Lake Michigan Management Reports - 2012

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

CONTENTS

INTRODUCTION AND OVERVIEW **1**

SPORTFISHING EFFORT AND HARVEST **5**

WEIR HARVEST **7**

GREEN BAY YELLOW PERCH **13**

LAKE MICHIGAN YELLOW PERCH **19**

WALLEYE IN SOUTHERN GREEN BAY **31**

GREAT LAKES MUSKELLUNGE **37**

GREEN BAY BROWN TROUT MANAGEMENT **43**

LAKE STURGEON **47**

COMMERCIAL CHUB FISHERY AND CHUB STOCKS **54**

GREEN BAY FORAGE TRAWLING **59**

SMELT WITHDRAWAL BY THE COMMERCIAL TRAWL FISHERY **63**

LAKE WHITEFISH **65**

AUTHOR CONTACT INFORMATION **71**

INTRODUCTION AND OVERVIEW

Bill Horns

These reports summarize some of the major studies and stock assessment activities conducted by the Lake Michigan Fisheries Team during 2011. They provide specific information about sport and commercial fisheries, and describe trends in some of the major fish populations. For further information contact the author at the address, phone number, or e-mail address shown at the end of this document.

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 2011 and spring of 2012.

species	strain	fall 2011	spring 2012
brown trout	seeforellen (feral)		322,703
	St. Croix (domestic)	21,207	
	Wild Rose (domestic)	106,391	233,929
chinook salmon			1,175,213
coho salmon			542,192
lake sturgeon		2077	
rainbow trout	Chambers Creek (steelhead)		141,161
	Ganaraska (steelhead)		144,968
	Arlee (nearshore)	8688	112,391
walleye			100,000
muskellunge	Great Lakes Spotted	5214	

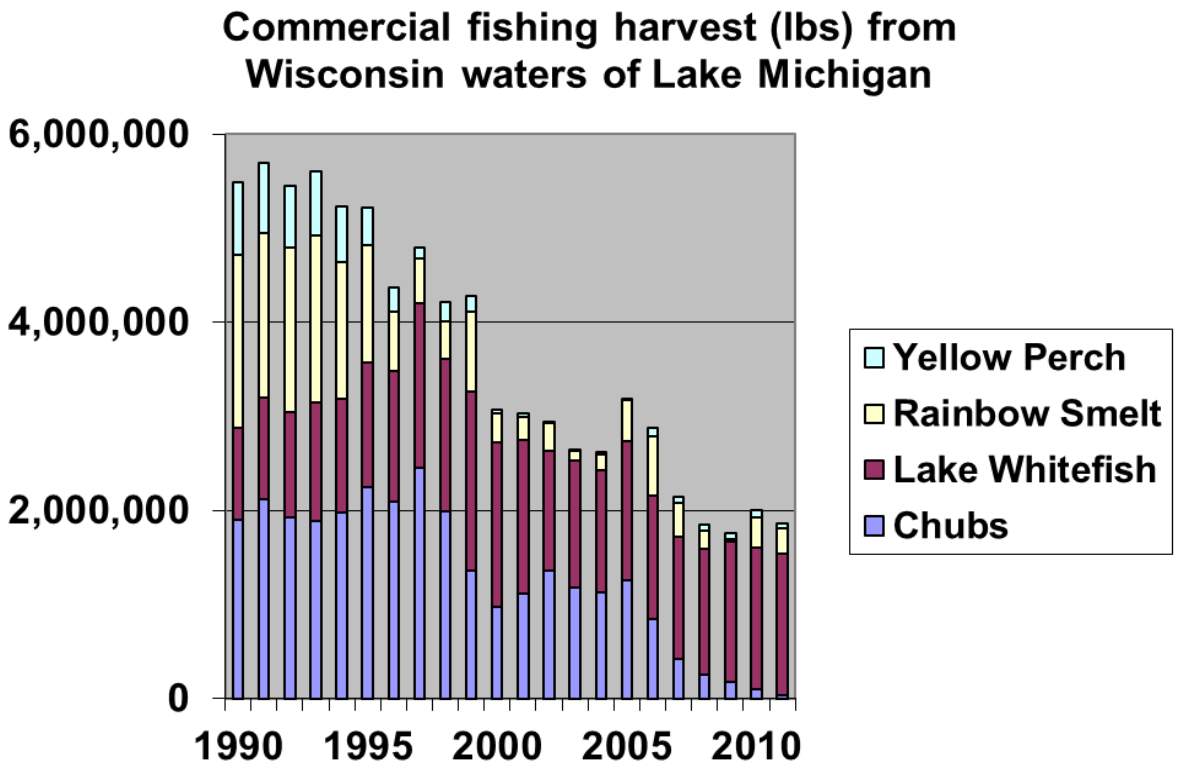
[1] Lake Michigan Fisheries Team. 2004. Lake Michigan Integrated Fisheries Management Plan, 2003-2013. Administrative Report No. 56, Wisconsin Department of Natural Resources.

[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. A copy may be obtained through the Great Lakes Fishery Commission at www.glfc.org.

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

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 recently reviewed the lakewide salmon and trout stocking program and will significantly reduce overall stocking, starting in 2013.

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 2011 was marked by a sharp decline in chinook salmon harvest along with a remarkable increase 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 higher in 2011 than in 2010, continuing an encouraging trend. 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 2005 producing the last reasonable year class (see "Lake Michigan Yellow Perch"), as reflected in the sport harvest, beach seining, micro-mesh YOY sampling, grade-mesh gill net surveys, and spawning assessments. The future of the southern Green Bay/lower Fox River walleye stock and sport fishery appears to be promising, with substantial year classes documented the past five years during fall electroshocking (see "Walleye in Southern Green Bay").

Stocking of Great Lakes spotted musky resumed in 2010 and 2011, 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 2011 reaching the lowest levels since we started recording harvests in 1979 (see "Commercial Chub Fishery and Chub Stocks"). Forage trawling in Green Bay reflects a diverse and changing Green Bay ecosystem (see "Green Bay Forage Trawling"). Rainbow smelt harvest, like that of bloater chubs, has declined steadily over the two decades (see "Smelt Withdrawal by the Commercial Trawl Fishery"), also reflecting a general lakewide decline in abundance. 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.

For additional information about our program on Lake Michigan, please contact one of the authors (see page 71), or visit http://dnr.wi.gov/topic/fishing/lakemichigan, the Department's Lake Michigan web page.

SPORTFISHING EFFORT AND HARVEST

Brad Eggold and Jeff Zinuticz

Wisconsin's Lake Michigan open water fishing effort was 2,540,985 hours during 2011, 7.92% below the five-year average of 2,759,518 (Table 1). Effort was below the five-year average for all the fishery types with pier effort (-28%) and shore effort (-18.28) showing the greatest decline.

Wisconsin Lake Michigan trout and salmon anglers had a slightly less successful season in 2011 than in 2010. Overall harvest was down, with 430,311 salmonids harvested, but the harvest rate increased to 0.1693, fish per hour (Table 3). Chinook comprised the majority of the catch, with a harvest of 169,752. Fishing for coho salmon was excellent in 2011, with 157,367 fish harvested representing the 3rd highest estimated harvest ever recorded by the Lake Michigan creel survey. Fishing for coho salmon was much longer in duration than most years with harvest starting in April and continuing throughout August from Kenosha to Door County. On the other hand, fishing for chinook salmon was not as good as previous years. Anglers had a hard time locating the fish throughout most of the year but were able to find and harvest them in larger amounts in August.

The open-water yellow perch harvest was 271,924 fish (Table 2), a slight decrease from 2010. The majority of the catch was comprised of the 2005 year-class, with 2001 and 2002 year-classes contributing significantly. Walleye harvest was estimated at 69,918, a minor increase from 2010. The northern pike catch was slightly higher in 2011 with 3,345 fish caught. Smallmouth bass harvest was 9,256 fish, a slight decrease from 2010.

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

Table 1. Open-water fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2011 and percent change from the 5-year average (2007-2011).

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2011	1,405,432	382,455	270,901	125,443	127,968	228,786	**2,540,985**
% change	-6.93%	-4.20%	-5.91%	-28.1%	-18.3%	-1.13%	**-7.92%**

Table 2. Open-water sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2011

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	76,988	41,717	35,487	538	847	1,790	**157,367**
Chinook salmon	53,162	37,551	56,527	2,737	5,642	14,133	**169,752**
Rainbow trout	30,920	17,642	22,417	102	1,283	3,078	**75,442**
Brown trout	4,396	1,241	1,189	1,055	753	1,302	**9,936**
Brook trout	0	0	26	0	0	0	**26**
Lake trout	6,972	5,396	5,397	0	19	4	**17,788**
Northern pike	1,429	0	0	1,451	13	452	**3,345**
Smallmouth bass	2,635	4,729	0	174	1,531	187	**9,256**
Yellow perch	218,413	25,924	0	2,685	5,413	19,489	**271,924**
Walleye	62,520	4,618	0	0	0	2,780	**69,918**
TOTAL	**457,435**	**138,818**	**121,045**	**8,742**	**15,501**	**43,215**	**784,754**

Table 3. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1996-2011.

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	TOTAL (SINCE 1986)
Brook Trout	419	299	159	574	199	263	144	126	1	18	17	62	13	27	0	26	39,022
Brown Trout	38,093	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	1,026,822
Rainbow Trout	77,099	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	1,798,850
Chinook Salmon	183,254	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	5,918,163
Coho Salmon	104,715	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	2,112,763
Lake Trout	36,849	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	1,266,365
TOTAL	**440,429**	**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**	**12,161,985**
Harvest Per Hour	0.1481	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	0.1450

Table 4. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1996-2011.

Fisheries Type	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	TOTAL (SINCE 1986)
Ramp	176,085	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	4,681,610
Moored	125,017	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	3,241,214
Charter	86,346	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	2,770,403
Pier	6,218	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	314,248
Shore	19,676	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	398,583
Stream	27,087	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	755,927
TOTAL	**440,429**	**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**	**12,161,985**

* Totals represent total number of salmonids harvested from 1986 – 2011.

WEIR HARVEST

Cheryl Masterson, Steve Hogler, Scott Hansen

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 in. 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 2011, all Lake Michigan salmon and trout egg quotas for Wisconsin waters were met.

Strawberry Creek Weir

Lake Michigan water level conditions were fair for the 2011 spawning run at Strawberry Creek although the flows were once again supplemented by the 3,500 foot pipeline and pump delivering approximately 1,500 – 2,000 gallons of water per minute to the creek. This greatly increases the flow thereby helping attract chinook salmon to the weir. During the fall 2011 run, 5,503 chinook salmon were handled at SCW (Table 1). This is a substantial increase from the average of the previous three years returns (2,630) and approximately 2.5 times the level of the 2010 return; it is the highest return since 2004. Although there have been modest increases in stocking levels at SCW in recent years, they can only explain a small proportion of the increased total return in 2011. As indicated, the amount of time the weir is operated plays a part in total return counts. During 2011 the weir was allowed to run a total of 21 days, a timespan 9 days shorter than in 2010. Therefore, the total return in 2011 may have been even higher if allowed to run as long as it was in 2010. Wisconsin's entire chinook salmon egg quota of 2.3 million eggs was easily collected at SCW in 2011.

Chinook average size at age in 2011 increased considerably from 2010 levels, continuing the rebound from record lows set in 2007 (Figures 1 and 2). From 2001 - 2007, mean lengths and weights at age for chinook salmon returning to Strawberry Creek generally followed a decreasing trend but then rebounded in 2008 and generally leveled off the next two years. However, the average length and weight of a 3+ male chinook in 2011 jumped to 937 mm and 7.6 kg, respectively. This is an increase of 39 mm (4.5%) in length and 1.4 kg (23%) in weight over the previous 3-year average.

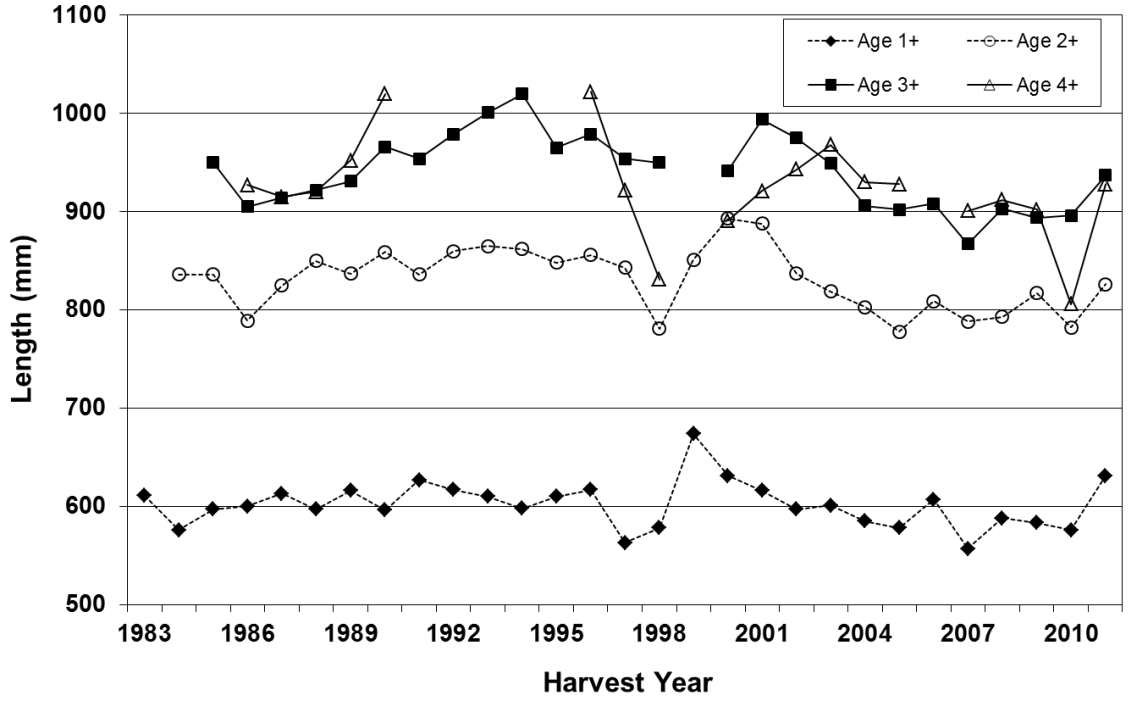


Figure 1. Average length at age of male chinook salmon returning to Strawberry Creek weir between 1983 and 2011.

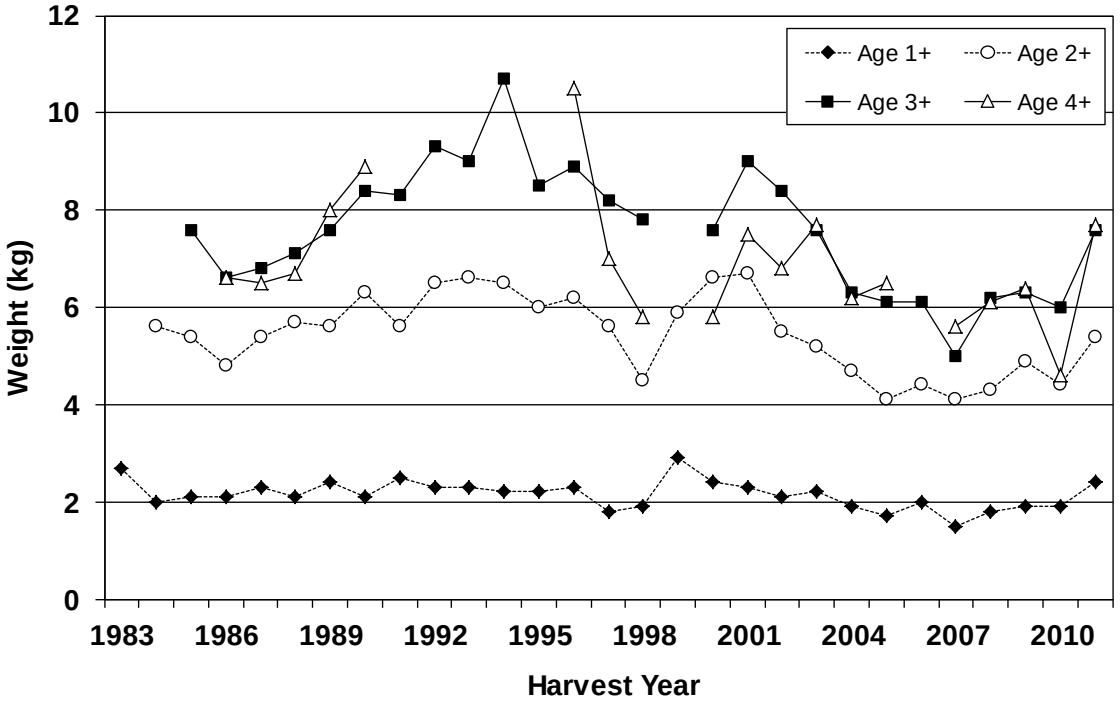


Figure 2. Weight at age of male chinook salmon returning to Strawberry Creek weir between 1983 and 2011.

Besadny Anadromous Fisheries Facility

Spring Operations

Spring operations in 2011 at BAFF began on April 11 and continued through April 27 when the ponds were emptied. During this period, 598 steelhead were captured at the facility. The run consisted of 142 Chambers Creek strain steelhead, 146 Ganaraska, 8 Skamania and 302 unclipped, misclipped or strays from other streams or states. The number of fish handled during the spring run in 2011 was lower than the 699 handled in 2009. In 2011, Chambers Creek and Ganaraska strain steelhead returned in near equal number.

Gamete collections for the two spring strains of steelhead were good from BAFF in 2011 and should result in normal numbers of Chambers Creek and Ganaraska being stocked as yearlings in 2013.

Fall Operations

The fall 2011 trout and salmon run on the Kewaunee River was very good with strong runs of chinook and coho salmon. However, large numbers of fish coupled with warm temperatures during a period in early October caused some higher than normal mortality in the holding ponds early in the season. Summer/fall fish collections began on October 7. BAFF ponds were sorted nine times during October and November to process migrating chinook and coho salmon and rainbow and brown trout.

Forty-one steelhead were captured at BAFF during the summer/fall run of 2011. This was a slight increase in returns when compared to the 2010 return. Five Skamania with identifiable clips were captured with one right maxillary right ventral (RMRV) fin clipped and four right maxillary (RM) clip Skamania captured. Also captured were four Chambers Creek steelhead and 32 unknown steelhead.

The number of chinook salmon captured at BAFF during the fall operations in 2011, as at the Strawberry Creek Weir, increased considerably from 2010 (Table 1). Return rates have been following a declining trend in recent years although numbers more than doubled from the previous year. This again reflects the strong overall return rate for WI weirs in 2011. Even though the stocking quota for the Kewaunee River has remained relatively consistent in recent years (albeit at lower levels), fish returned at the highest numbers since 2006. No chinook eggs were harvested from BAFF for WI stocking needs in 2011.

In 2011 the coho run was consistent with the 2010 level (Table 3). Approximately 467,000 coho salmon eggs were collected at BAFF in the fall of 2011 for Wisconsin stocking, and in conjunction with the Root River Steelhead Facility (see below) Wisconsin's egg collection quota for coho was met.

Root River Steelhead Facility

Spring Operations

The Root River Steelhead Facility (RRSF) was in operation for four processing dates during the spring 2011 migration. A total of 766 steelhead were captured and processed between March 14 and April 19 (Table 2). The number of fish captured at RRSF is a subset of the 2011 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. This was an above average return to RRSF, compared with the previous five spring seasons. For the year, 342,000 eggs were collected from the Chambers Creek strain of steelhead and 536,000 eggs were collected from the Ganaraska strain.

Adult Skamania to be used as brood fish were not collected from either steelhead facility in 2011 due to VHS concerns which will result in no Skamania stocking in 2013 by Wisconsin unless gametes or fingerlings are obtained from another source. However, the overall steelhead quotas are still being met using additional Chambers Creek and Ganaraska strains.

Fall Operations

Historically, RRSF began operating in late summer when the Skamania strain of steelhead appeared in the river. However, since we no longer collect Skamania at RRSF due to VHS concerns we only need to run the facility when coho start to show up in significant numbers, usually in October. With a later fall processing season, chinooks, as with 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 salmonines back to the Root River.

The Root River Steelhead Facility (RRSF) was in operation for 8 processing dates during the fall 2011 fish migration. A total of 2,121 chinook and 1,628 coho salmon were captured between October 4 and November 7 (Tables 1 and 3). Egg-take and biological sampling goals were met. Approximately 528,000 coho eggs were collected at RRSF and, in conjunction with the Besadny Fisheries Facility in Kewaunee, Wisconsin's egg collection quota for coho was met.

Table 1. The total number of chinook salmon handled during fall migrations at Strawberry Creek (1983-2011), Besadny (1990-2011) and Root River (1994-2011) weirs.

Harvest Year	SCW	BAFF	RRSF
1983	3,852		
1984	5,208		
1985	5,601		
1986	4,392		
1987	7,624		
1988	3,477		
1989	1,845		
1990	3,016	3,104	
1991	3,009	3,356	
1992	4,099	3,874	
1993	4,377	3,260	
1994	4,051	1,722	1,858
1995	2,381	2,621	2,979
1996	6,653	3,193	5,589
1997	4,850	1,518	4,102
1998	5,035	4,005	3,977
1999	1,934	5,798	6,022
2000[1]	6,649	2,774	7,382
2001	8,125	5,092	10,214
2002	11,027	6,224	10,439
2003	6,086	1,197[2]	149
2004	10,917	2,821[2]	392
2005	5,500	3,268[2]	3,623
2006	4,510	4,671[2]	10,318
2007	3,101	3,351	3,547
2008	3,706	2,451	1,504
2009	2,171	1,672	1,716
2010	2,014	1,565	1,508
2011	5,503	3,455	2,121

1 Beginning in 2000 through the present, low stream flow and low lake levels have persisted. A pipeline was installed in 2000 which delivers approximately 1,500 – 2,000 gallons of water per minute, and facilitiates weir operation.
2 All fish were allowed to bypass BAFF until October 1.

Table 2. The total number of steelhead examined during spring and fall runs at BAFF and RRSF (1995-2011).

Year	BAFF	RRSF
1996 – Spring	1,964	3,169
1996 – Fall	24	353
1997 – Spring	1,955	3,045
1997 – Fall	85	638
1998 – Spring	746	382
1998 – Fall	41	151
1999 – Spring	608	2,263
1999 – Fall	145	70
2000 – Spring	220	2,171
2000 – Fall	2	219
2001 – Spring	324	859
2001 – Fall	6	490
2002 – Spring	307	1,303
2002 – Fall	3	301
2003 – Spring	307	1,060
2003 – Fall	0	236
2004 – Spring	720	1,028
2004 – Fall	16	398
2005 – Spring	407	887
2005 – Fall	6	116
2006 – Spring	552	845
2006 – Fall	15	536
2007 – Spring	431	428
2007 – Fall	50	98
2008 – Spring	1,582	241
2008 – Fall	79	10
2009 – Spring	815	1,024
2009 – Fall	107	99
2010 - Spring	699	431
2010 - Fall	24	65
2011 - Spring	598	766
2011 – Fall	41	18

Table 3. The total number of coho salmon examined at BAFF (1990-2011) and the RRSF (1994-2011).

Year	BAFF	RRSF
1990	3,887	
1991	1,140	
1992	958	
1993	1,671	
1994	746	813
1995	3,767	3,321
1996	3,328	4,406
1997	1,162	7,645
1998	2,432	4,000
1999	1,638	1,150
2000	1,629	3,408
2001	175	1,327
2002	241	2,548
2003	266	198
2004	2,081	1,271
2005	937	841
2006	856	1,400
2007	2,482	1,169
2008	3,296	2,581
2009	487	1,338
2010	1,388	1,682
2011	2,236	1,628

GREEN BAY YELLOW PERCH

Tammie Paoli

This report summarizes assessments and monitoring of yellow perch in southern Green Bay completed in 2011. 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 a trend towards improved recruitment. Surveys from 2002 to 2011 indicate reasonably strong year classes (Figure 1).

Spawning assessment

The spring spawning assessment continued for the 34th year on Green Bay at Little Tail Point. Double-ended fyke nets were set at three locations at ice-out on April 18, 2011. Water temperatures reached 50F for a few hours on April 30, one week later than a typical year, and then dropped below 50F until May 7. Nets were fished until May 2, 2011, for a total effort of 42 net nights. By that date, the majority of mature females were spent. Peak spawning activity occurred about a week later 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=27,432). This was significantly more yearlings than the 10-year annual average (14,594) for the survey and is indicative of the large 2010 year class. Age-2 (2009 year class) males comprised 89% of the total males over 100 mm sampled (n=510) with a mean length of 139 mm, or 5.5 inches. A majority (96%) of immature females over 100 mm (n=499) were age-2 with a mean length of 138 mm, or 5.5 inches. Of the mature females sampled (n=679), a majority (63%) were age-2 with a mean length of 168 mm, or 6.6 inches, while 33% of mature females were age-3 with a mean length of 221 mm, or 8.7 inches. Younger females (ages 2 and 3), continue to contribute significantly to the spawning population in southern Green Bay. One notable fish was a 375 mm (14.7 inch) female that was age-8, a remainder of the record 2003 year class. Besides yellow perch, brown bullheads (n=464) dominated the catch followed by spottail shiner (n=453), trout perch (n=452), white sucker (n=195), and walleye (n=67).

Water temperature

A StowAway TidbiT® templogger (Onset Computer Corporation) was deployed on April 18, 2011 near Little Tail Point to record water temperature every 30 min until August. May 2011 water temperatures averaged 55.5 F. The 9-year May average for this location is 57 F.

Larval sampling

In 2011, larval sampling was discontinued because of staffing and workplan adjustments. University of Wisconsin-Milwaukee's Great Lakes Water Institute is processing 2010 samples and is summarizing previous results into a database.

Beach seining

Fifteen index sites along the west and east shores of Green Bay were sampled twice between late June and late July 2011 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 remaining in 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 100 ft seine haul. YOY yellow perch were captured at 12 out of 15 sites (mean CPE=115) during the June sampling and at all sites in July (mean CPE=38). The 13-year average CPE is 88. The site with the highest abundance in 2011 was Longtail West (CPE =1255).

Mean length of YOY yellow perch during the late June survey period was 33 mm (range: 18-43 mm) which was 8 mm smaller on average than the 2010 samples collected during the same time period. This smaller size is consistent with the later spawning activity and lower water temperatures in spring. By late July, mean length of YOY was 51 mm (range: 25-73 mm). As expected, escapement rates decreased with larger fish and all YOY $\geq$ 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 abundant cladophora. In these locations, retention of small YOY increased because algae clogged the mesh.

A total of thirty-four fish species were identified during the survey. Yellow perch YOY dominated the catches followed by yearling yellow perch, round goby, and gizzard shad YOY. Of interest were 7 largemouth bass YOY captured in the southern bay (Suamico, Longtail East, Longtail West), and 6 smallmouth bass (Suamico, Little Sturgeon). Additionally, 75 alewife YOY were captured, with highest abundance at Pensaukee. While black bass and alewife are occasionally captured in seining surveys, the 2011 surveys suggest strong year classes for those species.

Trawling survey

Annual late summer trawl surveys continued for the 34th 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 32 deep water sites added in 1988) using a 16-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 Gaylord Nelson. At each of the 12 locations, 100 YOY were measured. Mean length of YOY was 68 mm (range: 52-95 mm). Interestingly, the largest YOY were from Little River Shallow (LRS), in the northern part of the study area. The smallest YOY were from Little Tail (LIT) in southern Green Bay. Typically, larger YOY are captured in the southern bay presumably due to an earlier hatch, warmer water temperatures, and more productive waters. Rapid growth observed at LRS may be attributed to a high abundance of round goby (1772/hr) in that location, although it is unknown at what minimum size yellow perch would consume small fish. We documented numerous round goby YOY in stomachs of small yellow perch captured at LRS. A 128 mm yellow perch had 12 round goby in its stomach.

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 2011 produced a strong year class with the relative abundance of YOY yellow perch (1084/hr), ranking as the 8th highest since the deep water sites were added in 1988 (Figure 1).

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 increased at index sites from 51/hr in 2010 to 401/hr in 2011. A majority (72%) of the age-1 and older fish captured were

yearlings (2010 year class) with a mean length of 121 mm (range: 74-196 mm). This is indicative of the large 2010 year class. Other common species in decreasing order of abundance captured at shallow sites were white bass YOY, gizzard shad, round goby, and spottail shiner. Deep water trawls were dominated by adult alewife, juvenile lake whitefish, adult rainbow smelt, and round goby. Of particular note was the high CPE of adult alewife at deep sites, recorded as high as 2697/hr off the mouth of the Peshtigo River (MPR). Alewife catches have not been at these levels in Green Bay since 1996 surveys.

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 decreased at each site farther south, ranging from 3.5 m at Little River Deep (LRD) to 0.5 m at Point Sable (PS).

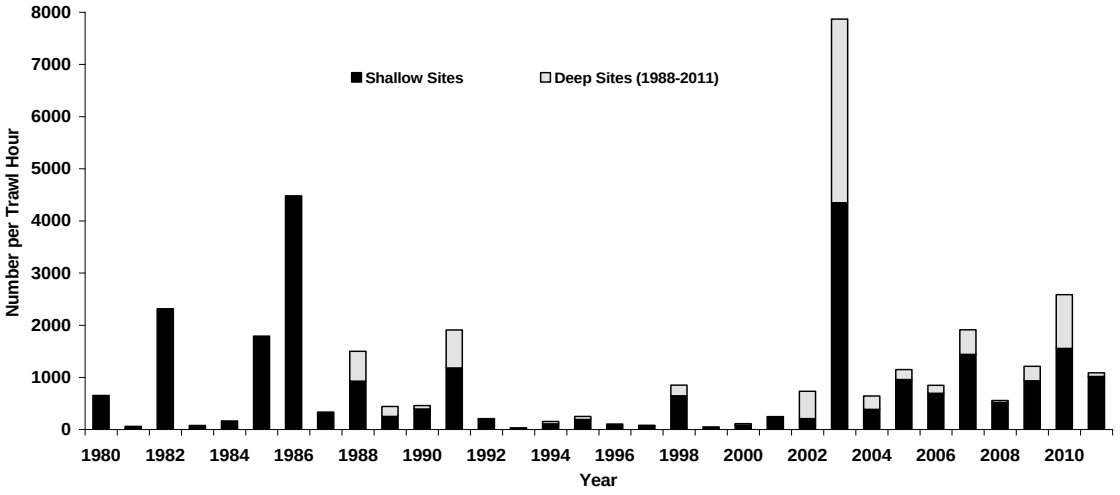


Figure 1. Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2011.

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 Green Bay waters in 2011 was 254,942 (67,729 lbs), compared to 225,995 fish (49,182 lbs) in 2010 (Figure 2). The majority of the open water harvest (41%) was by boat anglers launching at ramps at Door and Kewaunee Counties, followed by boat anglers launching in Brown (20%) and Oconto County (19%). The remaining 20% of harvest was by pier, shore, or stream anglers. The open water harvest rate (0.25/hr) and catch rate (0.53/hr) of yellow perch in 2011 increased slightly from 0.21/hr and 0.41/hr, respectively, in 2010. A majority (64%) of the open water harvest was from the 2009 year class, while the 2008 year class comprised approximately 33%. The mean length of open-water harvested yellow perch was 8.3 inches (n = 273; SE = 0.1), compared to 7.8 inches in 2010.

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 2011 (62,829 fish; 13,817 lbs.) was nearly twice that of 2010 (33,070 fish). The 14-year harvest average for Green Bay is 55,469 fish. Harvest rate for anglers targeting yellow perch improved significantly from 0.21/hr in 2010 to 0.60/hr in 2011. The mean length of yellow perch harvested through the ice was 7.9 inches compared to 7.4 inches in 2010.

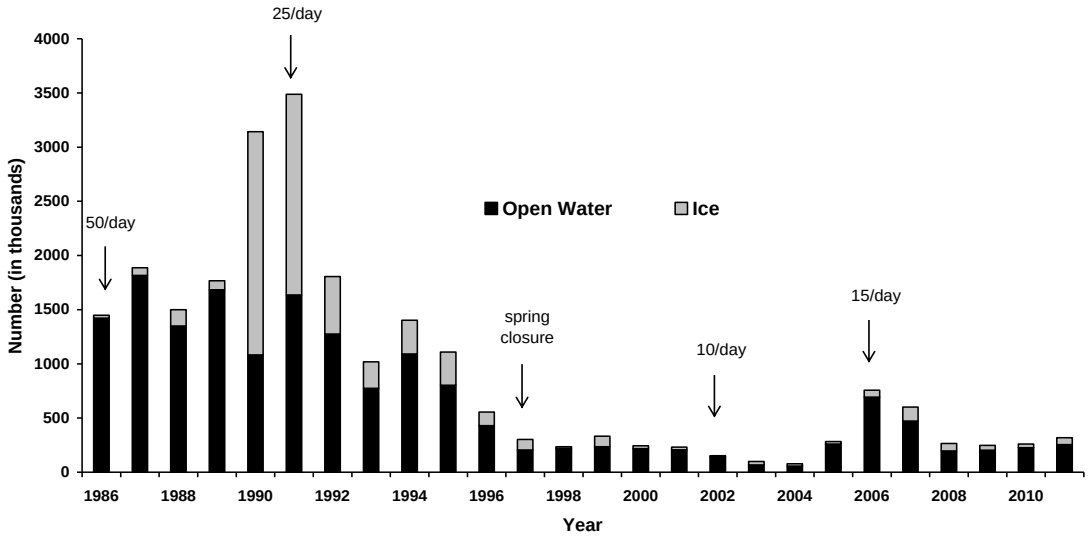


Figure 2. Estimated sport harvest of yellow perch in Green Bay from 1986 to 2011. Regulation changes indicated by arrows.

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.

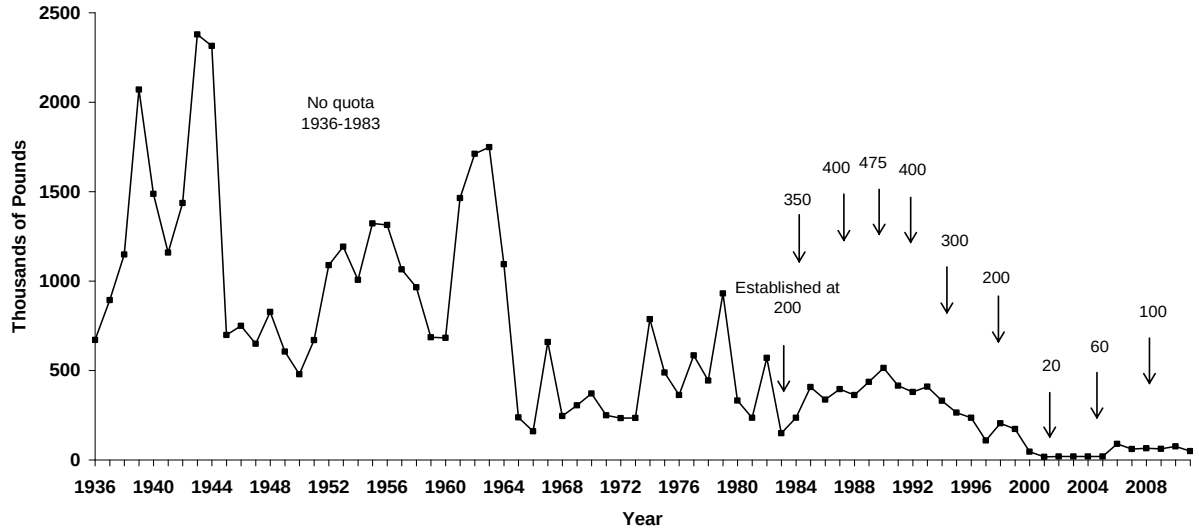


Figure 3. Commercial harvest of yellow perch in Green Bay from 1936 to 2011. Total allowable commercial harvest changes (thousands of pounds) indicated by arrows.

In 2011, commercial fishers harvested a total of 49,465 pounds (141,651 fish) of yellow perch using gill and drop nets, compared to 75,641 pounds in 2010 (Figure 3). The total allowable commercial harvest has remained at 100,000 pounds since 2008. The harvest rate (CPE) for gill nets dropped slightly from the previous eight years to around 22 pounds per 1000 ft fished, while drop net CPE rose to 17.1 pounds per net in 2011 (Figure 4). Age-3 perch (2008 year class) made up 46% of the total commercial harvest in 2011, while age-2 comprised 41%. 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.

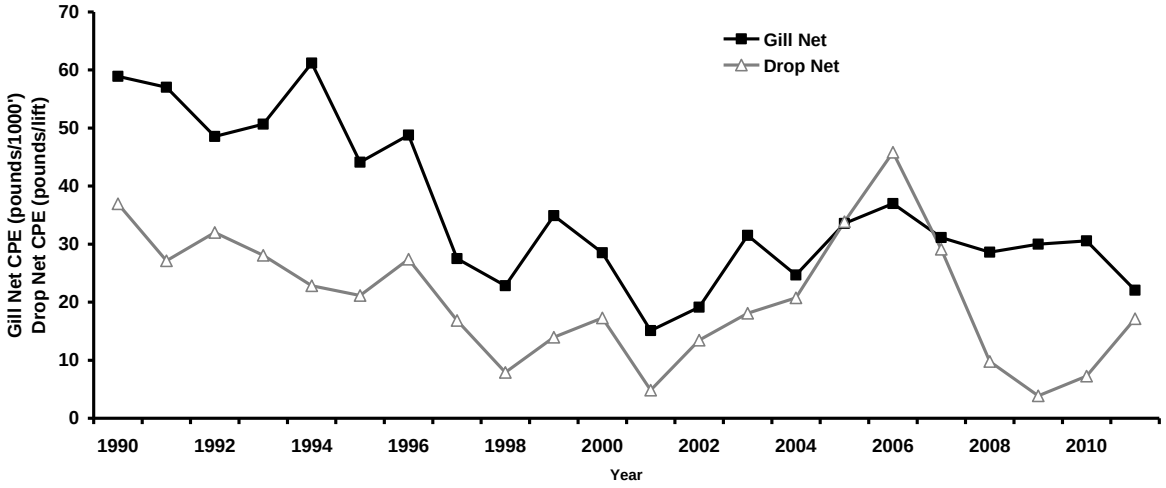


Figure 4. Gill net and drop net catch per unit effort (CPE) of all licensed yellow perch commercial fishers in Green Bay waters, 1990 – 2011. Gill net CPE is in pounds of yellow perch harvested per 1,000 feet lifted. Drop net CPE is in pounds of yellow perch harvested per pot lifted.

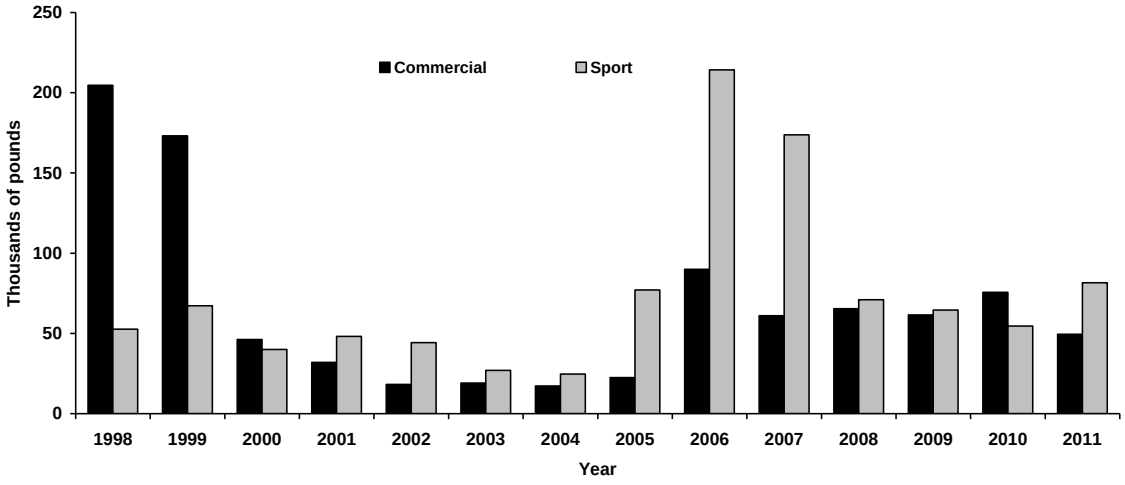


Figure 5. Commercial harvest and estimated sport harvest (open water and ice combined) in Green Bay from 1998 to 2011.

Discussion and Management Actions

Despite a delayed spring and corresponding slower growth rates in most of the study area (with the exception of northern sites with high round goby YOY abundance), the 2011 year class of yellow perch on Green Bay was strong. The relative abundance of YOY yellow perch (1084/hr) ranks as the 8th 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. We believe that the lack of increase in harvest 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.pd

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 2011-12.

Young-of-the-year Assessment

An annual survey of YOY yellow perch along the Lake Michigan shoreline was conducted from 8/29/2011 to 10/5/2011. 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. Some stations (Bender Park, McKinley beach, Klode park beach, and Sheboygan north jetties) were infested with cladophora during much of the season making it difficult to seine. Algae would clog the net making it hard to pull and would drastically reduce the catchability of the seine. A total of 12 species of fish were captured (Table 1). Young-of-the-year and juvenile alewife dominated the catch followed by Spottail shiner and longnose dace.

A total of 5,025 ft of seine hauls were conducted at fourteen sites capturing only five YOY yellow perch yielding a catch per effort (CPE) of 0.1 YOY yellow perch per 100 foot seine haul. All five YOY yellow perch were caught at one location – Sheboygan Jetties. In 2009, we had a similar outcome when we captured only seven YOY yellow perch with a CPE of 0.12. However, the CPE in 2010 was the third highest since 1990 (the other two years being 2005 and 2007; Figure 1). The average size of the YOY yellow perch in 2011 was 57.4 mm, ranging from 34 to 78 mm. The wide size range in 2011 is probably due to protracted spawning. Compared to previous years, we captured fewer fish in the seine net in 2011. Also, the diversity of fish caught during the survey was much lower in 2011 compared to previous years.

Two index stations, Shoop Park (Racine Co.) and Doctors Park (Milwaukee Co.), were selected for setting micromesh gill net. The nets were set 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 eight species of fish were captured in these nets with round goby and rainbow smelt dominating the catch. Only two YOY yellow perch were caught at the Doctors Park location. The catch per 100 ft of gillnet was only 0.2 YOY yellow perch (CPE=0.2; Figure 2). A total of only eight species of fish were captured in 2011, with round goby and rainbow smelt dominating the catch. The conditions were good for sampling with mild winds, and the temperature ranged from 58 ^{0}F to 68 ^{0}F.

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 2011, we took five samples from May 24th through June 23rd with a total effort of 7,000 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 46.5 ^{0}F to 52 ^{0}F. A total of 635 adult yellow perch – 200 male and 435 female - were caught in five lifts. The majority of females

caught were still green as late as June 14th. Extended period of colder water temperature probably led to protracted spawning period. This year we could not ascertain a clear peak spawning period. Both males and females were difficult to recognize if they had already spawned. Male perch generally dominate the catch during the spawning season. However, this year we caught very few males and not many were ripe. Age analysis of a subsample of fish revealed that the 2005 year-class (age 6 yellow perch) was the dominant year-class (Figure 3). There were no perch younger than age 4.

The yellow perch egg deposition survey was conducted by the WDNR dive team on June 7th, June 14th and June 28th. The divers surveyed an area of 54,300 square meters at depth ranging from 28-50ft. They counted 55 egg masses resulting in 1.01 egg mass per 1000 square meters (Figure 4) which is much lower than the 5.8 egg masses per 1000 square meters found in the 2009 survey.

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. Four lifts with a total effort of 17,600 ft gillnet (22 boxes of 800 ft each) were taken on12/02/2011, 12/8/2011, 12/9/2011 and 12/13/11 at depths ranging from 58ft to 80ft.

Table 3 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1998 through 2012. 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 in 1998 (dominated by male perch). However, data on age and size distribution of yellow perch from 1999 onward show 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, and is gradually declining in the catch while several other year-classes have since emerged.

In our 2012 winter graded mesh assessment we documented multiple year classes. The 2005 year-class yellow perch (age 7) emerged as a dominant group (49%; Figure 5) followed by 2003 and 2006 year-classes. In addition to the above three year classes, 2002 and 2007 year-classes also contributed substantially. Only a few yellow perch younger than 4 years were caught.

From 2000 to 2002 the sex ratio of the yellow perch population was predominantly female. This trend was reversed in 2003, but recently the female proportion has increased markedly with 71% in 2010, 76% in 2011 and 77% in 2012. The data from the 2008-2011 spawning assessment also indicated a decreased number of 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. Sport harvest is monitored by a contact creel survey. The sport bag limit was reduced to five fish per day in 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, but there was a dramatic decline in the sport harvest in 2011, with only 17,000 fish. The lakeshore counties – Milwaukee, Racine and Kenosha

accounted for 79% of the harvest. The main reason for the decline was probably 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 the 2011 sport harvest, the 6-year-old 2005 year-class yellow perch comprised 34% of the catch followed by the 2007 (20%), 2006 (16%) and 2003 (15%) year-classes (Figure 7). 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. It is interesting that 2007 and 2006 year-classes are also starting to contribute well to 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 the 2003, 2005, 2006, and 2007 year-classes comprise substantial numbers in the population. The 2005 year-class has emerged as a dominant year-class in recent years. 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 the perch population recovery by reducing the impact on spawning stocks, and allowing mature adults to spawn multiple years in their life time. The presence of multiple year-classes in the spawning population as well as in the sport harvest is a positive change. The current regulation will remain in effect until a detailed analysis is complete on the status of yellow perch population. A disproportionate decline in the male yellow perch in the spawning ground in recent years is concerning to fish managers.

Table 1. Number of fish caught in beach seining effort (Lake Michigan shoreline from Kenosha to Sheboygan) from 8/29/2011 to 10/5/2011, WDNR.

Fish species	**# of fish caught**
Alewife (YOY)	2569
Rainbow smelt	14
Common shiner	11
Spottail shiner	270
Sand shiner	2
Fathead minnow	7
Longnose dace	176
White sucker	1
Banded killifish	2
Yellow perch (YOY)	5
Yellow perch (juvenile)	1
Round goby	16
White perch	1

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

[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, WDNR, Lake Michigan Work Unit.

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

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

Table 4. Reported commercial Lake Michigan yellow perch harvest (excluding Green Bay), in thousands of pounds, and sport harvest, estimated in thousands of fish, by calendar year.

Year	Commercial harvest (lb. x 1000)	Sport harvest (number x 1000)
1995	128	214
1996	15[a]	41[b]
1997	Closed	27[b]
1998	Closed	36[b]
1999	Closed	23[b]
2000	Closed	16[b]
2001	Closed	121[b]
2002	Closed	88[b]
2003	Closed	66[b]
2004	Closed	42[b]
2005	Closed	33[b]
2006	Closed	68[b]
2007	Closed	66[b]
2008	Closed	20[b]
2009	Closed	51[b]
2010	Closed	51[b]
2011	Closed	17[b]

[a] commercial yellow perch fishery was closed effective September 1996
[b] sport bag limit was reduced to 5/day effective September 1996
(Note: Sport harvest data includes Moored boat catch since 1989)

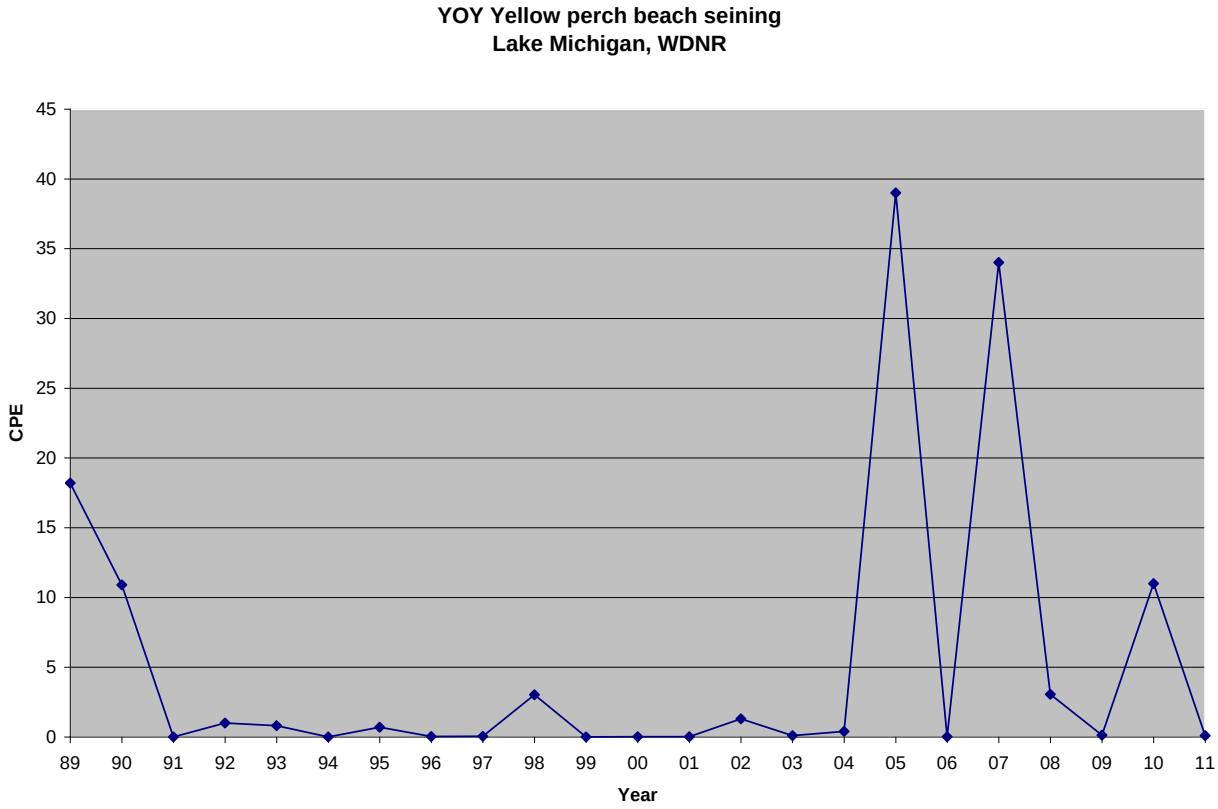


Figure 1. CPE (fish/100') of YOY yellow perch in summer beach seining, WDNR.

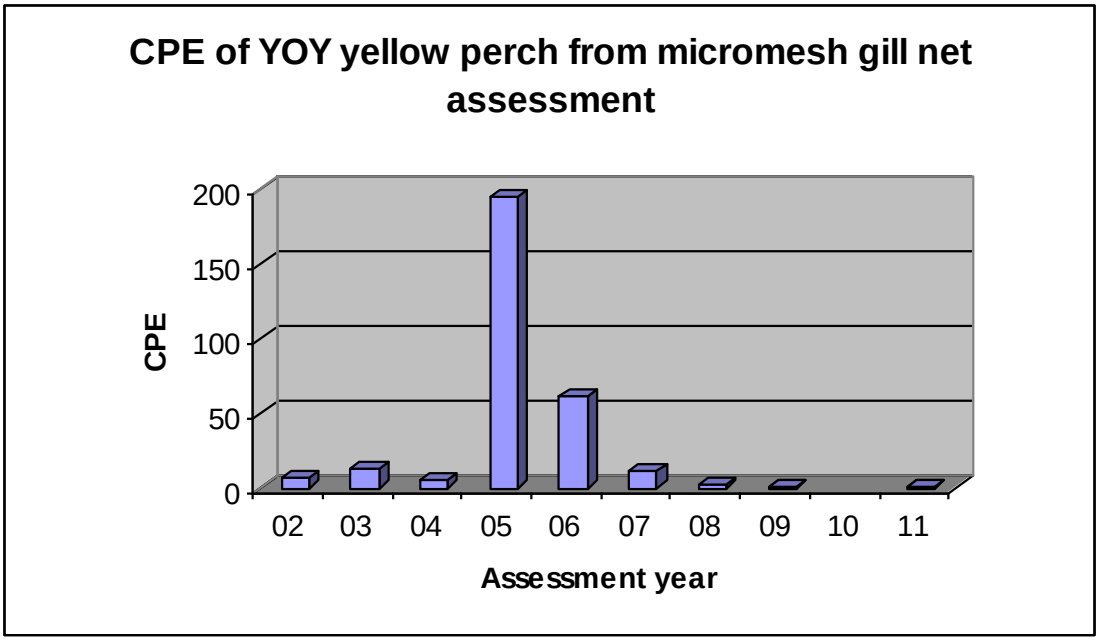


Figure 2. Catch per effort of young-of-the-year yellow perch captured in the micromesh gill net, WDNR,

2011.

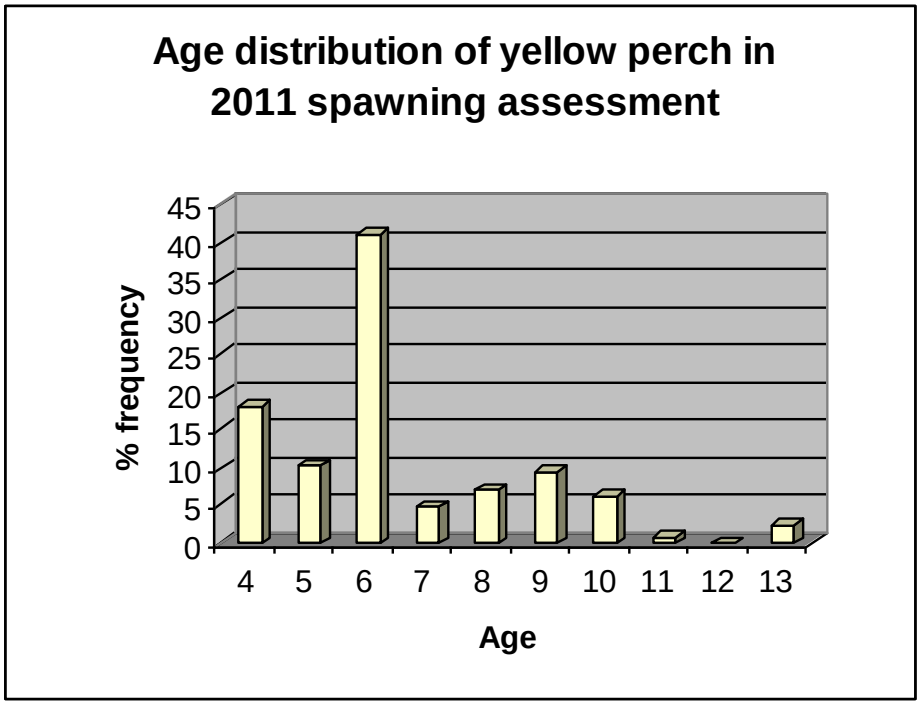


Figure 3. Age distribution of spawning population.

NA

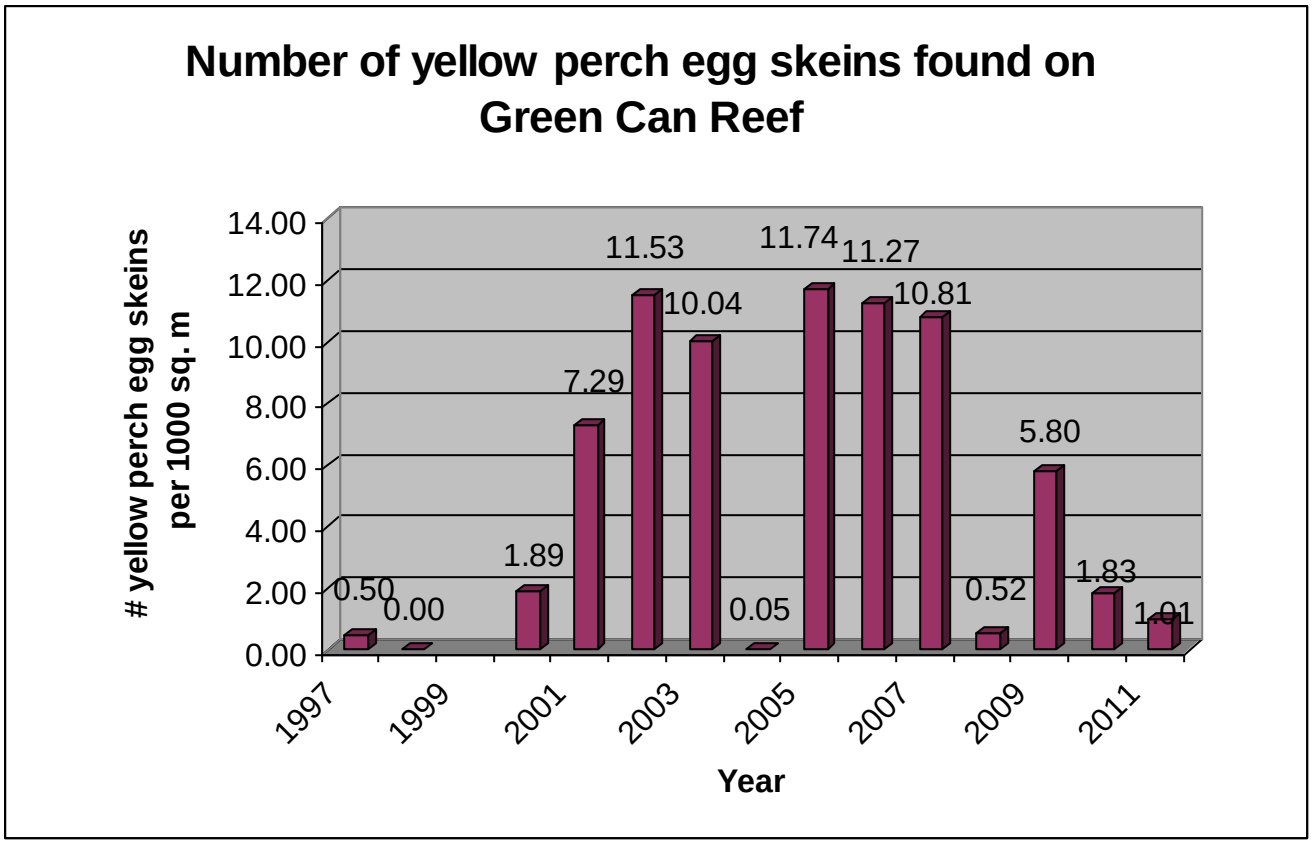


Figure 4. Yellow perch egg deposition survey in Lake Michigan near Green Can Reef, WDNR.

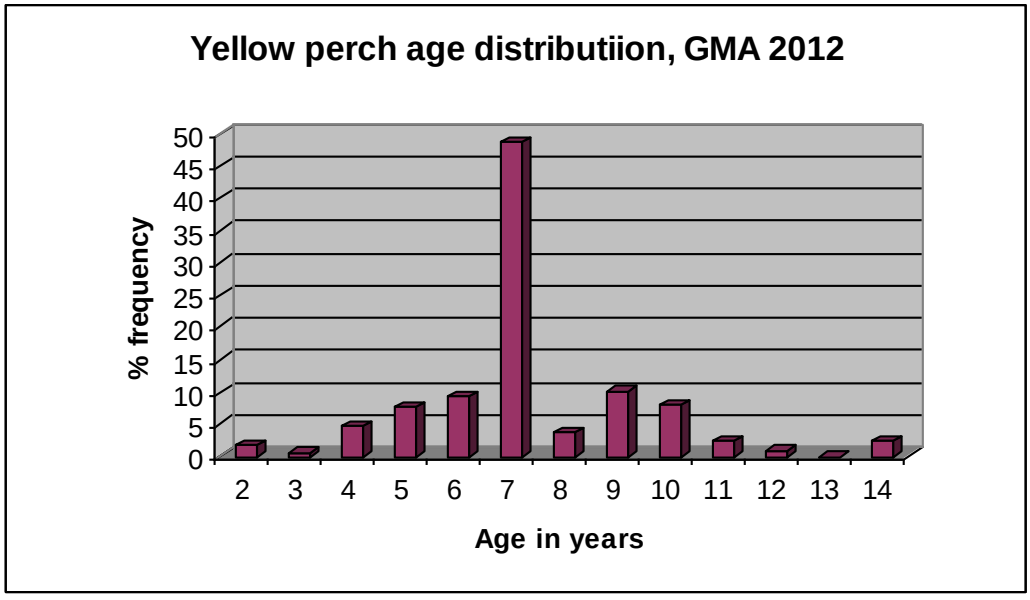


Figure 5. Age distribution of yellow perch in the winter graded mesh gillnetting assessment (GMA) in Lake Michigan, 2012.

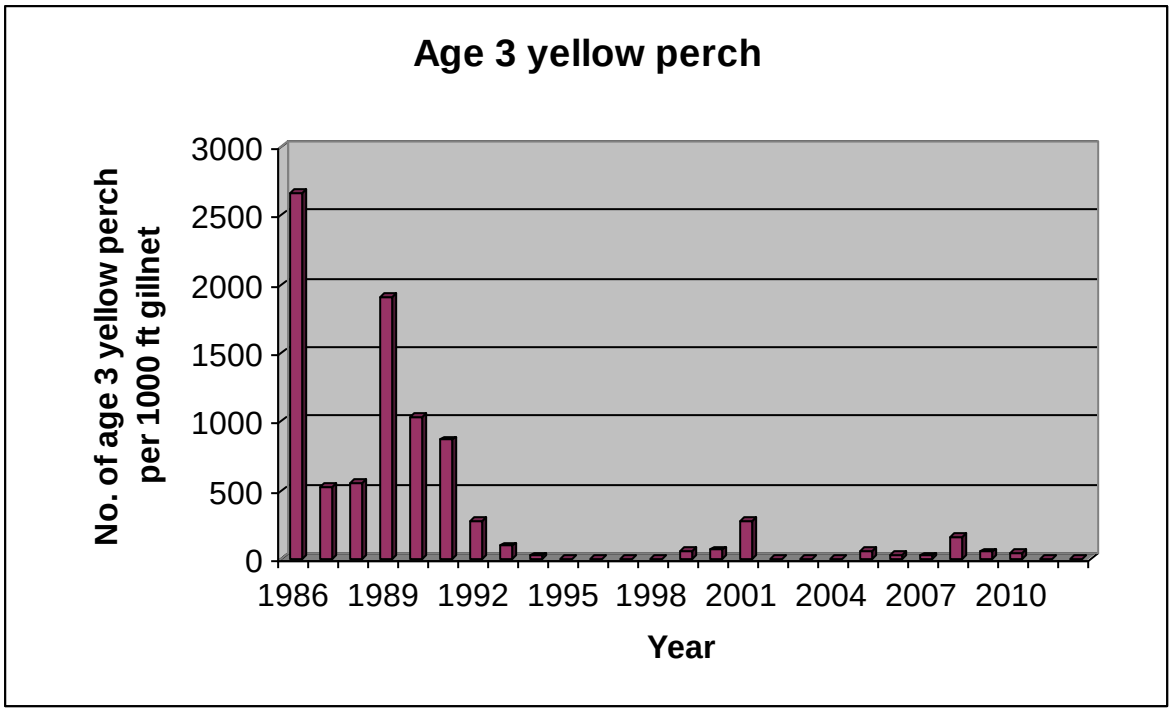


Figure 6. Age 3 yellow perch year-class strength (computed to 1000 ft of gillnet) in the winter graded mesh gillnetting assessment in Lake Michigan.

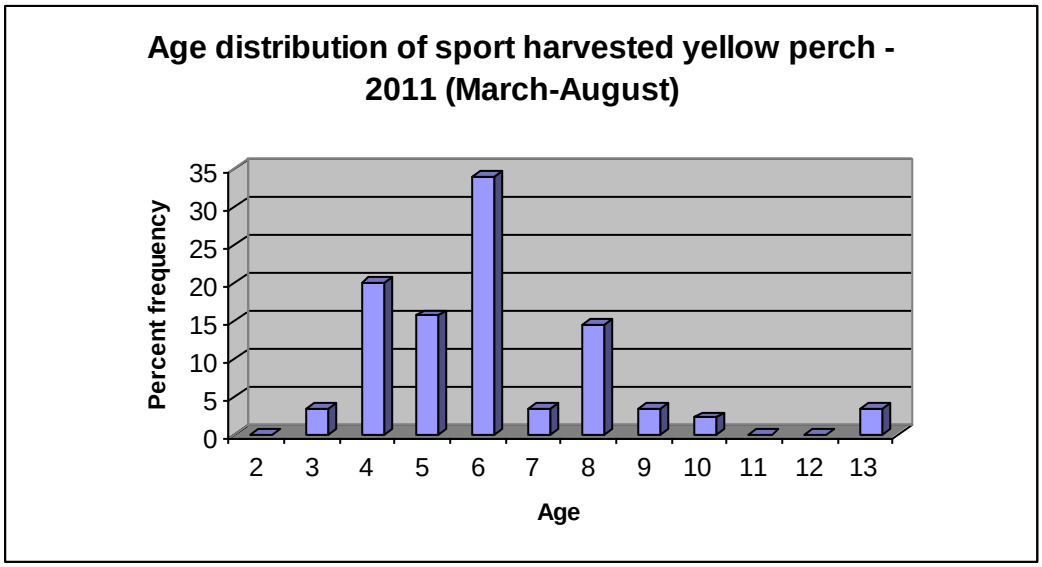


Figure 7. Age distribution of sport harvested yellow perch in Lake Michigan – 2011

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 by over-exploitation. The water quality of southern Green Bay and the fish community began to improve by the mid 1970s after the passage and enforcement of the Clean Water Act in 1972. Rehabilitation of walleye stocks by the Wisconsin Department of Natural Resources began during 1973 with the stocking of fry and fingerlings into the Sturgeon Bay area. Stocking expanded to include the lower Fox River (downstream from the DePere Dam) during 1977. 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.

The results of previous studies suggest that Green Bay walleye stocks are quite discrete by location (Schneider et al. 1991). The walleye stock in southern Green Bay and the lower Fox River is likely distinct from other stocks in Green Bay, but genetic analysis is needed to verify this assumption. Spawning walleye abundance and YOY production have been variable since monitoring began, but the stock has not been augmented through stocking since 1984 and is considered to be self-sustaining. The purpose of this report is to summarize data collected during the 2011 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 2011 electrofishing index surveys show that the relative abundance of young of the year (YOY) walleye at the fall fingerling stage was above average for the Fox River (Figure 1) and indicates a strong year class for 2011. The 2011 age 0 catch per unit effort (CPUE) from the Fox River was 20.3 YOY/hour of electrofishing which is well above the 1994-2010 average of 12.9 YOY/hour. The lower Green Bay catch was 3.3 YOY/hour, which is below the 1994-2010 average of 8.1 YOY/hour. The difference between the bay catch rate and the river catch rate may be attributed to differences in spawning success, warmer temperatures at time of sampling in the bay (16.1º C on the bay compared with 8.9º C to 12.2º C on the river) and in 2011 poor weather conditions encountered on Green Bay during sampling. The average length of YOY walleye in 2011 was 214 mm which was less than the 240 mm average length measured in 2010. A cold, late spring likely resulted in reduced walleye growth seen in 2011. 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).

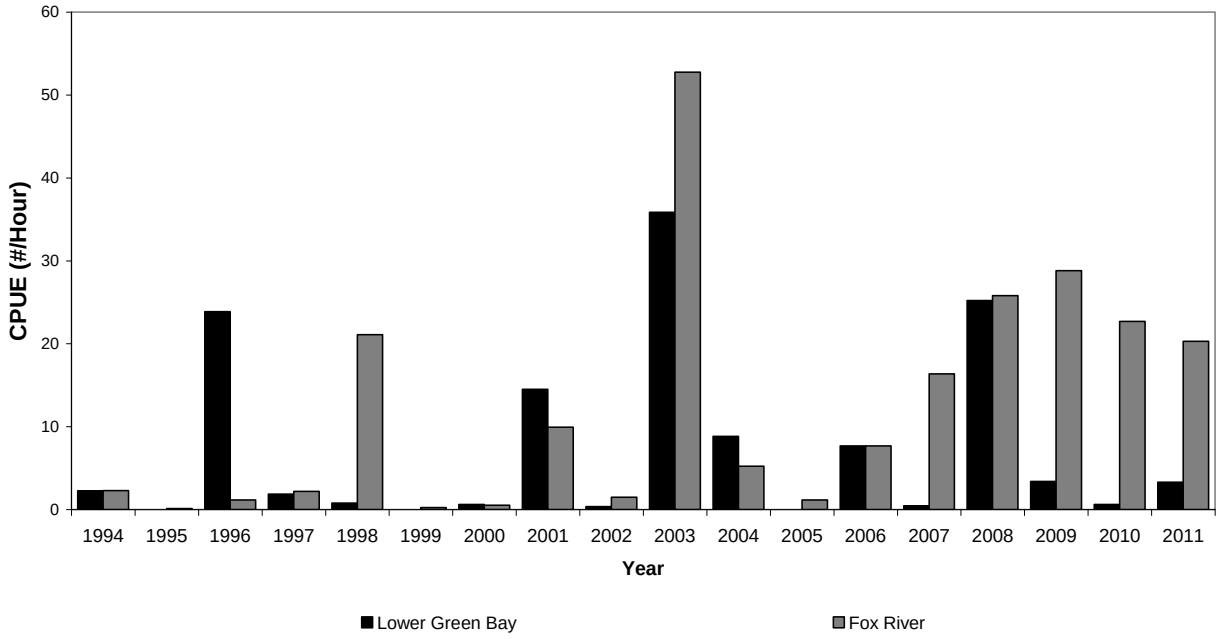


Figure 1. Relative abundance of young-of-year walleye in the lower Fox River (DePere Dam to mouth) and lower Green Bay (south of a line drawn from Longtail Point to Point Sable), as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1995-2010.

Walleye stock size and age structure

In 2011, during our electrofishing index surveys on the lower Fox River we captured 618 walleye with an average length of 380 mm (range 167-627 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=182) 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 2011 year class (YOY) and from the strong year classes of 2009 and 2008 dominated our catch. Few walleye that were from the apparently strong 2010 year class were captured and very few walleye older that age 5 were collected during sampling (Figure 3).

On Green Bay, we captured 55 walleye that averaged 359 mm in length (range 162 mm- 581 mm) during index electroshocking (Figure 4). The size distribution of captured walleye from Green Bay was similar to walleye from the Fox River. Poor weather during one night of electroshocking likely reduced our walleye catch from Green Bay.

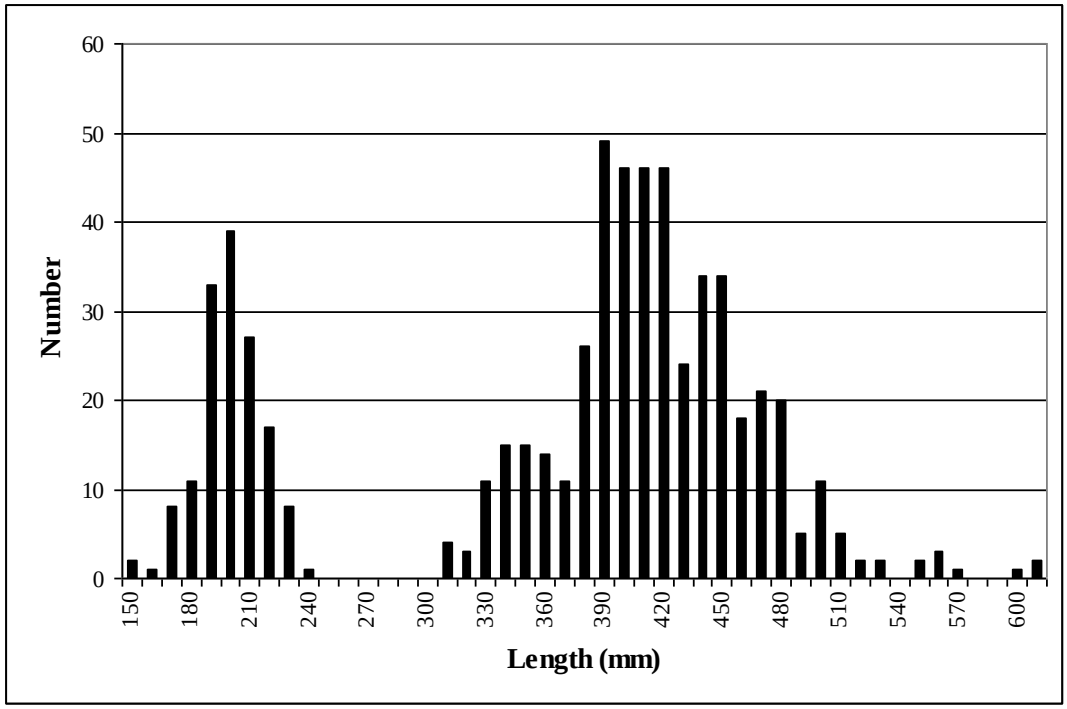


Figure 2. Length-frequency distribution of walleye sampled while electrofishing the lower Fox River during fall 2011.

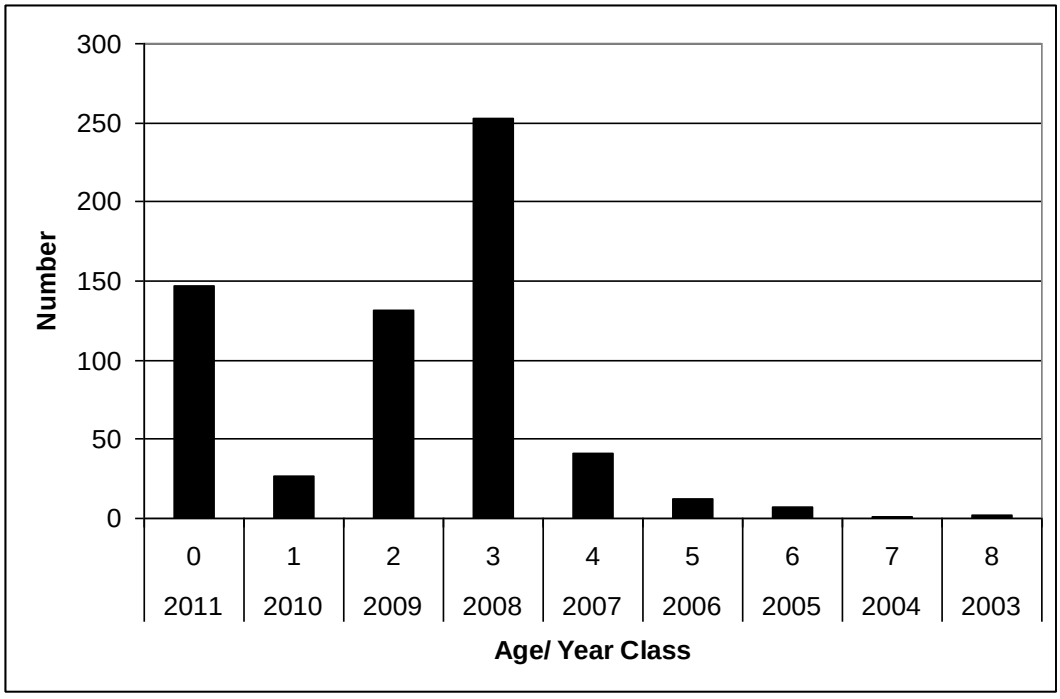


Figure 3. Estimated age-frequency distribution of walleye sampled while electrofishing on the lower Fox River during fall 2011.

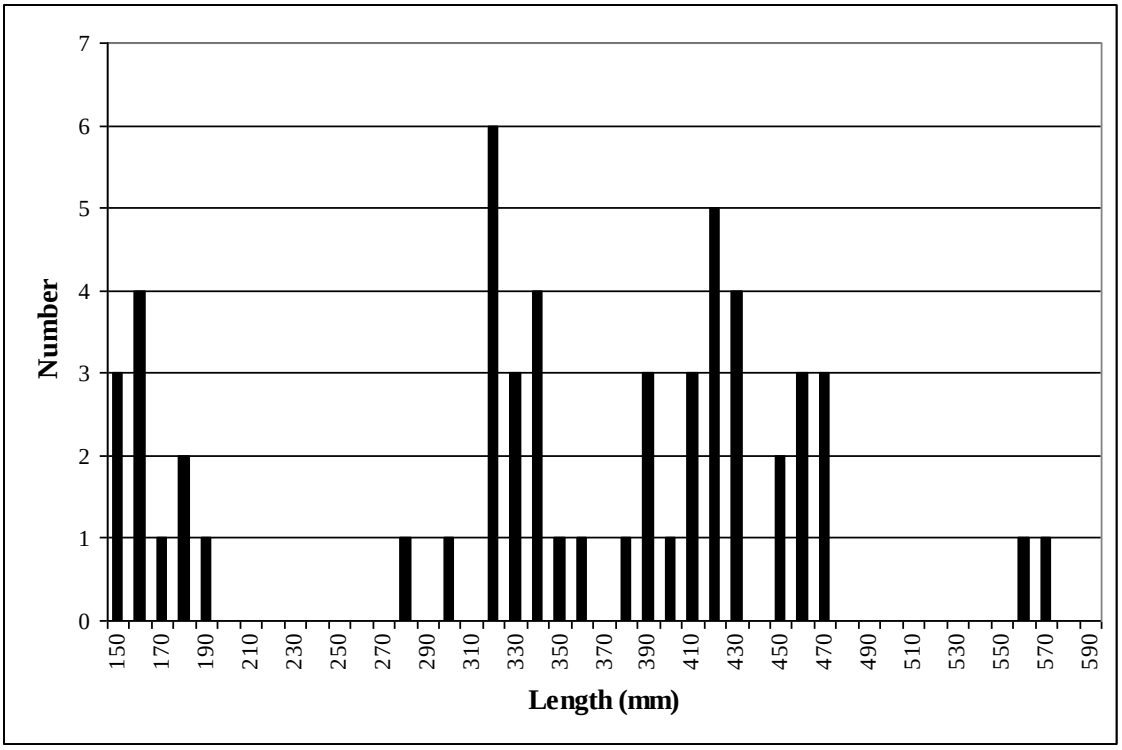


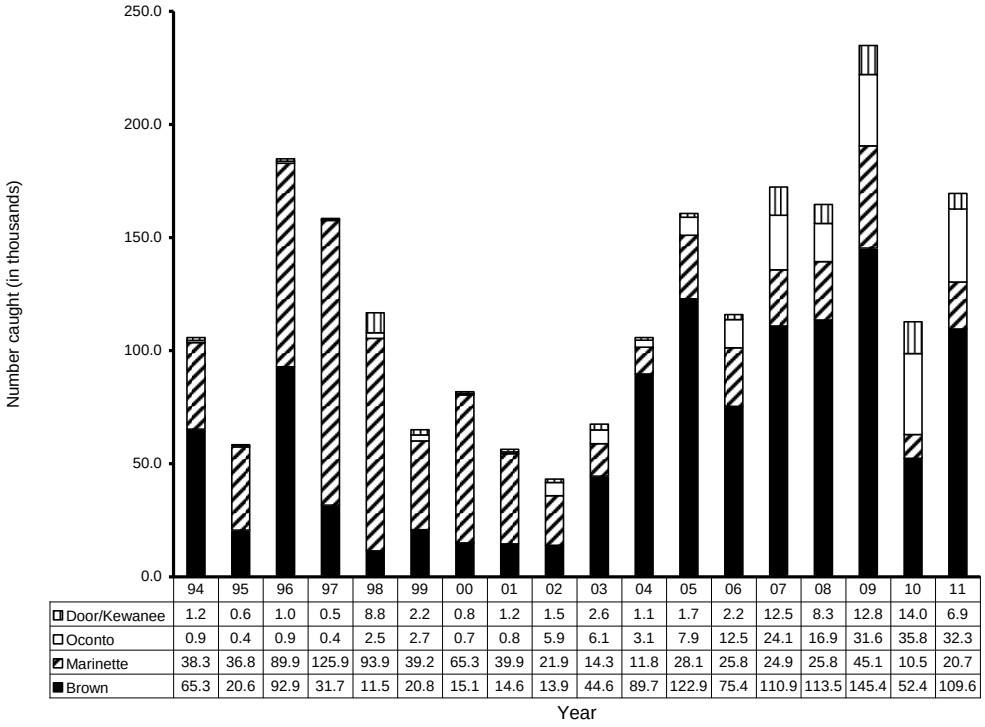
Figure 4. Length-frequency distribution of walleye sampled while electrofishing lower Green Bay during 2011.

Catch and Harvest

Total catch of walleye from Wisconsin waters of Green Bay was estimated at 169,508 during the 2011 open water season (March–October 31). This was a 50% increase from the estimated 112,751 walleye that were caught during the 2010 open water season. 2011 was in the top five years of estimated total catch noted since 1994 (Figure 5) and above the average catch of 96,878 estimated since 1986. The largest increases in catch in 2011 were noted in Brown and Marinette Counties, while the other counties, Oconto and Door/Kewaunee showed small declines.

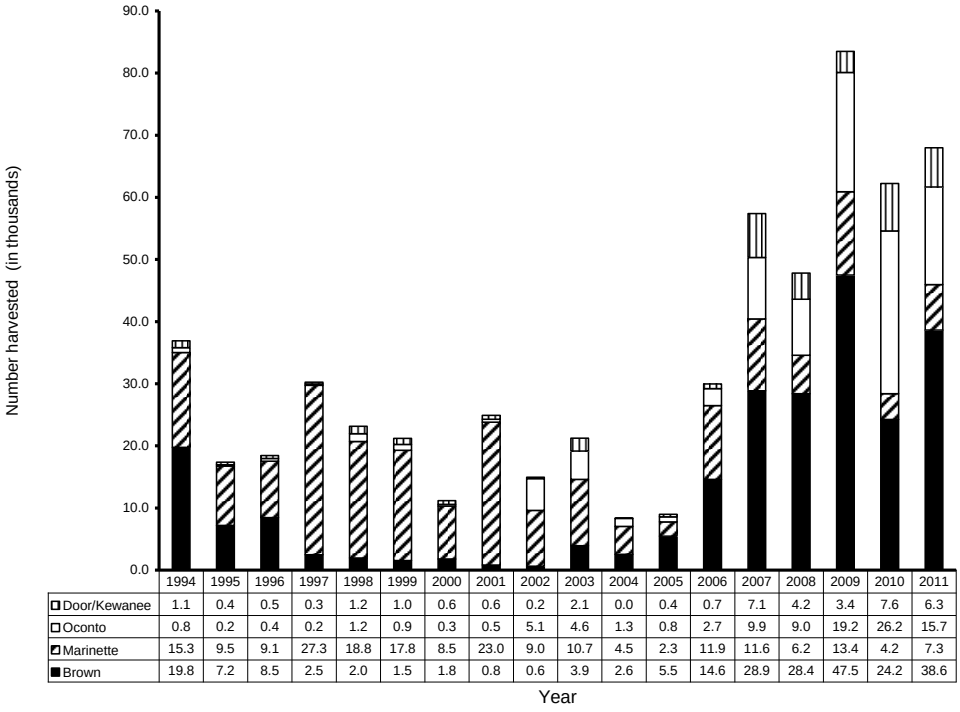
The total open water season harvest of walleye from Wisconsin waters of Green Bay increased 9.3% from 62,222 harvested in 2010 to 67,981 in 2011 (Figure 6). Despite the harvest only showing modest gains in 2011 compared to the large increase in catch, likely due to a large percentage of walleye caught being young and less than the 15 inch minimum size limit (Figure 3), the harvest in 2011 was the 2nd highest open water harvest measured since 1994. Harvest increased in Brown and Marinette Counties and decreased in Door/Kewaunee and Oconto Counties during 2011 compared to 2010.

The 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 and lower Green Bay. Increases in catch are likely due to strong year classes in 2008, 2009 and 2010. Increased harvests noted since 2007 are likely attributable to the very strong and abundant year class of 2003 and fast growing fish from the 2008 year class (Figure 1).



	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11
Door/Kewanee	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
Oconto	0.9	0.4	0.9	0.4	2.5	2.7	0.7	0.8	5.9	6.1	3.1	7.9	12.5	24.1	16.9	31.6	35.8	32.3
Marinette	38.3	36.8	89.9	125.9	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
Brown	65.3	20.6	92.9	31.7	11.5	20.8	15.1	14.6	13.9	44.6	89.7	122.9	75.4	110.9	113.5	145.4	52.4	109.6

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 1995-2011.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Door/Kewanee	1.1	0.4	0.5	0.3	1.2	1.0	0.6	0.6	0.2	2.1	0.0	0.4	0.7	7.1	4.2	3.4	7.6	6.3
Oconto	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
Marinette	15.3	9.5	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
Brown	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

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 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 will 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

Isermann, D. A. and C. T. Knight. 2005. A computer program for age length keys incorporating age assignment to individual fish. North American Journal of Fisheries Management 25:1153-1160.

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 Publicaiton 91-1.

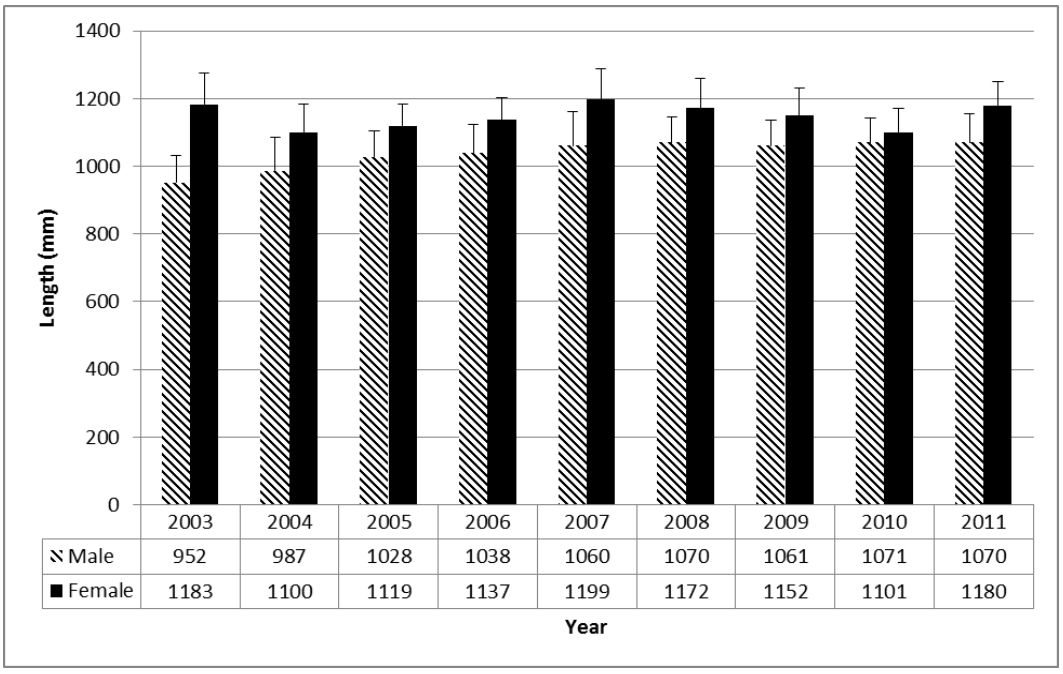
GREAT LAKES MUSKELLUNGE

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. The average size of male musky captured during the spring sampling period continues to increase as this re-established population continues to mature (Figure 1). In 2011, the average male length was 1070 mm (42.1”). The size of an average female captured during 2011 spring fyke netting was 1180 mm (46.5”). 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
Male	952	987	1028	1038	1060	1070	1061	1071	1070
Female	1183	1100	1119	1137	1199	1172	1152	1101	1180

Figure 1. Average length distributions of male and female muskellunge captured during spring netting surveys of the lower Fox River from 2003-2011.

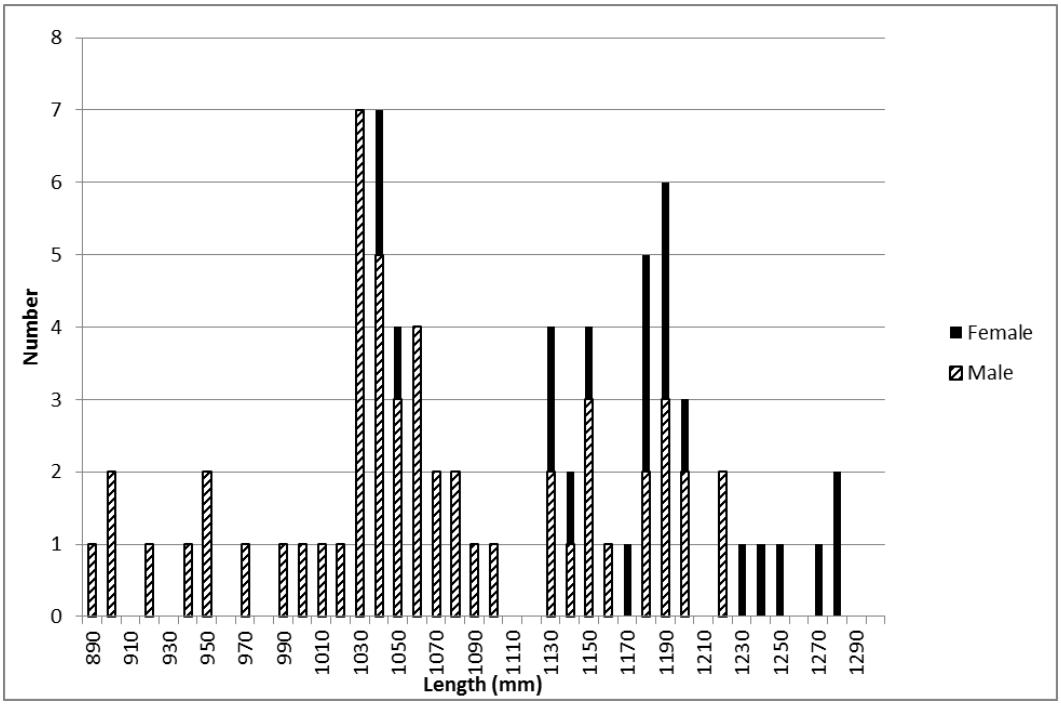


Figure 2. Length frequency distribution of Great Lakes Spotted muskellunge, by sex, captured during spring 2011 fyke netting of the Lower Fox River.

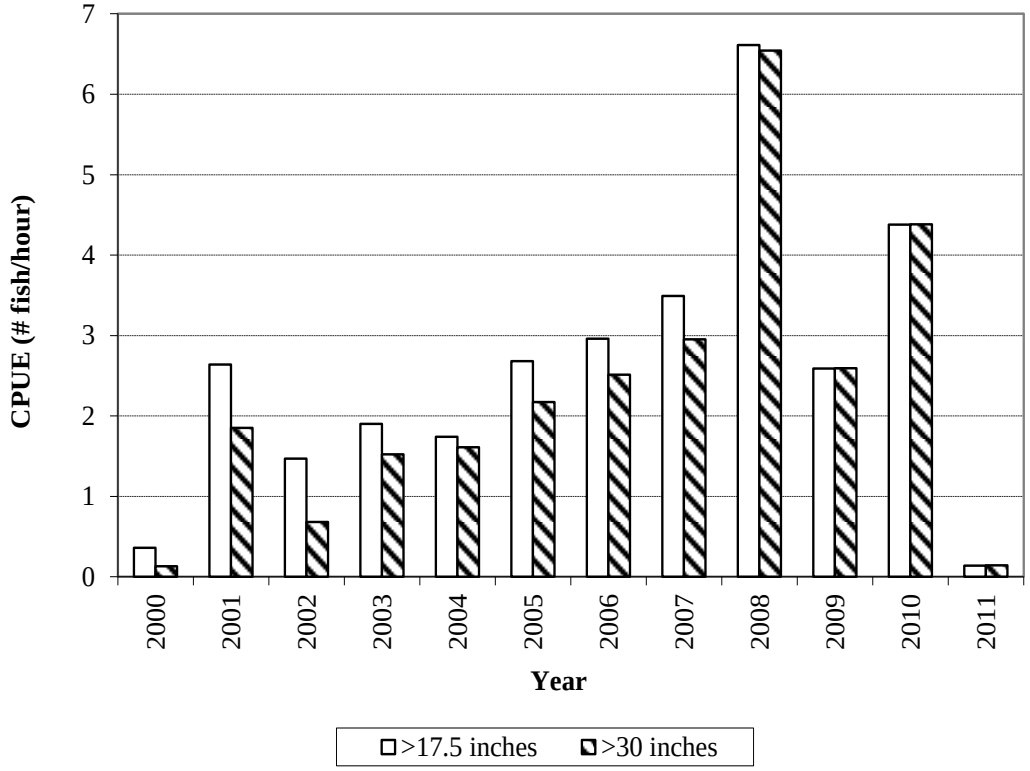


Figure 3. Catch per Unit Effort (CPUE) from night time electrofishing of Lower Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2011.

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 2011 because of warm water conditions, only a single musky, 1060 mm (41.7") in length was captured. The CPUE in the fall index sampling steadily increased between 2000 and 2008, but since has been more variable. This suggests a growing population, with increases in CPUE several years following stocking (2000-2008) and declines in CPUE following several years of low or no stocking (Table 1).

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 for three years. 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 2011 eggs were collected from the Fox River, raised at BAFF and 5,242 fingerling stocked into Green Bay at several locations in fall 2011 (Figure 4).

Table 1. Stockings of great lakes strain muskellunge into the waters and tributaries of Green Bay, Lake Michigan from 1989-2011.

Stocking	Fingerlings	Yearlings
1989	5261	0
1990	1274	9
1991	2624	0
1992	2107	152
1993	1394	215
1994	0	237
1995	1803	0
1996	3135	247
1997	1842	130
1998	4311	278
1999	3305	294
2000	2451	295
2001	1854	176
2002	9281	140
2003	33107	103
2004	20772	161
2005	18609	325
2006	18785	421
2007	0	640
2008	0	0

Stocking	Fingerlings	Yearlings
2009	0	0
2010	2791	0
2011	5242	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 a total of 24,153 hours of directed effort for muskellunge on Green Bay and the lower Fox River occurred from March 15th through October 31st, 2011 (Figure 5). Although the 2011 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 increased in 2011 after four years of declines (Figure 5). Despite the increase noted in 2011, CPUE was far below the high CPUE noted in 2006, although it was higher than the statewide directed muskellunge catch rate averages of 0.039 fish/hour (25.6 hours/fish) for naturally reproduced populations and 0.020 fish/hour (50 hours/fish) for populations maintained by stocking (Simonson 2003). In 2011 the creel survey estimated that anglers caught 828 musky but the harvest was estimated at zero.

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 creel estimates of CPUE have been higher than tournament CPUE. Likely poor fishing conditions during the Best of the Bay Tournament the past several years is responsible for much of the decline in CPUE noted.

Future

The population of adult Great Lakes strain muskellunge in Green Bay waters is increasing. Currently stocking maintains the population with only a few natural recruits captured during surveys. 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.

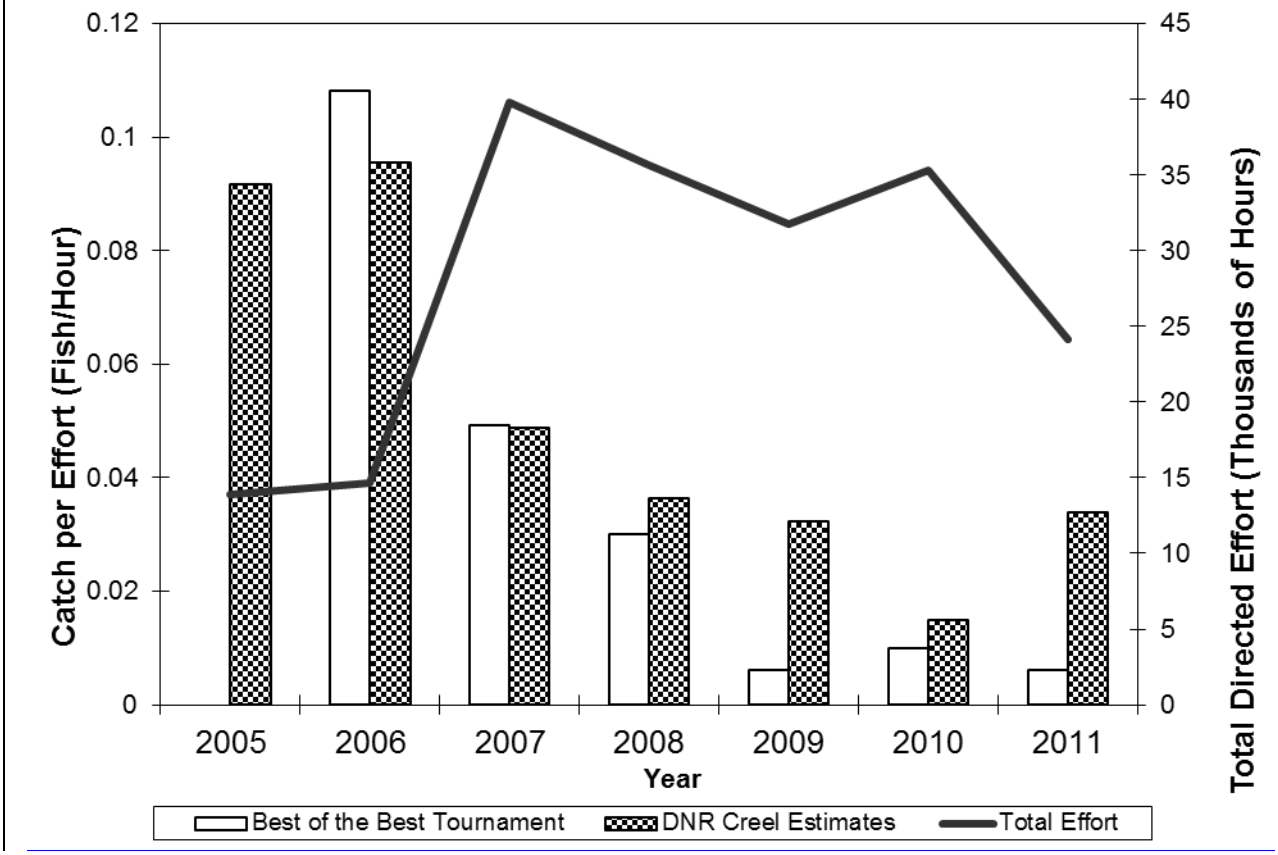


Figure 5. Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2011 is displayed by the solid black line and on the right axis. The left axis shows catch rate in number of muskellunge caught per hour of directed fishing, the estimated catch rate from creel surveys is displayed in black hatching, and the catch rate from the Muskies Inc. "Best of the Best Tournament" is shown by the clear bars.

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.

References

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.

Simonson, T. 2003. Muskellunge Management Update. Publication FH - 508 – 2003 Wisconsin Department of Natural Resources , Bureau of Fisheries Management and Habitat Protection, Madison, WI

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 2011.

Background and Sport Harvest

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).

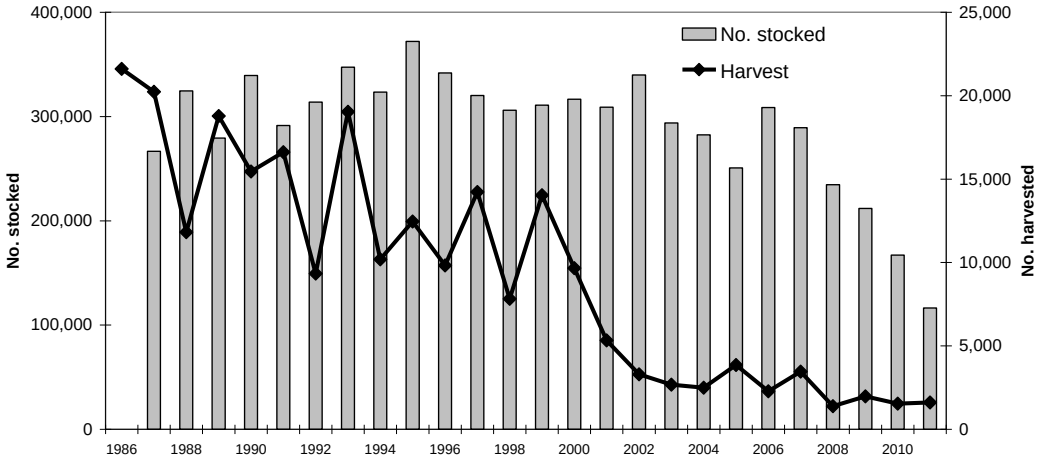


Figure 1. Number of stocked and harvested brown trout in Wisconsin waters of Green Bay by year. Fingerling stocking reduced in 2010 and eliminated in 2011. Only yearling brown trout are currently stocked into Green Bay waters.

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 present. 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 with a 0.6% return of stocked fish. Harvest estimates for 2011 continued to be low at 1,603 fish. Despite a low total harvest, harvest rates were improved (25 hours/fish) compared to recent years, mainly because salmonid effort in Green Bay was at an all-time low in 2011 at 40,225 angler hours. The 25-year average is 168,013 angler hours. Harvest rates from 1986 -1999 averaged 16.4 hours per fish and 32.9 hours per fish from 2000-2010.

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. Sharp reductions in fall fingerling stocking and implementation of offshore stocking began in 2010 (Table 1), and complete implementation (discontinue fall fingerlings; maintain offshore stocking) began in 2011. This 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) Fishing effort per brown trout caught less than or equal to 23 hours per fish based on targeted total salmonid fishing effort.*

Table 1. Green Bay brown trout stocking information for 2011.

Date	***Location***	***Strain/Size***	***Number***	***Clip***	***Vessel Used***
23-Feb-2011	Under ice Grid 804	Seeforellen yearling	21,898	ARM	--
24-Feb-2011	Under ice Grid 804	Seeforellen yearling	8,529	ARM	--
18-Apr-2011	Offshore Grid 804	Seeforellen yearling	25,218		WDNR pontoon cage
21-Apr-2011	Offshore Grid 804	Seeforellen yearling	19,881		WDNR pontoon cage
27-Apr-2011	Offshore Grid 804	Wild Rose yearling	23,626		WDNR pontoon cage
3-May-2011	Offshore Grid 804	Wild Rose yearling	17,157		WDNR pontoon cage
		Total yearlings	**116,309**		

Brown Trout Derby

The Marinette-Menominee Great Lakes Sport Fishermen 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. Since 2001, the number of brown trout registered in the derby has sharply declined. In 2011, brown trout comprised only 4% of the total derby harvest (Table 2). Chinook salmon catches were also severely reduced during the 2011 event, and many participants targeted walleye instead.

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

Fall Electrofishing Surveys

Electrofishing surveys on the lower Menominee River were completed on October 27, November 1, 7, and 14, 2011, with a combined CPE of 9.5 fish/hour (Figure 2). Fifty-four brown trout were captured, with a mean length of 23.3 inches. The majority (59%) of the fish were captured on October 27, with decreasing numbers as the weeks progressed. WDNR discontinued collecting seeforellen broodstock from the Menominee River beginning in 2010. The Kewaunee and Root Rivers continue to provide broodstock for Wisconsin's seeforellen program.

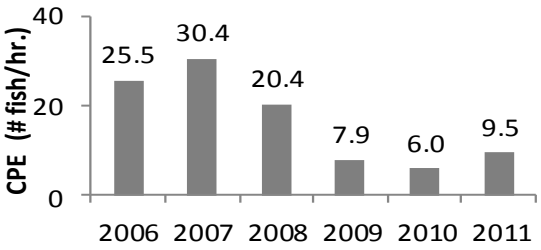


Figure 2. CPE (# fish/hour) of brown trout captured during fall electrofishing surveys on the lower Menominee River, 2006-2011.

Floy-tagging Studies and Voluntary Fishing Logs

Since 2009, WDNR and the Marinette-Menominee Great Lakes Sport Fishermen 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 as of August 2012. In 2011, the hatchery did not have large brown trout available, so the club purchased large rainbow trout instead. Three of four tag returns were caught within a month near the stocking site near Menominee. One rainbow (25 inch; 7 lbs) was caught in 2012 near Two Rivers, Manitowoc County.

Table 3. Trout floy-tagged at Menominee Marina for Kid's Fishing Day by MMGLSF Club, 2009-2011.

Year	Species	# tagged	mean size (inches)	% return[a]
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%

[a]As of August 2012

WDNR obtained information from four volunteer angler fishing logs in 2011. Anglers reported a total of 42 brown trout harvested, a total fishing effort of 489 hours, and an effort requirement of 4 hours per fish. This was improved from 2010, when 12 volunteer fishing logs reported a total of 32 brown trout harvested, and an effort requirement of 6.4 hours per fish. These effort requirements are significantly less than brown trout effort requirements (25 hr/fish) obtained from randomized creel surveys on Green Bay in 2011 using directed salmonid fishing effort. One likely reason for the difference is fishing ability. The creel survey includes anglers of all skill levels, while anglers volunteering to fill out a fishing log tend to be more experienced at successfully targeting brown trout. We will continue to look at trends obtained from these logbooks in subsequent years.

Summary

Although 2011 total harvest of Green Bay brown trout was low (1,603 fish) and not close to the target of 4% return, directed salmonid fishing effort was also low. It is encouraging that 2011 effort requirements (25 hours/fish) are trending towards the target of 23 hours/fish and that harvest and harvest rates obtained from 2011 volunteer fishing logs showed improvement from the previous year. 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

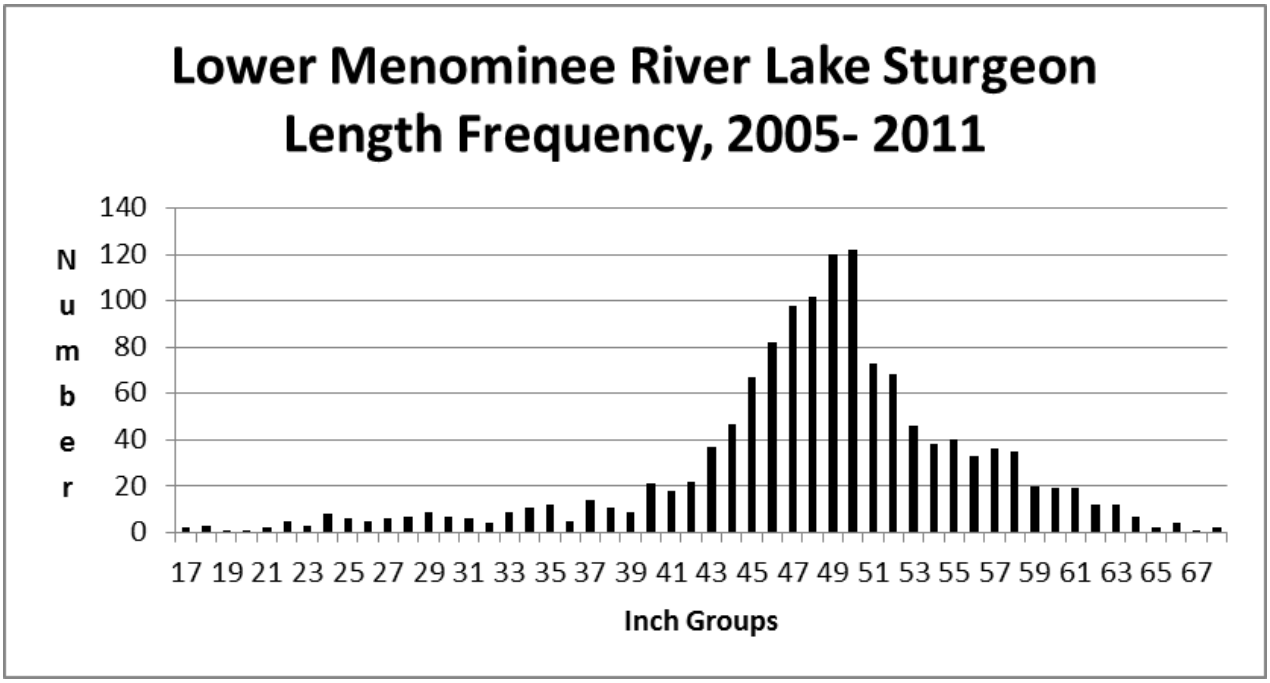
Michael Donofrio and Brad Eggold

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 3 distinct populations of sturgeon in Green Bay (Wolf-Fox, Peshtigo-Oconto, and Menominee River). The Menominee River contains the largest population in Lake Michigan waters. Lake sturgeon stocking has occurred on the Milwaukee and Manitowoc/ Kewaunee rivers and restoration of those populations 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 was conducted annually from 2005-11 on the lower Menominee River. These efforts produced 1,193 lake sturgeon. Over this seven year period, most of the fish (85%) were subjectively labeled as adults (>107 cm or 42 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 2005-10, the smallest sturgeon recorded was 44 cm and several fish were over 173 cm in length. The population estimate for the 107 cm and larger segment of the population was 2,287 with confidence intervals of 2,060 to 2,554 in 2009.



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 Wolf and Fox River populations are closely associated with linkage to the Lake Winnebago population. The Peshtigo and Oconto rivers form one population and the Menominee river is a third population. That theory is supported by movement studies from Menominee River recaptured lake sturgeon.

We proceeded with our movement study through ultrasonic transmitters implanted in lake sturgeon at the Menominee, Peshtigo, Fox and Oconto rivers. We have surgically implanted sonic tags in 151 adults (Menominee (42%), Peshtigo (32%), and Oconto (26%)). Their movements are monitored continuously through 2 stationery receivers in each of those 4 rivers. These fish were sexually identified as 1% F1, 13% F2, 4% F3, 27% F4, and 55% M2. The average length of the females was 60.1 inches and males were 54.9 inches. The spawning site fidelity in 4 rivers (Menominee, Peshtigo, Oconto, and Fox) will be monitored through 2014.

Menominee River Sport Fishery

The Menominee River is the only river open to sport harvest in Lake Michigan waters. Licensed, modern-day harvest of lake sturgeon on the Menominee River has occurred since 1946. A mandatory registration system was enacted in 1983. The minimum size limit was 50". The bag limit was reduced from 2 to 1 fish per season in 1992. In 1997, Tom Thuemler of WDNR wrote, "An alternative (regulation approach) would be complete closure of the season every other year. This would halve the exploitation rates and yet still allow some harvest, and might be acceptable if catch and release only season operated in the year when harvest was prohibited". In 2000, the minimum size limit differed in alternating years with a 70" limit in even years and a 50" limit in odd years.

The hook and line harvest of lake sturgeon from the Menominee River increased to the following in selected years: 80 in 1989, 109 in 1998, 167 in 1999, 185 in 2001, 210 in 2003, and 172 in 2005. The harvest in the three 70" size limit years (2000, 2002, and 2004) averaged at 0 fish. While the alternating year's size limits reduced the overall harvest, the average harvest for the last 6 years (1999- 2004) was 94 fish. Fishing pressure since 1999 has increased by 12%/ harvest year.

The Menominee River is jointly managed with the State of Michigan. The agencies decided that current harvest extractions were negatively impacting the recovery of lake sturgeon in the Menominee River and Green Bay. The State of Michigan adopted the following regulation for the 2006 hook and line season: catch and release only below the Menominee Dam, 1 lake sturgeon per angler with a minimum size limit of sixty inches above that dam and open season from first Saturday in September to September 30. Wisconsin Department of Natural Resources adopted the same regulations in 2006. Those regulation changes reduced the harvest to six lake sturgeon 2006-2011.

During the spawning of Lake Sturgeon on the Wolf River in 2011, genetic samples were taken from the adults used to provide eggs for the Milwaukee and Kewaunee streamside rearing facilities (SRF). A small section of the caudal fin was clipped and stored in uniquely number vials filled with 96% ETOH. In addition, fin samples from the all stocked lake sturgeon were taken and stored in 96% ETOH. These samples are being saved for genetic analysis and have been transferred to Dr. Brian Sloss.

The Lake Michigan Lake Sturgeon Rehabilitation Plan was used as a guideline during the collection of gametes for the Milwaukee and Kewaunee SRF. We collected 6 females and mated them with at least 4 and in most cases 5 males per female. This gave us 24 families of fish. The individual batches from a female were then put into separate hatching jars at the Milwaukee and Kewaunee SRF. Because we had 6 females for each Wisconsin SRF, we originally decided that each facility would keep eggs from 4

females. The Milwaukee River SRF kept eggs from females 2 – 5 and because of some poor hatches the Kewaunee Facility kept some eggs from each female (see above). Two egg batches in the Milwaukee trailer did not develop so we chose to use the 4 other females for further development. Because of lower densities of larvae in the fry tanks (1,000 per tank) and better feeding protocols we ended up with 1,116 large lake sturgeon for stocking in the Milwaukee River in October. The lake sturgeon in the Milwaukee SRF were stocked out below the Thiensville Dam in the City of Thiensville on October 1, 2011 and the lake sturgeon produced at the Kewaunee SRF were stocked out below the Buzz Besadny Fisheries Facility on September 30, 2011.

At the time of stocking, sturgeon averaged 172 mm (6.77") and 22.8 g (0.8 ounces) at the Milwaukee River SRF and 150.6 (5.93") and 14.4g (5.1 oz) at the Kewaunee River SRF. The lengths and weights for the Milwaukee River SRF fish are slightly lower than in past years. Two factors contributed to the lower condition factor in 2011: 1) Lake sturgeon did not spawn until May 4 about 20 days later than in previous years. Therefore, these fish lost 20 days of growth potential and could not reach the size found in previous years. 2) The Kewaunee Facility had a power failure in 2011 that killed 60% of their fish and affected the health of the survivors.

Milwaukee River SRF

The Milwaukee SRF was put into service on May 4, 2011. Wisconsin DNR personnel artificially spawned 6 females from the Wolf River and transferred those fertilized eggs to the trailer on May 4, 2011. Approximately 20,000 eggs from six females were transferred to the trailers. Eggs from each female were placed into a separate hatching jar. After hatch, eggs were selected from 4 females for further development. Weather conditions on the Wolf River caused the maturation schedule for the Lake Sturgeon to be delayed by about 20 days. Over time the average spawning date has been mid-April and the 20 day delay will affect the size and condition of Lake Sturgeon stocked in October.

During the initial egg incubation, formalin treatments were applied to the eggs on day 3, 4, 5 and 7. These treatments drastically reduced egg mortality and lead to increased number of hatched larval lake sturgeon. By May 11, lake sturgeon larvae began to hatch and could be seen in the incubation jars. Over the course of the next three days hatching continued until all larvae were in the smaller fry tanks. On May 23, all sturgeon were transferred from the smaller fry tanks to the larger fingerling tanks to make it easier to feed and clean the raceways. During the month of May and into June, sturgeon were fed brine shrimp followed by grated blood worms and finally whole blood worms.

It was estimated that following hatching, there were approximately 1,500 – 7,000 larvae per fry tank. Numbers of larvae were lowered to 1,200 fish in all four tanks. The number of lake sturgeon in each tank was set based on experiences in 2007 through 2009 that suggested higher levels would result in excessive mortalities.

VHS testing was conducted on June 6, 2011 which allowed us to stock smaller fingerlings to reduce density in the tanks. On August 10, 2011 we stocked 500. From August 10 until the fish were stocked on October 1 only a few more fish died. Because of the early success in number of hatched larvae, we were able to stock 1,116 on October 1, 2011. This year represented the second highest number of fish stocked from the facility in the 6 years of operation.

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 season. On day 90, 500 fish were removed for stocking and tanks were dropped to 300 fish per tank to meet our stocking objective. This drastically reduced the density in the tanks and allowed for greater growth potential for the remainder of the season.

Kewaunee River SRF

In 2010 the trailer in Kewaunee was installed in a more secure semi-permanent location so it was left in place after the 2010 production year. Consequently, set up of the facility entailed installation of the water intake and pump system and replacement of a few valves that were ice-damaged over the winter. Sturgeon eggs were collected on May 4th, a full 20 days later that in 2010 using the same protocol as previous years. Eggs were again disinfected 2 times, 1st at the collection site and 2nd just prior to being put in the hatching jars, with a 100ppm iodine treatment lasting 15 minutes. Eggs were collected from six females to maximize the genetic capacity of the trailers. Table 1 shows the egg information from each female.

Table 1. Sturgeon Egg information for the Kewaunee SRF 2011

Female #	eggs/fl oz	ml of eggs	oz of eggs	# of eggs
F1	787	700	23.67	18,628
F2	963	300	10.15	9,774
F3	1,083	240	8.12	8,794
F4	1,083	500	16.91	18,314
F5	1,008	220	7.44	7,500
F7	963	410	13.87	13,357

Four of the egg batches were put into the same funnel-type hatching jars that have been used the last few years and two were put into downsized versions of McDonald hatching jars. The new jars were being compared to the funnel Style to avoid the turbulence in the bottom in the funnel style jars. Water flow in the new jars was much smoother and more evenly distributed. Staff is now looking into purchasing additional new jars to transition the facilities to the new type jars. Eggs were treated with formalin on days 5 and 8. Fish began to hatch on day 10, at 218 Daily Temperature Units (DTU). Hatching in all jars was completed by day 13, at 270 DTU. At 8 days post hatch the fry were measured by volume and placed as shown in Table 2 into each tank with F1 & F2 being combined, F3 & F5 combined and F4 & F7 put in separate tanks.

Table 2. Sturgeon Fry information for the Kewaunee SRF 2011

Female #	# fry/ml	ml for 2,000 fry/tank	Total fry per tank	ml fry discarded	Total fry hatched/family
F1	27.36	73/36*	985	100	3,721
F2	22.15	90/43*	952	185	5,050
F3	21.30	94/87**	1853	0	1,853
F4	18.90	106	2003	215	6,067
F5	14.50	138/70*	1015	60	1,885
F7	21.00	95	1995	250	7,245

*Two families were combined, so only 1,000 fry per family were added to each tank using about ½ of volume of fry needed per family to get 2,000 fry per tank. **-total fry produced, 87ml was put into tank

Brine shrimp feeding operations, utilizing the Milwaukee brine shrimp feeder design, started on day 14. Although most fish may not have been ready to feed, food was offered to allow fry that were ready to start eating.. On day 15 post hatch all tanks were sampled for fish health with 15 fish from each tank removed for the sampling process. The fry began to feed on chopped blood worms at 30 days post hatch. As happened in 2010, dirty water periods again plagued the early rearing stages when the fish are most

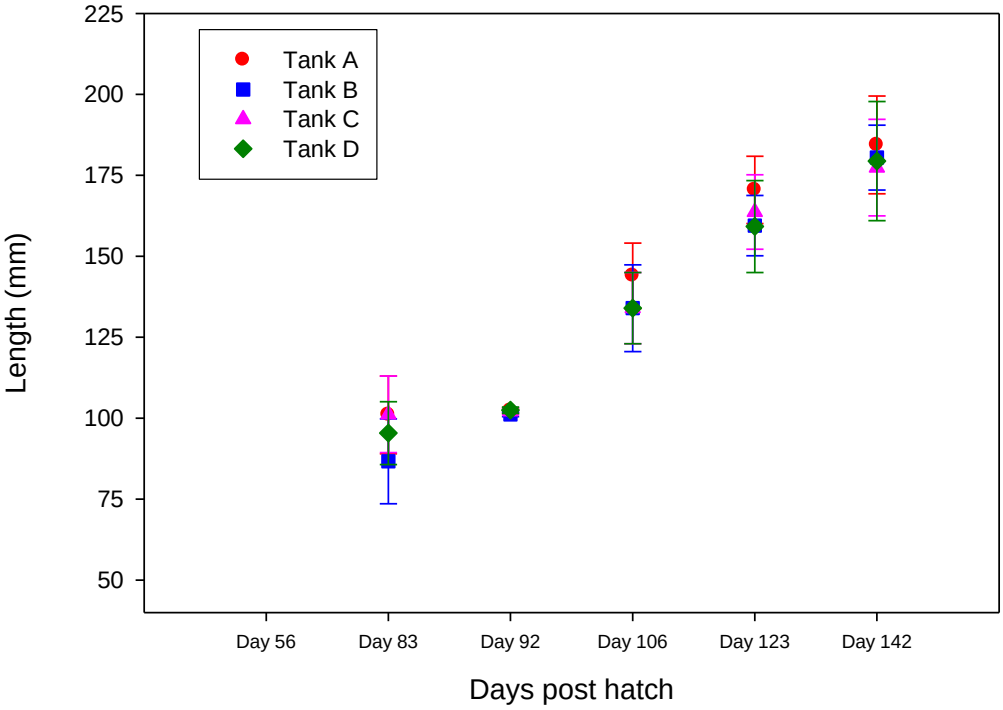
vulnerable. A new system was devised for providing clearer water to the facility during the inevitable dirty water periods. This system, basically a recirculation system, will be put into production for the 2012 rearing cycle and will hopefully provide more suitable conditions for the fry during the times when the dirty water occurs. Salt treatments of 1% were used regularly as a means to battle the effect the dirty water conditions have on the fish, mainly gill problems. Poor conditions slow fry growth and endanger health. Daily mortalities continued thru late July. Fish were thinned to about 500 per tank on July 14 (day 58 post hatch). Four days later a power and simultaneous alarm failure caused the fish to be without water for about 8 hours which resulted in about 60% final mortality. As a result, some additional health samples were taken and permission to treat as needed with up to 100ppm hydrogen peroxide was given. Fish were sorted by size into four different groups on August 16 to facilitate feeding operations within each tank.

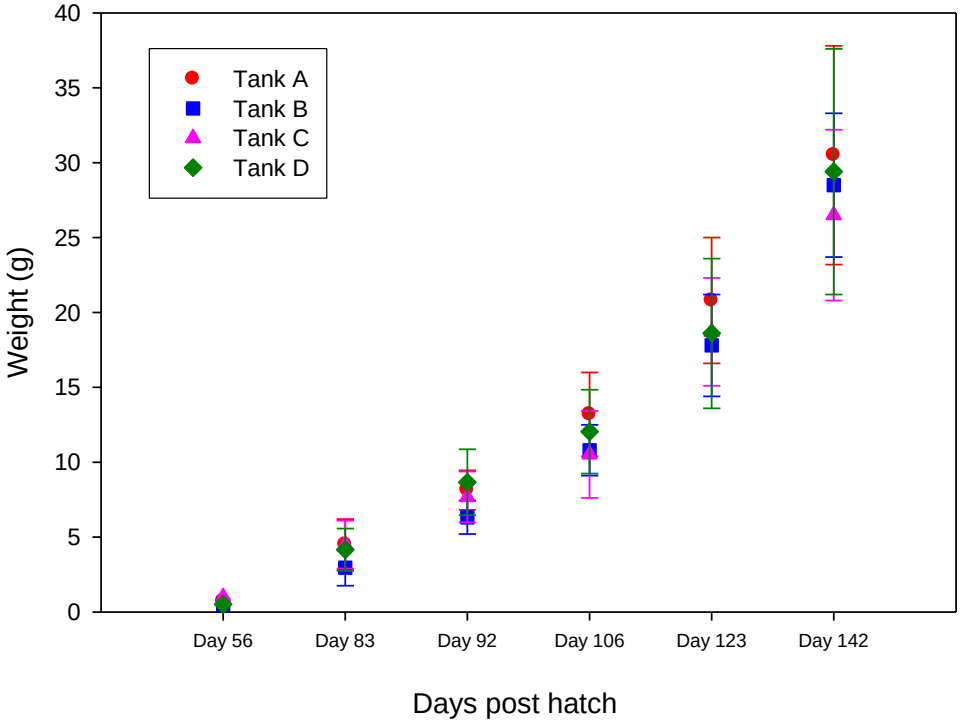
Eggs from all six of the females at the Kewaunee SRF hatched out some fry as shown in Table 2. Fry from two families were able to be kept in separate takes while 2 pairs of families were combined in the other two tanks so all six females were represented. At 91 days post hatch the fish were sorted into similar size groups to facilitate feeding and minimize predation. Frequent poor water quality periods when the fish were small and a power outage event led to only about half of the 1,000 fish quota being stocked into the Kewaunee River. Average size at stocking in 2011 was a bit smaller than the previous two years for the fish from the Kewaunee SRF but was still, at 150mm (5.8") in length and 14g (.5 oz) in weight, close to the project goal of stocking 6 inch fish . A total of 461 left vent (LV) clipped sturgeon were stocked into the Kewaunee River on September 30, 2011, 136 days after hatching. Just over 80% of the fish (361) were also large enough to be injected with a PIT tag along with the LV fin clip.

Table 3. Growth trajectories, expressed as numbers of fish per gram of total fish weight.

Days Post Hatch	Fish per g Tank 1	Fish per g Tank 2	Fish per g Tank 3	Fish per g Tank 4	Note
34	7.11	8.63	10.41	8.57	
41	7.9	7.5	9	8	
58	1.9	2.75	3.3	2.7	
91	0.65	0.18	0.16	0.14	sorted by size
104	0.26	0.12	0.16	0.09	
128	0.11	0.06	0.08	0.05	pit tag data

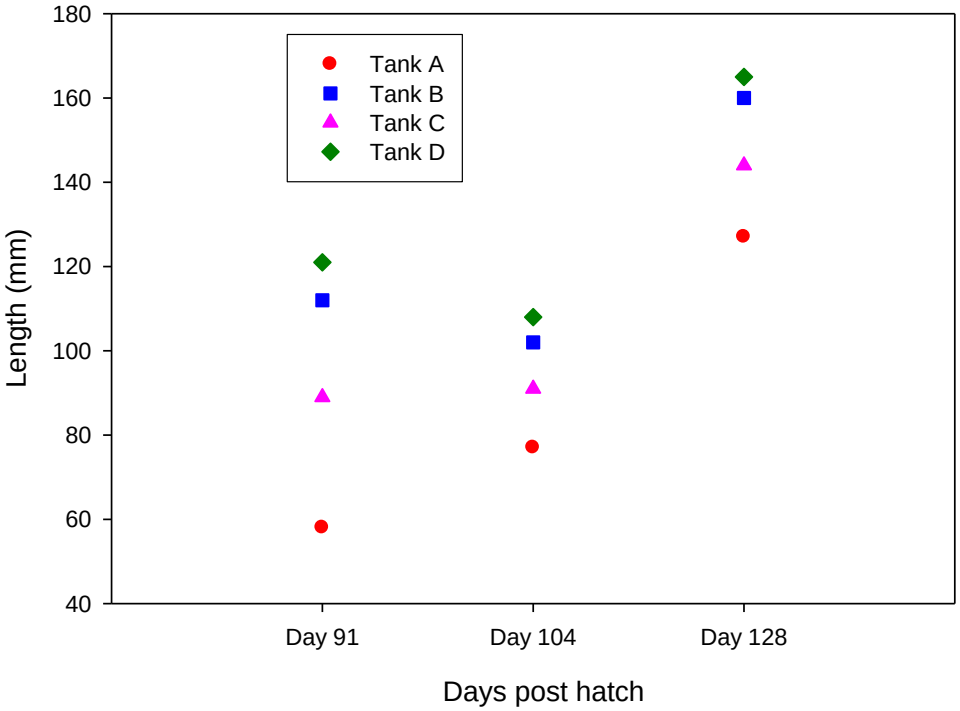
Average length and weight of Lake Sturgeon at the Milwaukee Streamside Rearing Facility, 2011

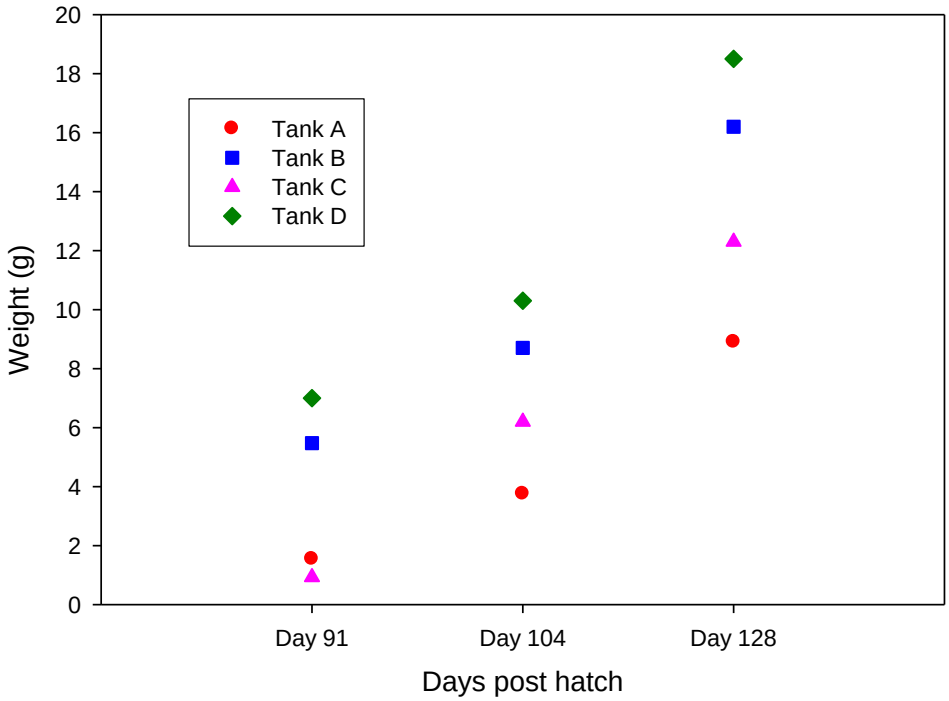




Lake Sturgeon were stocked and 300 sturgeon where put in each tank on Day 90

Average length and weight of Lake Sturgeon at the Kewaunee Streamside Rearing Facility, 2011





Lake Sturgeon were sorted and sized graded on Day 91

COMMERCIAL CHUB FISHERY AND CHUB STOCKS

Timothy Kroeff and David Schindelholz

The total bloater chub harvest from commercial gill nets was 39,630 pounds for calendar year 2011, a decrease of 56% from 2010 (Tables 1 and 2). Commercial smelt trawlers harvested 39,540 pounds of unmarketable chubs incidental to the targeted smelt harvest. No marketable chubs were reported for the year from the trawlers. This compares to 16,090 pounds of unmarketable chubs harvested in 2010.

Table 1. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gill net chub fishery 1979-2011. 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

Table 2. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2011.

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

[a] For the years 81-85, 90 & 91, 98-11 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 34,262 pounds. This is a decrease of 62% from 2010, and a drop of almost 80% from 2009. Only about 1% of the allowed quota of 3 million pounds was caught in 2011 in this zone. The 2011 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, 5,368 pounds were reported caught, slightly less than what was harvested in 2010. Again, less than 1% of the total northern quota of 600,000 pounds was caught. This is the lowest yearly catch for this zone since chub fishing reopened in 1981. The southern zone CPE was slightly less than 2010 while the CPE in the north increased by 46%, however, fishing effort was one of the lowest on record. 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. Gill net effort in the south decreased by 62% or 3,476,000 feet, while effort in the north decreased 161,200 feet or 34%. In the south, 11 of the 35 permit holders reported harvesting chubs, while in the north 4 of 17 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 2011 and off Sheboygan in January and February of 2012 (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, Baileys Harbor and Sheboygan. 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 down from 2010 off Algoma/Baileys Harbor (pooled data) and up slightly off Sheboygan. Chubs up to 16 years of age were collected off Algoma/Baileys Harbor and up to 19 off Sheboygan (Figure 1). There has also been a dramatic shift in sex ratios. In recent years the females have generally outnumbered the males, but males were favored in the catches off all the latest assessment sights. This switch in sex ratios was first recorded in our Sheboygan assessments in 2010.

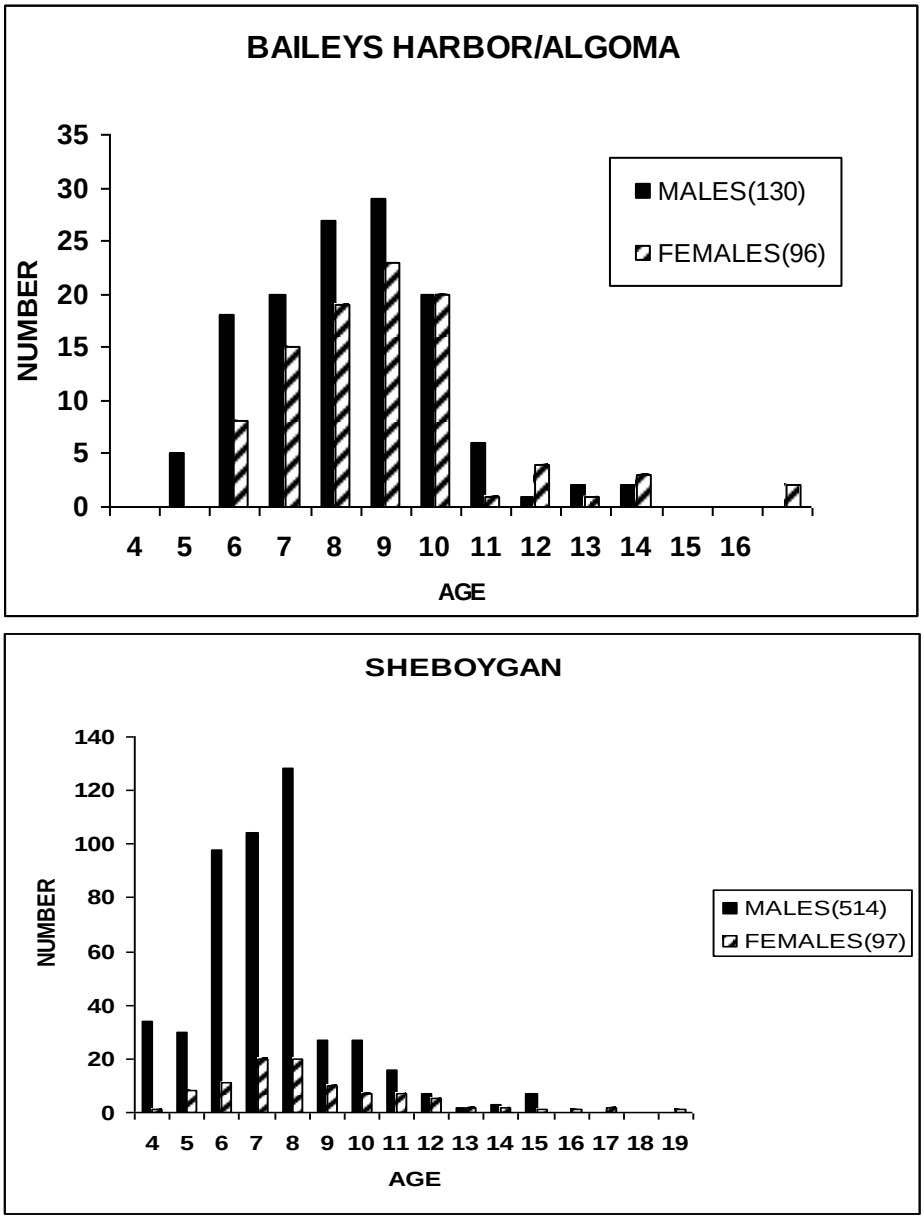


Figure 1. Age composition by number and sex of chubs captured during graded-mesh assessments along the Wisconsin L. Mich. shoreline, 2011.

Catches of chubs in the standard 2-1\2 inch mesh were poor off Algoma/Baileys Harbor and lower than in 2010. Catches from all three sites were combined for reporting purposes. Ages from standard mesh ranged from 4 to 18 years of age (Figure 2). Sex ratios in this year's standard mesh have also 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 63% catch of females. This is in comparison to a 71% catch of females in 2010. 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.

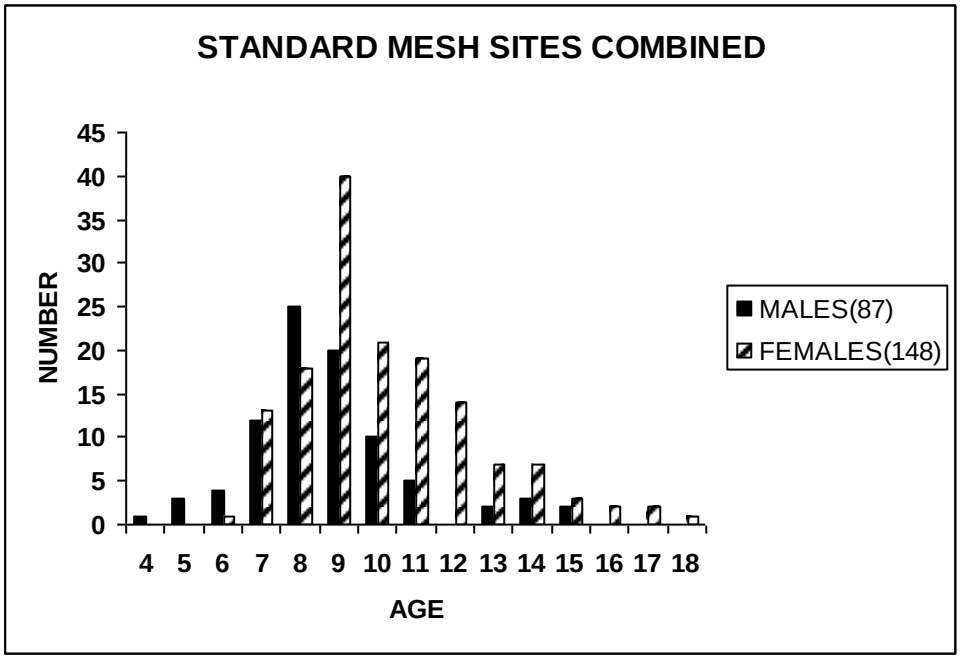


Figure 2. Age composition by numbers and sex caught from standard mesh gill nets off Algoma/Baileys Harbor and Sheboygan combined.

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.

GREEN BAY FORAGE TRAWLING

Steve Hogler and Steve Surendonk

Since 2003 the Wisconsin DNR has been assessing forage fish in central Green Bay utilizing bottom trawling gear. Two transects, one running between Sturgeon Bay and Marinette (north transect) and the other between Rileys Point and Peshtigo Reef (south transect) were trawled during daylight hours in September using a 39-foot head rope trawl net. Along each transect, trawl drags were made along depth contours starting at 50 feet and then every 10 feet in depth increment. Each trawl was five minutes in length at 2 MPH. The catch from each drag was individually bagged and returned to shore to be analyzed. For each sample, individual fish were sorted by species and weighed in aggregate. A subsample of fish from each drag was measured to develop length frequencies. Dreissenid mussels were sorted from the fish catch and an aggregate weight measured. Catch from similar depths (east and west) along each transect were combined to determine the catch by depth.

In 2011, all six drags were completed on the north transect, but bad weather prevented us from completing three of six drags along the south transect. On the north transect the total weight of the catch and CPE (kg/hour trawled) was the highest at 90 feet and the lowest at 80 feet (Figure 1). Overall, with all drags combined by weight, dreissenid mussels, lake whitefish and round goby accounted for 97.6% of the biomass captured along the north transect.

At 50 feet, the catch by weight was dominated by dreissenid mussels, round goby and white sucker (Figure 1). Other common species collected at this depth included whitefish and yellow perch. Dreissenid mussels and round goby were also dominant at 60 feet and 70 feet. Other species including lake whitefish, rainbow smelt and yellow perch were captured at substantially lower abundances at these depths. At 80 and 90 feet lake whitefish and dreissenid mussels dominated the catch. Other species commonly caught at these depths included rainbow smelt, round goby, white suckers and alewife but these were captured in much lower weights.

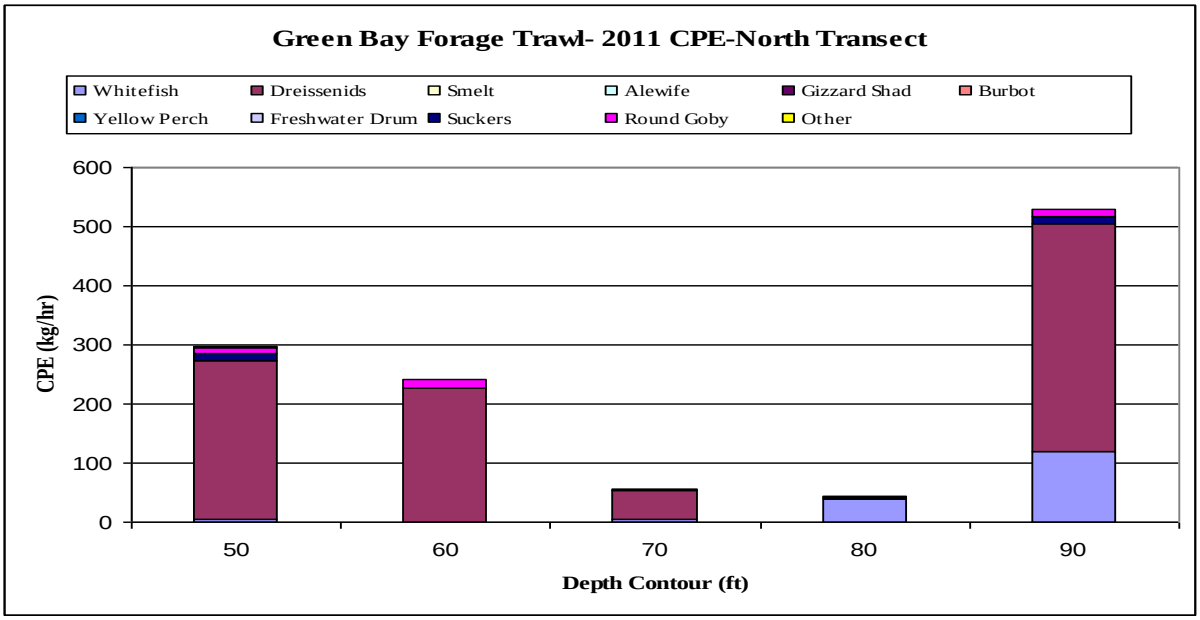


Figure 1. The 2011 CPE (kg/hr) of fish captured by species and depth strata on the north transect on Green Bay.

Across the south transect, CPE (kg/hr trawled) was the highest at 60 feet with lower CPE at 50 feet and 70 feet (Figure 2). Dreissenid mussels, lake whitefish and trout-perch dominated the catch and accounted for 86.2% of the catch by weight along this transect. Suckers, round goby, rainbow smelt, yellow perch and alewife were also commonly caught.

Trout-perch dominated the catch at 50 feet with the other species caught in much lower abundances (Figure 2). Other species captured at this depth included dreissenid mussels, suckers, round goby, lake whitefish, rainbow smelt and yellow perch. At 60 feet the catch was dominated by dreissenid mussel and lake whitefish with rainbow smelt, round goby and trout-perch captured in much lower weights. At 70 feet lake whitefish was the dominant species captured. Dreissenid mussel, round goby, white sucker and rainbow smelt were also commonly captured at this depth.

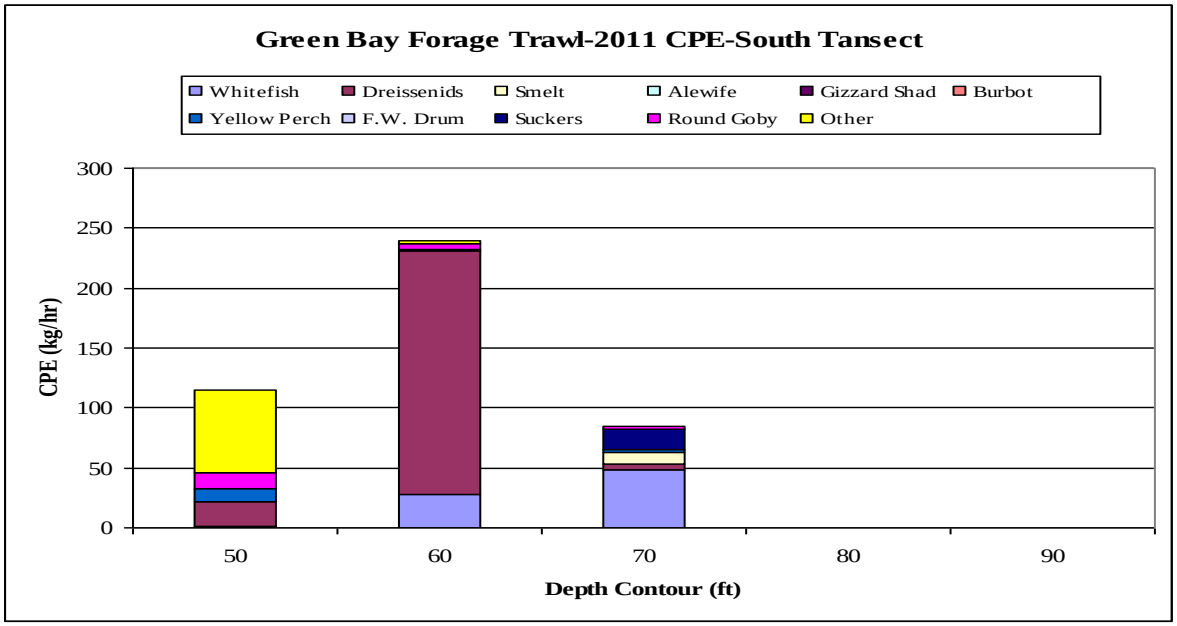


Figure 2. The 2011 CPE (kg/hr) of fish captured by species and depth strata on the south transect on Green Bay.

Nine years of trawling data allows us to make several general statements about the survey results. Total catch and CPE increased in 2011 above 2010 levels after decreasing from 2006 through 2009 (Figures 3 and 4, appendix 1 and 2). The improved catches noted in 2010 and 2011 were likely due to an increased catch of dreissenid mussels and lake whitefish on the north transect and one large catch of trout-perch at 50 feet on the southern transect.

Second, round goby and dreissenid mussels are well established in Green Bay and generally dominate our catch. In 2010 dreissenid mussel and round goby accounted for 72% and 4% of our total catch by weight respectively while in 2011 dreissenid mussel accounted for 84% of the catch and round goby made up2,5% of the catch. Both are more abundant along the north transect than on the south transect. Numerically round goby is the dominant fish species that we capture during trawling.

Thirdly, lake whitefish based on our catch are abundant in Green Bay. After several years of declining lake whitefish, CPE increased 2011. It is likely that several good year classes from the Menominee River and favorable water temperature played a role in our increased catch of lake whitefish. Since 2004 our catch of

adult whitefish has been variable, but the catch of young of year and age 1+ lake whitefish has continued to increase throughout this survey.

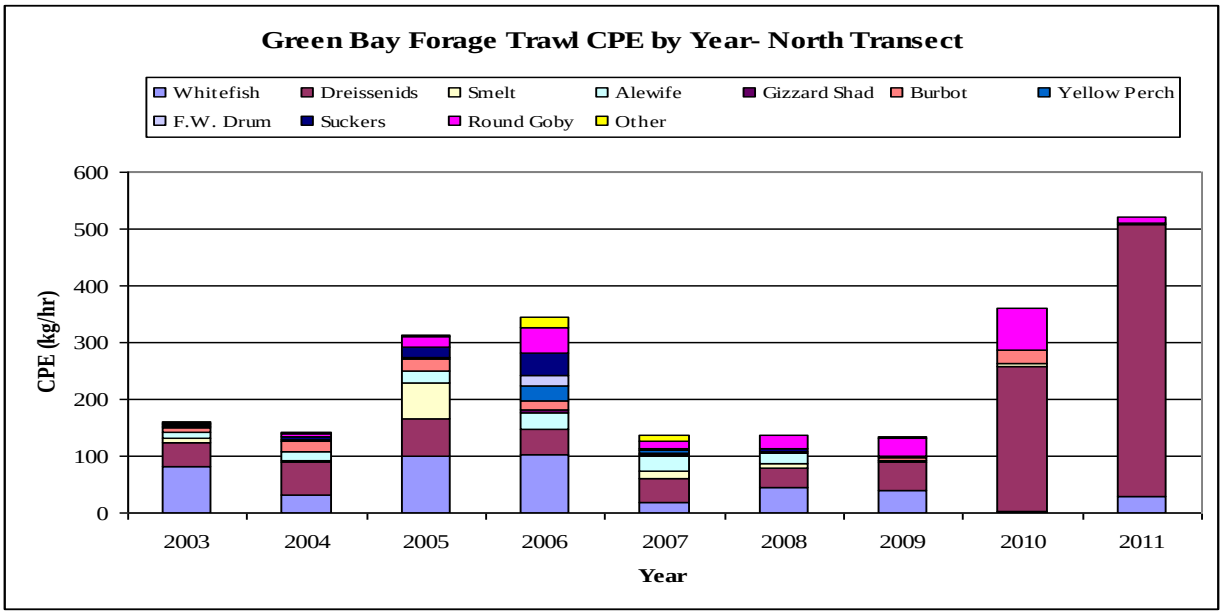


Figure 3. CPE by species for fish and mussels captured during trawling on Green Bay along the north transect, 2003-2011.

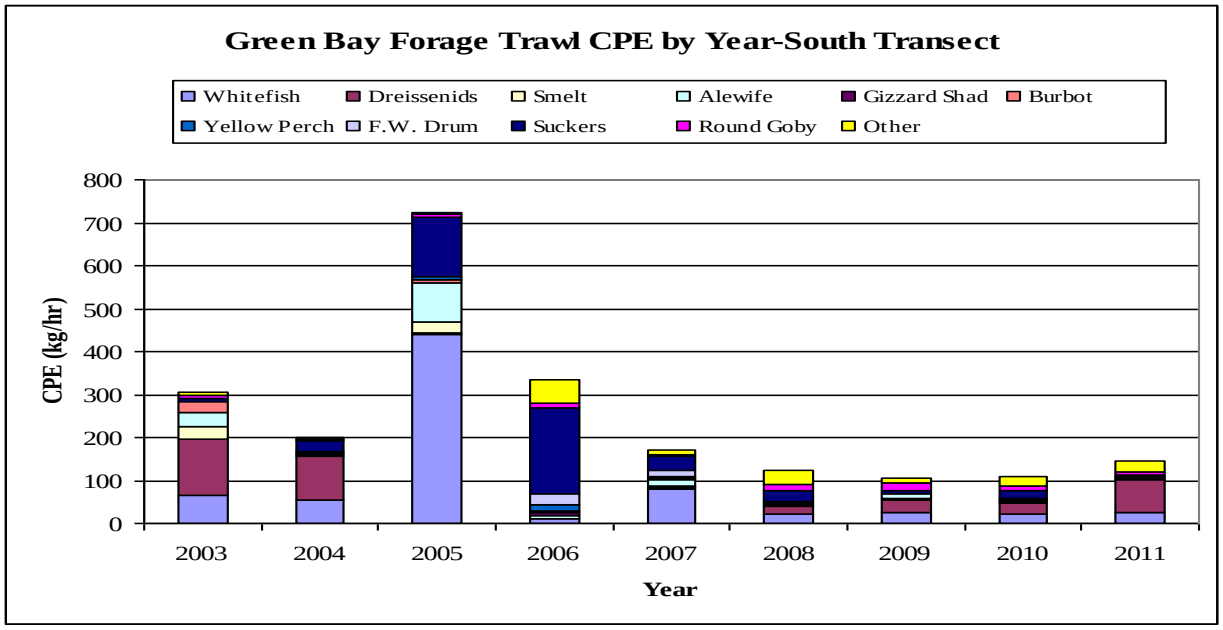


Figure 4. CPE by species for fish and mussels captured during trawling on Green Bay along the south transect, 2003-2011.

Appendix 1. Green Bay forage trawling CPE (kg/hour trawled) by species on the north transect 2003-2011.

North (kg/hr)	2003	2004	2005	2006	2007	2008	2009	2010	2011
Whitefish	80.6	32.7	99.4	102.9	17.3	44.7	39	2.9	27.8
Dreissenids	44.1	55.7	65.4	44.5	42.2	33.1	50.7	255.8	481.2
Smelt	6.2	4.7	63.7	1.2	14.6	9.3	2.4	3.7	0.7
Alewife	11.7	14.1	21.5	28.6	26.8	19.4	0.2	0	0.2
Gizzard Shad	0	0	0	3.9	0.8	0	0.4	0	0
Burbot	8.7	20	21.7	16.8	2.9	1.9	3.6	23.7	0
Yellow Perch	0.2	2.8	0.8	25.2	7.1	0.2	1.3	0	0.3
F.W. Drum	0	0	0	17.7	0	0	0	0	0
Suckers	3.1	2.9	20.7	41.2	1.9	5.8	1.8	0	0.9
Round Goby	2.5	7.6	18.2	43.1	13	22.6	33.1	74.1	9.8
Other	2.5	0.7	2	19.3	11.5	0.5	1.7	0.2	0.03
Total	**159.5**	**141.3**	**313.3**	**344.4**	**138.1**	**137.5**	**134.2**	**360.4**	**520.9**

Appendix 2. Green Bay forage trawling CPE (kg/hour trawled) by species on the south transect 2003-2011.

South (kg/hr)	2003	2004	2005	2006	2007	2008	2009	2010	2011
Whitefish	65	52.9	439.6	9.8	81.4	23.2	25.9	21.5	25.9
Dreissenids	129.8	102.5	5.6	0.4	3.6	15.2	27.6	26.3	76.2
Smelt	31.4	4.1	24.9	0.2	3.2	5.8	4.1	3.9	3.2
Alewife	32.5	4.8	90.4	9.1	12.5	3.3	11.2	3.4	0.04
Gizzard Shad	0	0	0.1	6.1	3.8	0	0	0	0
Burbot	23.5	0	5	3.4	0	0	0	0	0
Yellow Perch	0.1	2.1	9.7	14.3	5	4.1	1	2.2	4.7
F.W. Drum	0	0.6	0.2	26	12.5	0	0	0	0
Suckers	7.1	25.1	137.5	201.1	34.5	26.5	5.3	19.9	4.5
Round Goby	10.5	5	8.5	10.8	3.4	13.5	20	10.3	6.8
Other	4.4	2.9	1.5	52.6	12.4	33.1	9.2	23.1	23.9
Total	**304.1**	**200.2**	**722.9**	**333.8**	**172.3**	**124.7**	**104.3**	**110.4**	**145.2**

SMELT WITHDRAWAL BY THE COMMERCIAL TRAWL FISHERY

Steve Hogler and Steve Surendonk

Historically, commercial trawling targeted three main species of fish in the Wisconsin waters of Lake Michigan. Much of the harvest was a general forage catch that caught large numbers of fish, chiefly alewife *Alosa pseudoharengus*, rainbow smelt *Osmerus mordax*, and bloater chub *Coregonus hoyi*. The other portion of the trawl fishery was a targeted rainbow smelt harvest. With the adoption of new rules in 1991 the general forage harvest component of the fishery was eliminated. Targeted rainbow smelt trawling rules were established for the waters of Lake Michigan and Green Bay and the quota was set at 2,358,000 pounds, of which no more than 830,000 pounds could be harvested from Green Bay. Those harvest limits were reduced in 1999 and 2004. Today the total harvest limit is 1,000,000 pounds, of which no more than 25,000 may be taken from Green Bay.

During calendar year 2011, commercial trawlers reported catching 266,115 pounds of rainbow smelt from Lake Michigan (Figure 1). In 2011 reported harvest declined 17% from the reported harvest of 320,503 pounds landed in 2010. The 2011 harvest was greater than the three-year average harvest of 174,188 pounds and was very near the average harvest from the previous five years,271,219 pounds.

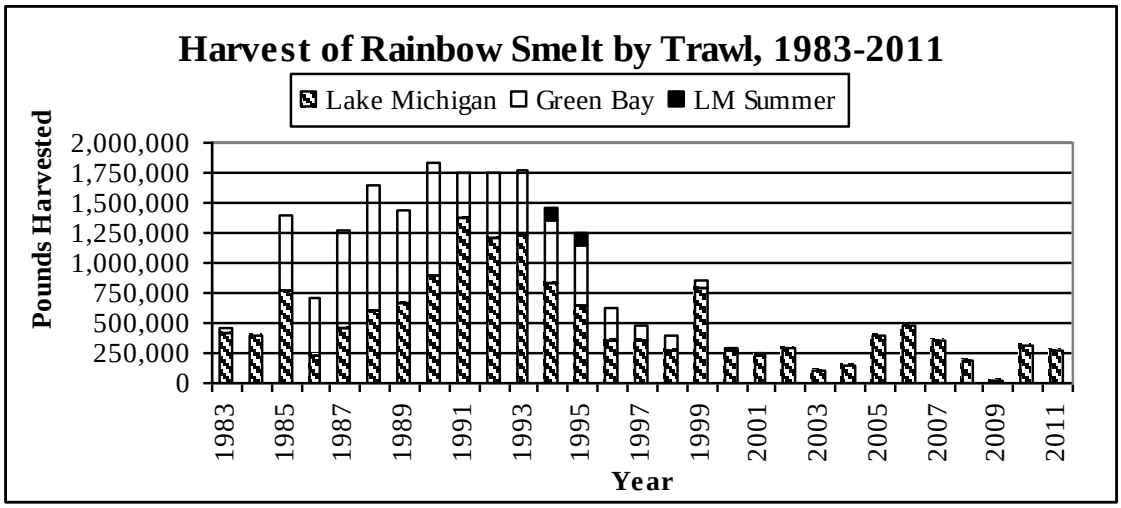


Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 2011.

CPE in 2011 was 236 pounds of smelt per hour trawled which was a 28% decline from the 2010 level (Figure 2). CPE in 2011 was greater than the three year average CPE but less than the five year average indicating a decline in rainbow smelt abundance.

Commercial trawlers did not fish on Green Bay in 2011 making it the fifth time in the last seven years they did not fish the summer season on Green Bay. The lack of fishing effort on Green Bay in 2011 continued the trend of declining harvest, CPE, and effort noted on the Wisconsin waters of Green Bay since 1991.

Commercial rainbow smelt trawlers experienced an average Lake Michigan rainbow smelt season in 2011. Although harvest and CPE declined from 2010 levels, 2011was the second year of improved harvest since 2009 when trawlers had their lowest reported catch since the current reporting system began in 1983. Although commercial trawlers had a good Lake Michigan season, the lack of effort and harvest of rainbow smelt from Green Bay seems to indicate that in Green Bay the rainbow smelt population is

below what is needed to make commercial harvest feasible.

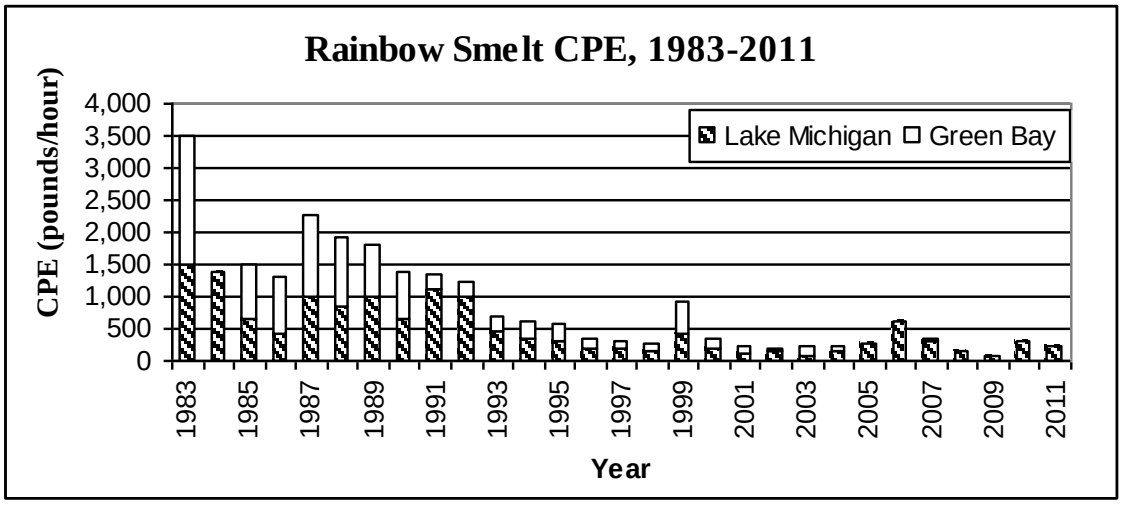


Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan and Green Bay during the years 1983 through 2011.

Although the status of the rainbow smelt population in Lake Michigan and Green Bay remains uncertain, it is clear that rainbow smelt biomass and commercial harvest have declined sharply from their peak levels in the late 1980's and early 1990's. More recently, the commercial harvest has been variable with several poor catch years followed by one or two good catch years. The decline of the trawl fishery on Green Bay has been even more dramatic with only token effort and very low harvest the past five years. The continued low biomass of rainbow smelt in Lake Michigan and Green Bay makes the continuing viability of the commercial smelt fishery unknown.

LAKE WHITEFISH

Scott Hansen

Commercial Harvest

Lake whitefish *Coregonus clupeaformis* harvest in Wisconsin's waters of Lake Michigan continued at high levels for the 2011 calendar year with 1,503,347 dressed weight pounds of fish harvested[4] (Figure 1). The 2011 harvest decreased slightly, approximately 6,000 pounds, from 2010 but still exceeds the 20 year average of approximately 1.44 million pounds.

The commercial whitefish harvest in Wisconsin has been regulated by license or quota year beginning in July and carrying through June of the following year with a closed period during spawning. Starting in 2012, the quota year will coincide with the calendar year, January through December. 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).

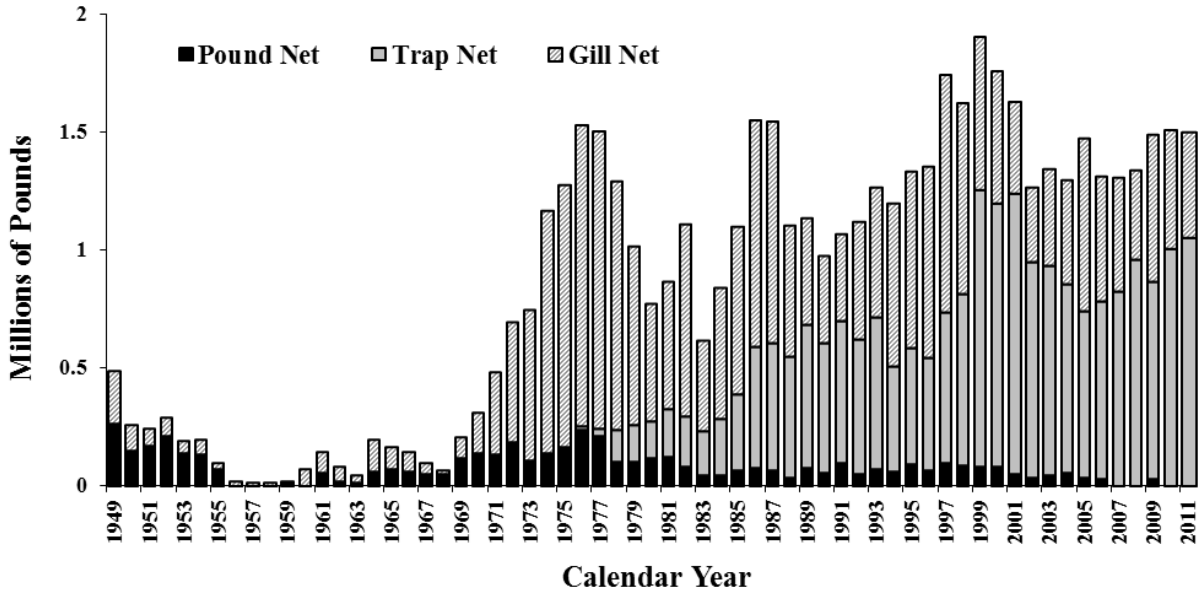


Figure 1. Lake whitefish calendar year commercial harvest reported by gear type in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay from 1949 through 2011.

[4] Compared to previous years, whitefish quotas were allocated in a different manner during part of the 2010-2011 quota year. This may have had a small effect on the total calendar and quota year harvest levels.

Wisconsin commercial fishermen have used trap nets as a legal gear to harvest lake whitefish from Lake Michigan since 1976. The use of trap nets has generally increased over the last two decades and on average has annually accounted for over 50 percent of the whitefish harvest during this time span. For the calendar year, the total proportion of whitefish harvested by trap nets increased from 66.9% in 2010 to 70.2% in 2011 (Figure 1). Pound nets were not fished in 2011.

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

[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.

While trap net gear continues to be the primary gear type for commercial whitefish harvest, the overall effort has been variable since 2003 (Figure 2). Although trap net effort increased considerably during the 2010 season there was a small decrease of about 200 pots lifted between 2010 and 2011. Meanwhile, after a spike in 2005 and subsequent decline over the following two years, the general gillnet effort has recently remained moderately steady. However, gillnet effort dropped by over 1 million feet of net fished between 2010 and 2011, a decline of approximately 13.5%. After dropping the previous two years, trap net catch per unit of effort (CPE) improved between 2010 and 2011, increasing by 40 pounds per pot lifted (Figure 3). Gillnet CPE continues to remain relatively steady increasing in 2011 by only 1.8 pounds per 1000 feet fished.

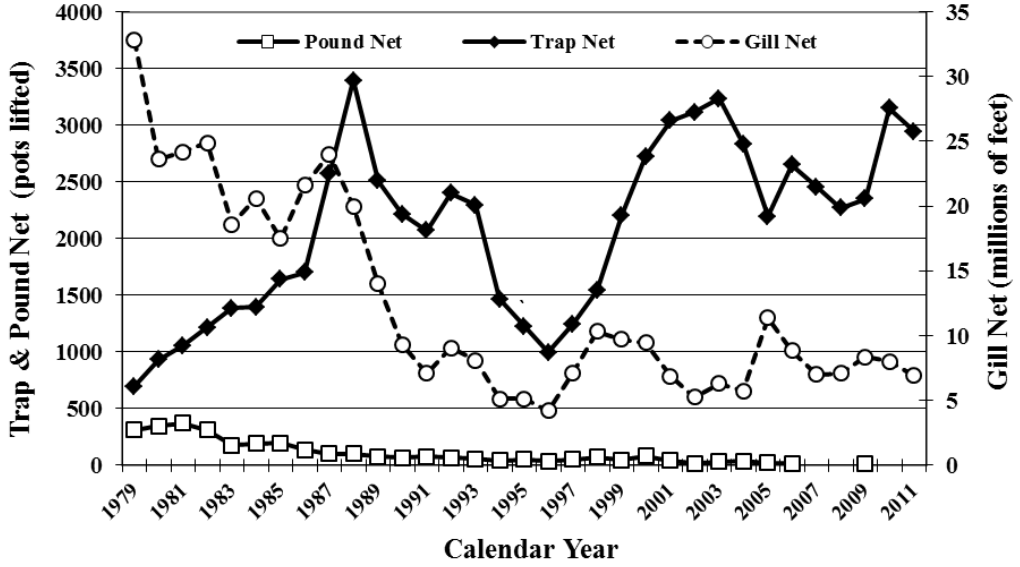


Figure 2. Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2011. Gill net effort is in millions of feet; trap and pound net effort is number of pots lifted.

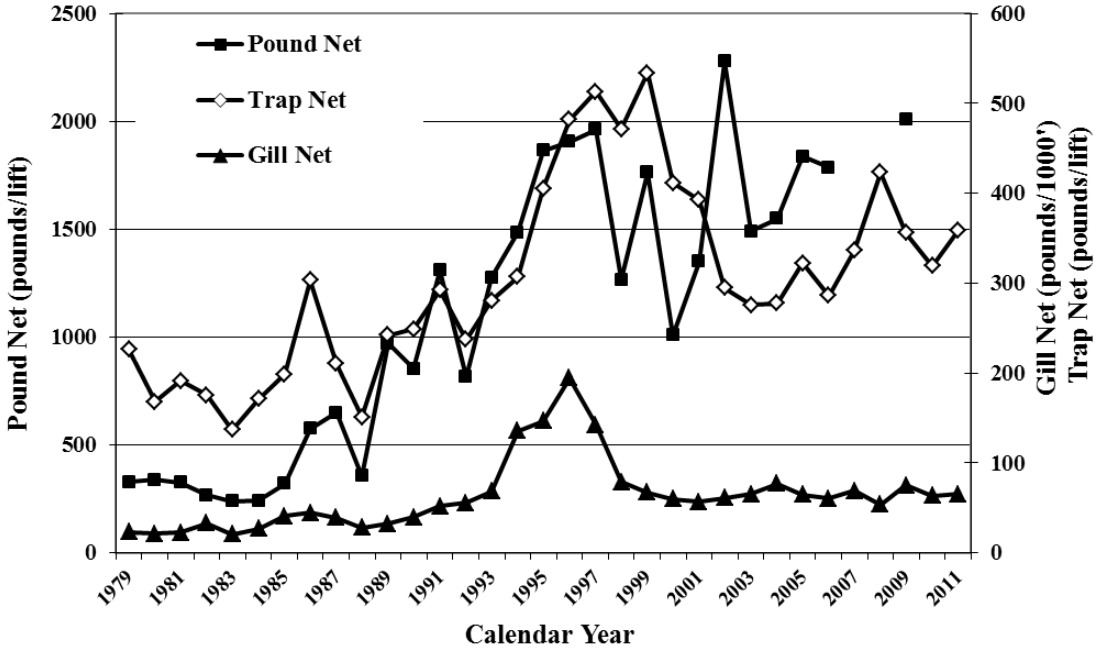


Figure 3. Trends in gill net, trap net, and pound net catch per unit of effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2011. Gill net CPE is pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE is pounds of whitefish harvested per pot lifted.

Growth

Mean length and weight-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 average lengths have rebounded modestly. 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 rebounded in 2011 making age-7 fish again available to the commercial fishery, on average. Whitefish weight-at-age levels during 2011 continued to struggle near historic lows for many of the age groups.

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. However, a certain level of whitefish stock mixing likely occurs in Green Bay depending on the time of year. Therefore, the consistency in measuring growth of NMB fish over time may now be affected by fish from other stocks as a result of the respective differences in stock specific growth rates.

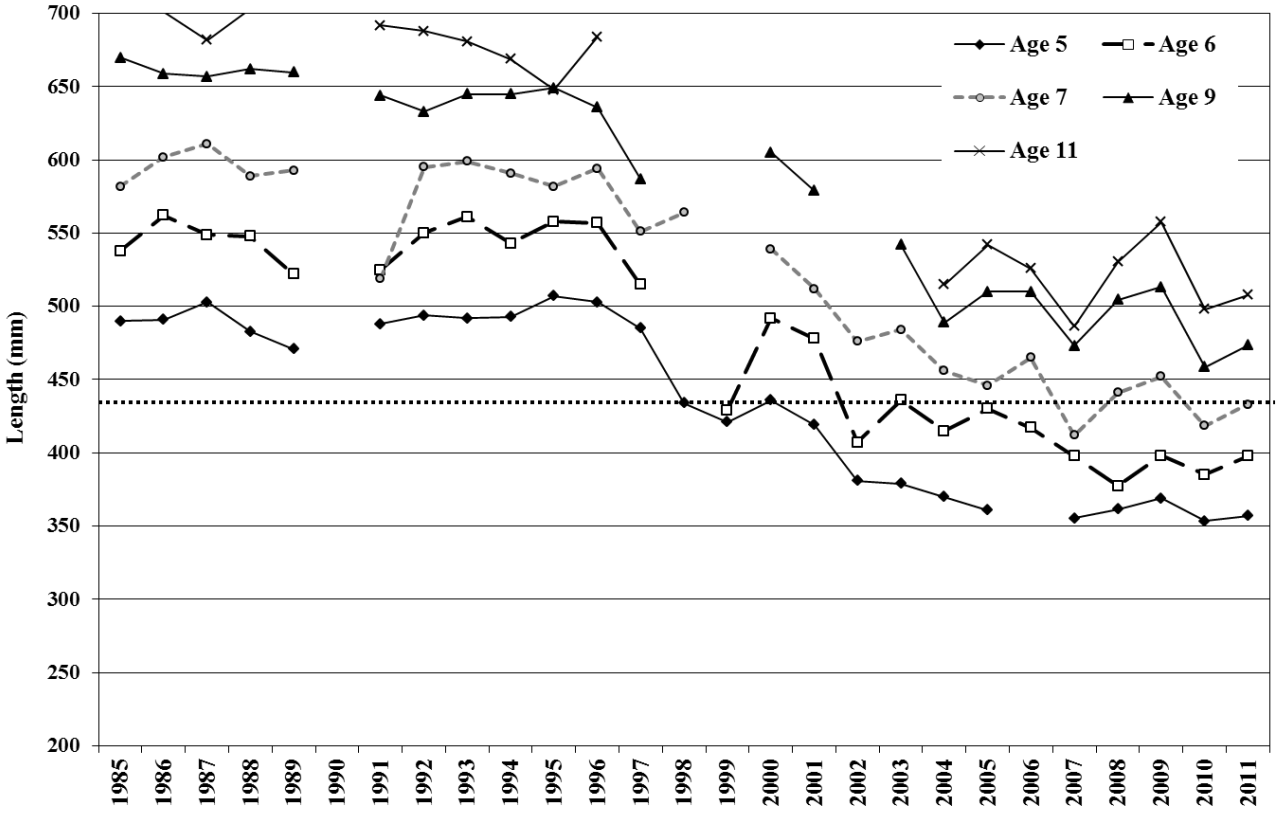


Figure 4. Mean length at age of spring sampled lake whitefish from 1985 thru 2011. **The minimum allowable length of 432 mm is shown by a dotted line.**

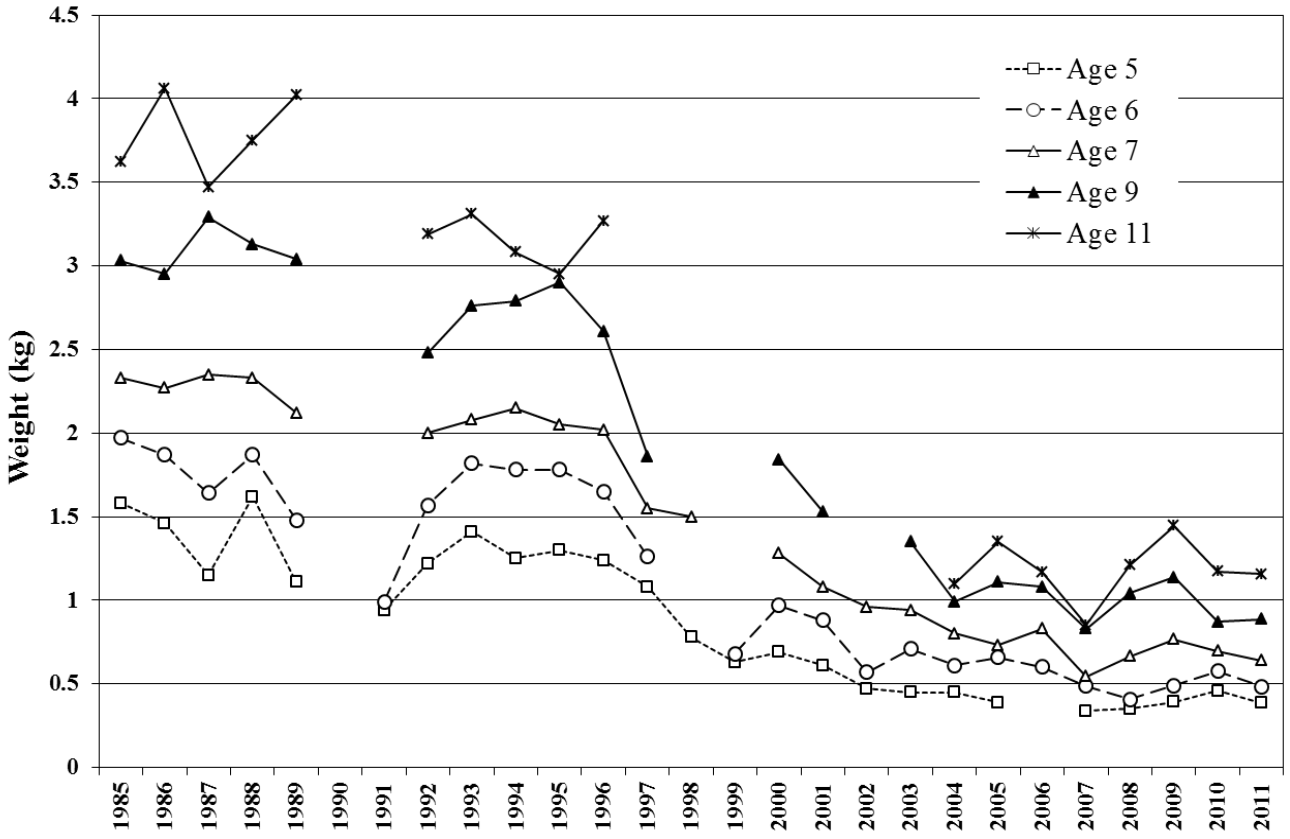


Figure 5. Mean weight at age of spring sampled lake whitefish from 1985 thru 2011.

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 2010, estimated whitefish harvest was 190,175 fish, more than double the 2010 harvest (Figure 6). Angler effort directed toward whitefish increased considerably as well, up from 120,551 hours in 2010 to 174,915 hours in 2011, an increase of around 45%. Harvest rates specific to whitefish in 2011 were 0.506, 1.039, and 0.922 whitefish harvested per hour of fishing for January, February, and March, respectively. For the winter of 2011 the overall average whitefish specific harvest rate was 0.836 fish per hour of fishing, over twice the level of 0.397 fish per hour in 2010 (Figure 7). So while the total hours fished for whitefish increased by 45% from 2010 to 2011, the harvest rate increased by more than 100%.

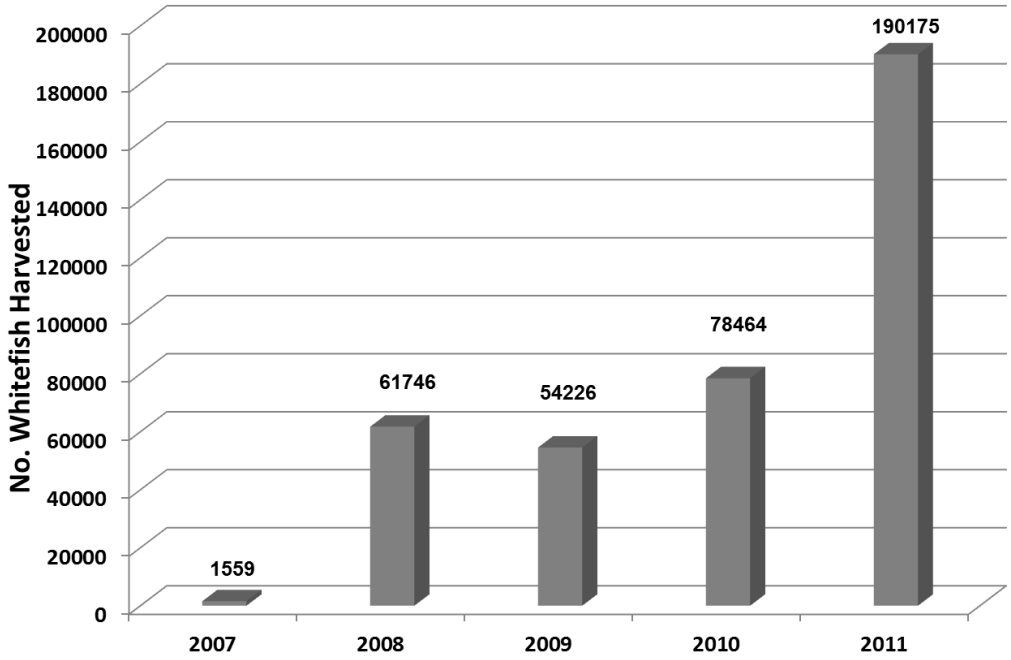


Figure 6. Estimated number of lake whitefish harvested in Wisconsin waters of Green Bay during the winter creel season (January- March) for 2007-2011.

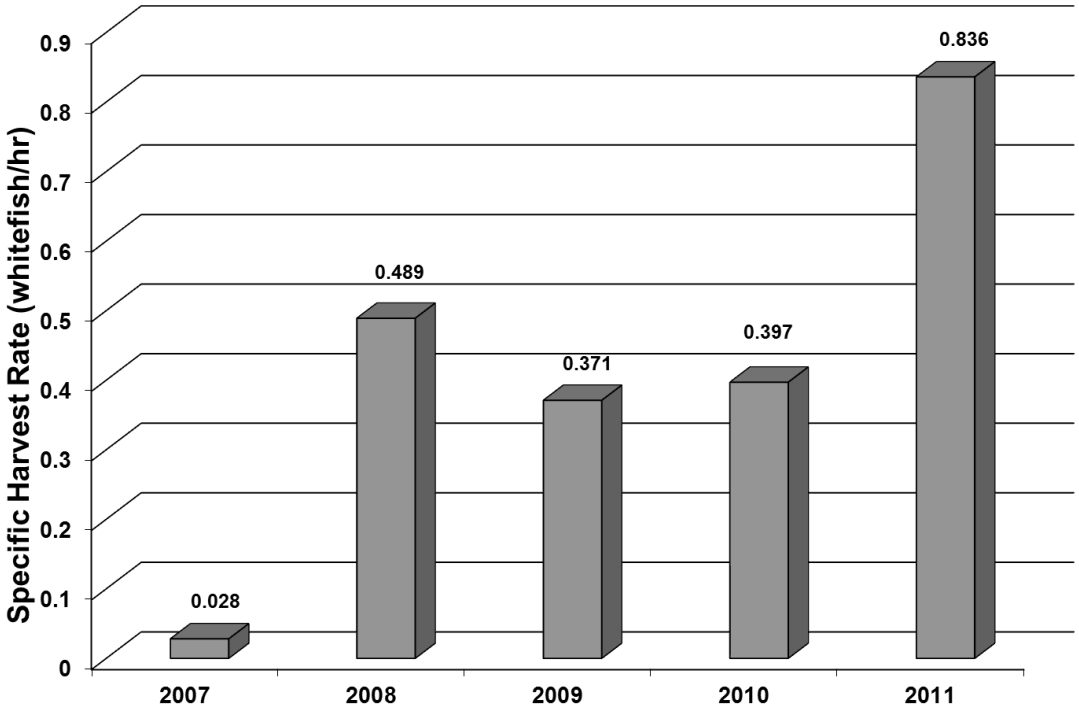


Figure 7. Harvest rate in number of whitefish per hour of fishing specifically for whitefish in Wisconsin waters of Green Bay during the winter creel season for 2007-2011.

AUTHOR CONTACT INFORMATION

Brad Eggold -- 600 E. Greenfield Ave.; Milwaukee, WI 53204. 414-382-7921.
bradley.eggold@wisconsin.gov

Jeff Zinuticz -- 600 E. Greenfield Ave.; Milwaukee, WI 53204. 414-382-7921.
jeffrey.zinuticz@wisconsin.gov

Steve Hogler – 2984 Shawano Ave.; Green Bay, WI 54311. 920-662-5480.
Steven.hogler@wisconsin.gov

Scott Hansen -- 110 South Neenah Ave.; Sturgeon Bay, WI 54234. 920-746-2864.
scott.hansen@wisconsin.gov

Tammie Paoli -- 101 N. Ogden Rd.; Peshtigo, WI 54157. 715-582-5052.
tammie.paoli@wisconsin.gov

Pradeep S. Hirethota -- 600 E. Greenfield Ave.; Milwaukee, WI 53204. 414-382-7928.
pradeep.hirethota@wisconsin.gov

Timothy Kroeff -- 110 South Neenah Ave.; Sturgeon Bay, WI 54234. 920-746-5107.
timothy.kroeff@wisconsin.gov

Michael Donofrio -- 101 N. Ogden Rd.; Peshtigo, WI 54157. 715-582-5050.
michael.donofrio@wisconsin.gov

Rodney M. Lange -- 2984 Shawano Ave.; Green Bay, WI 54307. 920-662-5457.
rodney.lange@wisconsin.gov

Steve Surendonk -- 2984 Shawano Ave.; Green Bay, WI 54311. 920-662-5459.
stephen.surendonk@wisconsin.gov

Cheryl Masterson -- 600 E. Greenfield Ave.; Milwaukee, WI 53204. 414-382-7923.
cheryl.masterson@wisconsin.gov

Dave Schindelholz 600 E. Greenfield Ave.; Milwaukee, WI 53204. 414-382-7925.
david.schindelholz@wisconsin.gov

Bill Horns -- 101 S. Webster St.; Madison, WI 53707, 608-266-8782.
william.horns@wisconsin.gov