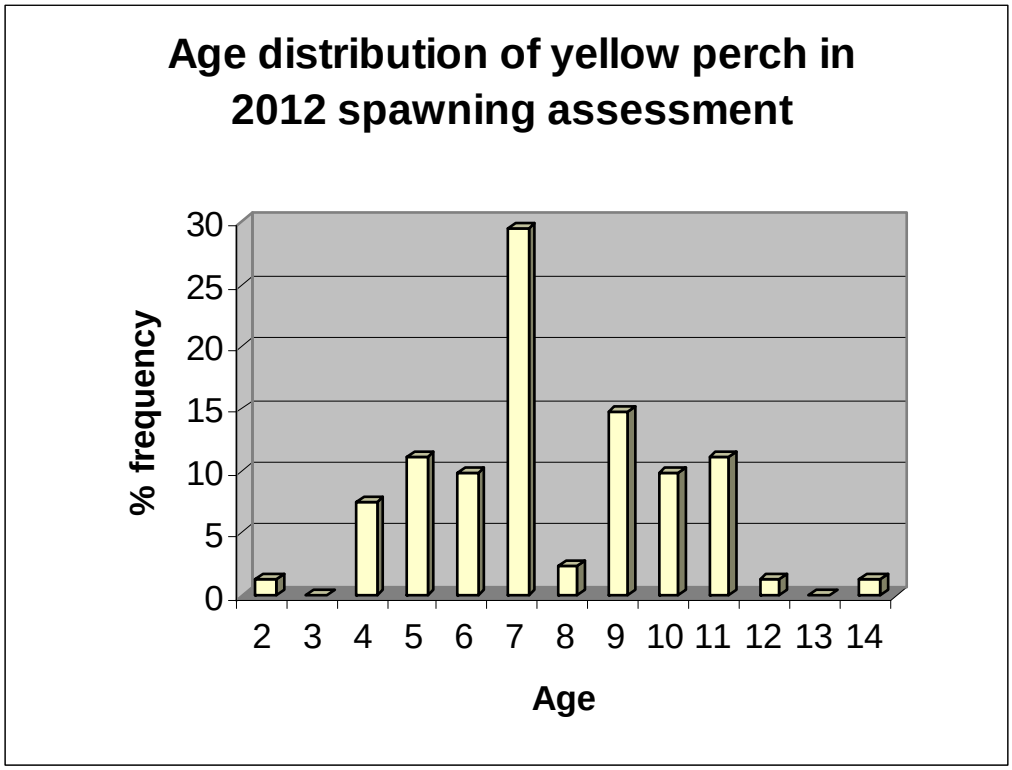


Figure 3. Age distribution of spawning population.

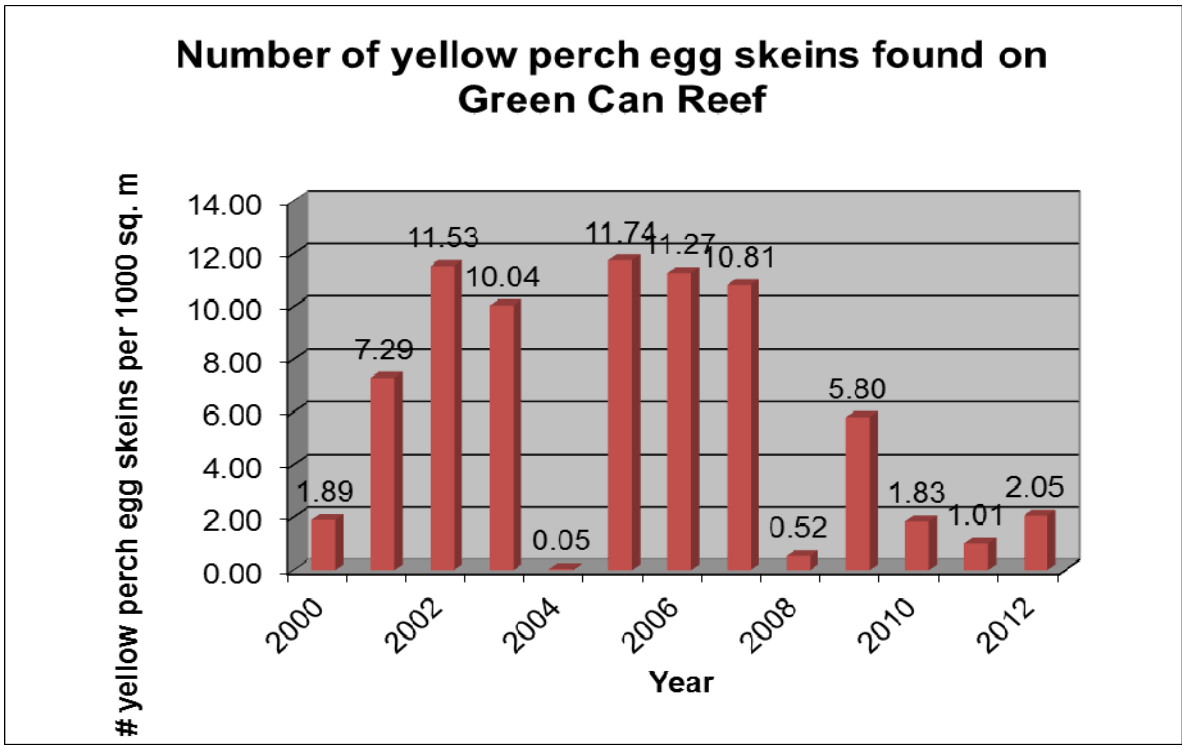


Figure 4. Yellow perch egg deposition survey in Lake Michigan near Green Can Reef, WDNR.

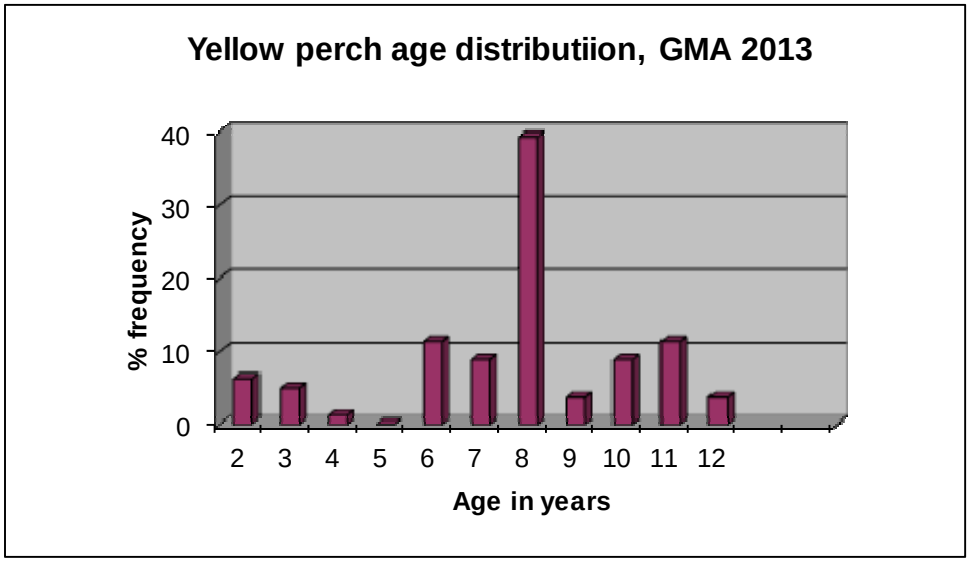


Figure 5. Age distribution of yellow perch in the winter graded mesh gillnetting assessment (GMA) in Lake Michigan, 2013.

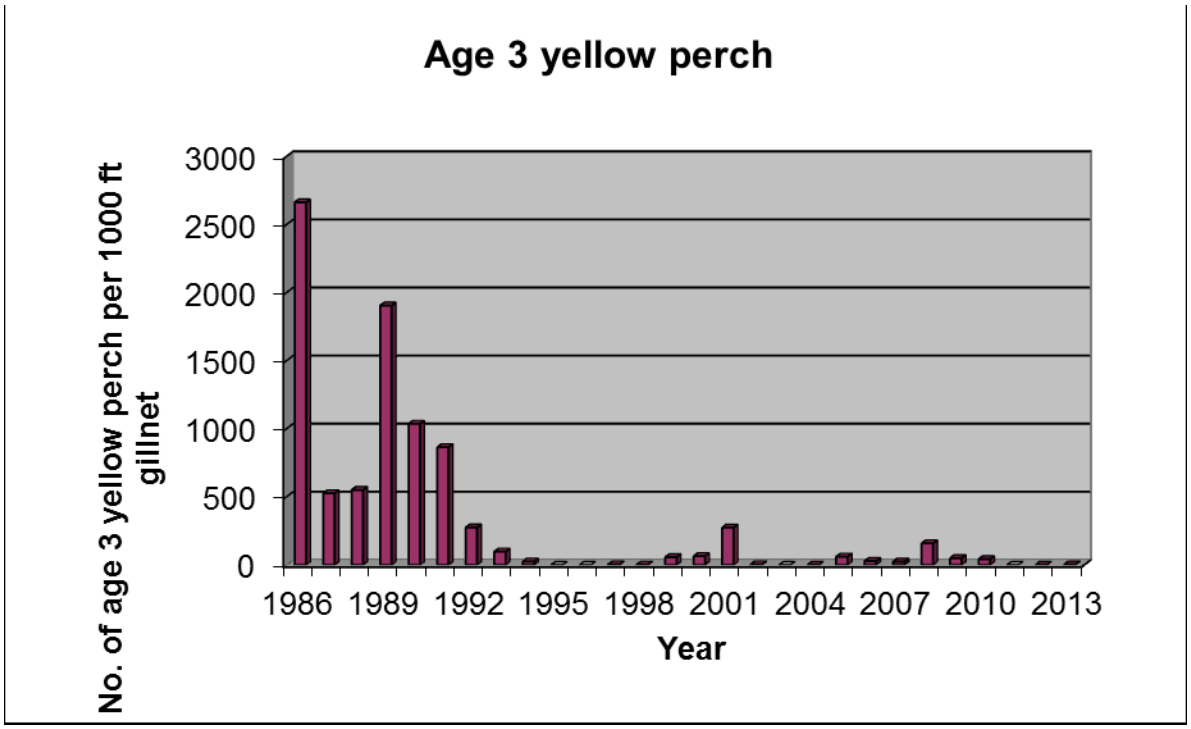


Figure 6. Age 3 yellow perch year-class strength (computed to 1000 ft of gillnet) in the winter graded mesh gillnetting assessment in Lake Michigan.

WALLEYE IN SOUTHERN GREEN BAY

Steve Hogler and Rodney Lange

Background

Walleye stocks in southern Green Bay were decimated during the early to mid 1900s by habitat destruction, pollution, interactions with invasive species, and from over-exploitation. Following water quality improvements in the early 1970's, the Wisconsin Department of Natural Resources began to stock fry and fingerlings to rehabilitate the walleye population (Schneider et al 1991). Stocking began in the Sturgeon Bay area and later expanded to include the lower Fox River (downstream from the DePere Dam). This stocking (fingerlings and fry) was so successful in southern Green Bay and the lower Fox River that it was discontinued in 1984 to allow surveys to determine if substantial natural reproduction and recruitment was occurring. However, stocking in the Sturgeon Bay area resumed in 1994 and continues today with a mix of fry and fingerling being stocked to augment the population. The total number of number of walleye stocked in Wisconsin waters of Green Bay has varied by location and year (Table 1). In total, over 70,000,000 fry and 4,500,000 fingerling have been stocked into Green Bay and the Fox River since 1973. Kapuscinski et al (2010) provides a detailed description of walleye stocking across the entire bay covering the years of 1973 to 2005 that show the numbers and mix of ages stocked by Wisconsin and Michigan.

Table 1. Walleye stocking in Wisconsin's Green Bay waters since 1972. Walleye totals are in millions of fish stocked and are divided into two time periods: 1972 to 1984 (Rehabilitation phase) and 1994-2012 (Augmentation phase). No walleye were stocked from 1985 to 1993 and walleye stocked during the 1994 to 2012 period were all stocked in the Sturgeon Bay area.

	Fry		Fingerling	
Year	Green Bay	Fox River	Green Bay	Fox River
1973-1984	29.0	44.0	3.06	0.058
1994-2012	1	0.0	1.46	0.0

Although spawning abundance and young of year (YOY) production have been variable since monitoring began, the stock has not been augmented through stocking in southern Green Bay or the Fox River since 1984 and the walleye population is considered to be self-sustaining. The purpose of this report is to summarize data collected during the 2012 field season on the southern Green Bay / lower Fox River walleye stock, and to describe long-term trends in YOY production and angler catch and harvest.

Fall electrofishing index surveys

Recruitment of YOY walleye

Results of our 2012 electrofishing index surveys show that the relative abundance of young of the year (YOY) walleye at the fall fingerling stage was below average for the Fox River (Figure 1) and indicates a poor 2012 year class. The 2012 age 0 catch per unit effort (CPUE) from the Fox River was 3.6 YOY/hour of electrofishing which is well below the 1994-2010 average of 12.9 YOY/hour. The southern Green Bay catch was 0.3 YOY/hour, which is below the 1994-2010 average of 8.1 YOY/hour. The difference between the bay and river catch rates may be attributed either to differences in spawning success or to

differences in water temperatures that were noted between Green Bay and the Fox River at the time each was surveyed. The average length of YOY walleye in 2012 was 238 mm. A warm, early spring likely accounted for the larger average size of YOY noted in 2012 (average 238 mm) to those measured in 2011 (average 214 mm) which was a late and cold spring. Year-class failures have not been observed in more than two consecutive years from the Fox River and Green Bay since the springs of 1999 and 2000 (Figure 1).

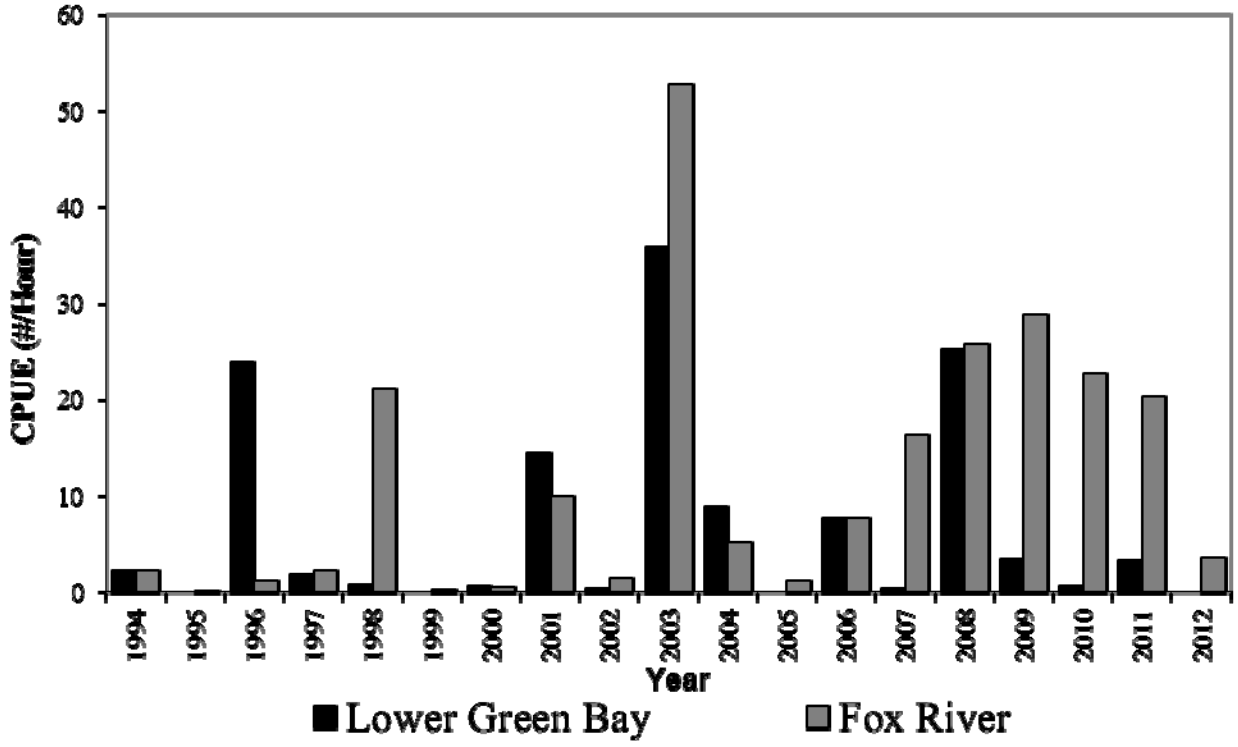


Figure 1. Relative abundance of young-of-year walleye in the lower Fox River (DePere Dam to mouth), lower Green Bay (south of a line drawn from Longtail Point to Point Sable), as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1994-2012.

Walleye stock size and age structure

In 2012, during our nighttime index electroshocking surveys on the lower Fox River, we captured 356 walleye that had average length of 356 mm (range 207 mm to 692 mm). The length-frequency distribution of captured walleye indicates that the stock's size structure has not been negatively affected by year-class failures, low recruitment, slow growth, or excessive mortality (Figure 2). Spines were collected from a stratified subsample (n=216) and ages were estimated by cross sectioning and counting annuli. An age-length key was used to assign ages to un-aged individual fish by proportion of known aged fish at length from the sub-sample (Iserman and Knight 2005). Fish from the 2012 year class (YOY) and from the strong year classes of 2008, 2009 and 2010 dominated our catch. Very few walleye older than age 4 were collected during sampling (Figure 3).

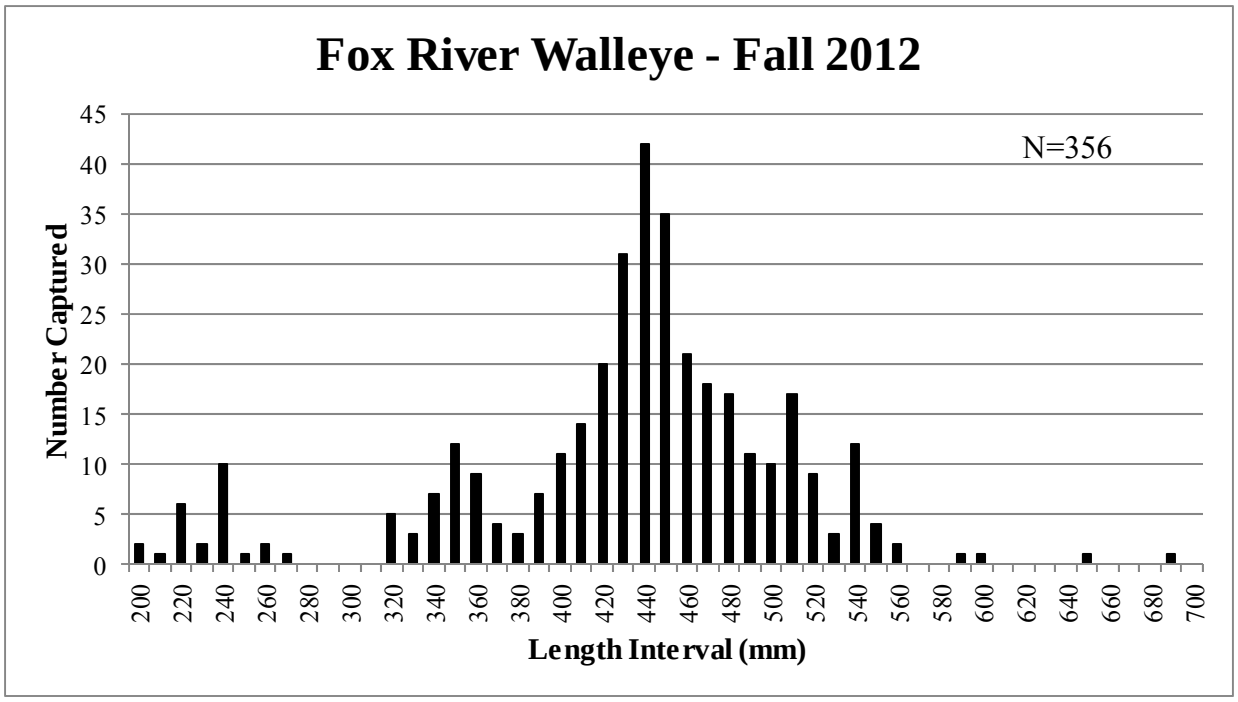


Figure 2. Length-frequency distribution of walleye sampled while electrofishing the lower Fox River during fall 2012.

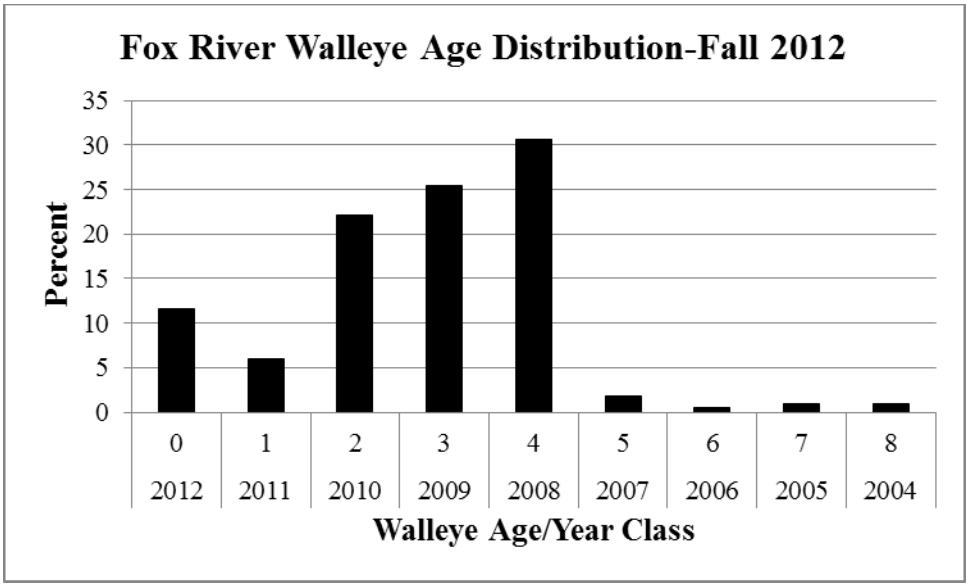


Figure 3. Estimated age-frequency distribution of walleye sampled while electrofishing on the lower Fox River during fall 2012.

On Green Bay, we captured 103 walleye that averaged 459 mm in length (range 215 mm to 670 mm) during index electroshocking (Figure 4). The size distribution of captured walleye from Green Bay was slightly skewed toward larger sizes than the length frequency from the Fox River. Based on the age frequency (Table 3) from the Fox River it is likely our Green Bay catch had a high proportion of age 4 (2008 year class) walleye in it.

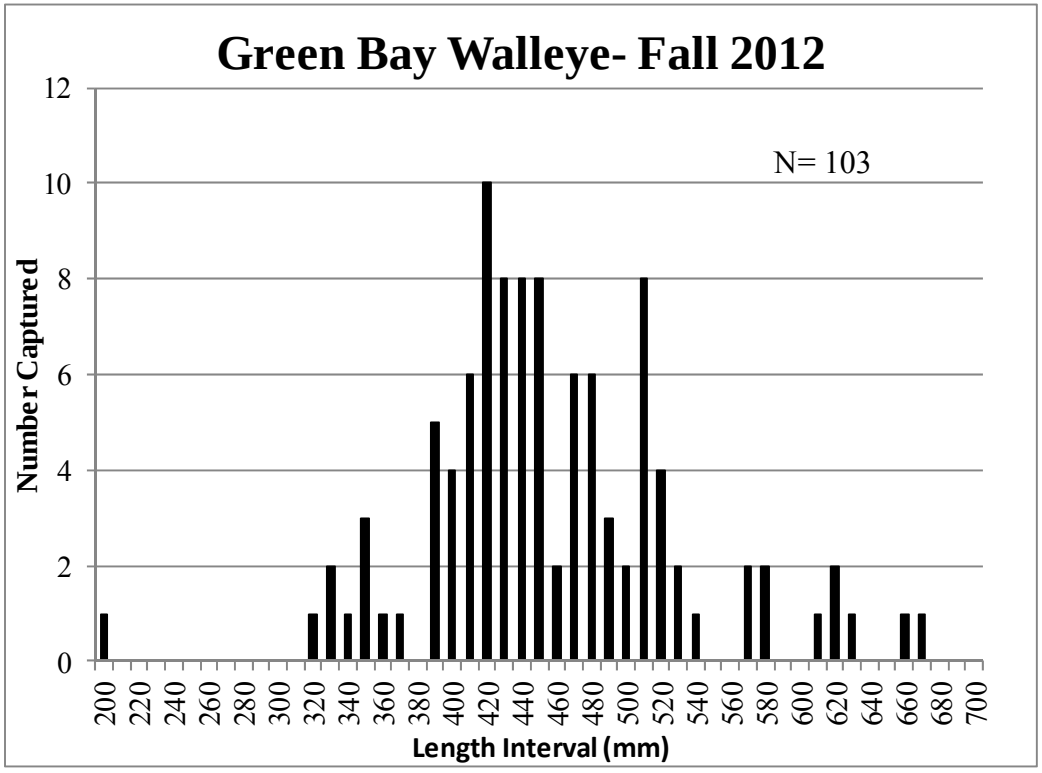


Figure 4. Length-frequency distribution of walleye sampled while electrofishing lower Green Bay during 2012.

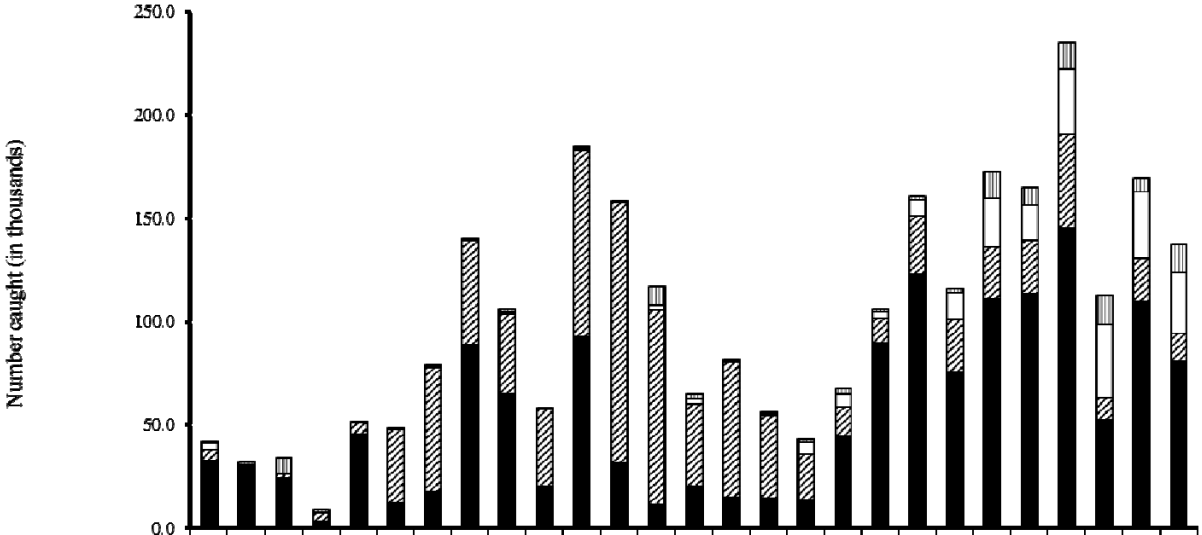
Catch and Harvest

Total catch of walleye from Wisconsin waters of Green Bay was estimated by creel survey at 137,042 during the 2012 open water season (March–October 31). This was a 19.2% decrease from the estimated 169,508 walleye that were caught during the 2011 open water season. Despite the decrease in catch noted, 2012 was still substantially above the average annual catch of 96,878 walleye estimated since 1986. The 2012 walleye catch increased in Door County while decreases were noted in the other counties surrounding Green Bay.

The total open water season harvest of walleye from Wisconsin waters of Green Bay increased by 6.6% from 67,981 harvested in 2011 to 72,481 in 2012 (Figure 6). The 2012 harvest of walleye was the

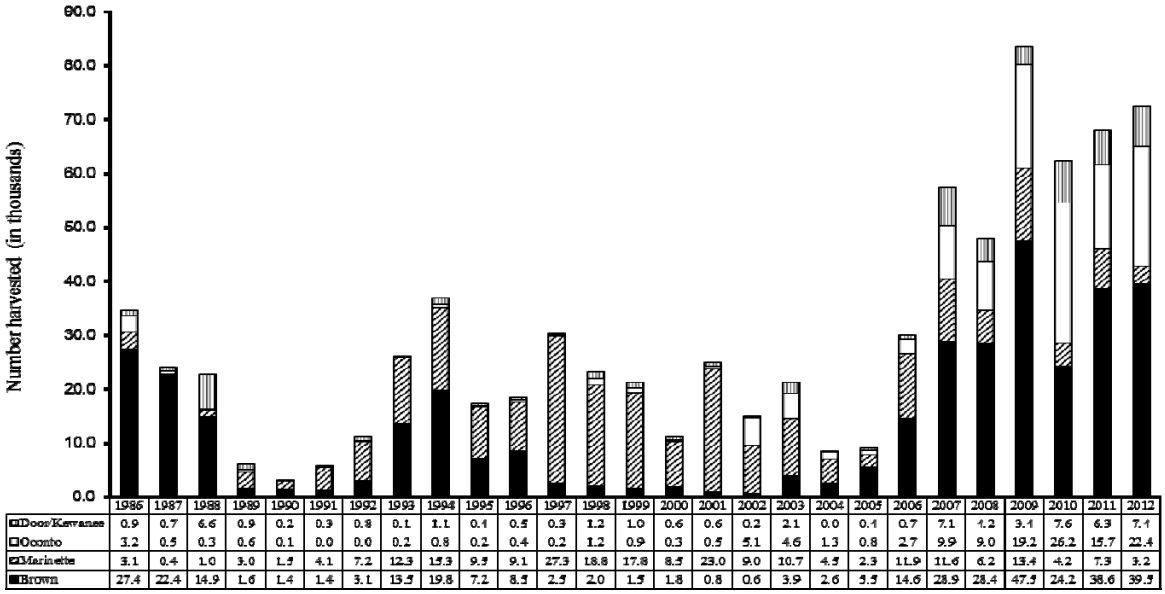
seconded highest measured since 1986 and was well above the average annual harvest from 1986 to 2011 of 29,340 walleye. In 2012, harvest increased in Brown, Oconto and Kewaunee-Door Counties and decreased Marinette County when compared 2011 harvest estimates.

Walleye catch and harvest has been relatively high for the last five seasons, with the greatest contribution to the fishery from the lower Fox River, lower Green Bay and Oconto County. Increases in catch are likely due to strong year classes in 2008, 2009 and 2010. Although catch decreased in 2012 from the estimated 2011 catch, harvest increased during the time period. This was likely due to fewer sublegal length fish being caught from a less abundant 2010 year class and more legal size fish from the 2008 and 2009 year classes being caught and harvested.



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Door/Kewanee	0.9	0.9	7.5	0.9	0.7	0.7	0.8	0.2	1.2	0.6	1.0	0.5	8.8	2.2	0.8	1.2	1.5	2.6	1.1	1.7	2.2	12.5	8.3	12.8	14.0	6.9	13.6
Oconto	3.3	0.5	0.3	0.6	0.1	0.0	0.3	0.5	0.9	0.4	0.9	0.4	2.5	2.7	0.7	0.8	3.9	6.1	3.1	7.9	12.5	24.1	16.9	31.6	35.8	32.3	28.9
Marinette	4.9	0.7	1.9	4.0	5.3	35.6	60.3	50.6	38.3	36.8	89.9	125.	93.9	39.2	65.3	39.9	21.9	14.3	11.8	28.1	25.8	24.9	25.8	45.1	10.5	20.7	13.9
Brown	33.1	29.8	24.4	3.5	45.7	12.2	17.5	88.8	65.3	20.6	92.9	31.7	11.5	20.8	15.1	14.6	13.9	44.6	89.7	122.	75.4	110.	113.	145.	52.4	109.	80.7

Figure 5. Estimated total open water season (March-October) walleye catch from Wisconsin waters of Green Bay and the lower Fox River by county during 1986-2012.



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Door/Kewaunee	0.9	0.7	6.6	0.9	0.2	0.3	0.8	0.1	1.1	0.1	0.5	0.3	1.2	1.0	0.6	0.6	0.2	2.1	0.0	0.1	0.7	7.1	4.2	3.1	7.6	6.3	7.1
Oconto	3.2	0.5	0.3	0.6	0.1	0.0	0.0	0.2	0.8	0.2	0.4	0.2	1.2	0.9	0.3	0.5	5.1	4.6	1.3	0.8	2.7	9.9	9.0	19.2	26.2	15.7	22.4
Marinette	3.1	0.4	1.0	3.0	1.9	4.1	7.2	12.3	15.3	9.9	9.1	27.3	18.8	17.8	8.5	23.0	9.0	10.7	4.5	2.3	11.9	11.6	6.2	13.4	4.2	7.3	3.2
Brown	27.4	22.4	14.9	1.6	1.4	1.4	3.1	13.5	19.8	7.2	8.5	2.5	2.0	1.5	1.8	0.8	0.6	3.9	2.6	5.5	14.6	28.9	28.4	47.5	24.2	38.6	39.5

Figure 6. Estimated total open water season (March-October) walleye harvest from Wisconsin waters of Green Bay and the lower Fox River by county during 1995-2011.

The Future of the Sport Fishery

The future of the southern Green Bay/lower Fox River walleye stock and sport fishery appears to be very promising. Substantial walleye year classes have been measured the past five of six falls during electroshocking. Furthermore, year-class failures have not been observed in more than two consecutive years since 1999-2000 indicating a substantial walleye population. As the 2008 and 2009 year classes fully recruit to the fishery in the next couple of years yearly harvest is likely to increase because these fish will obtain a size desired by anglers. Additionally as contaminant levels continue to decrease from river clean-up, walleye harvest will likely continue to increase.

References

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Kapuscinski, K., T.G. Zorn, P.J. Schneeberger, R.P. O'Neal, B.T. Eggold. 2010. The Status of Lake Michigan Walleye Stocks. *In* Status of walleye in the Great Lakes: proceedings of the 2006 Symposium. Great Lakes Fish. Comm. Tech. Rep. 69. pp 15-69.

Schneider, J. C., and five coauthors. 1991. Walleye rehabilitation in Lake Michigan, 1969-1989, p. 23-61. *In* P.J. Colby, C. A. Lewis, and R. L. Eshenroder [ed.]. Status of walleye in the Great Lakes: case studies prepared for the 1989 workshop. Great Lakes Fisheries Commission Special Publication 91-1.

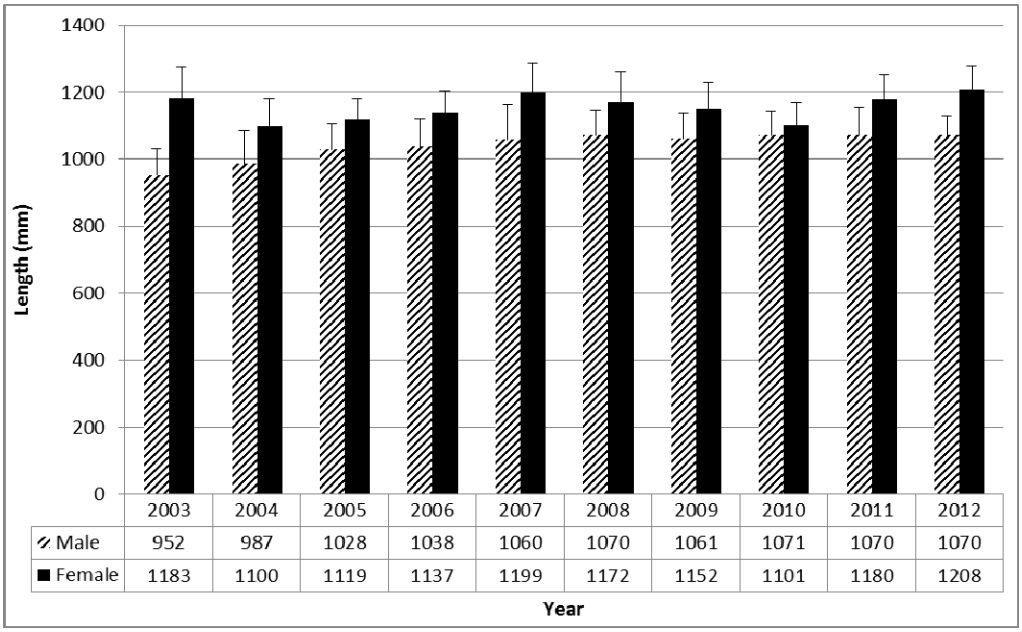
GREAT LAKES MUSKELLUNGE

Steve Hogler, and Rodney Lange

The Wisconsin Department of Natural Resources (WDNR) in cooperation with several local musky clubs and the Musky Clubs Alliance of Wisconsin initiated a Great Lakes strain muskellunge reintroduction program in 1989 in the Green Bay waters of Lake Michigan. Muskellunge in southern Green Bay were decimated during the early to mid 1900s by habitat destruction, pollution, and over-exploitation (Kapuscinski 2007). A three-phase plan was drafted by WDNR biologists to re-establish a self-sustaining population of muskellunge in Green Bay: (1) identify an appropriate egg source, obtain eggs, and successfully hatch, rear and stock fish, (2) establish an inland lake broodstock population, and (3) develop a self sustaining population in Green Bay.

Annual Assessments

Nearly annual assessments to determine the status of the Green Bay muskellunge population have been conducted using fyke nets in spring and electrofishing in fall since 2003. In 2012, the average male length was 1070 mm (42.1") (Figure 1). The average size of male musky captured during the spring sampling period has varied little from this length since 2007. The size of an average female captured during 2012 spring fyke netting was 1208 mm (47.6"). This was the largest average length for female fish captured in the time series, however the average size of female musky has been stable since 2003. Male fish appear to recruit to the population sooner, but female fish grow faster and attain larger ultimate size (Figure 2).



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Male	952	987	1028	1038	1060	1070	1061	1071	1070	1070
Female	1183	1100	1119	1137	1199	1172	1152	1101	1180	1208

Figure 1. Average length distributions of male and female muskellunge captured during spring netting surveys of the lower Fox River from 2003-2012.

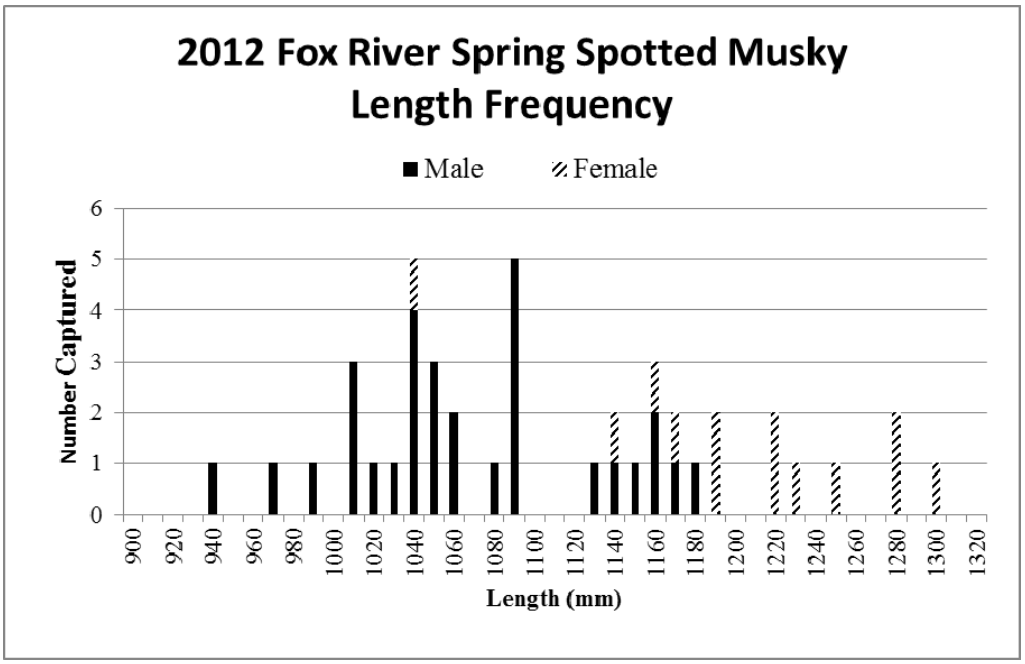


Figure 2. Length frequency distribution of Great Lakes Spotted muskellunge, by sex, captured during spring 2012 fyke netting of the Lower Fox River.

Nighttime electrofishing surveys have been conducted along the length of the Fox River from the mouth to the DePere dam during October since 2000 to index muskellunge and walleye populations. In 2012 because of warm water conditions, only two musky greater than 445 mm were captured. These fish were 575 mm (22.6") and 978 mm (38.5") in length. Musky CPUE from fall index sampling steadily increased between 2000 and 2008 indicating increasing number of adult musky in the river, but since has been more variable (Figure 3). Likely the sharp decline in fall CPUE noted in 2011 and 2012 is due to warmer river temperatures encountered during our surveys the past two years.

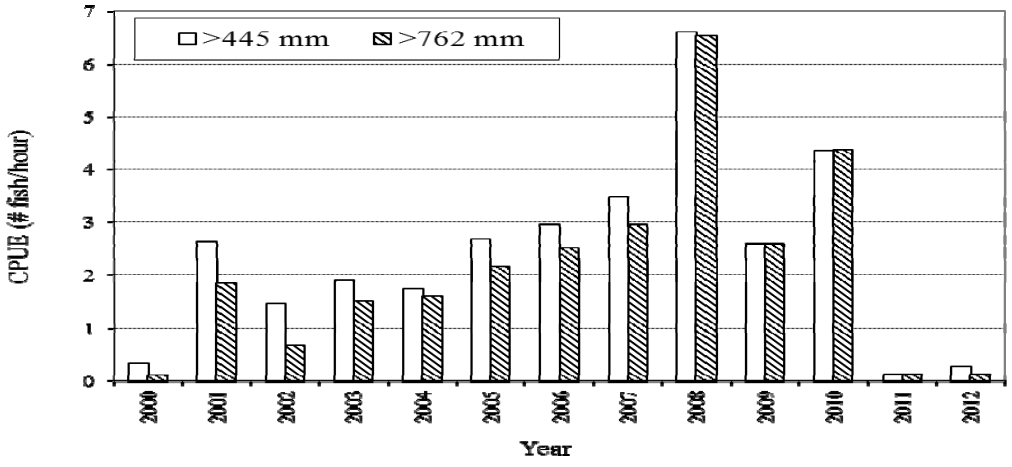


Figure 3. Catch per Unit Effort (CPUE) from night time electrofishing on the Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2012.

Propagation and Stocking

During the first six years of the program (1989-94), hatchery production averaged 2,200 fingerling and yearling musky per year. These fish resulted from spawn collected from the Indian Spread Chain in the State of Michigan. From 1995 to 2001, hatchery production averaged 2,875 musky each year and was primarily from spawn collection from Long Lake, with the exception of 1997 when spawn was collected from Lake St. Clair, Michigan. From 2002 to 2006, spawn was collected from the Fox River and Long Lake and the annual hatchery production increased to average 20,324 muskellunge. Stocking has increased as hatchery production increased (Table 1). In 2005, the lower Fox River became the sole location for spawn collection for the reintroduction program. When Viral Hemorrhagic Septicemia (VHS) virus was discovered in Lake Michigan in 2007, DNR policy regarding the collection of spawn from VHS positive waters prevented the collection of eggs from Green Bay and the Fox River in 2008 and 2009. Collection of spawn was again permitted in 2010 with eggs collected from the Fox River and raised at the Besadny Anadromous Fisheries Facility (BAFF). In 2012 eggs were collected from the Fox River and raised at BAFF which resulted in 5,100 fingerling stocked into Green Bay and Fox River at several locations (Figure 4).

Table. 1. Numbers of Great Lakes spotted musky stocked from 1989 through 2012, by age class.

	fingerlings	yearlings		fingerlings	yearlings
1989	5,261	0	2001	1,854	176
1990	1,274	9	2002	9,281	140
1991	2,624	0	2003	33,107	103
1992	2,107	152	2004	20,772	161
1993	1,394	215	2005	18,609	325
1994	0	237	2006	18,785	421
1995	1,803	0	2007	0	640
1996	3,135	247	2008	0	0
1997	1,842	130	2009	0	0
1998	4,311	278	2010	2,791	0
1999	3,305	294	2011	5,242	0
2000	2,451	295	2012	5,100	0

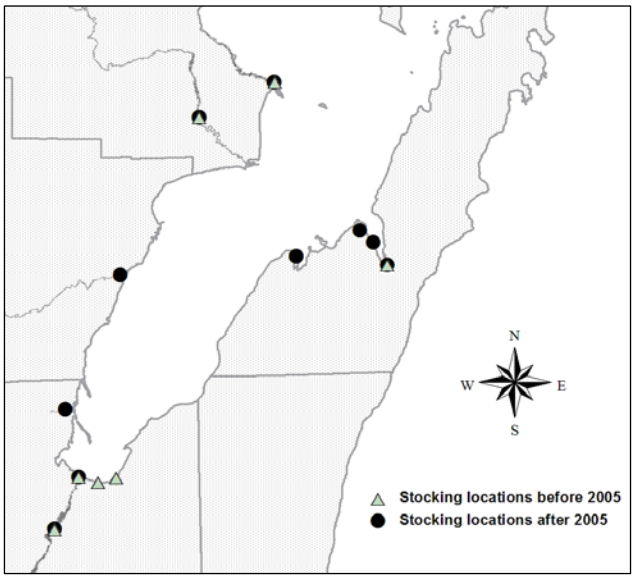


Figure 4. Stocking locations of Great Lakes spotted muskellunge in Green Bay and tributaries before and after 2005.

Fishery

The Lake Michigan creel survey estimated that a total of 22,595 hours of directed effort for muskellunge occurred on Green Bay and the lower Fox River from March 15th through October 31st, 2012 (Figure 5). Although the 2012 total effort estimate was the lowest since 2006, it is likely that this value underestimates total effort since a substantial amount of angling goes on in November after the creel survey ends. The creel estimated that CPUE declined to 0.012 fish per hour in 2012 after increasing in 2011 (Figure 5). In 2012 the creel survey estimated that anglers caught 271 musky and the harvest was estimated at zero. The 2012 estimated catch was the lowest estimated since 2005 (Figure 5).

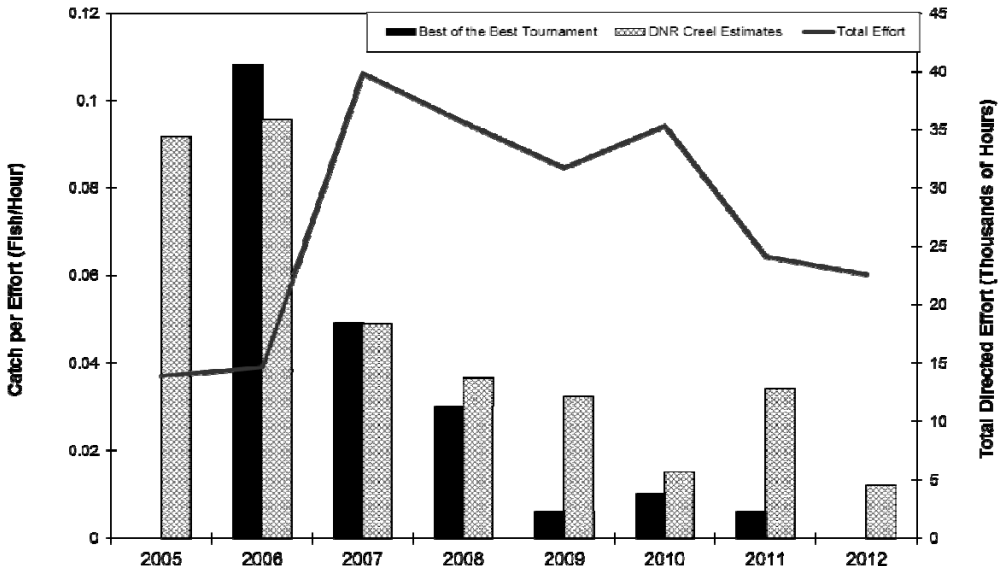


Figure 5. Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2012 is displayed by the solid black line and on the right axis. The left axis shows catch rate in number of muskellunge caught per hour of directed fishing, the estimated catch rate from creel surveys is displayed by hatched bars, and the catch rate from the Muskies Inc. "Best of the Best Tournament" is shown by the black bars.

Figure 5 also shows the catch rates from a Muskies Inc. tournament that has been held annually on the lower part of the Bay and the Fox River since 2006. This tournament is conducted over 2 days but during the most active period of muskellunge angling. The similarity in values of the tournament census data and the creel estimates from 2006 through 2008 indicates that that creel survey estimates were doing a good job at estimating CPUE despite the lack of coverage during November. However, recently this relationship has not been as strong as creel estimates of CPUE have been higher than tournament CPUE. In 2012 anglers fishing in this tournament did not report any musky being captured. It is likely that a combination of factors including poor fishing conditions during the Best of the Bay Tournament, changes in musky movement patterns caused by warmer water temperatures and declines in the number of available musky are responsible for much of the decline in CPUE noted the past several years.

Future

The population trend of adult Great Lakes strain muskellunge in Green Bay waters is unknown. Currently stocking maintains the population with few natural recruits captured during surveys. Increasing stocking numbers the past three years should increase the number of musky in Green Bay in upcoming years. The

population appears to be spreading out from the Fox River and lower Green Bay as surveys have found good numbers of musky in the Menominee, Peshtigo Rivers and the Sturgeon Bay area.

Fishing effort has sharply increased since 2005 prompting concern among musky anglers regarding overharvest despite low harvest estimates from the creel survey. This concern has lead to development of a new management plan and a review of the current minimum size limit for Great Lake Muskellunge in the Wisconsin waters of Green Bay.

Reference

Kapuscinski, K. L., B.J. Belonger, S. Fajfer, and T.J. Lychwick. 2007. Population Dynamics of muskellunge in Wisconsin waters of Green Bay, Lake Michigan, 1989-2005. Environmental Biology of Fishes 79:27-36.

GREEN BAY BROWN TROUT MANAGEMENT

Tammie Paoli

This report summarizes assessments and management actions for brown trout in Green Bay waters of Lake Michigan completed in 2012.

Background

The Wisconsin Department of Natural Resources has stocked various salmonid species into Green Bay since the 1960's. The initial intent of that stocking effort was to control introduced prey species like alewives and rainbow smelt while providing a quality near shore and offshore fishery for Green Bay anglers. Brown trout provided a consistent early season nearshore and summer trolling fishery, along with other stocked salmonines. Creel survey results indicate that harvest and return rates for Green Bay brown trout were exceptional throughout the late 1980's and 1990's. Since 2000, brown trout fishing has experienced a sharp decline. Stocking numbers for Green Bay have varied somewhat over the last 23 years but, in general, remain fairly consistent until 2010 when fingerling stocking was greatly reduced. Beginning in 2011, fingerling stocking was eliminated, and only yearling brown trout are currently stocked into Green Bay (Figure 1).

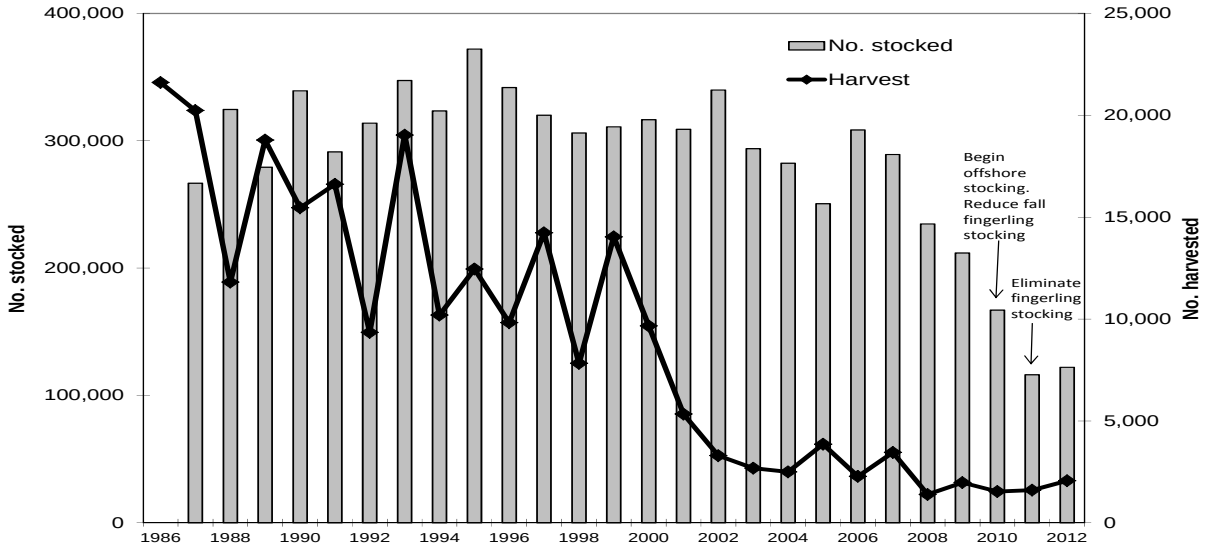


Figure 1. Number of stocked and harvested brown trout in Wisconsin waters of Green Bay by year. Fingerling stocking reduced in 2010 and eliminated in 2011. Only yearling brown trout are currently stocked into Green Bay waters.

Return to creel of brown trout in Green Bay has fallen from an average of 4% prior to 2000 to around 1% from 2001 to 2010. Based on results from the Lake Michigan creel survey, the harvest in 2008 reached an all-time low in Green Bay and was estimated at 1,384 fish.

A comprehensive review of brown trout data and related fisheries information was completed in 2009. The problem was discussed at several meetings of the Lake Michigan Fisheries Team throughout 2009 and forwarded to the Fisheries Management Board. In January 2010, the FM Board adopted a plan to offshore stock fish to avoid nearshore predators and to discontinue stocking fall fingerlings into Green Bay. That plan seeks an integrated approach to adjust stocking strategies with the following management objective:

Two indices measured by creel surveys for Green Bay waters (% return and total harvest of brown trout) will trend towards the targets within five years of implementation of the plan. Results should indicate consistent returns from stocking levels. Fishing pressure will be considered in the analyses to determine if changes in harvest or return rate are associated with changes in effort. Lastly, catch per unit effort of fall electrofishing surveys in the lower Menominee River will continue to serve as a fishery-independent index of brown trout abundance in Green Bay.

The target indices are:

a) Total harvest greater than or equal to 4% of number stocked BNT. This return rate is comparable to return rates for Green Bay prior to 2000; OR

b) Total harvest of 5,000 or more fish based on 126,000 yearlings stocked annually into Green Bay, AND

c) Brown trout harvest rate less than or equal to 23 hours per fish based on targeted total salmonid fishing effort.

Management Actions

Sharp reductions in fall fingerling stocking and implementation of offshore stocking began in 2010 using the U.S. Fish and Wildlife Service vessel RV Spencer Baird, and complete implementation (discontinue fall fingerlings; maintain offshore stocking) began in 2011 using a WDNR pontoon cage. The newly acquired WDNR vessel RV Coregonus was first used in 2012 to haul fish offshore (Table 1).

Creel Results and Discussion

The harvest estimate for Green Bay brown trout in 2012 was 2,060 fish. This is a slight improvement from 2011 estimates (1,603 fish), but still not yet reaching the target of 5,000 fish harvested. Despite low total harvest, harvest rates were much improved in 2011 (25 hours/fish) and in 2012 (20 hours/fish) compared to the 2000-2010 average of 33 hours per fish. Harvest rates are derived from fishing effort, so even though total harvest remained fairly low, fishing effort was also low, which drives harvest rates up. The fishing effort for salmonids in Green Bay was at an all-time low in 2011 at 40,225 angler hours, and only slightly higher in 2012 at 42,119 angler hours. The previous 25-year average (1986-2010) is 168,013 angler hours per year.

Table 1. Green Bay brown trout stocking information for 2012.

Date	*Location*	*Strain/Size*	*Number*	*Clip*	*Vessel Used*
31-Jan-2012	Under ice Grid 804	Seeforellen yearling	14,273	ARV	--
2-Feb-2012	Under ice Grid 804	Seeforellen yearling	13,984	ARV	--
6-Apr-2012	Offshore Grid 804	Seeforellen yearling	20,284		RV Coregonus
11-Apr-2012	Offshore Grid 703	Wild Rose yearling	21,492		RV Coregonus
12-Apr-2012	Offshore Grid 703	Wild Rose yearling	24,513		RV Coregonus
17-Apr-2012	Offshore Grid 703	Seeforellen yearling	27,525		RV Coregonus
		Total yearlings	**122,071**		

Brown Trout Derby

The Marinette-Menominee Great Lakes Sportfishing Club has sponsored a summer Brown Trout Derby for over 30 years. Data sets from this derby indicate that upwards of a thousand brown trout were typically harvested during the 2-day event. However, from 2001 to 2011, the number of brown trout registered in the derby were much lower than the previous two decades. In 2012, the number of brown

trout registered increased to 211 fish (Table 2).

Table 2. Number and mean weights of fish harvested during the two-day MMGLSF Brown Trout Derby.

	BROWN TROUT		*CHINOOK*		*RAINBOW TROUT*		*WALLEYE*	
	#	**Avg lb.**	**#**	**Avg lb.**	**#**	**Avg lb.**	**#**	**Avg lb.**
2006	28	5.4	693	10	10	4.1	44	2.3
2007	143	5.9	969	8.5	54	6	22	2.9
2008	102	8.4	730	8.4	47	5.6	30	3.1
2009	26	7.8	444	8.7	18	6.5	21	3.1
2010	89	8	818	9.6	39	4.9	55	3.8
2011	13	8.5	87	9.6	10	5.5	231	2.8
2012*	211	6.9	344	10.4	165	4.5	23	3.8

*Participants allowed to register only one fish per species per day in 2012. Past rules allowed for all legal-size fish to be registered.

Fall Electrofishing Surveys

Electrofishing surveys targeting brown trout on the lower Menominee River were completed on October 8, 23, 29, and November 5, 2012, with a combined CPE of 5.3 fish/hour (Figure 2). Twenty-six brown trout were captured, with a mean length of 22.1 inches. All fish were captured on October 23 or 29, and zero were captured on October 8 and November 5. Unusually low water levels in the river and difficulty in accessing riffle areas likely contributed to the low numbers of brown trout. Beginning in 2010, no brown trout have been stocked by WDNR into the Menominee River. Michigan DNR annually stocks approximately 28,000 brown trout yearlings into the Menominee River.

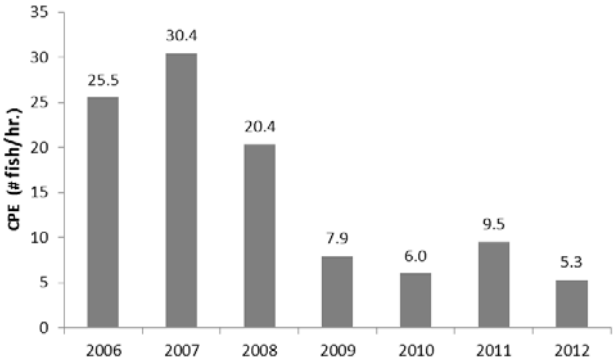


Figure 2. CPE (# fish/hour) of brown trout captured during fall electrofishing surveys on the lower Menominee River, 2006-2012.

Floy-tagging Studies and Voluntary Fishing Logs

Since 2009, WDNR and the Marinette-Menominee Great Lakes Sportfishing Club have cooperatively floy-tagged yearling brown trout that are stocked into the Menominee Marina for the club-sponsored annual Kid's Fishing Day. The goal of this tagging project is to gain information on harvest return and movement of fish. Excluding the fish that were harvested for the Kid's Fishing Day, the percent return from fish stocked in 2009 is 4.4% (Table 3). The majority of tag returns came from the Menominee/Marinette area or Stoney Point. However, there were three fish captured near the Peshtigo River mouth, Oconto River mouth, and Egg Harbor/Door County, suggesting that these fish dispersed 8 miles or more from the release location. In 2010, smaller brown trout were stocked. There have been no tag returns on those fish to date. In 2011, the private hatchery did not have large brown trout available, so the club purchased large rainbow trout instead. Tag returns include: One rainbow (25 inches) caught in 2012 near Two Rivers, Manitowoc County, WI, and a second rainbow near Pentwater, Michigan (24

inches). The other five rainbow trout were caught in 2011 or 2012 in Green Bay. Six of the tagged brown trout stocked in 2012 have been harvested by anglers, and an additional four fish were captured in surveys. This is encouraging since those fish have only been swimming at large for 8 months at the time of writing.

Table 3. Trout floy-tagged at Menominee Marina for Kid's Fishing Day by MMGLSF Club, 2009-2012.

Year	Species	# tagged	mean size (inches)	% return*
2009	Brown trout	392	11.1	4.4%
2010	Brown trout	772	8.6	0
2011	Brown trout	22	8.0	0
2011	Rainbow trout	415	10.1	1.7%
2012	Brown trout	1118	10.1	1.4%

*As of July 2013. Fish caught during Kid's Derby were excluded from % return calculations.

WDNR distributed voluntary fishing logbooks to anglers who frequently target brown trout on Green Bay. Data obtained from those logbooks is summarized in Table 4. The number of brown trout caught increased substantially in 2012, to 396 fish.

Table 4. Information from voluntary fishing logbooks, 2010-2012.

	2010	2011	2012
# logbooks turned in	12	5	16
# brown trout caught	32	48	396
Average of Catch per Effort (hours per fish)	6.7	4.1	4.5
Average of length (in.)	24.4	21.7	22.8

Summary

Although 2012 total harvest of Green Bay brown trout was low (2,060 fish) and not yet close to the target of 4% return, directed salmonid fishing effort was also low. It is encouraging that 2011 and 2012 harvest rates are near or below the target of 23 hours/fish. It is also promising that harvest of brown trout obtained from 2012 volunteer fishing logs showed a significant improvement from 2010 and 2011. WDNR will continue to closely monitor total harvest and harvest rates of brown trout in Green Bay to determine if those indices are responding to the new stocking strategy that began in 2010.

LAKE STURGEON

Michael Donofrio, Brad Eggold, and Mike Baumgartner

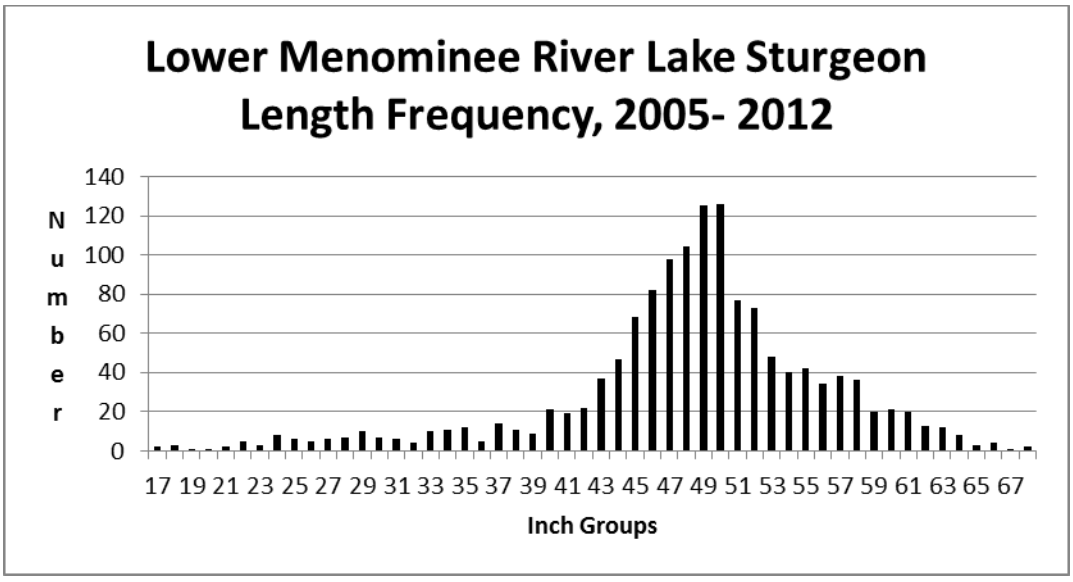
Introduction

Lake sturgeon populations were decimated by the early 1900s through over fishing by commercial fishermen, altered stream flows, interruption of migration routes with dams and water quality degradation in Wisconsin's Lake Michigan's major rivers (Milwaukee, Manitowoc, Kewaunee, Menominee, Peshtigo, Oconto, and Fox). Passage of the Clean Water Act with associated permits for industry and implementation of new Federal Energy Regulatory Commission licenses have improved conditions for fisheries in general. Lake Sturgeon populations have also benefited in the last 20 years and natural reproduction currently occurs on the Menominee, Peshtigo, Oconto, and Fox Rivers. These populations are self sustaining without benefit of stocking. The results of tagging studies and genetic analysis indicate a distinction between the Fox and Oconto River sturgeon and another population on the northern tributaries of Green Bay (Menominee and Peshtigo). The Menominee River contains the largest population in Lake Michigan waters with contributions from stocks of Wisconsin's Peshtigo River and Michigan's Cedar and Whitefish rivers. The Menominee River supports a hook and line fishery from 1946 to the present. The exploitation was highest in 2005 at 172, although recent regulation restrictions reduced the total harvest to 8 from 2006-12 fall seasons. Lake sturgeon stocking is occurring on the Milwaukee and Manitowoc/ Kewaunee rivers and recovering is dependent on those stocking efforts and continued habitat improvements.

Menominee River Population Assessment

Field sampling, a one day electrofishing surveys with 2 electrofishing boats, in 2010 produced just 24 lake sturgeon from the lower Menominee River. However, similar results yielded a total of 1,454 lake sturgeon from 2005-2012. From 2005-12, most of the fish (85%) were subjectively labeled as adults (>107 cm in total length), but several sub-adults sturgeon were observed during the surveys. The overall average total length during these sampling events was 123 cm. From 2005-12, the smallest sturgeon recorded was 44 cm and several fish were over 173 cm in length. Based on 1999-2012 tagging data, the population estimate for the 50 inch and larger segment of the population was 697 in 2012.

The agencies continue to participate in genetic analysis research of Lake Michigan's lake sturgeon performed by Michigan State University through Great Lakes Fishery Trust and USFWS grants. That research indicated that Fox and Oconto river populations are closely associated with linkage to the Lake Winnebago population. The Menominee and Peshtigo rivers form one population and ranged north to the Cedar and Whitefish rivers in Michigan's Upper Peninsula. That theory is supported by movement studies from Menominee River recaptured lake sturgeon. Sturgeon recaptured from 2005-12 in the Menominee River originated in the Peshtigo- Oconto River (4%), Fox- Wolf River (7%), Manistee- Kalamazoo (3%) and Menominee (86%).



We proceeded with our movement study through ultrasonic transmitters implanted in lake sturgeon at the Menominee, Peshtigo and Oconto rivers. From 2005-2012, we inserted have sonic tags in 124 adults (Menominee (40%), Peshtigo (27%), and Oconto (33%)). Their movements are monitored continuously through 2 stationery receivers in each of those 3 rivers. Since we have recaptures from the Cedar and Fox rivers, we installed additional receivers in those rivers. The sex distribution was 44% female and 56% male. The average length of the females was 60.1 inches and males were 54.9 inches. The movements between rivers will be monitored through 2022.

Milwaukee River SRF

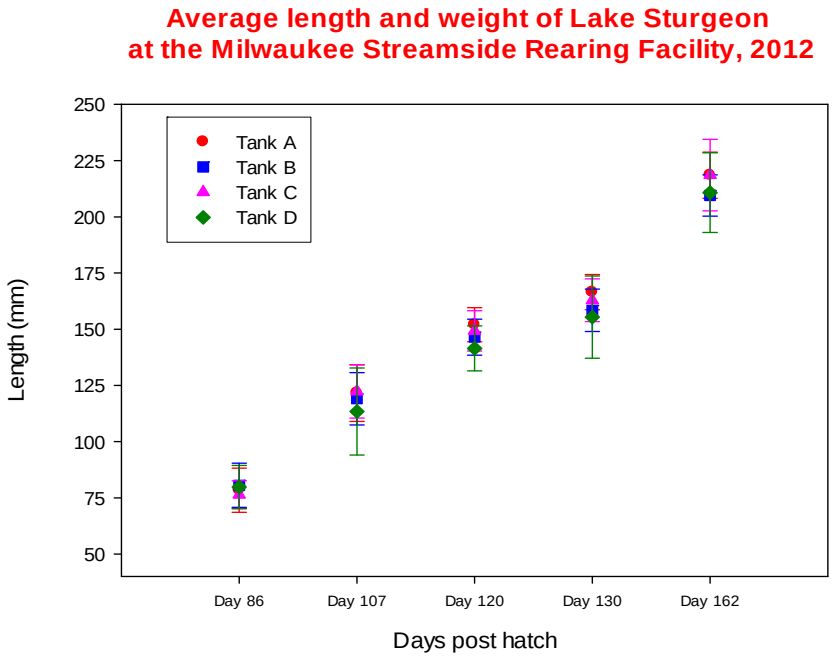
The Milwaukee SRF was deployed in 2012 on April 5, 2012 and put into service on April 9, 2012. Wisconsin DNR personnel artificially spawned 7 females from the Wolf River and transferred those fertilized eggs to the trailer on April 9, 2012. Approximately 20,000 eggs from seven females were transferred to the trailers. Eggs from each female were placed into a separate hatching jar.

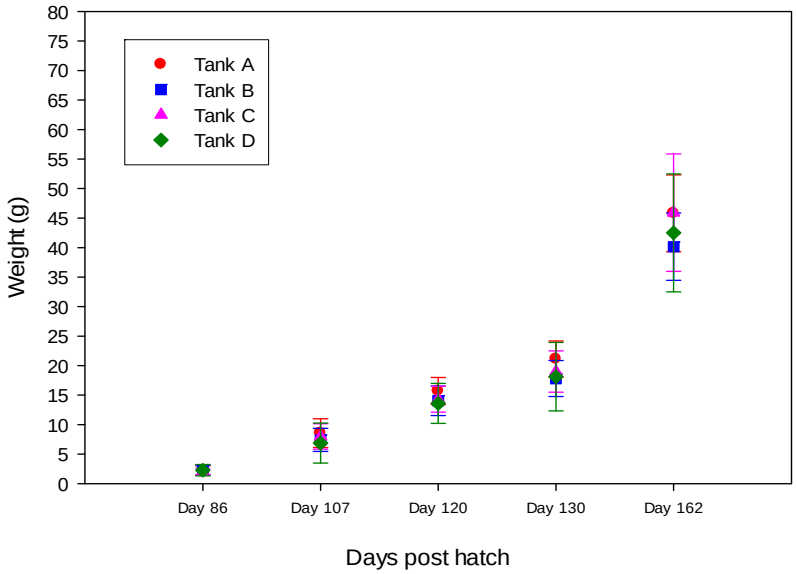
By April 18, lake sturgeon larvae began to hatch and could be seen in the incubation jars. Over the course of the next four days hatching continued until all larvae were in the smaller fry tanks. During the month of May and into June, sturgeon were fed brine shrimp followed by grated blood worms and finally whole blood worms. Eggs from one female did not hatch so surplus larvae from another female was used to create four tanks of sturgeon

It was estimated that following hatching, there were approximately 1,000 – 5,000 larvae per fry tank. Numbers of larvae were lowered to 1,200 fish in all 4 tanks. The number of lake sturgeon in each tank was set at 1,200 because of issues encountered with high densities in the tanks which caused excessive mortalities. However, once again we did see some high mortalities of fish in the tanks that started around May 25 and subsided by June 10.

From August 1 until the fish were stocked on October 6 only a few more fish died. Testing for VHSv in conjunction with our normal fish health screening process prior to stocking reduced the numbers by 50 which left 1,609 lake sturgeon left for stocking on October 6, 2012.

Total length and weight has been measured biweekly for the fish in the Milwaukee River SRF and are summarized below. Lake Sturgeon in the four tanks (A – D) exhibited similar growth patterns for the entire time they were raised in the facility. Starting from our first measurement at day 86 and continuing until the fish were stocked, both the weigh and length of the sturgeon in all the tanks were very similar. In addition, since the sturgeon eggs were obtained April 9, about two weeks earlier than normal, the average size and weight was significantly higher than previous years. Fish stocked in October averaged a remarkable 218 mm in length and 47 grams in weight.





Kewaunee River SRF

Sturgeon eggs were collected from the Wolf river at Shawano on April 9th, 25 days earlier than in 2011. Facilities were prepared to collect and incubate eggs from 8 females but eggs were collected from a total of only 7 females. Established genetic protocols to maximize genetic diversity continue to be followed. The separate families of eggs were incubated in eight jars (Female 6 (F6) had too many eggs to fit in 1 jar so they were split into 2 jars). Scaled down versions of a McDonald jar replaced the cone-shaped incubators used in the past and were sued with good success. Table 2 shows the number of eggs and fry for each of the adult females used for egg collection. During incubation the eggs were treated 2 times with Formalin before they started to hatch on day 9 with hatching completed on day 14 (April 23).

Table 1. 2012 lake sturgeon egg and fry numbers for each female/family. Note - Number of fry tossed for F5, F6, F7 are estimates

Female	Number of eggs	Number of Fry kept	Number of Fry tossed	Total Number of fry	Approx % Hatch
F1	10,577	958	0	958	9.1
F2	4,977	1,077	0	1,077	21.6
F3	11,383	1,001	0	1,001	8.8
F4	6,895	1,000	1,274	2,274	33.0
F5	10,567	1,025	1,800	2,825	26.7
F6	34,819	2,038	5,000	7,038	20.2
F7	15,643	1,000	3,000	4,000	25.6
Totals	94,861	8,099	11,074	19,173	20.2

Fry began to feed in earnest on brine shrimp about 23 days after hatching. Water conditions were almost ideal except for a couple brief periods of turbid water conditions. Fry were counted individually, by hand, into the rearing tanks at 22 Days Post Hatch (DPH) with tank numbers set to about 2,000 per tank (1,000 per female, F6 was 2,000). Fry began to respond favorably to chopped bloodworms at about 40 (DPH). Excellent water conditions for rearing continued due to drier than normal conditions. On June 13 (52 DPH) staff began to reduce fish numbers in each tank by removing the smallest fish by approximately 100/ tank every other day. Approximately 2 weeks later (6/28, 67 DPH), with maximum water temperatures reaching the upper 70's, well water was mixed with the incoming river water to reduce water temps in the tanks. Initially well water was added at each tank diffuser, but was later (8/2) added to the head tank thru a packed column where it was also mixed with incoming river water with an agitator. The addition of well water typically reduced max water temps in the tanks by 6°-9°F.

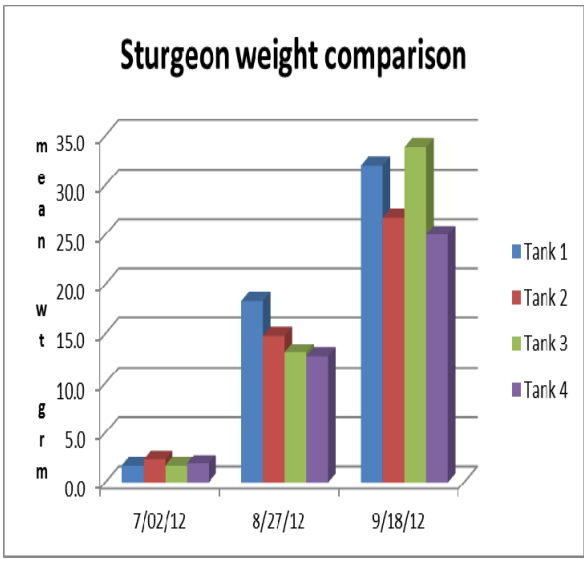
Warm water temps allowed the fish to grow at a good rate but also was the cause of chronic columnaris (diagnosed on 7/7) that caused low level mortalities over the course of the rearing cycle. The columnaris was treated with hydrogen peroxide, 1% salt treatments, cooler tank water temps via well water additions and continued reducing numbers in the tanks. The change to adding well water to the head tank thru a packed column served 4 purposes, 1) the need for higher O^2 levels for the fish being affected by the columnaris, 2) remove equipment (hoses etc) from inside the, already cramped for space, trailer, 3)

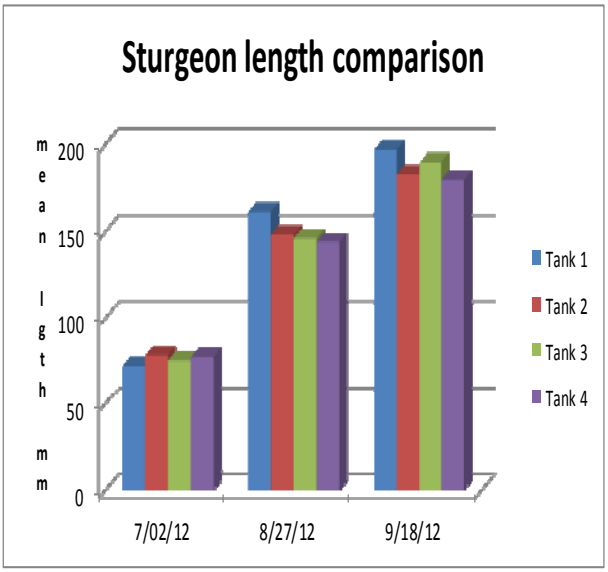
mixing water with agitator in head tank eliminated cold and warm spots in the tanks, 4) packed column stripped excess Nitrogen from the well water.

On 8/1, as part of the need to reduce fish densities in each tank, 406 of the smallest fish (66.5/lb, 4.6") from tanks 1, 2, & 4 were stocked into the river. Surplus tank 3 fish were discarded (8/6) due to continuing active columnaris infection. Fish continued to grow very well and at 73 DPH (7/5) the largest fish were able to consume krill. A total of 76 fish (31/lb, 6.0") were stocked to reduce tank numbers to about 255 (final #'s are 250/tank) in each tank. All stocked fish were given at least a left ventral clip with the final 250 per tank getting a LV clip and PIT tag. On September 24th all the fish from tanks 3 & 4 (smallest avg size), 464 fish (15.5/lb, 7.3"), were stocked into the river just below the dam at BAFF. This was the site to be used for the adopt-a-sturgeon program at the upcoming open house. On October 6th, 183 fish, of the 500 from tanks 1 & 2 (15.4/lb, 7.5") were adopted and stocked at the BAFF dam site. The remaining 317 fish not used as part of the adopt-a-sturgeon program were stocked later that day in the Kewaunee river at the County Road E boat landing. A total of 1,446 (quota=up to 1,500) small and large fingerling lake sturgeon were stocked into the Kewaunee River in 2012.

After the trailer was shut down a new backup generator, transfer switch, and compatible VFD for the pump were installed as part of another grant to continue sturgeon rearing and population rehab in Lake Michigan. Other updates done to the trailer were to increase the size of the UV system, and install some rigid PVC in place of flexible hose. The trailer and associated components were cleaned, drained and winterized in late October.

The figures below compare growth of Kewaunee River sturgeon fingerlings in each tank on July 2, August 27, and September 18





COMMERCIAL CHUB FISHERY AND CHUB STOCKS

Timothy Kroeff, David Schindelholz, and Pradeep Hirethota

The total bloater chub harvest from commercial gill nets was 15,216 pounds for calendar year 2012, a decrease of 62% from 2011 (Tables 1 and 2). Commercial smelt trawlers harvested 4,140 pounds of unmarketable chubs incidental to the targeted smelt harvest. No marketable chubs were reported for the year from the trawlers. This compares to 39,540 pounds of unmarketable chubs harvested in 2011.

Table 1. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gill net chub fishery 1979-2012. The actual quota is broken down into three separate periods and runs from July 1 of the previous year to June 30 of the current.

YEAR	HARVEST	QUOTA	FISHERS	EFFORT (x1,000 FT)	CPE
1979	992,143	900,000		12,677.2	78.3
1980	1,014,259	900,000		21,811.6	46.5
1981	1,268,888	1,100,000		18,095.6	70.1
1982	1,538,657	1,300,000		16,032.6	96.0
1983	1,730,281	1,850,000		19,490.0	88.8
1984	1,697,787	2,400,000		30,868.7	55.0
1985	1,625,018	2,550,000		32,791.1	49.6
1986	1,610,834	2,700,000		34,606.1	46.5
1987	1,411,742	3,000,000	59	32,373.9	43.6
1988	1,381,693	3,000,000	60	58,439.0	23.6
1989	1,368,945	3,000,000	64	48,218.1	27.6
1990	1,709,109	3,000,000	54	41,397.4	41.3
1991	1,946,793	3,000,000	58	45,288.3	43.0
1992	1,636,113	3,000,000	53	40,483.7	40.4
1993	1,520,923	3,000,000	58	42,669.8	35.6
1994	1,698,757	3,000,000	65	35,085.5	48.4
1995	1,810,953	3,000,000	59	28,844.9	62.8
1996	1,642,722	3,000,000	56	27,616.6	59.5
1997	2,094,397	3,000,000	53	28,441.8	73.6
1998	1,665,286	3,000,000	49	23,921.1	69.6
1999	1,192,590	3,000,000	46	25,253.2	47.2
2000	878,066	3,000,000	41	22,394.7	39.2
2001	1,041,066	3,000,000	44	26,922.8	38.7
2002	1,270,456	3,000,000	47	24,940.5	50.9
2003	1,069,148	3,000,000	43	22,613.0	47.3
2004	1,057,905	3,000,000	43	21,468.9	49.3
2005	1,213,345	3,000,000	43	24,119.8	50.3
2006	807,031	3,000,000	40	19,110.4	42.2
2007	410,025	3,000,000	43	13,837.4	29.6
2008	227,026	3,000,000	39	9,823.2	23.1
2009	165,158	3,000,000	37	7,960.8	20.7
2010	90,879	3,000,000	38	5,645.6	16.1
2011	34,262	3,000,000	35	2,169.6	15.8
2012	8,583	3,000,000	32	784.0	11.0

Table 2. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2012.

YEAR	HARVEST	QUOTA	FISHERS	EFFORT (x1,000 FT)	CPE
1981	241,277	200,000		4,920.4	49.0[a]
1982	251,832	200,000		3,469.8	72.5
1983	342,627	300,000		6,924.7	49.5
1984	192,149	350,000		6,148.4	31.2
1985	183,587	350,000		3,210.0	57.2
1986	360,118	400,000		7,037.2	51.2[b]
1987	400,663	400,000	23	6,968.6	57.5
1988	412,493	400,000	23	8,382.3	49.2
1989	329,058	400,000	25	8,280.8	39.7
1990	440,818	400,000	23	8,226.4	53.6
1991	526,312	400,000	22	9,453.5	55.7
1992	594,544	500,000	24	11,453.1	51.9
1993	533,709	500,000	24	15,973.6	33.4
1994	342,137	500,000	24	8,176.2	41.8
1995	350,435	600,000	24	5,326.4	65.8
1996	332,757	600,000	24	4,589.7	72.5
1997	315,375	600,000	23	4,365.6	72.2
1998	266,119	600,000	23	3,029.0	87.9
1999	134,139	600,000	23	1,669.7	80.3
2000	77,811	600,000	21	2,199.5	35.4
2001	36,637	600,000	21	972.4	37.7
2002	63,846	600,000	21	1,098.6	58.1
2003	102,692	600,000	21	2,326.5	44.1
2004	50,029	600,000	21	1,354.0	36.9
2005	50,831	600,000	21	1,376.8	36.9
2006	36,285	600,000	19	1,011.1	35.9
2007	6,590	600,000	18	216.0	30.5
2008	23,942	600,000	18	845.0	28.3
2009	17,091	600,000	18	831.4	20.6
2010	5,551	600,000	18	474.2	11.7
2011	5,368	600,000	17	313.0	17.1
2012	6,633	600,000	16	497.0	13.3

[a] For the years 81-85, 90 & 91, 98-12 totals were by calendar year.
[b] For the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.

Harvest in the southern zone, which essentially includes waters from Algoma south to Illinois, was 8,583 pounds. This is a decrease of 75% from 2011, and a drop of almost 95% from 2009. Only about one quarter of 1% of the allowed quota of 3 million pounds was caught in 2012 in this zone. The 2012 chub catch for this zone is easily the lowest on record since chub fishing reopened in 1979. In the northern zone, essentially waters from Baileys Harbor to Michigan, 6,633 pounds were reported caught, slightly more than what was harvested in 2011. Slightly more than 1% of the total northern quota of 600,000

pounds was caught. The southern zone CPE dropped significantly compared to 2011 as it did in the north. The CPE in the south was the lowest on record since chub fishing reopened in 1979 and the CPE in the north was the second lowest since chub fishing reopened in 1981. Total gill net effort in the south decreased by 64% from 2011 to 2012. Although effort in the north increased slightly, the CPE was down from 2011 to 2012 (Tables 1 and 2). In the south, 32 permits were issued with 6 reporting harvesting chubs in 2012, while in the north 3 of 16 permit holders reported harvesting chubs.

Population assessments with graded-mesh gill nets (1,300 ft. per box), were conducted off Algoma and Baileys Harbor in September 2012 and off Sheboygan in January of 2013 (1 box per lift) set along with standard mesh 2-1/2 or 2-3/8 inch gill nets. Two assessment lifts each were made off Algoma and Sheboygan, and one at Baileys Harbor. Net nights totaled 19 for all sights combined. Biological samples were collected out of standard mesh gear at all sights and aging results were combined.

Catches from graded-mesh gill nets were up from 2011 off Algoma/Baileys Harbor (pooled data) as well as Sheboygan. Chubs up to 11 years of age were collected off Algoma/Baileys Harbor (Figure 1) and up to 14 off Sheboygan (Figure 2). There has also been a dramatic shift in sex ratios in recent years. But, that does not seem to be the case in 2012 assessment, where sexes were somewhat evenly distributed.

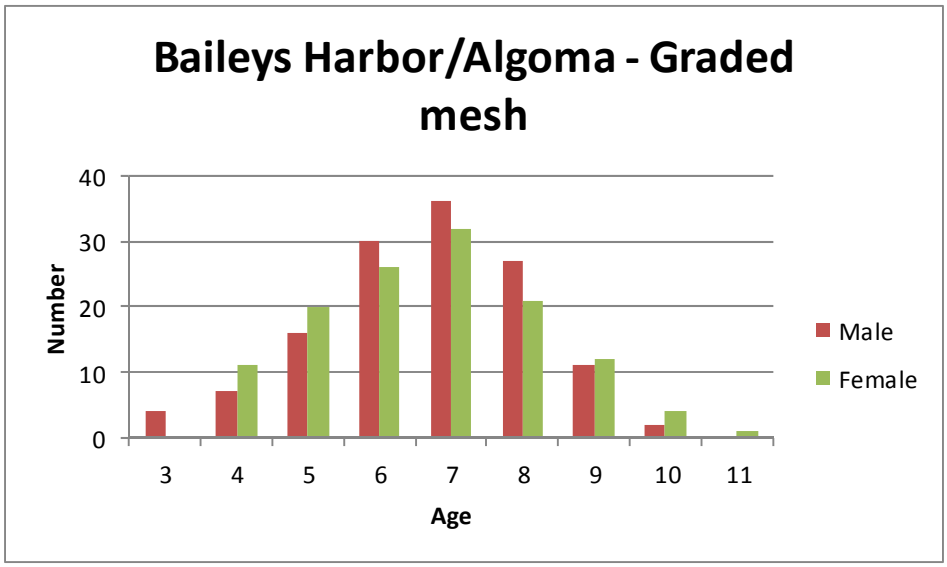


Figure 1. Age composition by sex of chubs captured during graded mesh assessment off Baileys Harbor and Algoma, Wisconsin – 2012.

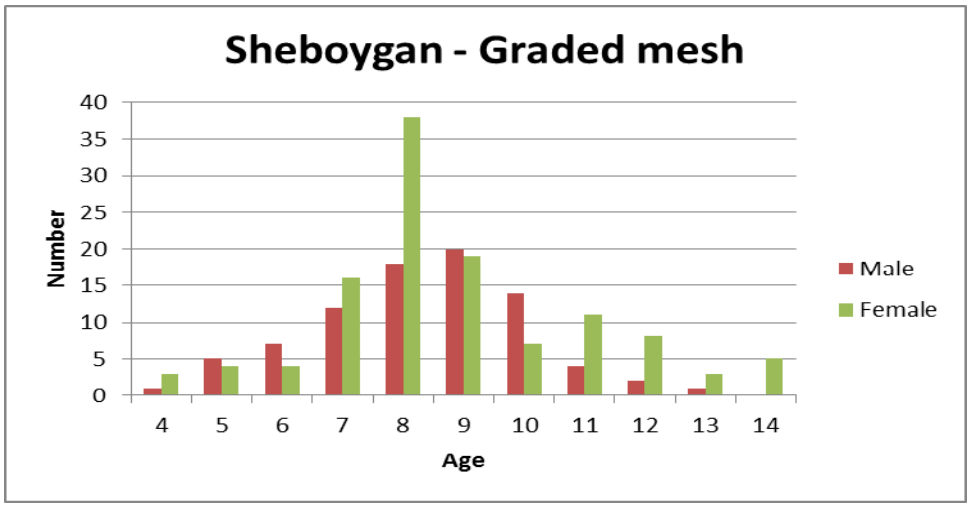


Figure 2. Age composition by sex of chubs captured during graded-mesh assessments off Sheboygan, Wisconsin - 2012.

Catches of chubs in the standard 2.5 inch mesh were poor off Algoma/Baileys Harbor although slightly higher than 2011. Catches were combined for reporting means off all three sites. Ages from standard mesh ranged from 4 to 16 years of age (Figure 3). Sex ratios in this year's standard mesh have shown a change from recent trends of female dominated catches. Although still favoring females, this sex ratio continues to close the gap with this year showing a 67% catch of females. This is in comparison to a 71% catch of females in 2010, and 63% in 2011. Between 2004 and 2009, the proportion of females in the standard mesh catch ranged from 80% to 90%. An advantage of the female dominated population in the commercial fishery is an added profit in the sale of chub roe to the caviar market during the late fall and winter.

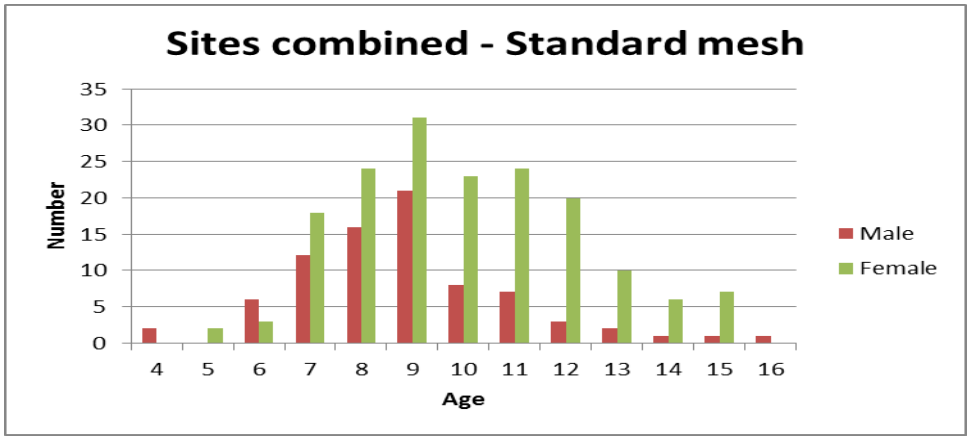


Figure 3. Age composition by sex of chubs caught from standard mesh gill nets off Algoma/Baileys Harbor and Sheboygan combined, Wisconsin - 2012 .

We are grateful to Mark Nelson, a commercial fisherman out of Sheboygan, for the setting and lifting of assessment nets off Sheboygan, essential to the completion of this project.

LAKE WHITEFISH

Scott Hansen

Commercial Harvest

Lake whitefish *Coregonus clupeaformis* continue to be harvested at a relatively high level in Wisconsin's waters of Lake Michigan with the 2012 season's harvest the highest since 2001 The 2012 harvest increased approximately 20,000 pounds to 1,523,861 dressed weight pounds of fish[a] (Figure 1) from 2011 and exceeds the 20 year average of approximately 1.46 million pounds.

The commercial whitefish harvest in Wisconsin was formerly regulated on a "quota year" basis beginning in July and running through June of the following year, with a closed period during spawning in November. Beginning in 2012 the quota season now operates on a "calendar year" with the same closed period. The initial quota established in 1989-90 was 1.15 million pounds. It increased to 2.47 million pounds during the 1998-99 quota year. The quota was increased during the 2009-10 quota year resulting in the current total allowable catch limit of 2.88 million pounds. The Wisconsin quota is allocated to three zones at roughly 9% of the quota for zones 1 and 3, and 82% for zone 2. However, the 2009-2010 quota increase of approximately 410,000 pounds was treated as a "Special Increase" and split equally among the zones (Table 1).

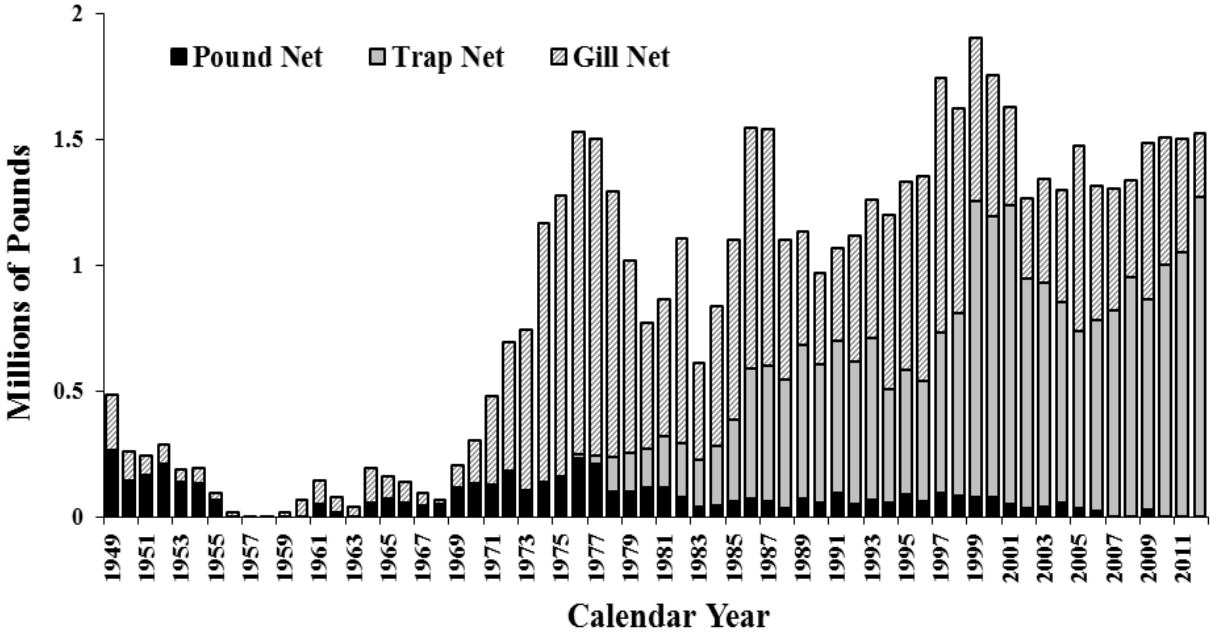


Figure 1. Lake whitefish calendar year commercial harvest reported by gear type in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay from 1949 through 2012.

Wisconsin commercial fishermen have used trap nets as a legal gear to harvest lake whitefish from Lake Michigan since 1976. The trend in use of trap nets has generally increased over the time since their implementation and over the last two decades has on average accounted for well over 50 percent of the whitefish harvest annually. For the calendar year, the total proportion of whitefish harvested by trap nets increased substantially about from 70% in 2011 to nearly 84% in 2012 (Figure 1). Pound nets were not fished in 2012.

Table 1. Lake whitefish harvest in dressed weight in Wisconsin by quota year broken down by zone through the 2010-2011 quota year and 2012 calendar year.

Quota Year [a,b]	Zone 1 Harvest	Zone 2 Harvest	Zone 3 Harvest	Total Harvest
1998-99	143,225	1,474,605	182,486	1,800,316
1999-00	57,659	1,516,187	193,592	1,767,438
2000-01	72,496	1,330,107	210,604	1,613,207
2001-02	39,333	1,301,209	129,084	1,469,626
2002-03	107,827	1,085,599	131,344	1,324,770
2003-04	81,525	1,050,697	111,389	1,243,611
2004-05	129,081	1,248,689	166,319	1,544,089
2005-06	173,563	1,104,843	118,823	1,397,229
2006-07	181,289	901,935	214,909	1,298,133
2007-08	180,835	938,005	215,228	1,334,068
2008-09	182,614	944,580	211,614	1,338,808
2009-10	317,140	922,533	286,066	1,525,739
2010-11	263,389	1,030,042	270.370	1,563,801
2012[c]	205,244	985,408	333,209	1,523,861

[a] Through quota year 2008-2009 the quota was 2.47 million pounds and quotas for zones 1 thru 3 were 225,518, 2,029,662, and 214,820, respectively

[b] Beginning April, 2010 the WI quota was increased to 2.88 million pounds and quotas for zones 1 thru 3 were changed to 362,185, 2,166,629, and 351,487 pounds respectively.

[C] Beginning in January 2012, the WI commercial whitefish fishery began quota administration on a calendar year basis.

While trap net gear continues to be the primary gear type for commercial whitefish harvest, the overall effort has been generally variable since 2003 (Figure 2). Although trap net effort increased considerably during 2010, the last three years have been relatively stable with only a slight decrease of 25 pots lifted between 2011 and 2012. Meanwhile, after a spike in 2005 and subsequent decline over the following two years, the general gillnet effort remained moderately steady for an extended time period. However the last few years have demonstrated a steady decline in gillnet effort dropping by more than 2.5 million feet of net fished between 2009 and 2012, a decline of nearly 30%. The trap net catch per unit of effort (CPE) continued to improve for a second year and increasing considerably between 2011 and 2012 by over 75 pounds per pot lifted (Figure 3). Gillnet CPE has remained relatively steady over the past decade though it decreased by 22.7 pounds per 1000 ft. fished between 2011 and 2012. The 2012 gillnet CPE of 42.3 pounds is the lowest level since 1990.

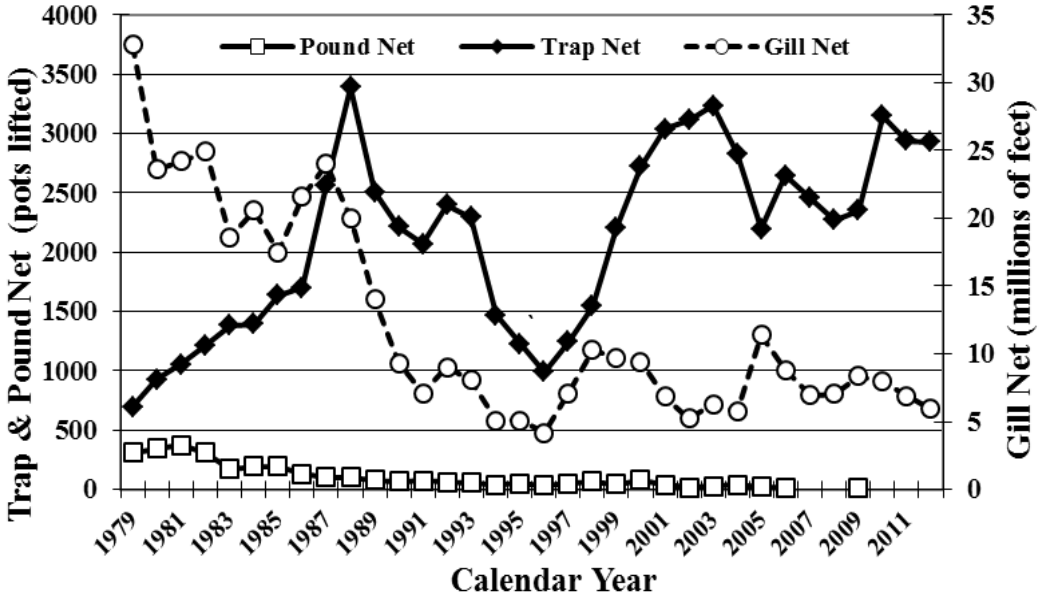


Figure 2. Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2012. Gill net effort is in millions of feet; trap and pound net effort is number of pots lifted.

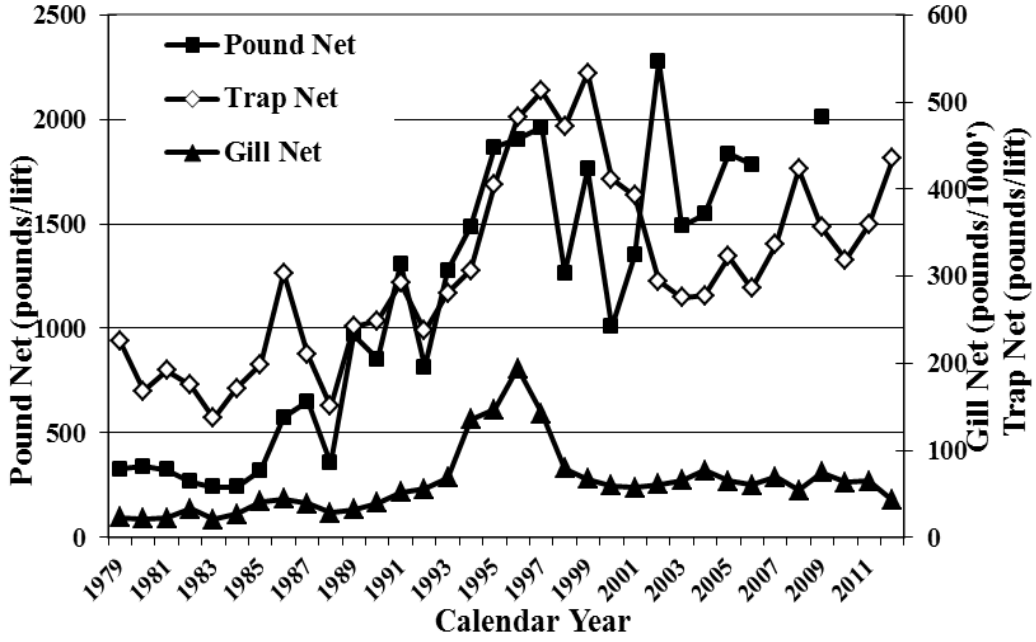


Figure 3. Trends in gill net, trap net, and pound net catch per unit of effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2012. Gill net CPE is pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE is pounds of whitefish harvested per pot lifted.

Growth

Mean lengths and weights-at-age of lake whitefish measured during the spring in Wisconsin waters have demonstrated a general decline since around 1995 (Figures 4 and 5). Although these levels revealed some improvement in 2008 and 2009, once again a considerable decline was measured in 2010. The 2011 and 2012 average lengths have rebounded modestly for some age classes. Although the average length-at-age for 7 year old fish dropped below the commercial harvest limit (432 mm) in 2010, the average length for this age class over the last couple years has hovered closer to the harvest length limit making at least a portion of age-7 fish available to the commercial fishery. Whitefish weight-at-age levels during 2012 continued to struggle near or even below (e.g. age-9) historic lows for most age classes.

Within the past 5 -10 years, obtaining a viable sample size of younger whitefish age classes near the North/Moonlight Bay (NMB) spawning grounds, our historical spring assessment area, has become difficult to impossible. In the spring of 2007 we began sampling for juveniles in Green Bay and the samples from this area now constitute all of the spring assessment data. Studies have shown a certain level of whitefish stock mixing likely occurs in Green Bay depending on the time of year (Andvik 2012). Therefore, the consistency in measuring growth of NMB-stock fish over the time series has likely been compromised as a result of mixing and the influence of stocks with different specific growth rates.

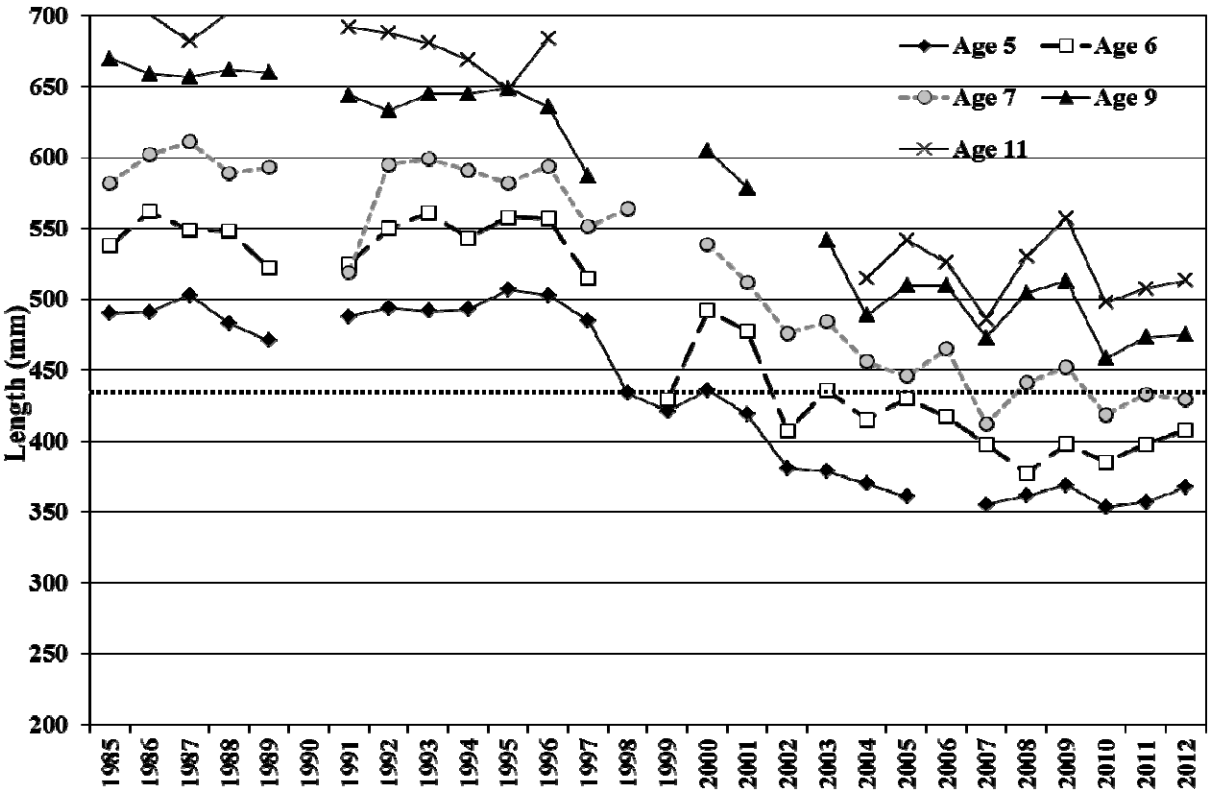


Figure 4. Mean length at age of spring sampled lake whitefish from 1985 thru 2012.

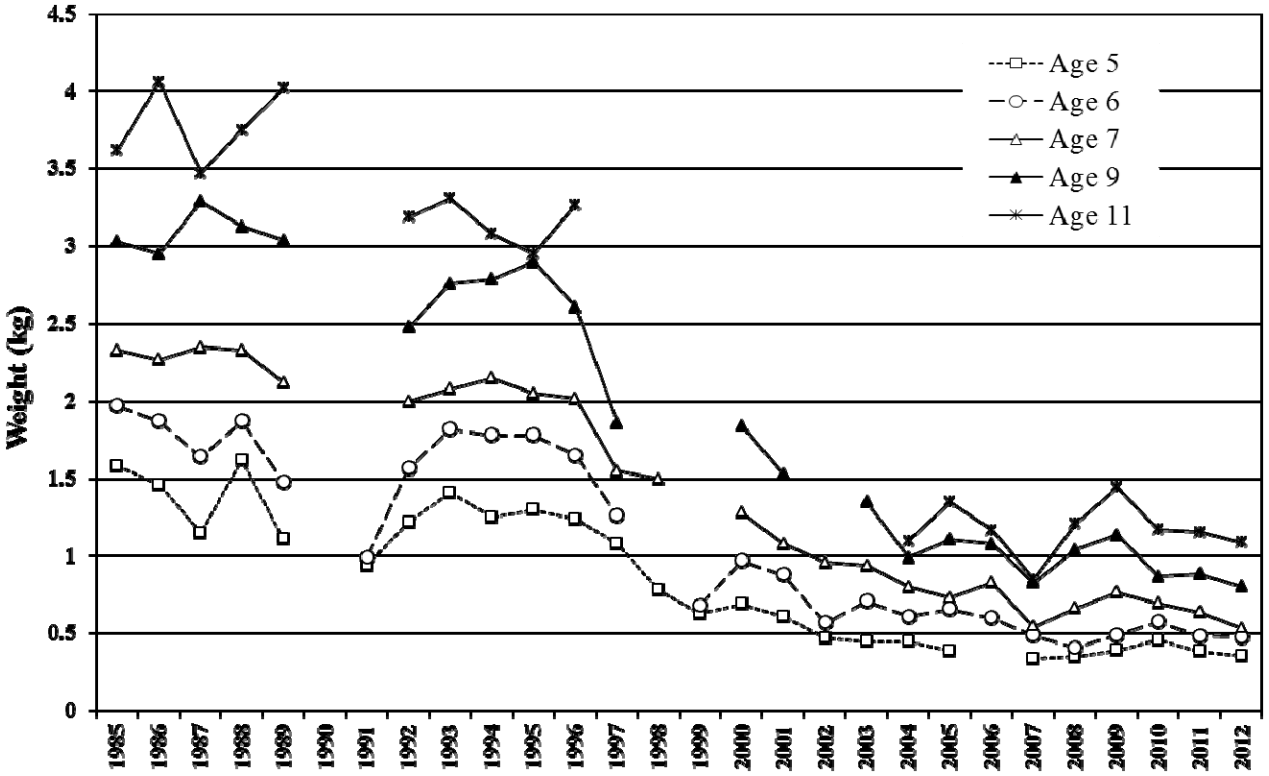


Figure 5. Mean weight at age of spring sampled lake whitefish from 1985 thru 2012.

Sport Angler Harvest

Beginning in the winter of 2006-2007, a sport fishery for lake whitefish developed on the bay of Green Bay at levels unprecedented in recent history. The winter creel season of 2007 recorded the first significant lake whitefish harvest of an estimated 1,559 fish.

Winter creel surveys for Green Bay are conducted during the months of January, February, and March. For the winter of 2012, estimated whitefish harvest was 58,675 fish, a substantial decrease from the 2011 harvest (Figure 6). Angler effort directed toward whitefish decreased considerably as well, down from 174,915 hours in 2011 to 91,090 in 2012, a decrease of around 48%. Harvest rates specific to whitefish in 2012 were 0.531, 0.611, and 0.293 whitefish harvested per hour of fishing for January, February, and March, respectively. For the winter of 2012 the overall average whitefish specific harvest rate was 0.595 fish per hour of fishing, a greater than 30% decrease from the 0.863 fish per hour in 2011 (Figure 7).

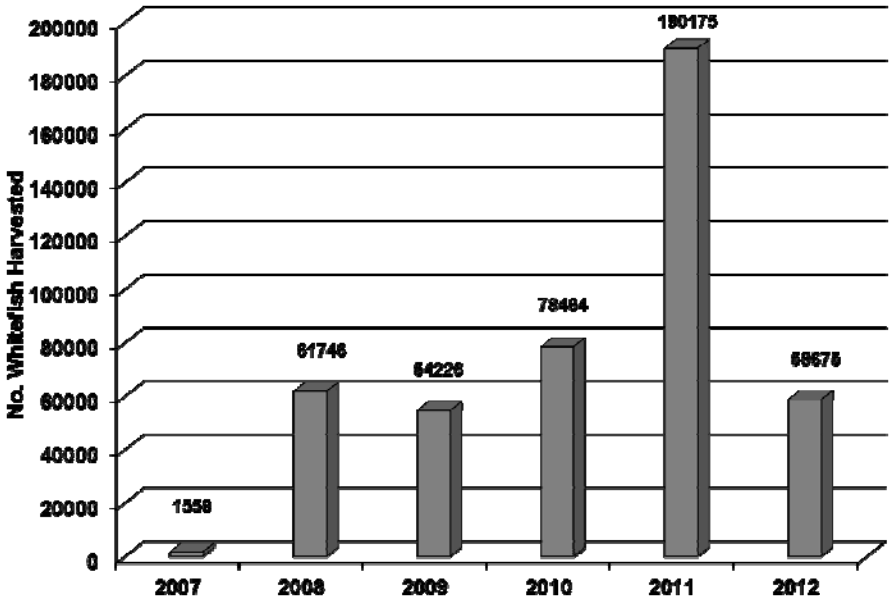


Figure 6. Estimated number of lake whitefish harvested in Wisconsin waters of Green Bay during the winter creel season (January- March) for 2007-2012.

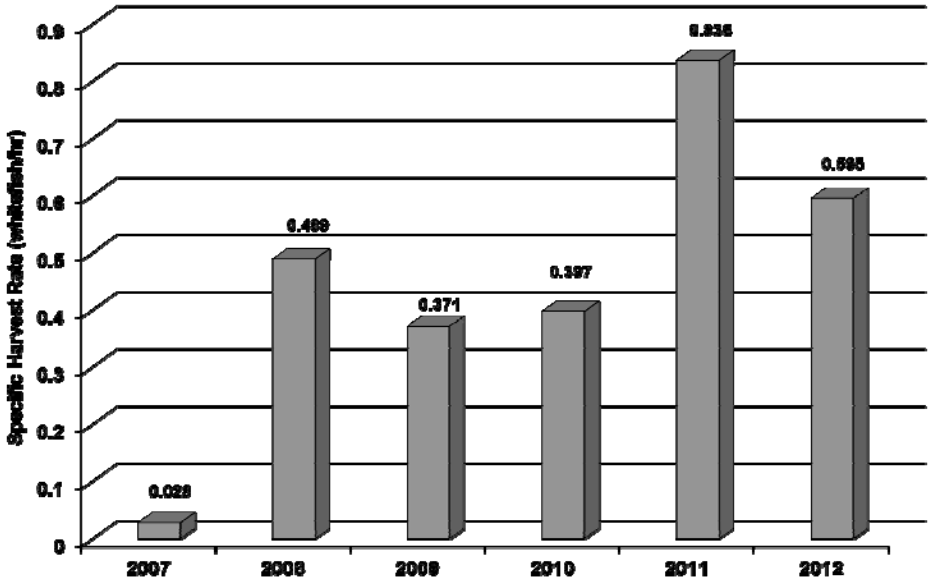


Figure 7. Harvest rate in number of whitefish per hour of fishing specifically for whitefish in Wisconsin waters of Green Bay during the winter creel season for 2007-2012.

Reference:

Andvik, R.T. 2012. Mixed-stock analysis of Lake Michigan's lake whitefish (*Coregonus clupeaformis*) commercial fishery. Master's Thesis. College of Natural Resources, University of Wisconsin-Stevens Point, Stevens Point, WI.

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