Lake Michigan Management Reports - 2009

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

Releasing a tagged sturgeon into the Milwaukee River (see page 53)

CONTENTS

INTRODUCTION

Bill Horns

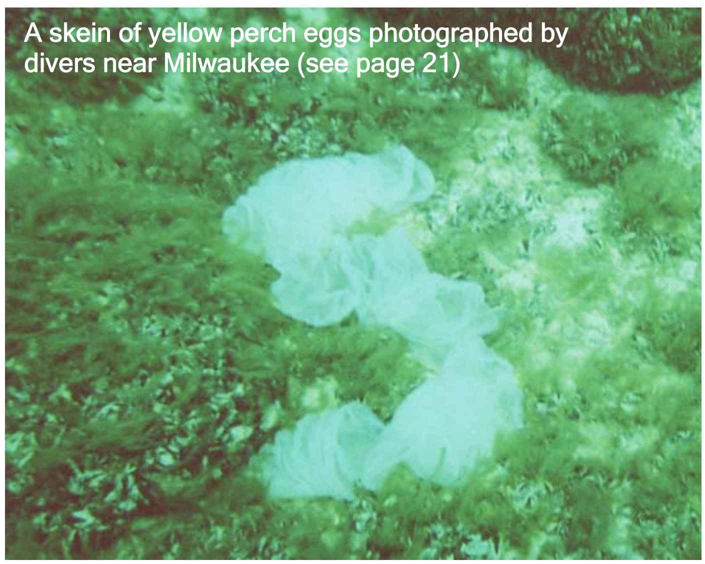
The Lake Michigan Fisheries Team is charged with implementing the Lake Michigan Integrated Fisheries Management Plan[1] and coordinating the Lake Michigan Fisheries Program for the Department of Natural Resources. Our management of Lake Michigan fisheries is conducted in partnership with other state, 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 reports summarize some of the major studies and stock assessment activities conducted by the Lake Michigan Fisheries Team during 2008. They provide specific information about sport and commercial fisheries, and describe trends in some of the major fish populations. For further information regarding any individual report, contact the author at the address, phone number, or e-mail address shown at the end of this document.

Below I have summarized some highlights from these reports and added some notes on other topics related to Lake Michigan fisheries. For additional information, I recommend that you visit the Department's Lake Michigan web page at http://dnr.wi.gov/org/water/fhp/fish/lakemich/index.htm.

Sport fishing

Harvests of all salmonine species (chinook salmon, coho salmon, brown trout, steelhead, lake trout, and brook trout) were lower in 2008 than 2007 (see report by Eggold and Zinuticz), possibly reflecting unusual weather patterns, but the fish were generally healthy. We are concerned by the decline of brown trout in Green Bay, which stands in contrast to a very healthy brown trout fishery in the southern half of our Lake Michigan shoreline. We expect to initiate some changes in our Green Bay brown trout stocking strategy starting in 2010 (contact Tammie Paoli for further information). Yellow perch catches were also disappointing in Green Bay and in Lake Michigan, where population recoveries seen to have stalled (see reports by Paoli and Hirethota). Increased interest in the Green Bay muskellunge fishery reflects the success of the ongoing Great Lakes spotted musky restoration program and walleye fishing in Green Bay remains good (see musky and walleye reports by Rowe and Lange).

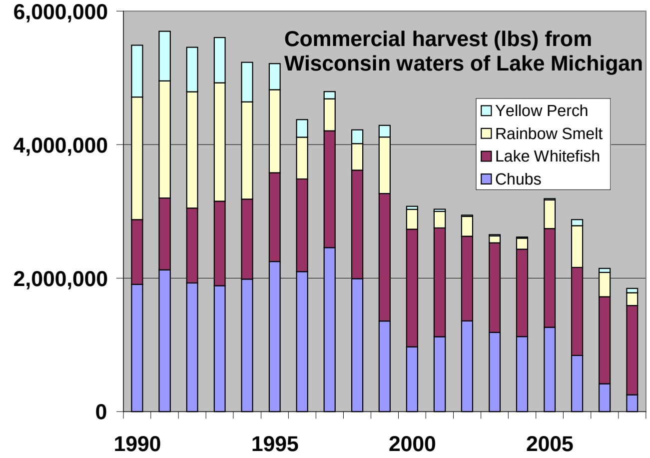


A skein of yellow perch eggs photographed by divers near Milwaukee (see page 21)

Commercial fishing

[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.



The combined harvest of commercial fish species (lake whitefish, bloater chub, yellow perch, and rainbow smelt) has declined by two-thirds over the past 20 years. Only the lake whitefish is holding its own (see report by Hansen). We have seen similar declines in yellow perch and bloater chubs in decades past, but these declines may reflect long lasting ecological consequences of invasive species, especially the zebra and quagga mussels. For more information about the lakewide yellow perch population please see the reports below by Paoli and Hirethota, as well as the annual report of the inter-jurisdictional Yellow Perch Task Group, which is available at the following site: http://www.in.gov/dnr/fishwild/files/FW_YPTG_annual_2009_final.pdf. For information about bloater chubs see the report below by Kroeff and Shindelholz. Additional information about the lakewide bloater chub population is available in the annual USGS trawl survey, which is available at the following site: http://www.in.gov/dnr/fishwild/files/FW_lake_michigan_BT_08_Final.pdf.

Commercial fishing rule changes were proposed in 2009. The first, related to relicensing requirements and the number of available commercial licenses (see http://dnr.wi.gov/org/nrboard/2009/August/08-09-3B3.pdf) was adopted by the Natural Resources Boarod (NRB) and is now in effect. The second, related to harvest limits and allocation of lake whitefish (see http://dnr.wi.gov/org/nrboard/2009/September/09-28-09-2A1.pdf for the proposed version), is scheduled for NRB consideration in December 2009 in modified form.

Native species restoration

Two Great Lakes spotted musky (each about 10" long), along with a northern pike (see page 39)

We are involved in three native species restoration efforts: lake sturgeon, Great Lakes spotted musky, and lake trout. The lake sturgeon program is described below by Donofrio, Eggold, and Hogler. Lake trout restoration is an inter-jurisdictional program with virtually all stocked lake trout produced in federal hatcheries and stocked according to a plans developed by the States and the Chippewa/Ottawa Resource Authority acting through the Lake Michigan Committee. We expect to finalize a new lake trout rehabilitation strategy in 2010, with a focus on stocking in the two large refuges, but holding total stocking at levels that can be sustained by the existing forage fish communityi. For general background information, consult *A Guide for the Rehabilitation of Lake Trout in Lake Michigan* at http://dnr.wi.gov/fish/lakemich/Lake_trout_rehabilitation_guide_for_Lake_Michigan.pdf.

SPORTFISHING EFFORT AND HARVEST

Brad Eggold and Jeff Zinuticz

The open water fishing effort was 2,496,481 hours during 2008, 9.2% below the five-year average of 2,748,642. The 2008 near-shore fishing opportunities varied from being incredible to difficult in a matter of days, cold water near-shore made opportunities to target trout and salmon available for most of the spring and summer months, albeit shore fishing along Lake Michigan was slower overall than recent years. The 2008 ramp and charter effort was below the five-year average by 11.81% and 7.51%, respectively.

Wisconsin Lake Michigan trout and salmon anglers had a tougher season in 2008, compared to the past three seasons. Overall harvest was lower, primarily due to weather related conditions, such as uniform warm water conditions near-shore. Very little if any thermocline had set-up in deeper waters that historically hold baitfish which in turn congregates schools of trout and salmon. Low forage abundance, high gas prices and news of slow fishing may have also played a role in the lack of angling pressure and harvest numbers in 2008. Although overall harvest was down, the Chinook salmon harvest was at a respectable level. Chinook harvest dominated the catch yet again in 2008 with 256,796 fish caught. Coho salmon harvest dropped considerably with 25,453 fish taken, a 59.27% decrease over the five-year mean.

The open-water Yellow Perch harvest was 217,500 fish, a dramatic decrease from past years (Table 2). Although the perch harvest was low in 2008, there was some encouraging news because most of the fish caught were from the 2005, 2003, and 2002 year-classes. As in past years the majority of the perch harvest was caught by Green Bay anglers.

Walleye harvest was estimated at 51,103 fish a slight decrease from 2007, but still within the range from past years. Northern Pike catch was low as well from the previous season with 2,249 harvested. Smallmouth Bass harvest was 8,656 fish, a decrease from 2007.

For more summaries, check out the Wisconsin's Lake Michigan website at:
http://dnr.wi.gov/fish/lakemich/managementreports.htm

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2008 and percent change from the 5-year average (2004-2008).

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2008	1,290,115	382,849	312,990	146,418	139,913	224,196	**2,496,481**
% change	-11.81%	.74%	7.51%	-18.49%	-20.09%	-13.75%	**-9.17%**

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2008.

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	7,357	7,921	8,034	556	364	1,221	**25,453**
Chinook salmon	81,739	67,460	79,491	3,533	4,581	19,992	**256,796**
Rainbow trout	11,975	10,975	14,701	909	484	2,508	**41,552**
Brown trout	10,904	2,687	2,842	1,454	4,749	1,127	**23,763**
Brook trout	0	0	0	13	0	0	**13**
Lake trout	3,723	3,592	5,413	35	0	0	**12,763**
Northern pike	2,123	0	0	9	93	24	**2,249**
Smallmouth bass	2,455	5288	0	194	697	22	**8,656**
Yellow perch	183,351	28,031	0	1,875	2,057	2,186	**217,500**
Walleye	48,033	1,625	0	0	28	1,327	**51,013**
TOTAL	**351,660**	**127,579**	**110,481**	**8,578**	**13,053**	**28,407**	**639,758**

Table 9. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1994-2008.

Species	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL*
Brook Trout	7,481	1,914	419	299	159	574	199	263	144	126	1	18	17	62	13	38,969
Brown Trout	52,397	49,654	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	988,065
Rainbow Trout	114,776	117,508	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	1,627,758
Chinook Salmon	99,755	162,888	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	5,218,496
Coho Salmon	110,001	65,647	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	1,870,261
Lake Trout	53,989	69,332	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	1,216,148
TOTAL	438,399	466,943	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	10,959,697
Harvest Per Hour	0.1256	0.1426	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	0.1449

Table 10. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1994-2008.

Fisheries Type	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL*
Ramp	167,388	193,752	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	4,233,809
Moored	134,315	128,743	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	2,918,325
Charter	81,909	84,898	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	2,441,023
Pier	15,130	14,621	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	293,638
Shore	16,370	17,676	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	375,122
Stream	23,287	27,253	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	697,780
TOTAL	438,399	466,943	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	10,959,697

* Totals represent total number of salmonids harvested from 1986 – 2008.

WISCONSIN'S 2008 WEIR HARVEST

Cheryl Peterson, Steve Hogler, and Scott Hansen

The Wisconsin Department of Natural Resources (WDNR) operates three salmonid 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 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 near Kewaunee. BAFF is a co-primary egg collection station for three 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 Racine. RRSF is a co-primary egg collection station for the three strains of steelhead, and coho and serves as a backup for Chinook salmon egg collection.

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, whether fish were passed upstream, and the number of smolts previously released at these sites. The salmonid 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 2008, all Lake Michigan salmon and trout egg quotas for Wisconsin waters were met. In addition, coho and Chinook salmon eggs were collected for Indiana and Illinois.

Strawberry Creek Weir

Considerably lower than average water levels continued in Lake Michigan in 2008 posing a potential problem for Chinook salmon harvest at SCW. However, since 2000 we have utilized our 3,500 foot pipeline and pump to deliver approximately 1,500 – 2,000 gallons of water per minute to Strawberry Creek to greatly increase flow and attract Chinook salmon to the weir. During the fall 2008 run, 3,706 Chinook salmon were handled at SCW (Table 1). The number of fish handled at the weir is dependent upon the period of time that fisheries staff allows the pipeline to run and can attend to the returning fish. The weir was allowed to run approximately the same amount of time in 2008 as in 2007. However, 600 more fish were handled in 2008 than 2007. Nevertheless, this total still ranks as the second lowest since 1999, the last year the weir was operated without the pipeline supplement. These reduced returns are not unexpected because of stocking reductions. However, the overall returns are somewhat lower than would be expected from stocking cuts alone. Despite the reduced number of returning Chinook salmon, Wisconsin's entire Chinook salmon egg quota was once again collected at SCW in 2008 where approximately 2.06 million eggs were harvested.

Chinook average size at age increased modestly in 2008 from levels that were at or near record lows in 2007 (Figs 1 and 2). However, for the past nine years, mean length and weight at age for Chinook salmon returning to Strawberry Creek has generally followed a decreasing trend. For example, since 2001 length at age for age 2+ and 3+ male Chinooks has on average decreased by 95 and 91 mm, respectively (Figure 1). Consequently, weight at age has decreased by approximately 2.4 and 2.8 kg for these age classes, respectively (Figure 2). To monitor changes in overall weight of Chinooks returning to the Strawberry Creek Weir, standard weights of 30" Chinooks are calculated annually using the overall length weight regression of fish returning to the weir. Standard weight of a 30" fish increased in 2008 to 4.02 kg from 3.830 kg in 2007.

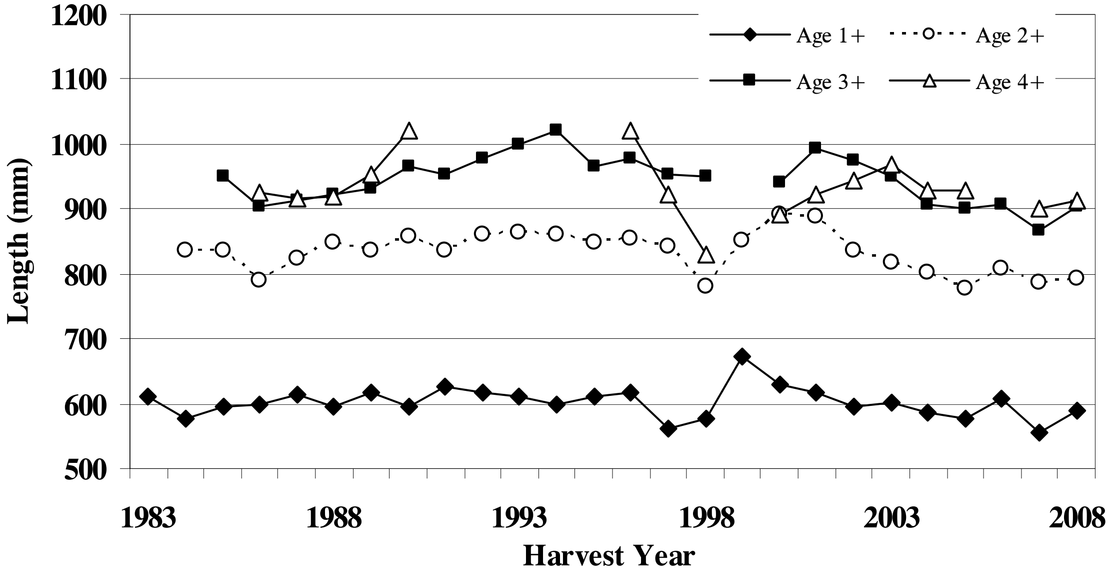


Figure 1. Length at age of male chinook salmon returning to the Strawberry Creek weir between 1983 and 2008.

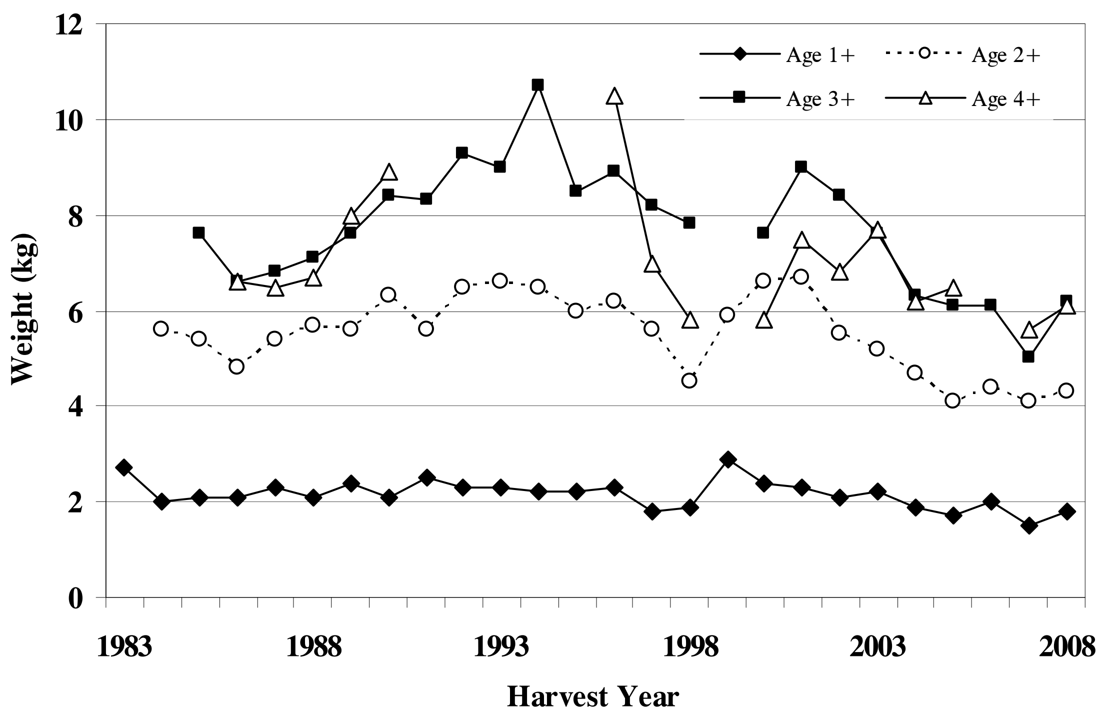


Figure 2. Weight at age of male chinook salmon returning to Strawberry Creek weir between 1983 and 2008.

Besadny Anadromous Fisheries Facility

Spring Operations

Spring operations in 2008 began on April 3 when the ponds were sorted to look for steelhead with Chambers Creek and Ganaraska fin clips and continued through April 22. During this period 1,582 steelhead were handled at BAFF (Table 2). The run consisted of 499 Chambers Creek, 545 Ganaraska, 21 Skamania Wisconsin clipped steelhead and 517 unclipped, misclipped or stray steelhead from other streams or states. The 2008 spring run total more than tripled the run total of 2007 making it the best spring run at BAFF since 1998.

Gamete collections for the two spring strains of steelhead were in excess of 1.3 million at BAFF in 2008 and should result in near normal numbers of Chambers Creek and Ganaraska steelhead being stocked in 2010.

Fall Operations

Kewaunee River water levels were somewhat below normal levels during the fall of 2008. BAFF ponds were sorted eight times during October and November to process migrating fish. Once again in 2008, as a measure taken to prevent the spread of Viral Hemorrhagic Septicemia (VHS), fish were not allowed to bypass the BAFF facility.

Summer/fall steelhead collections began on September 29 when the fish ladder began to operate. Ponds were sorted eight times during October and November to process migrating fish. Seventy nine steelhead were captured at BAFF during the 2008 summer/fall run (Table 2). This was the highest total since 1999. Sixty-nine of the 79 captured steelhead had identifiable Skamania clips which was the highest number of Skamania captured since 1999. It is likely a very dry summer and fall resulting in a low river level still limited the fall/summer run of Skamania.

The number of Chinook salmon captured at BAFF during the fall operations in 2008 was down over 600 fish from 2006 (Table 1). Once again, stocking cuts may have played a role in the reduced return. No eggs were harvested from Chinook at BAFF.

Adult Skamania used as brood fish were not collected from either steelhead facility in 2008 due to VHS concerns which will result in no Skamania stocking in 2010 by Wisconsin unless gametes or fingerlings are obtained from another source.

During the fall 2008 run, over 250 more cohos were handled at BAFF than in 2007 (Table 3). The return was the fourth highest since 1990. Approximately 476,500 coho salmon eggs were collected at BAFF in the fall of 2008 for Wisconsin stocking. Approximately 289,500 additional coho eggs were collected at BAFF for Illinois and Indiana.

Root River Steelhead Facility

Spring Operations

Very few steelhead made their way to the Root River Steelhead Facility during the spring of 2008 (Table 2). Storms kept water levels extremely high, at times flooding the areas adjacent to the facility, making stream angling very difficult. Upstream migration during periods of such high water is a struggle for the fish and experience has shown that extremely high flows usually yield a poor run. Over 96,000 eggs were collected for Ganaraska and Chambers Creek steelhead strains at RRSF in 2008. Fortunately, conditions were much better at the Besadny Facility on the Kewaunee River and between these two facilities the Wisconsin steelhead egg-take goal was met for the Kettle Moraine State Fish Hatchery. This season illustrates why it is so important to maintain both of these facilities. Without Besadny's contribution, the 2008 year-class of Wisconsin steelhead would have been in jeopardy. In recent years the steelhead runs on the Root River have had a downward trend. No conclusions can be drawn from this season because water volume has to be considered an overriding circumstance.

Fall Operations

The Root River Steelhead Facility (RRSF) was in operation for 9 processing dates during the fall 2008 fish migration. Despite very low streamflows all season, good numbers of coho salmon returned to the facility. A total of 1,504 Chinooks and 2,581 coho salmon were captured and processed between October 13 and November 10 (Tables 1 and 3). Not only were 887,000 coho eggs collected for WDNR hatcheries, RRSF also provided 960,000 Chinook eggs for Illinois and 1.06 million coho eggs for Illinois and Indiana. Biological sampling goals were met, and fish health sampling was conducted.

Table 1. The total number of chinook salmon handled during fall migrations at Strawberry Creek (1981-2008), Besadny (1990-2008) and Root River (1994-2008) weirs.

Harvest Year	SCW	BAFF	RRSF
1981	4,314		
1982	3,963		
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	6,649[1]	2,774	7,382
2001	8,125[1]	5,092	10,214
2002	11,027[1]	6,224	10,439
2003	6,086[1]	1,197[2]	149
2004	10,917[1]	2,821[2]	392
2005	5,500[1]	3,268[2]	3,623
2006	4,510[1]	4,671[2]	10,318
2007	3,101[1]	3,351	3,547
2008	3,706[1]	2,742	1,504

1 From 2000 through 2008 extreme low stream flow and low lake levels persisted. A pipeline was installed which delivered approximately 1,500 – 2,000 gallons of water per minute, and allowed 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 (1992-2008) and RRSF (1994-2008).

Year	BAFF	RRSF
1993 – Spring	2,273	
1993 – Fall	205	
1994 – Spring	2,804	
1994 – Fall	321	848
1995 – Spring	1,696	2,720
1995 – Fall	457	538
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	61	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

Table 3. The total number of coho salmon examined at BAFF (1990-2008) and the RRSF (1994-2008).

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	2,745	2,581

GREEN BAY YELLOW PERCH

Tammie Paoli

This report summarizes assessments and monitoring of the yellow perch population in southern Green Bay. It provides data from surveys and harvest from 1978 through 2008. 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 (Figure 1). The population growth was fueled by the production of strong year classes in 1982, 1985, 1986, and 1988 (Figure 4). 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 (Figure 1). 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 4). More recent summer trawling surveys, however, show a trend towards improved recruitment. Surveys from 2002 to 2007 indicate reasonably strong year classes, while a fair year class was produced in 2008. The 2003 survey indicates an extremely strong year class was produced that year (Figure 4). This report is a summary of the status of yellow perch in southern Green Bay based on annual assessments during 2008.

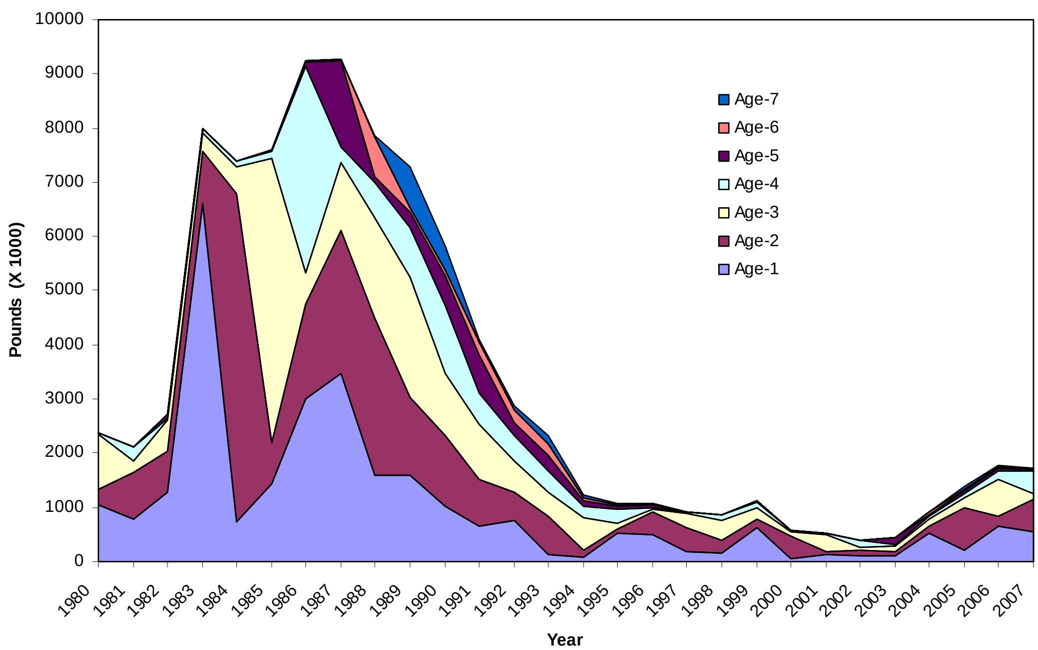


Figure 1. Estimated yellow perch population biomass in Green Bay from 1978 to 2007.

Spawning assessment

The spring spawning assessment continued for the 31st year on Green Bay at Little Tail Point (Figures 2, 3). Double-ended fyke nets were set at two locations at ice-out on April 17, 2008. Water temperature reached 50 F on April 22. On April 29, 72% of mature females sampled were ripe or spent which triggered the removal of the nets on April 30 for a total effort of 37 net nights.

Aging structures from immature females, mature females, and males were collected from 20 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. Age-2 males comprised 59% of the total males sampled. A majority (56%) of the mature females sampled were age-2 (2006 year class) with a mean length of 171 mm, or 6.7 inches. Younger females (ages 2 and 3), contribute significantly to the spawning population in southern Green Bay (Table 1). In contrast, older fish (1998 and 2002 year classes) have dominated the spawning population in southern Lake Michigan in recent years (Hirethota 2008).

Emerald shiners, white suckers, spottail shiners, and trout perch were common. Most notably, the catch rate of emerald shiners increased from 0.1 per net night in 2007 to 16.8 in 2008. Cladophora was not as abundant compared to the 2007 survey, but many days of high winds this year made it difficult or impossible to check nets on several days. Because the most southern net is more exposed to winds than the other two net locations, it was not set in 2008.

Table 1. Percent mature females by age sampled during April fyke netting surveys, 2003 - 2008.

Year	Age-2	Age-3	Age-4	Age-5	Age-6+	Total (*n*)
2008	56%	35%	2%	5%	2%	271
2007	72%	6%	16%	3%	3%	511
2006	56%	34%	5%	3%	2%	447
2005	42%	26%	15%	3%	14%	302
2004	56%	28%	7%	1%	8%	191
2003	55%	15%	4%	25%	1%	269

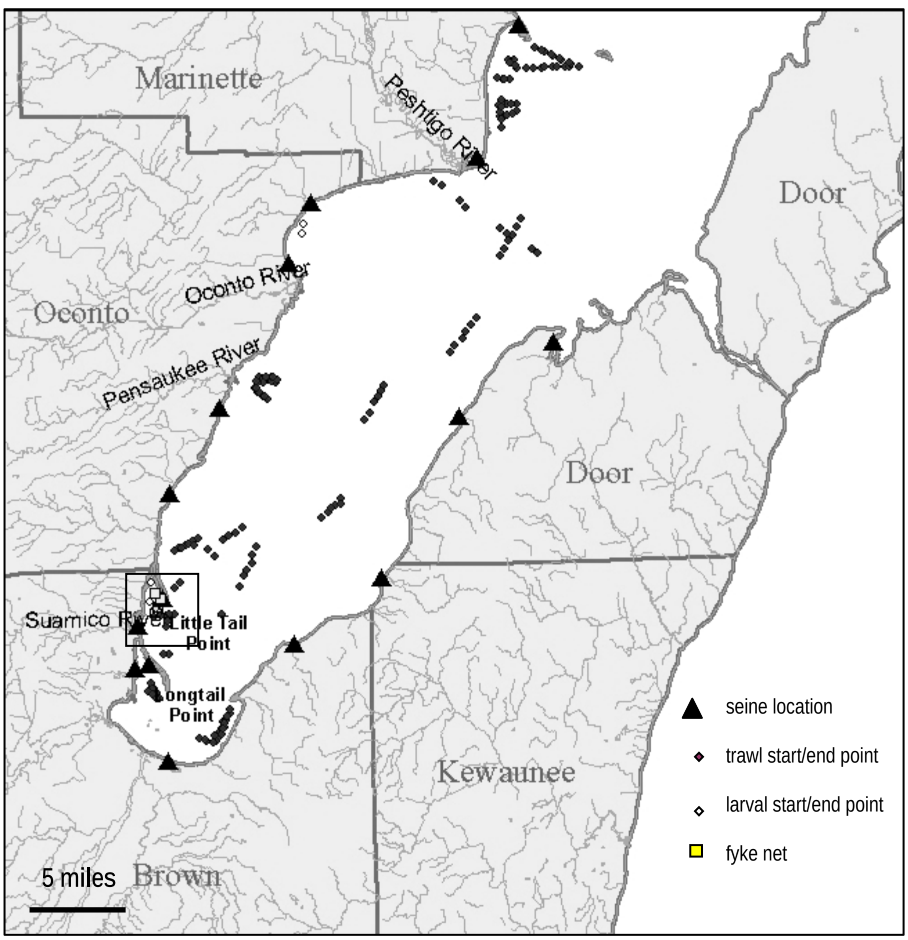


Figure 2. Southern Green Bay, Lake Michigan, showing sampling locations. Red box indicates Little Tail area shown in Figure 3.

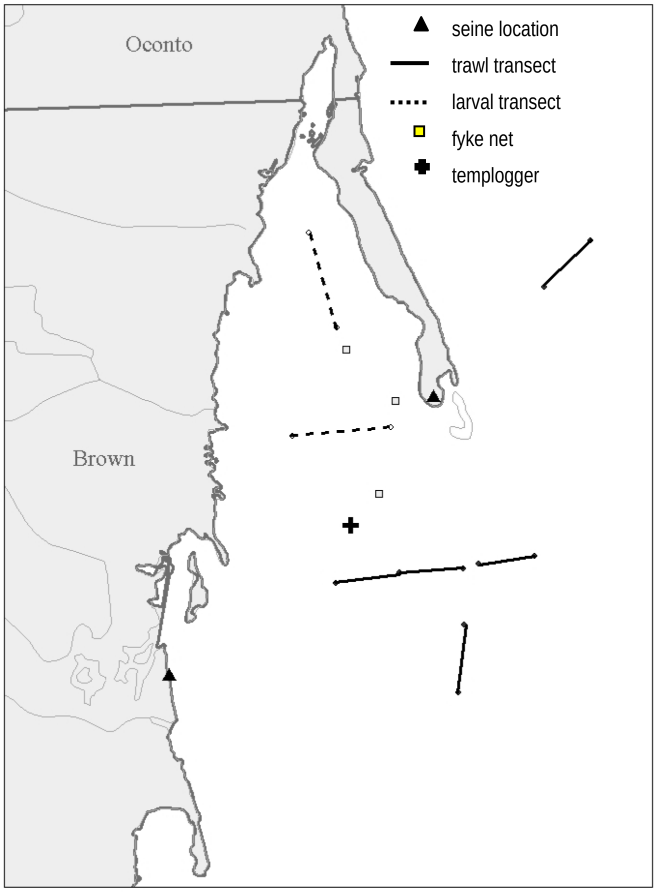


Figure 3. Sampling locations within Little Tail Point. Fyke net at most southern location not set in 2008.

Water temperature

A StowAway TidbiT® templogger (Onset Computer Corporation) was deployed on April 17, 2008 near Little Tail Point (Figure 3) to record water temperature every 30 min until August. The number of hours that water temperature was equal to or greater than 56.3F was calculated for May, as this is considered the minimum temperature required for yellow perch growth (Le Cren 1958; Nakashima and Leggett 1975). There were 7 fewer growing days (169 hours) in May 2008 compared to May 2007. Minimum water temperatures in June for both years exceeded 60F, so the number of growing days was not calculated for that month. However, June 2008 water temperatures averaged 2.6F lower than in 2007.

Larval sampling

In 2008, larval sampling continued for the 11th year, with support from University of Wisconsin Sea Grant for equipment and a boat. Larval yellow perch were collected using a high-speed Miller sampler at two locations off of Little Tail Point and one standard location north of Oconto River on June 5 (Figures 2, 3). Sampling occurred at Little Tail every one to six days from May 12 through June 9, as dictated by wind conditions. Cladophora was at low levels compared to 2007 larval surveys. Additional tows were conducted at 14 sites on the west and east shores of Green Bay to obtain larval fish for genetic archives. All samples were delivered to University of Wisconsin-Milwaukee's Great Lakes Water Institute for identification and analysis.

Beach seining

Index station seining continued for the 27th year at 15 sites spread over 130 miles of Green Bay shoreline (Figure 2) using a beach seine (25ft x 6ft, ¼-in delta mesh with 6x6x6ft bag). Seining was implemented three times per site between June 16 and July 10, 2008. At each site, two 50ft hauls were pulled in perpendicular to shore. The number of YOY retained and escaped from the seine bag when it was placed in a tub was recorded. Catch per effort (CPE) was calculated as the mean number of YOY perch per 100ft seine haul. During the three sampling periods, the mean CPE was 91, 185, and 97 respectively. Overall, this was lower than 2007 which yielded CPEs of 175, 184, and 104. The site with the highest abundance in 2008 was on June 24 at Little Tail Point which had a CPE of 1569 and a high escapement rate (83%).

Mean length of YOY during the third sampling week was 38 mm, compared to 45 mm in 2007. As expected, escapement rates decreased with larger fish and all YOY ≥ 43 mm were retained in the seine bag. Because many YOY had not yet reached a size where they were effectively captured even in the third week of sampling, our CPE values are probably underestimated. However, a seine with a smaller mesh would be difficult to pull in areas with abundant cladophora. In these locations, retention of small YOY increased because algae clogged the mesh. White suckers dominated the catches followed by yearling yellow perch (n=286), spottail shiners, banded killifish, and round gobies. A total of twenty-four fish species were identified during the survey.

Trawling survey

Annual late summer trawl surveys continued for the 31st year to monitor trends in yellow perch abundance. Trawling was conducted at 78 index sites at 12 locations: 46 shallow sites (established in 1978-1980) and at 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. Hauls were made during daylight hours. At each of the 12 locations, 100 YOY were preserved when possible and later measured.

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 2008 produced a fair to moderate year class with the relative abundance of YOY yellow perch (555) ranking as the 10th highest since the deep water sites were added in 1988 (Figure 4).

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 65 in 2007 to 105 in 2008. A majority (89%) of the age-1 and older fish captured were yearlings (2007 year class) with males and females represented near equally. Common species in order of abundance captured at shallow sites were round goby, adult alewife, white perch YOY, and gizzard shad. Deep water trawls were dominated by adult alewife, adult whitefish, trout perch, and whitefish YOY.

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 decreased from 472,597 fish (144,554 lbs) in 2007 to 196,852 fish (55,922 lbs) in 2008 (Figure 5). The harvest rate (0.22/hr) and catch rate (0.33/hr) of yellow perch in 2008 also decreased significantly from 0.52/hour and 0.87/hour in 2007. A majority (54%) of the open water harvest was from the 2005 year class. Fish from the 2003 year class only comprised approximately 14% of the total sport harvest. The mean length of open water harvested yellow perch was 8.5 inches (n = 263; SE = 0.1). Recently, it was noted that perch harvest from Door County ramp and shore sites within the Sturgeon Bay canal were inadvertently added into Lake Michigan harvest estimates, even though the majority of perch anglers using these sites fish in Green Bay waters. The above creel estimates for 2007 and earlier do not reflect the Sturgeon Bay canal sites because the statistical catch-at-age model has not been adjusted with those harvest estimates prior to 2008.

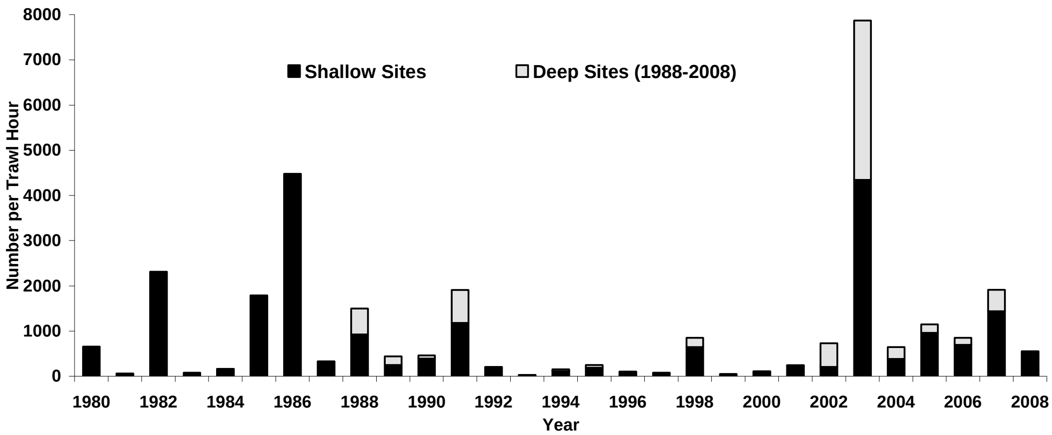


Figure 4. Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2008.

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 a high of 2 million fish in 1990 to a low of 6,930 in 2002 (Figure 5). Winter harvest of yellow perch in 2008 (67,868) was similar to 2006 estimates but was reduced by nearly half compared to 2007. Harvest per hour for anglers targeting yellow perch fell from 0.64/hr in 2007 to 0.43/hr in 2008. The 2005 year class comprised the majority (50%) of fish harvested under the ice with a mean length of 8.1 inches (n = 22; SE = 0.02).

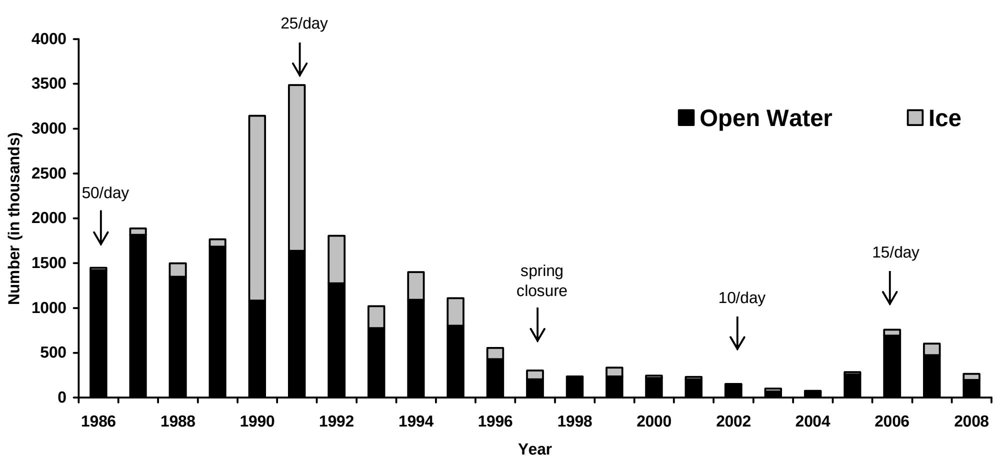


Figure 5. Estimated sport harvest of yellow perch in Green Bay from 1986 to 2008. Regulation changes indicated by arrows.

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 the 1983-1984 commercial fishing license year, 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.

In calendar year 2008, commercial fishers harvested a total of 65,401 pounds using gill and drop nets, compared to 61,031 pounds in 2007 (Figure 6). The total allowable commercial harvest was increased from 60,000 pounds to 100,000 pounds in 2008, effective prior to the start (May 20) of the commercial fishing season. The harvest rate (CPE) for gill nets decreased from 31.15 in 2007 to 28.62 in 2008, while drop net CPE dropped from 29.11 to 9.77. Age-3 perch (2005 year class) made up 55% of the total harvest in 2008, while age-5 perch (2003 year class) comprised an additional 22% of the harvest. Although the extraordinary 2003 year class supported the commercial and sport fisheries in 2006 and 2007, this year class is no longer dominant and is being replaced by the robust 2005 year class.

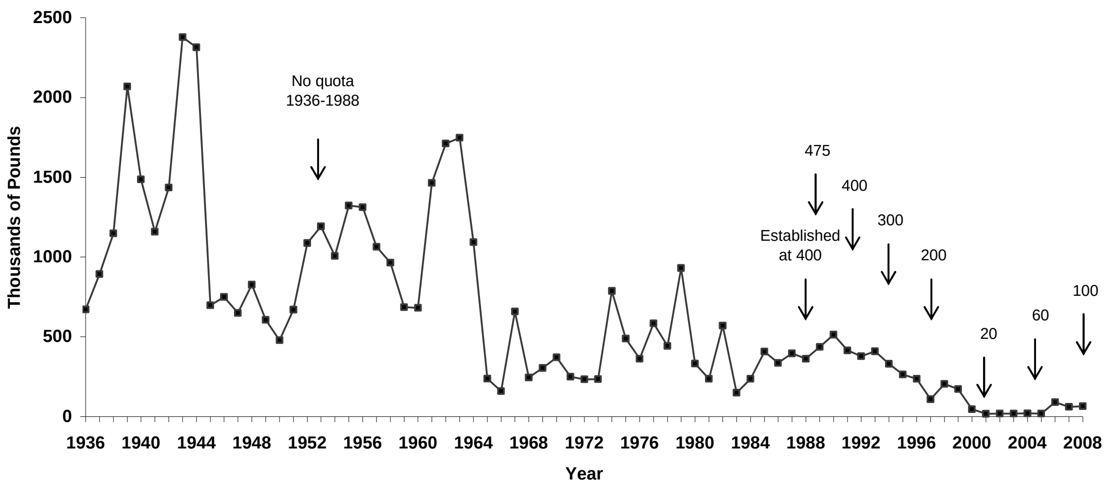


Figure 6. Commercial harvest of yellow perch in Green Bay from 1936 to 2008. Total allowable commercial harvest changes (thousands of pounds) indicated by arrows.

Management actions

Wisconsin DNR annually evaluates a statistical catch-at-age (SCAA) model regarding changes to yellow perch commercial and sport regulations. Model outputs after 2006 data was entered suggested that higher harvest levels of adult perch could be sustained based on several years of improved recruitment. Wisconsin DNR sought to increase the commercial quota from 60,000 to 100,000 pounds in Green Bay. After a series of public hearings in August 2007, this proposal passed Wisconsin Natural Resources Board and legislative approval to become rule, effective prior to the May 20, 2008 commercial fishing season opener. The current sport bag limit remained at 15 per day. Presently, WDNR has a policy of allocating yellow perch harvest equally between the sport and commercial fishery over the long term (Figure 7) while protecting the resource from overfishing.

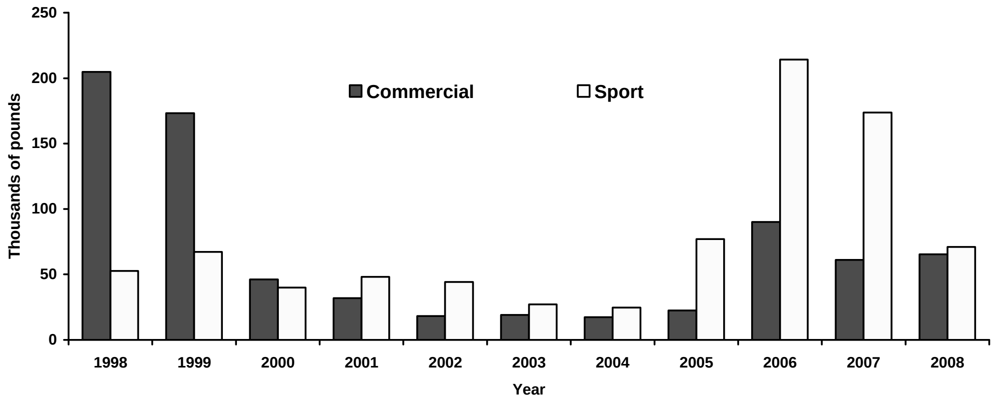


Figure 7. Commercial harvest and estimated sport harvest in Green Bay from 1998 to 2008.

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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 2008-09.

Young-of-the-year Assessment

In southeastern Wisconsin, beach seining was conducted to assess young-of-the-year (YOY) yellow perch. In 2008, we sampled at 15 sites between Kenosha and Sheboygan from August 25, 2008 to September 17, 2008 using a 25' bag seine with ¼" delta mesh. The number of stations at each port city varied from 2 to 6; Kenosha -2, Racine -2, Milwaukee -6, Port Washington -2 and Sheboygan -3. Each station was visited at least twice during the sampling period. Surface water temperature remained in the lower 70s (^{0}F) during most of the sampling period. The density of filamentous alga, cladophora, did not inhibit seining effort. A total of 4,790 ft of seine haul at fifteen stations produced 146 YOY yellow perch. The over all catch per effort (CPE) of YOY yellow perch in the southern Lake Michigan was 3.05. The CPE is calculated as the mean number of YOY perch per 100ft. seine haul. This number is used as an index of year-class strength. Most of the perch were captured in the Sheboygan area, especially at the Lake View park jetties. The average total length of the YOY perch caught was 52.7 mm. Figure 1 shows the catch per effort of YOY yellow perch for the sites in the Southeast Region (SER) since 1989. In recent years, 2005 and 2007 surveys produced higher YOY yellow perch with CPEs of 39 and 34, respectively. Based on previous experience, current observation of CPE of 3.05 may not develop into a strong year class. However, it is too premature to draw any conclusion at this point as our future graded mesh assessment data will provide a better indication of year-class strength. A total of sixteen species of fish (young and adult) were documented during the survey. Alewife dominated the catch followed by spottail shiner and longnose dace. Rainbow smelt, though in smaller numbers, appeared frequently in the catch during the 2008 survey.

In addition to using a standard bag seine, two index stations - Wind Point and Doctors Park - were selected for setting micromesh gillnet (from 9/25/2008 to 10/14/2008). The nets were set using an inflatable boat on a calm day at depths ranging from 6 to 11 feet and fished over night. Two kinds of nets were used in the assessment: a 40-foot graded mesh gillnet made of four meshes (12mm, 20mm, 24mm and 12mm stretch mesh), each 10-foot long, and a 100-foot long and 5 feet deep net made of 12mm stretch mesh. The first lift at each station consisted of two gangs of 100 ft net (200ft total) and one gang of 40 ft net, set to fish overnight. The second lift at each station consisted of only two gangs of 100 ft net. A total of ten species of fish were captured in these nets. The YOY yellow perch were captured mainly in the 12mm stretch mesh. The average total lengths of YOY perch caught in the gillnet were 61.5mm and 63.6mm at Doctors Park and Wind Point, respectively. The catch per 100 ft of gill net (CPE) was 2.6 YOY yellow perch in 2008, which is smaller than the previous three years. The CPEs from 2005, 2006 and 2007 were in the order of 195, 61 and 11 YOY yellow perch per 100 ft of gillnet.

Spawning Assessment

This assessment has been conducted since 1990 on the Green Can Reef and in the Milwaukee Harbor (Table 1). The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. In spring 2008, we took five samples from May 21st to June 17th. The effort varied from 500ft (1 box) to 1000ft (2 boxes) of gillnet in each lift. Each box of 500 ft gillnet consisted of 2, 2.5, 2.75, 3.0 and 3.25 inch mesh (100 ft each panel). The nets were set at depths ranging from 30ft to 55ft, and allowed to fish overnight. The bottom water temperature was 35 ^{0}F on May 21st and 54 ^{0}F on June 18th. Of the 24 females caught in the first lift, majority of them were still green. By mid June almost all perch were spent. When compared to the previous years, the total number of perch caught in 2008 spawning assessment was much lower (Table 1) even though effort was almost doubled. Only 326 perch were caught in five lifts with a total effort of 4000 ft of gillnet. The main difference was in the proportion of males in the catch. Of the 326 perch caught, only 64% were males as opposed to 97% in 2007 assessment. A total of 152 yellow perch were aged; the ages ranged from 3 to 10 years. The 1998 year-class perch, which are 10 year old, still comprise a significant proportion in the spawning population (32%). But, 2002 year-class was the dominant one with 37% (Figure 2).

Yellow perch egg deposition survey was conducted by the WDNR dive team on June 2nd and June 18th. They counted 15 egg masses resulting in 0.52 egg mass per 1000 square meters (Figure 3) which is much lower compared to 10.81 egg mass per 1000 square meters found in 2007 survey. The reason for such drop is unclear. The overall number of spawning perch on the reef dropped in 2008. However, female perch proportion (35.9%) was relatively greater than previous years.

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 on 1/4 inch increments. Yellow perch begin to recruit to this assessment gear by age 2 and are almost fully recruited by age 3 (Figure 4). Four lifts with a total effort of 16,000 ft gillnet were taken from 12/04/2008 to 12/12/2008 at depths ranging from 49ft to 78ft.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1995 through 2009. The data show variability in catch rates by calendar year. These data show very low CPEs of youger fish and higher CPEs of older fish until 1998 (dominated by male perch). However, data on age and size distribution of yellow perch from 1999 onward represented smaller and younger perch in significant proportions, essentially from 1998 year-class (Table 2). The fast growing 1998 year-class, which is 11 years-old now, recruited to the fishery at the end of age 2 and continued to dominate the catch until recently. The 1998 year-class perch comprised the major portion of the population for a number of years, and is gradually declining in the catch.

In our 2009 graded mesh assessment included multiple year classes. The 2005 year-class yellow perch (age 4) emerged as a dominant group comprising 41% (Figure 5) followed by 2002 year-class (22%). The 1998 year-class is no more the dominant player (11%). The majority of large male and female perch that belonged to 1998 year class were captured in the 3 inch and 3.25 inch mesh. In addition to the above three year classes, 2006 and 2003 year classes also comprised substantially with 10% and 9%, respectively.

Since 2000 the sex ratio of the yellow perch population was shifted toward predominantly female and lasted until 2002. This trend is reversed again since 2003 with greater number of males, except for 2007. In 2009 survey, the female proportion is even higher (60%). We captured 493 male and 745 female yellow perch in four lifts. The data from 2008 spawning assessment also indicated a decreased male perch in the population. An absence of commercial harvest in Lake Michigan certainly has helped decrease the impact on fast growing larger female perch in the fishery, allowing them to spawn multiple years.

Harvest

In September 1996, the commercial yellow perch fishery was closed in the Wisconsin waters of Lake Michigan. Hence, the information on commercial harvest is limited up to 1995 catches. Sport harvest is monitored by a contact creel survey. The sport bag limit has been reduced to five fish per day since September 1996, which is reflected in the total harvest (Table 3). Our creel survey data on the sport caught yellow perch in 2008 indicated a major drop in the sport harvest. The overall harvest in Lake Michigan was decreased by 70% from 66,000 perch in 2007 to 20,000 in 2008. In general, the lakeshore counties –

Milwaukee, Kenosha and Racine are the main producers. The harvest was dropped by more than 90% in Kenosha and Racine counties in 2008 compared to 2007 harvest. The main reason for the decreased harvest was poor weather conditions during much of the fishing season. The higher gas prices may also have contributed to the reduced fishing effort. The huge reduction in 2008 harvest may not reflect the changes in lake-wide population. Nevertheless, we observed a significant reduction in the adult perch in the spring 2008 spawning assessment.

The 2005 year-class yellow perch recruited to the fishery as 3-year-old fish and dominated the sport catch comprising about 36% of the catch followed by 2003 (28%) and 2002 (22%) year-classes. The 1998 year-class, which was the dominant year-class for many years is now reduced to only 3.5% in the sport harvest. 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. We hope 2009 would be a better year for perch anglers!

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, the 1998 year-class was the strongest year-class in recent years supporting the fishery. While 1998 year-class continues to support the fishery, the proportion of these fish is gradually decreasing. Recent data indicate that the 2002, 2003 and 2005 year-classes comprise substantial numbers in the population. Thirty six percent of the sport caught yellow perch in 2008 and 41% of winter graded mesh perch in 2009 belonged to 2005 year-class which is emerging as a dominant year-class. The sport harvest of 1998 year-class in Lake Michigan is gradually decreasing which is probably due to their decreasing abundance. These observations are consistent with data collected by other agencies throughout the lake. Effective September 1996 commercial fishing was closed in the Wisconsin waters of Lake Michigan and daily sport bag limit was reduced to 5 fish. Effective May 2002, the sport fishery for Lake Michigan yellow perch is closed from May 1 to June 15. These rule changes are implemented to benefit perch population recovery by reducing impact on spawning stocks, and allowing mature adults to spawn multiple years in their life time. Presence of multiple year-classes in the spawning population as well as in the sport harvest is a positive change. The current regulation will remain in effect until a detailed analysis is complete on the status of yellow perch population. The Yellow Perch Task Group is working with a research team on developing a Statistical Catch at Age model to help guide management actions.

Table 1. 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

[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 2. 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	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	42	323	1	0	2	3	0	3	40	3	2
3	0	0	4	2	57	65	243	4	0	1	61	29	24	159	50
4	28	0	14	6	215	9	20	118	0	0	12	249	60	7	282
5	65	0	11	29	93	27	2	4	33	1	0	37	204	46	6
6	120	19	18	35	57	2	2	3	0	27	11	0	31	120	59
7	76	51	77	20	45	0	1	1	0	1	226	23	4	16	139
8	65	71	251	43	63	8	2	0	0	0	6	417	20	7	18
9	24	31	109	110	44	9	1	0	0	0	0	7	113	7	12
10	2	12	15	60	33	11	1	0	0	0	0	0	0	69	5
11	0	3	0	15	9	1	1	1	0	0	0	0	0	1	78
12	0	0	0	4	7	0	0	1	1	1	2	0	0	0	2
%M	90	95	89	80	58	36	36	38	52	60	64	53	48	51	40
%F	10	5	11	20	42	64	64	62	48	40	36	47	52	49	60

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

Table 3. 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]

[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)

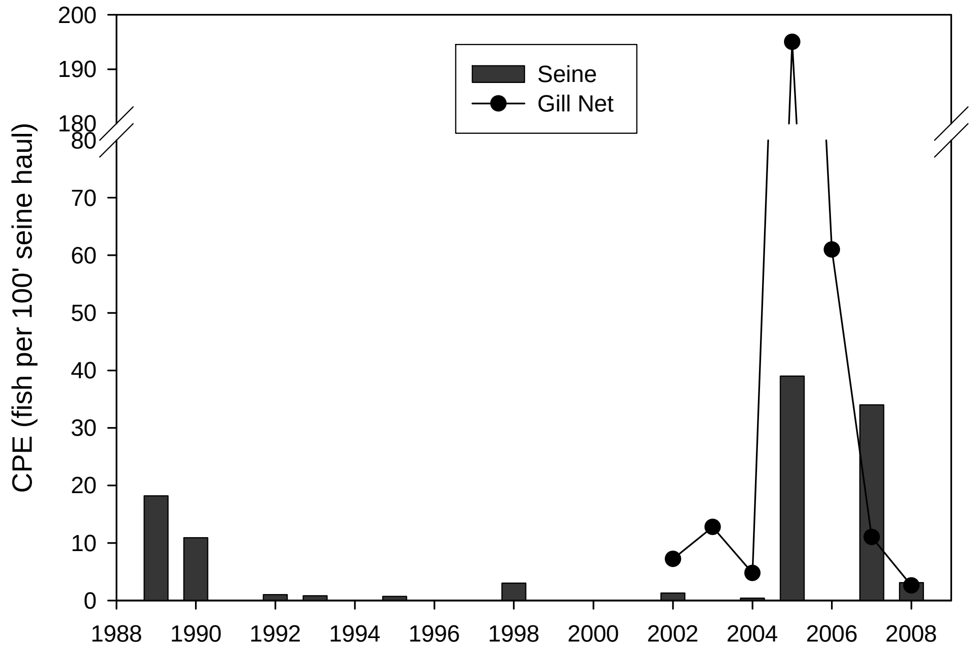


Figure 1. CPE (fish/100') of YOY yellow perch in summer beach seining and graded mesh gillnetting.

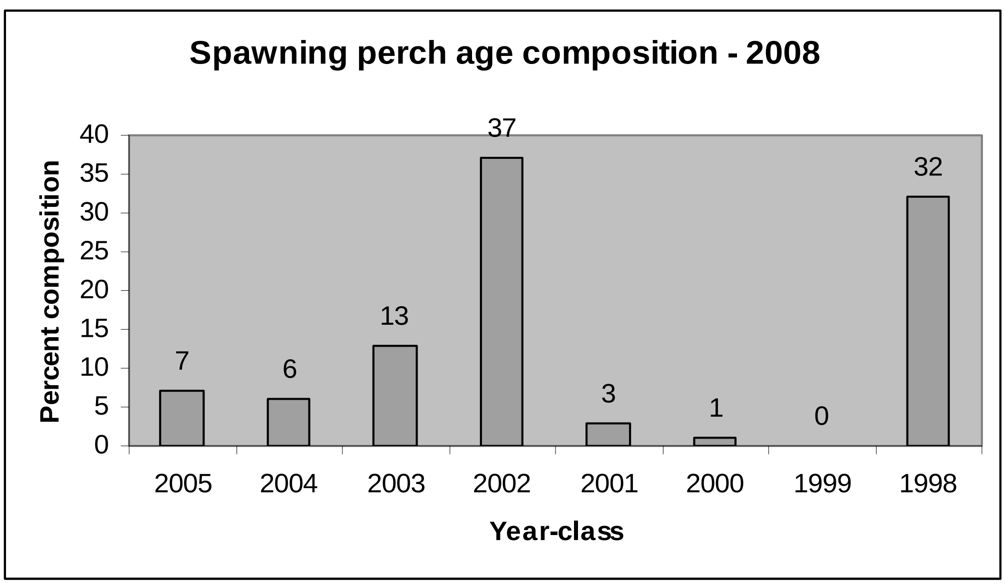


Figure 2. Composition of different age groups (year-classes) in the spawning population of yellow perch on the Green Can Reef off Milwaukee in Lake Michigan, 2008.

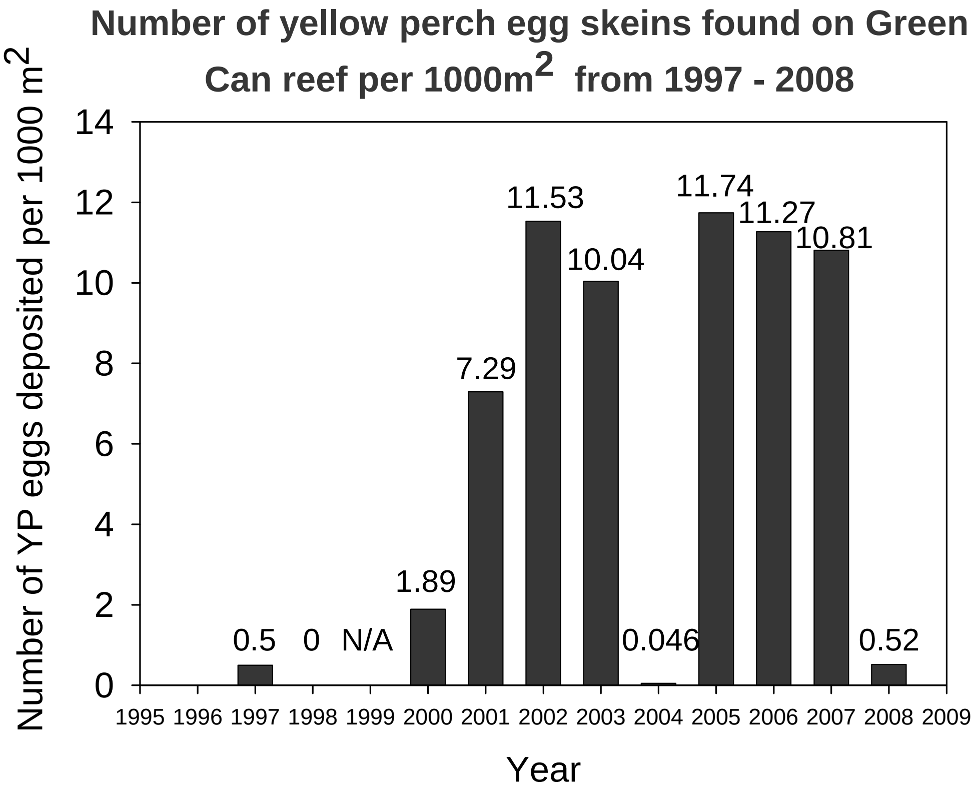


Figure 3. Yellow perch egg deposition survey in Lake Michigan, WDNR.

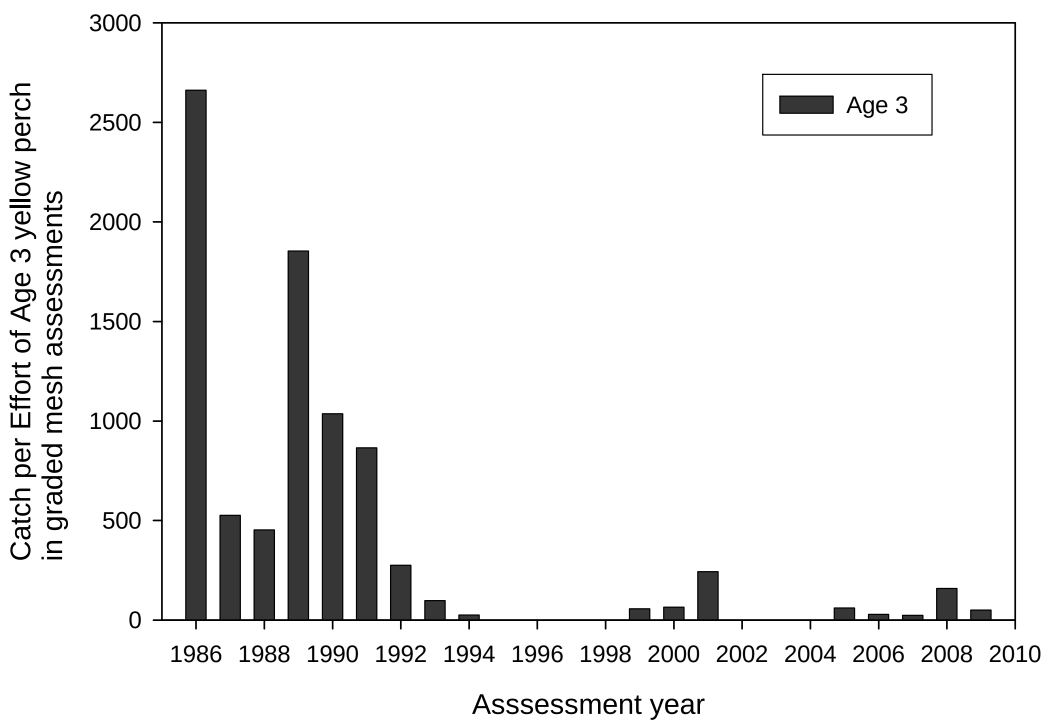


Figure 4. Age 3 yellow perch in the winter graded mesh gillnetting assessment in Lake Michigan.

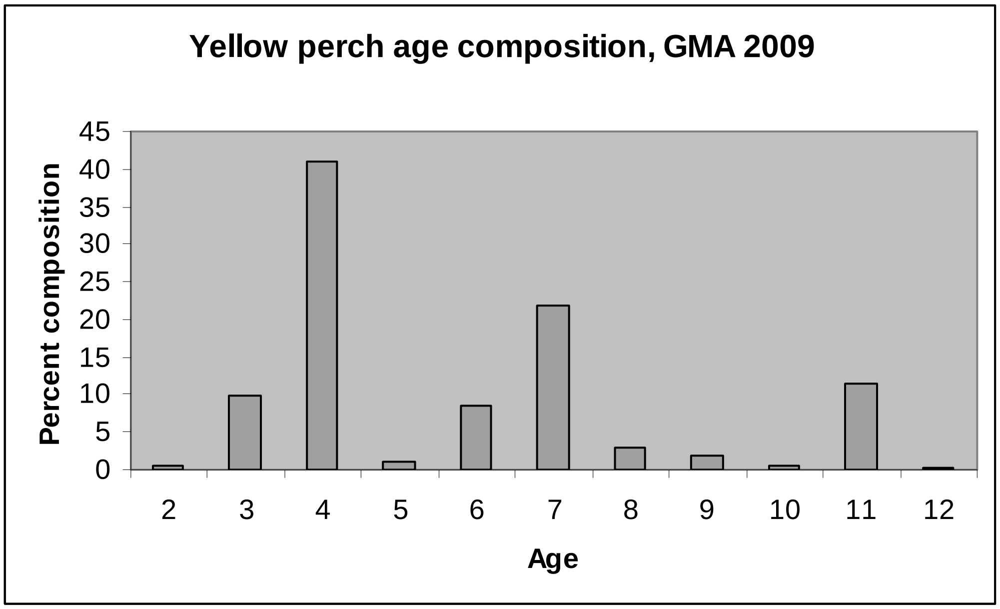


Figure 5. Age distribution represented as year-class of yellow perch in the winter graded mesh gillnetting assessment in Lake Michigan, 2009.

WALLEYE IN SOUTHERN GREEN BAY AND THE LOWER FOX RIVER

David Rowe 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 over-exploitation. At one point, only the Menominee River supported a spawning stock (Schneider et al. 1991). The water quality and fish community of southern Green Bay began to improve by the mid 1970s after the passage and enforcement of the Clean Water Act (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 began in 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 for surveys of natural reproduction and recruitment. The Sturgeon Bay area is still stocked with walleyes.

Spring fyke net surveys that targeted spawning walleyes were conducted in the Sturgeon Bay area of Green Bay during 1982-1996 and in the lower Fox River below the De Pere Dam during 1981-1984 and 1987-2004. The lower Fox River spring fyke net survey was discontinued after 2004 because the walleye stock was considered to be self-sustaining for about two decades and resources were required for other surveys. Electrofishing index surveys were conducted on southern Green Bay (during August or early September 1990-2008) and the lower Fox River (during late October or early November 1991-2008). These surveys were designed to target young-of-year (YOY) walleye and other gamefish, but all species were netted when possible. We plan to continue these index electrofishing surveys in the future

The results of previous studies suggest that Green Bay walleye stocks remain in small areas and are quite discrete (Schneider et al. 1991). The walleye stock in southern Green Bay and the lower Fox River (generally residing between a line drawn across Green Bay from Longtail Point to Point Sable and the DePere Dam) is likely distinct from other stocks in Green Bay. Walleye spawner abundance and YOY production have been variable since monitoring began (Kapuscinski and Lange 2005), but the stock has not been augmented through stocking since 1984 and is considered self-sustaining. The purpose of this report is to summarize data collected during the 2008 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 2008 electrofishing index surveys show that 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 2008. The 2008 age 0 catch per unit effort (CPUE) from the Fox River was 25.8 YOY/hour of electrofishing which is above the 15 year average of 10.4 YOY/hour. The Lower Green Bay catch was 25.2 YOY/hour, which is three times greater than the 15 year average of 7.8 YOY/hour. These catch rates may also have been biased by turbid water during the sampling and YOY walleye abundance may have been higher than observed. Stable water temperatures and the extended warming period during the 2008 spawning and hatching periods likely provided good conditions resulting in a very strong year class (Hansen et al. 1998). The extended spawning period also resulted in a wide range of sizes of young of the year in the sample, ranging from 100mm to over 270mm (Figure 2). Years with extremely low or no catches of YOY walleyes are not uncommon in the data set and do not pose a direct risk to the future spawning stock abundance. However, consecutive years with poor year-class production have lead to successive years with low abundance of spawners (Kapuscinski and Lange 2005).

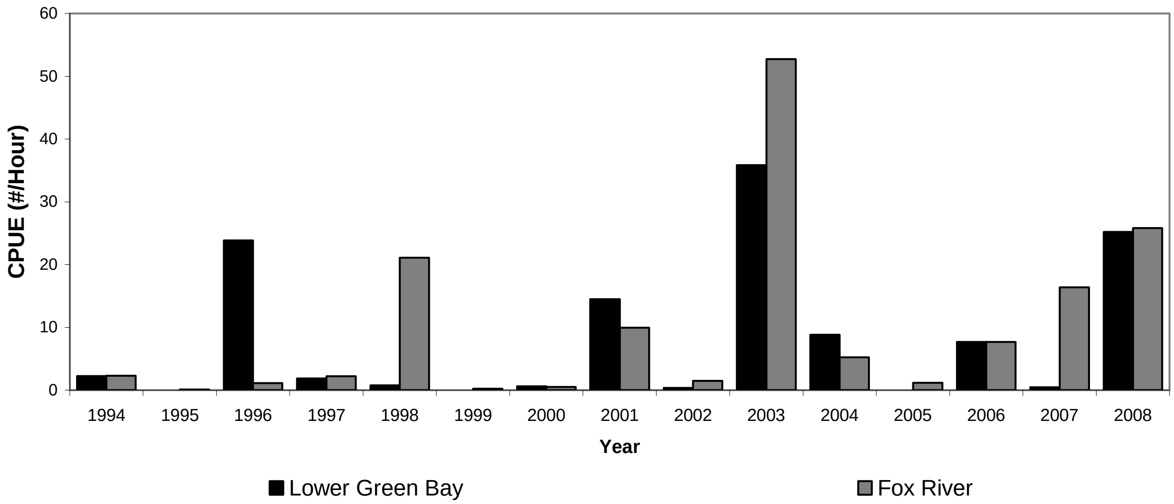


Figure 1. Relative abundance of young-of-year walleye in the lower Fox River (DePere Dam to mouth), lower Green Bay (south of a line drawn from Longtail Point to Point Sable), as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1994-2008.

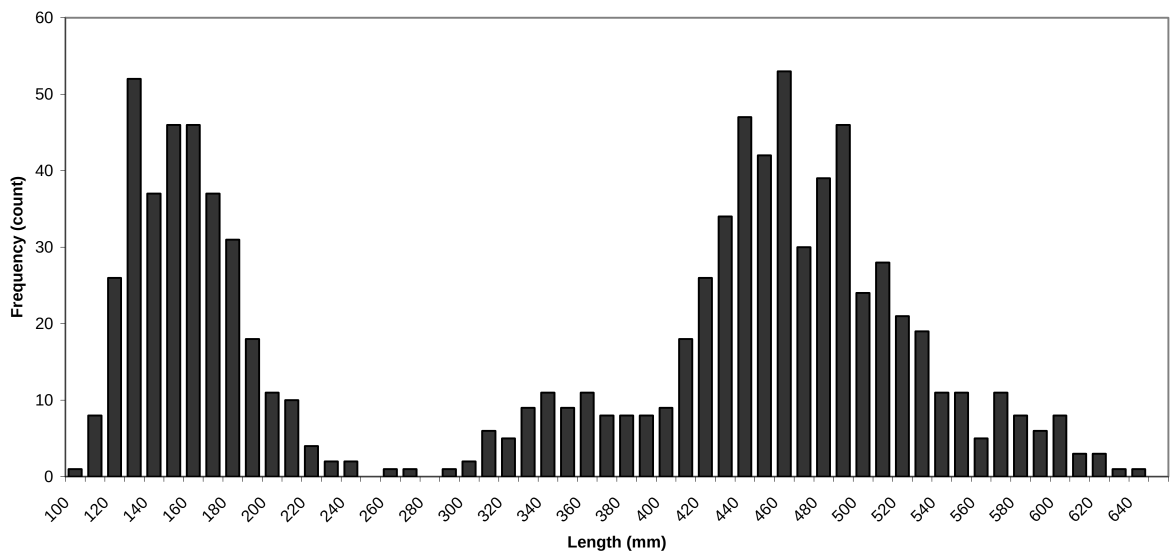


Figure 2. Length-frequency distribution of walleye sampled while electrofishing southern Green Bay and the lower Fox River during 2008.

Walleye stock size structure

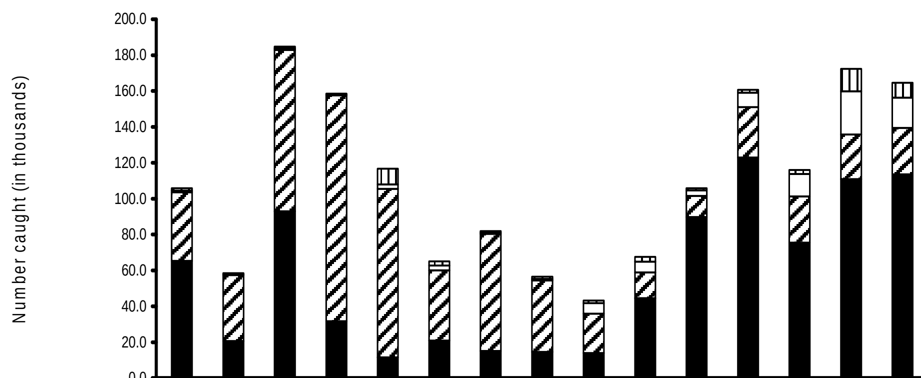
In 2008, walleye captured during our electrofishing index surveys averaged 356 mm total length (range 104-677). The length-frequency distribution of captured walleye indicates that the stock's size structure is not being negatively affected by year-class failures, low recruitment, slow growth, or excessive mortality (Figure 2). The proportional stock density (PSD), where walleye quality length (380 mm) and stock length (250 mm) minimums proposed by Gabelhouse (1984), was 89. The generally accepted PSD range for walleye stocks is 30-60 (Anderson and Weithman 1978). Comparing this suggested range to our results indicates that the southern Green Bay / lower Fox River walleye stock may be out of balance, because most fish sampled were greater than quality length (Figure 2). We propose that the stock is healthy (despite the high PSD value) because: 1) there is no negative trend in recruitment (Figure 1), 2) year-class failures have not been observed in more than two consecutive years during 1994-2008 (Figure 1), 3) the length-frequency distribution of the stock does not indicate excessive mortality at any size (Figure 2), 4) forage is abundant, and 5) growth rates are above average (Schneider et al. 1991). The dominance of the 2003 year class is evident in the large proportion of fish between 480 and 550 mm.

Catch and Harvest

Total catch of walleye from Wisconsin waters of Green Bay was estimated at 164,601 during the 2008 open water season (March –October 31), a slight decrease from the estimated 172,341 caught during 2007 (Figure 3). This was 50% greater than the average estimated walleye catch for the last 15 years of 109,565. The total catch of walleye increased in Brown County and Marinette County waters in 2008 compared to 2007, and decreased in Door, Kewaunee and Oconto County waters.

Total open water season harvest of walleye from Wisconsin waters of Green Bay decreased from 57,382 during 2007 to 47,820 during 2008 (Figure 4). Harvest decreased in all counties during 2008 compared to 2007, but was almost consistent in Brown and Oconto Counties.

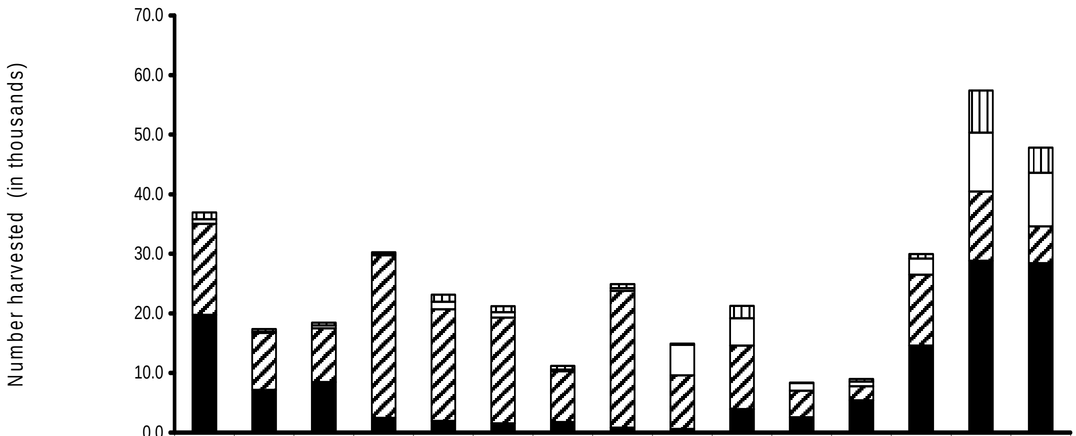
The walleye catch has been relatively high for the last five seasons, with the greatest contribution to the catch from the lower Fox River and Brown County waters of Green Bay. Anglers also appear to be harvesting higher numbers of walleyes from Brown County waters. This may be in response to the decrease in PCB contaminant levels and the increased size of fish available for consumption based on consumption guidelines (WDNR 2007). However, the relationship between catch and harvest of walleye from Green Bay is likely complicated by anglers: 1) targeting trophy walleye, 2) catching most of their walleye during the restricted spring season, 3) practicing catch and release, or 4) some combination of these three scenarios.



	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
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
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
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
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

Year

Figure 3. Estimated total open water season (March-October) walleye catch from Wisconsin waters of southern Green Bay and the lower Fox River by county during 1994-2008.



	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
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
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
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
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

Year

Figure 4. Estimated total open water season (March-October) walleye harvest from Wisconsin waters of southern Green Bay and the lower Fox River by county during 1994-2008.

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. The size structure of the population indicates that the majority of the stock is at or above quality size, and mortality is not excessive at any size. Furthermore, year-class failures have not been observed in more than two consecutive years during 1994-2008, and forage is abundant. A high spawner abundance and excellent sport fishery should be present over the next several years. Harvest will be continued to be monitored in relation to PCB contamination levels. As contaminant levels continue to decrease, harvest will likely continue to increase.

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GREEN BAY FORAGE TRAWLING
Steve Hogler and Steve Surendonk

In 2003, the Wisconsin DNR began a project to assess forage fish on Green Bay that utilized sampling protocols and trawl gear developed by the U.S.G.S. for forage assessment on Lake Michigan. We trawl during daylight hours in September using a 39-foot headrope trawl net. A five minute trawl at 2 MPH is made at ten foot depth increments following contours beginning at 50 feet along two transects that cross the commercial trawling zone. Transects in 2003 began at the entrance buoy to Sturgeon Bay and ran northwesterly toward either Marinette or Peshtigo Point. In 2004 new transects as shown in Figure 1 were established to improve coverage and have been sampled each year since.

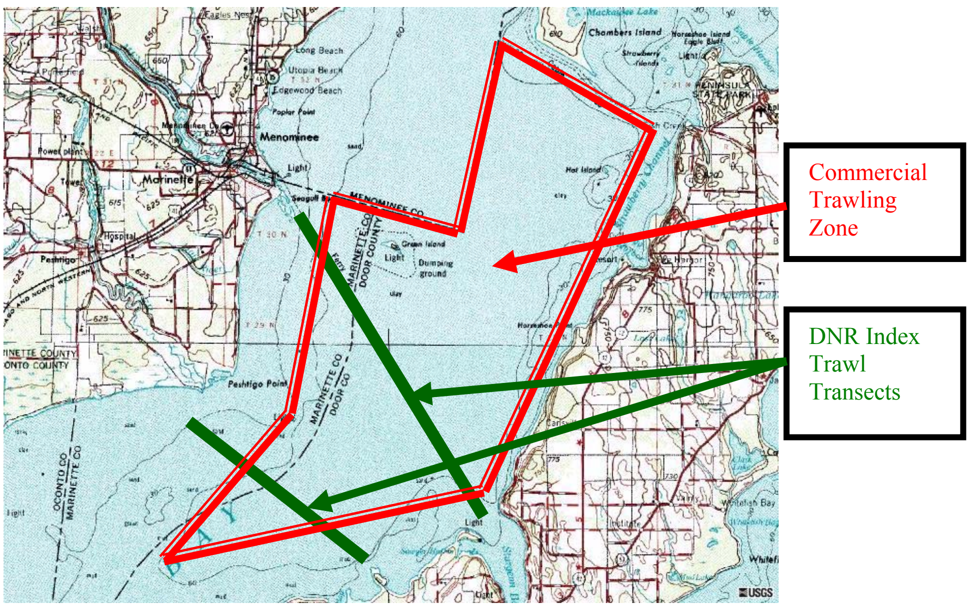

Figure 1. The location of the index trawling transects in relation to the Green Bay commercial trawling zone.

In 2008, both transects were sampled starting at 50 feet and continued across Green Bay in ten foot increments. The catch from each trawl drag was bagged and retained for laboratory analysis. 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.

Along the north transect the total weight of the catch and CPE (kg/hour trawled) increased with depth (Figure 2). These results are similar to results from 2003 through 2006, but not consistent with those from 2007 when catch and CPE decreased with increasing depth. At 50 feet and 60 feet the catch (weight) was dominated by dreissenid mussels. Other common species at these depths included alewife, rainbow smelt and round goby. Alewife dominated the catch at 70 feet while at 80 feet, lake whitefish was the dominant species. CPE for other species such as rainbow smelt, round goby, dreissenid mussels and suckers where substantially lower than for either alewife at 70 feet or lake whitefish at 80 feet. Fish captured along the north transect and reported in the category listed as other included trout perch and burbot.

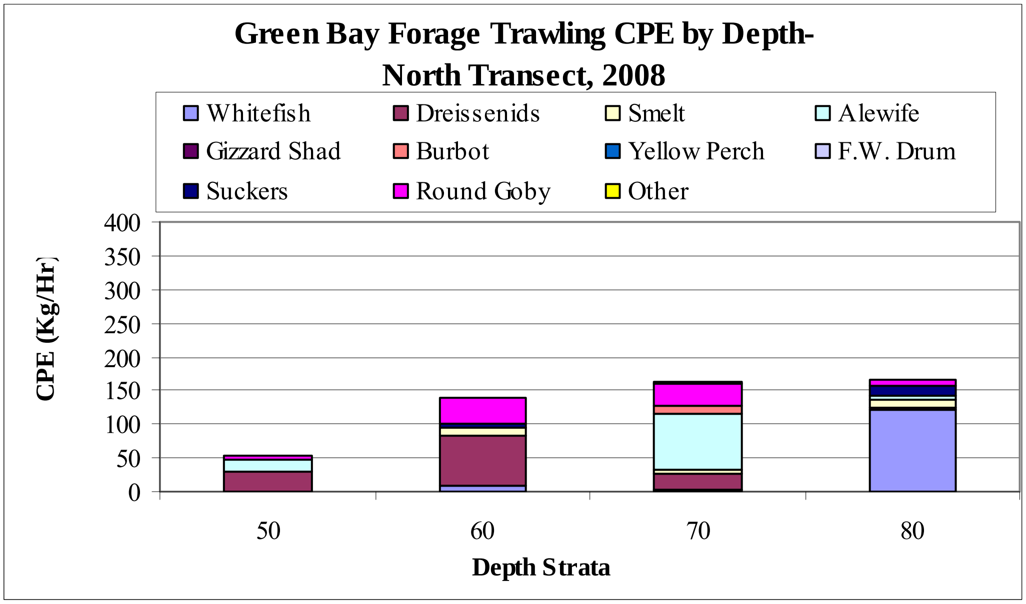

Figure 2. The 2008 CPE (kg/hr) of fish captured by species and depth strata on the north transect on Green Bay.

Unlike the north transect, CPE (kg/ hour trawled) across the south transect decreased with increasing depth (Figure 3). Trout perch, dreissenid mussels and round goby dominated the catch at 50 feet. At 60 feet the catch was dominated by white sucker, trout perch and lake whitefish. At 70 feet and 80 feet, lake whitefish was the dominant species captured. Other species that contributed to the catch along this transect included rainbow smelt, yellow perch, spottail shiner, alewife and walleye.

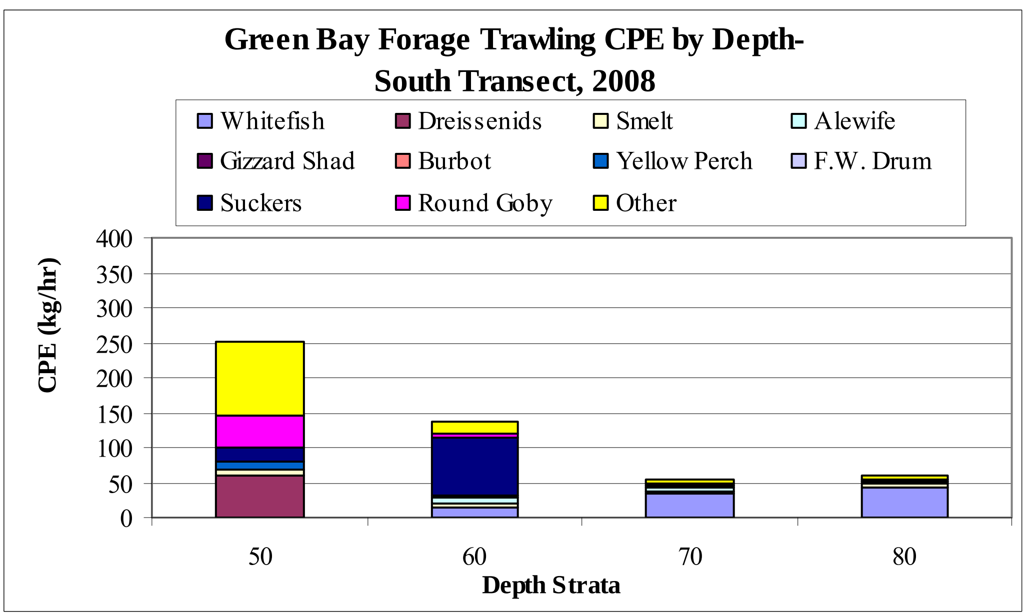

Figure 3. The 2008 CPE (kg/hr) of fish captured by species and depth strata on the south transect on Green Bay.

Six years of trawling data allows us to make several general statements about the survey results. First, total catch and CPE increased in 2008 from 2007 levels and was our second highest catch since 2003 (Figures 4 and 5, Appendix 1). The largest increases in CPE in 2008 over 2007 levels were for lake whitefish, dressenid mussels, white sucker, round goby and alewife (Appendix 1). Declines in CPE were noted for yellow perch, gizzard shad and freshwater drum. Overall, total catch and CPE was similar on each transect, but the species composition differed between the two transects.

Second, there appears to be a difference in the catch between the north and south transects although they are less than 10 km apart (Figures 1, 4 and 5). During the first five years of trawling, the catch along the north transect was consistently more diverse than the catch on the south transect which tended to be dominated by one or two species. It was believed that the diversity of fish species found along the north transect was a reflection of the diversity of habitat that is sampled along that transect. The southern transect is dominated by open water habitats at all depth strata, while the northern transect has a protected bay on the eastern end and a shallow water flat on the western end (Figure 1). In 2008, the diversity on each of the transects was more alike than in past years. It is not clear why, although the lack of several species, freshwater drum and gizzard shad, could account for the differences that we noted in 2008.

Third, round goby after experiencing a sharp decline in CPE in 2007 rebounded in 2008 to reach the highest CPE we have measured during this survey period (Figure 4 and 5). The largest increases in round goby CPE were noted along the south transect at 50 feet and on the north transect at 60 feet.

Fourth, dreissenid mussels appear to be increasing in abundance along the south transect after several years of low CPE while CPE on north transect has been steady, although in 2008 dreissenid mussel CPE increased sharply along the north transect as well (Figures 4 and 5, Appendix 1). Most dreissenid mussels were encountered in waters less than 70 feet (Figures 2 and 3).

Finally, on Green Bay, the rainbow smelt population trend remains unclear. Total rainbow smelt CPE and young of year abundance increased in 2008 after poor catches in 2006 and 2007 (Figure 4 and 5). Past history has shown that CPE obtained during this survey is a poor predictor of rainbow smelt population trends in Green Bay. Low rainbow smelt catches in 2003 and 2004 did not predict that the highest CPE of rainbow smelt caught during this time series would be in 2005. Likewise good rainbow smelt CPE in 2005 did not predict the low CPE measured in 2006. It is unknown how improved young of year numbers in 2007 and 2008 will affect adult rainbow smelt CPE in succeeding years.

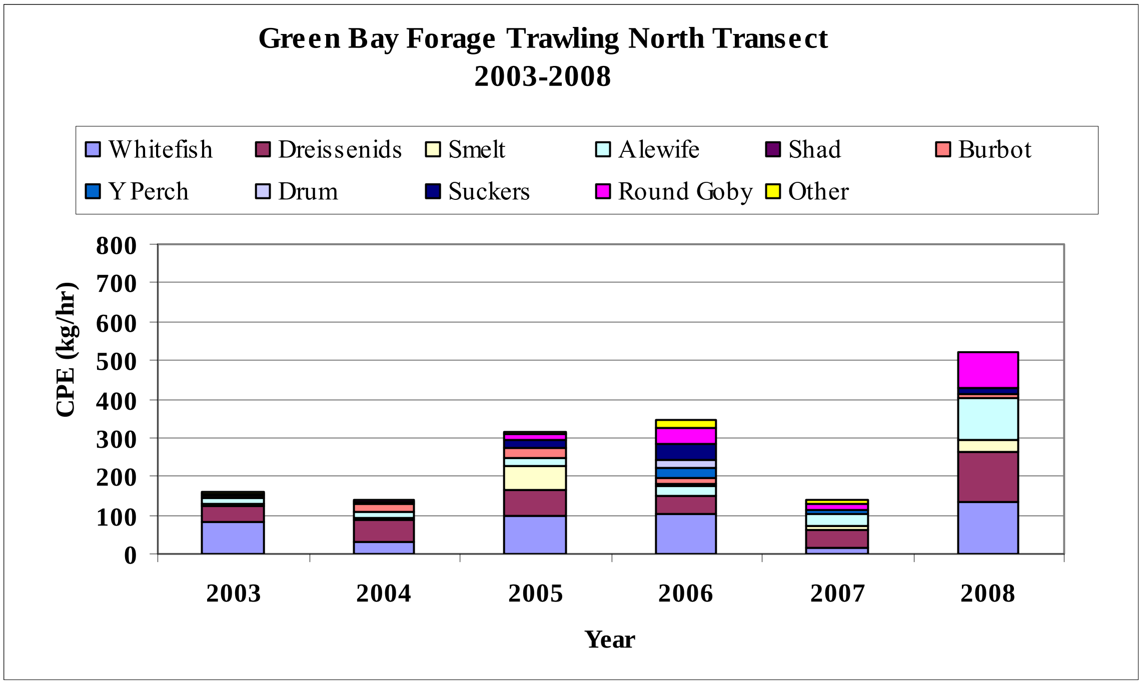

Figure 4. CPE by species for fish and mussels captured during trawling on Green Bay along the north transect, 2003-2008.

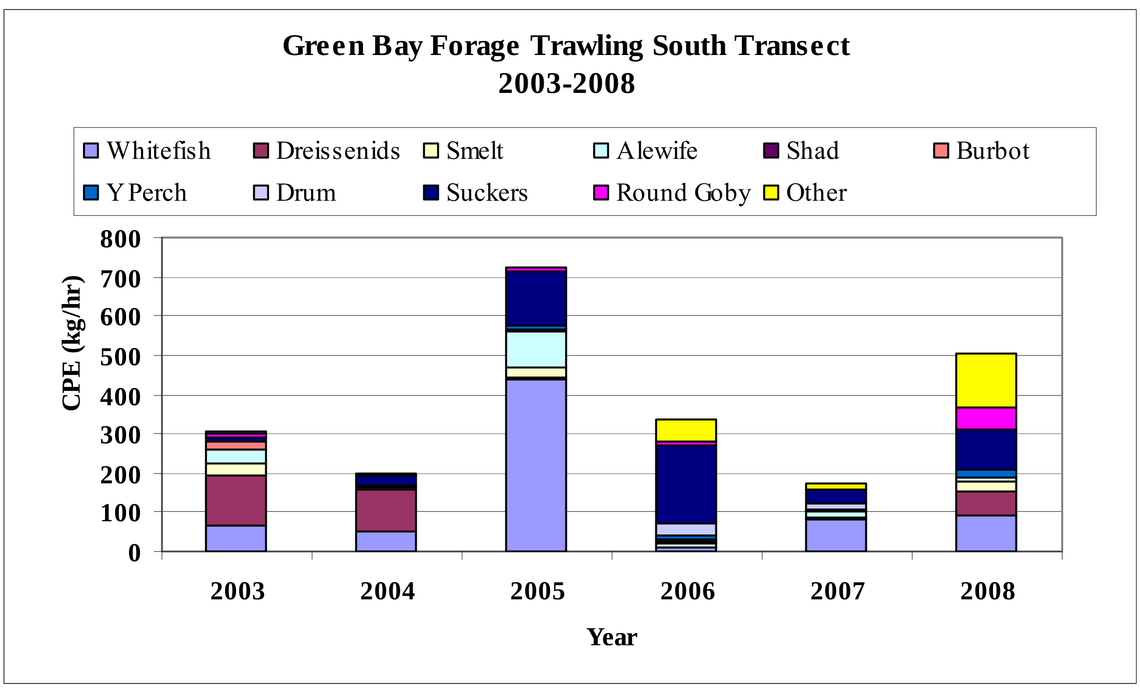

Figure 5. CPE by species for fish and mussels captured during trawling on Green Bay along the south transect, 2003-2008.

Appendix 1. Green Bay forage trawling CPE (kg/hour trawled) by species on the north transect and the south transect, 2003-2008.

North (kg/hr)	2003	2004	2005	2006	2007	2008
Whitefish	80.6	32.7	99.4	102.9	17.3	135.6
Dreissenid spp.	44.1	55.7	65.4	44.5	42.2	125.1
Smelt	6.2	4.7	63.7	1.2	14.6	31.5
Alewife	11.7	14.1	21.5	28.6	26.8	108.4
Gizzard Shad	0.0	0.0	0.0	3.9	0.8	0.0
Burbot	8.7	20.0	21.7	16.8	2.9	11.5
Yellow Perch	0.2	2.8	0.8	25.2	7.1	1.0
F.W. Drum	0.0	0.0	0.0	17.7	0.0	0.0
Suckers	3.1	2.9	20.7	41.2	1.9	17.4
Round Goby	2.5	7.6	18.2	43.1	13.0	88.3
Other	2.5	0.7	2.0	19.3	11.5	1.9
Total	**159.5**	**141.3**	**313.3**	**344.4**	**138.1**	**520.7**

South (kg/hr)	2003	2004	2005	2006	2007	2008
Whitefish	65.0	52.9	439.6	9.8	81.4	92.6
Dreissenid spp.	129.8	102.5	5.6	0.4	3.6	60.9
Smelt	31.4	4.1	24.9	0.2	3.2	23.3
Alewife	32.5	4.8	90.4	9.1	12.5	13.2
Gizzard Shad	0.0	0.0	0.1	6.1	3.8	0.0
Burbot	23.5	0.0	5.0	3.4	0.0	0.0
Yellow Perch	0.1	2.1	9.7	14.3	5.0	16.4
F.W. Drum	0.0	0.6	0.2	26.0	12.5	0.0
Suckers	7.1	25.1	137.5	201.1	34.5	106.1
Round Goby	10.5	5.0	8.5	10.8	3.4	54.2
Other	4.4	2.9	1.5	52.6	12.4	135.4
Total	**304.1**	**200.2**	**722.9**	**333.8**	**172.3**	**502.1**

REINTRODUCTION OF GREAT LAKES MUSKELLUNGE TO GREEN BAY

David Rowe and Rodney Lange

Background

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). The need to reestablish a native inshore predator fish species has been identified in several planning efforts including the Lake Michigan Integrated Fisheries Management Plan and the Lower Green Bay Remedial Action Plan (Lake Michigan Fisheries Team 2004, WDNR 1986).

A three-phase plan was drafted by WDNR biologists to re-establish a self-sustaining population of muskellunge in Green Bay: (1) identify and 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. Phase 1 included the collection of gametes from the Indian Spread Chain in the lower peninsula of Michigan, a tributary system to Lake Huron. In cooperation with the Michigan DNR, gametes were collected and brought to the Wild Rose Fish Hatchery from 1989-1993. In 1997, additional spawn was collected from Lake St. Clair to increase the genetic diversity of the population.

Phase 2 was initiated with the stocking of muskellunge fingerlings into Long Lake in Waushara County, Wisconsin from 1989-1992. From 1995-2001, Long Lake was the main brood source for the reintroduction effort. However in 2002 the WDNR discontinued the use of Long Lake as a broodstock lake. In April of 2009, three new inland lakes were stocked with muskellunge from Georgian Bay, Lake Huron, in order to establish brood populations.

There has been no significant amount recruitment from natural reproduction of muskellunge documented in Green Bay or the Lower Fox River as of the fall of 2008. However in 2008, two young of the year muskellunge were collected from the Lower Menominee River. Tissue samples have confirmed these two individuals are the progeny of Great Lakes spotted muskellunge, the first evidence of natural reproduction.

Current Status

Current assessment of the Green Bay muskellunge population includes spring fyke netting and fall electrofishing. Spring netting was conducted in 2009 from April 24th through May 14th. A total of 94 net nights were fished and 197 muskellunge were captured ranging in size from 914mm (36in) to 1289mm (50.75in, Figures 1 and 2). The average daily catch rate was 2.5 fish per net night. The mean size of fish has continued to increase as this re-established population continues to mature (Figure 1). The average fish length was 1105mm (43.5in); in 2008 the average was 1085mm (42.7in). Twelve fish were larger than 1270mm (50in) and 30 fish were larger than 1219mm (48in). Male fish appear to recruit to the population sooner, but female fish grow faster and attain larger ultimate size (Figure 2).

Nighttime electrofishing surveys have been conducted along the length of the Fox River from the mouth to the DePere dam during the last week of October to index walleye and muskellunge populations. In 2008, we captured 52 muskies ranging in size from 737mm (29in) to 1206mm (47.5in), during 7.9 hours of effort over three evenings (Figure 3). The average length of an adult fish was 1026mm (40.4 in).

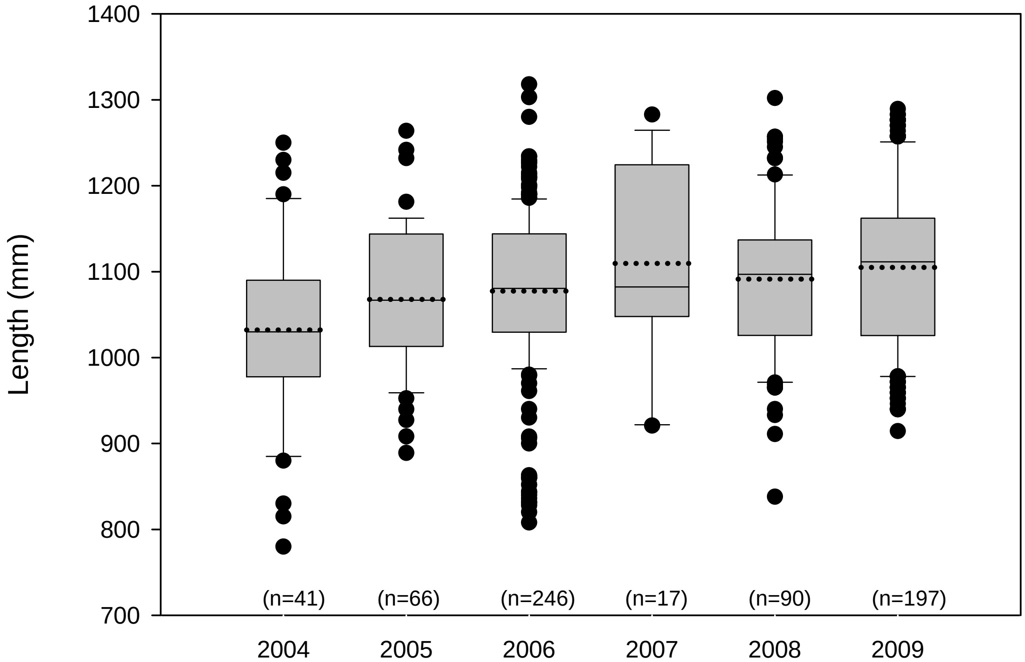

Figure 1. Length distributions of muskellunge captured during spring netting surveys of the lower Fox River from 2004-2009. The shaded box is defined as the upper and lower quartiles with the median described by the solid line in the box and the mean by the dotted line. The whiskers represent the 10th and 90th percentiles of the distribution.

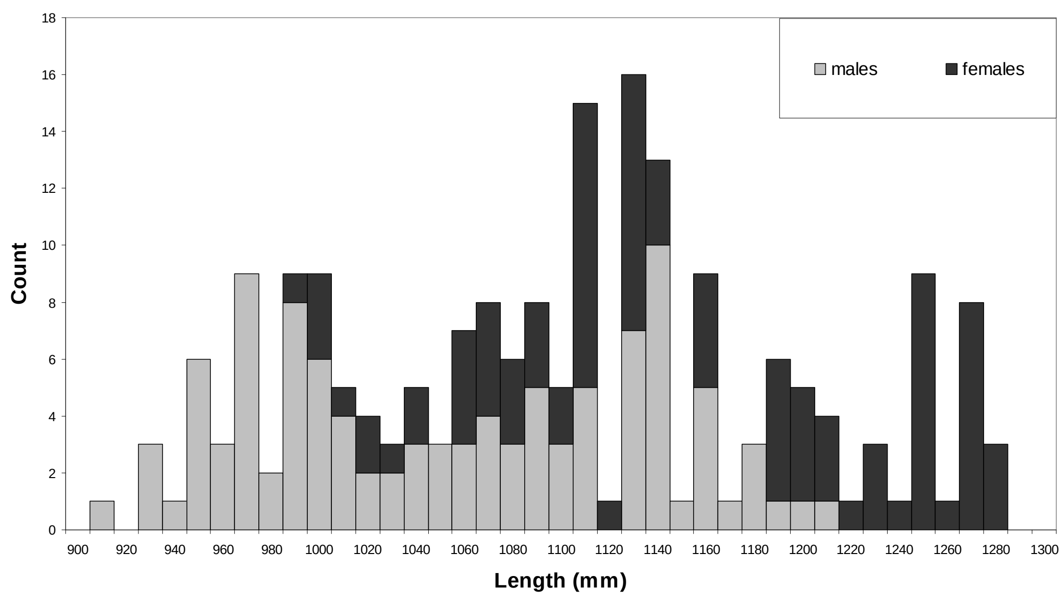

Figure 2. Length frequency distribution of Great Lakes Spotted muskellunge, by sex, from spring 2009 netting of the Lower Fox River and Green Bay.

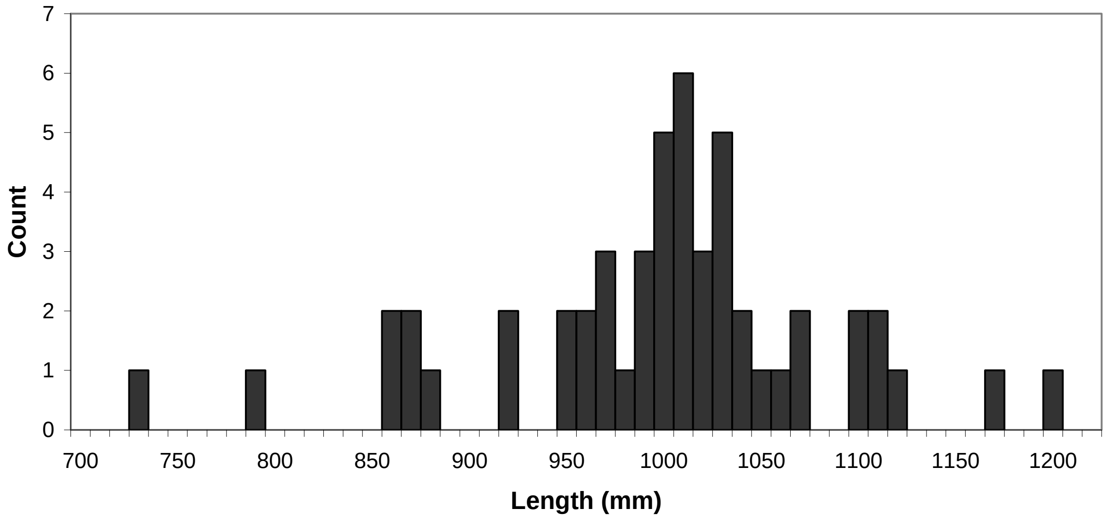

Figure 3. Length frequency distribution of Great Lakes Spotted muskellunge from fall 2008 electrofishing of the Lower Fox River.

Adult muskellunge catch per unit of effort (CPUE) was 6.61 fish per hour, the highest recorded since the index surveys began in 2000 (Figure 4). The CPUE in the fall index sampling has steadily increased over the past eight years, suggesting a growing population, likely as a result of the increases in stocking. The dramatic increase in the fall 2008 catch rate is attributable to the 2002 and 2003 year classes beginning to recruit. In those years the stocking rate increased from around 3000 a year to average of 20000 per year (Table 1).

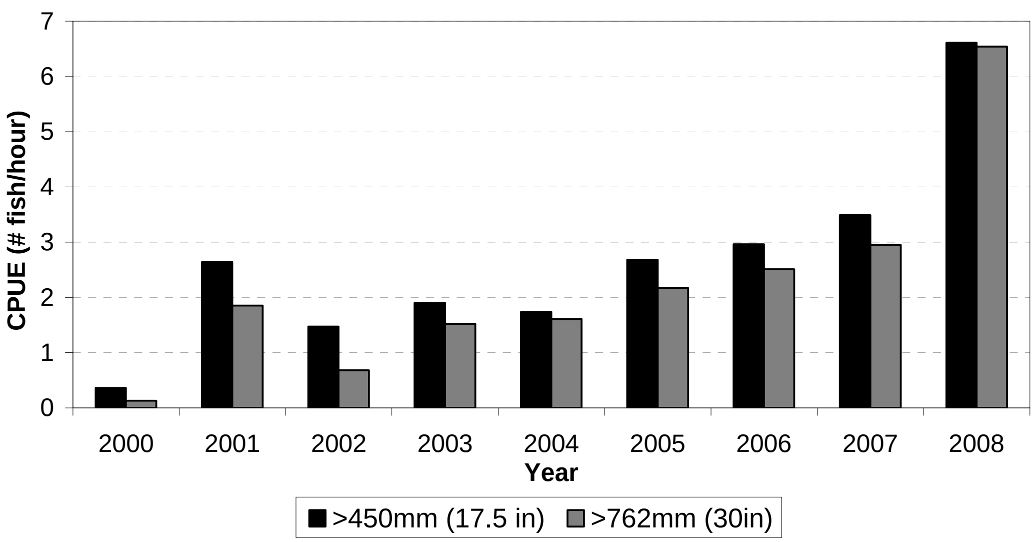

Figure 4. Catch per Unit Effort (CPUE) from night time electrofishing of Lower Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2008.

Propagation and Stocking

The first six years of the program (1989-94), hatchery production averaged 2,200 fingerling and yearling muskies and was based upon spawn collected directly from the Indian Spread Chain in the State of Michigan. From 1995 to 2001, hatchery production averaged 2,875 muskies 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 an average of 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. During 2007, discovery of other species of fish infected with Viral Hemorrhagic Septicemia virus in Lake Michigan, Green Bay and the Fox River prevented any collection of gametes from those waters and no spawn was collected. Additional stocking has been indefinitely postponed until egg disinfection protocols are approved or a disease free source of gametes becomes available. Since 2005, stockings have been distributed to a greater diversity of locations around Green Bay (Figure 5). There is evidence that muskellunge may exhibit spawning site fidelity (Crossman 1990) and more areas with appropriate habitat have been stocked to foster natural reproduction.

Table 1. Stockings of great lakes strain muskellunge into the waters and tributaries of Green Bay, Lake Michigan from 1989-2009.

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
2009	0	0

Figure 5. Stocking locations of Great Lakes spotted muskellunge in Green Bay and tributaries before and after 2005.

Fishery

The reintroduction program has resulted in a muskellunge fishery that rapidly increased in popularity and participation in 2007. The Lake Michigan creel survey estimated a total of 35,638 hours of directed effort for muskellunge on Green Bay and the lower Fox River from March 15th through October 31st, 2008 (Figure 6). However, this value underestimates effort since a substantial amount of angling goes on in November after the creel census ends. This was down slightly from 2007 but still over twice the effort of 2005 and 2006. With the increase in effort the catch rate has decreased (Figure 6). An estimated 1,300 muskies were caught and released in 2008 compared to 1,945 in 2007. The catch rate in 2005 and 2006 was about 0.094 fish /hour (10.6 hours/fish). The rate slowed to 0.049 fish/hour (20.4hours/fish) in 2007 and in 2008 slowed even further to 0.036 fish/hour (27.8 hours/fish). In comparison, statewide directed muskellunge catch rates average 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). Figure 6 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 only 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 gives strong confidence in the survey estimates.

Future

The population of adult great lakes strain muskellunge in Green Bay waters is increasing as documented by the fall index CPUE steadily increasing since 2000. This is likely in response to the increases in stocking and hatchery production. A Jolly Seber population estimate of the Lower Fox River and Green Bay estimated a population size of 8469 individuals in the fall of 2008. This population appears to be separate from the populations in the Menominee River and Peshtigo River area, and the Sturgeon Bay and Little Sturgeon Bay area based on recaptures of tagged fish.

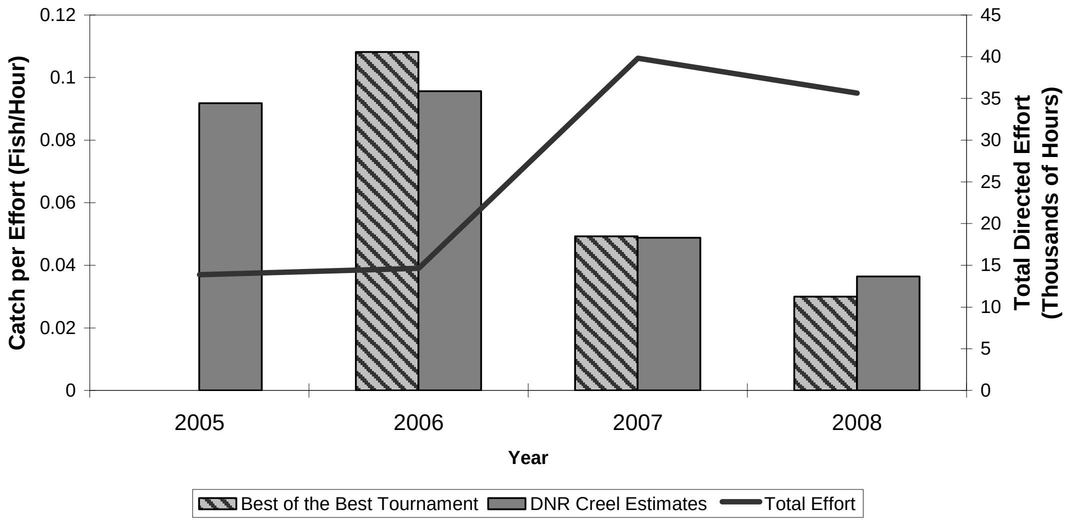

Figure 6. Total directed fishing effort for muskellunge on Green Bay waters of Lake Michigan from 2005-2008 is displayed by the solid black line and on the right axis. The left axis shows catch rate in number of muskellunge caught per hour of directed fishing, the estimated catch rate from creel surveys is displayed in gray, catch rate from the Muskies Inc. "Best of the Best Tournament" is shown with diagonal stripes.

Hopefully the increase will push the population over a density threshold and there will begin to be significant recruitment from natural reproduction. As the population has increased the WDNR has received anecdotal reports of muskellunge spawning in Green Bay and tributary rivers. The WDNR in cooperation with the University of Michigan and supported by a Great Lakes Fish and Wildlife Restoration Act Grant has begun efforts to document if natural reproduction is occurring. In the spring of 2009, 20 gravid females were implanted with miniature radio transmitters during spring netting. Transmitters were inserted into oviducts, so during spawning the transmitter would be expressed and deposited with the eggs allowing identification of spawning sites. Identification of spawning locations and quantifying associated habitat will allow for prediction of additional locations for habitat protection, enhancement, and selection of more effective stocking locations.

Efforts are continuing to increase the genetic diversity of the present Green Bay muskellunge stock by establishing new inland brood lakes with fish from Canadian waters of the Great Lakes. Three new brood lakes were established in April 2009 when 1063 yearling muskies, of Georgian Bay, Lake Huron ancestry were imported and stocked into Northeast Wisconsin lakes. Hopefully these brood populations can begin contributing gametes by the year 2015. This project is a cooperative effort between the WDNR, Ontario Ministry of Natural Resources, Sir Sanford Fleming College and supported financially by the Natural Resource Damage Assessment and Restoration settlements from the Fox River and Green Bay cleanup as well as local musky clubs, Muskies Inc., and the Musky Clubs Alliance of Wisconsin.

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NEARSHORE RAINBOW TROUT

Steve Hogler and Brad Eggold

Nearshore fishing opportunities for Lake Michigan trout and salmon have declined since the late 1980's due to changes in species or strains stocked, reduction in the Lake Michigan forage base or perhaps from clearer water nearshore making trout and salmon more difficult to catch. With reduced yellow perch abundance and salmon and trout moving farther offshore, anglers have requested the Wisconsin DNR to evaluate the stocking of rainbow trout to increase nearshore fishing opportunities.

The original study outline called for stocking six ports, Kenosha, Milwaukee, Sheboygan, Manitowoc, Algoma and Sister Bay with two strains of rainbow trout to facilitate the evaluation of the effectiveness of rainbow trout stocking. The stocking goal was to stock 10,000 rainbow of each strain at each port for five years to aid in the direct comparison of the two strains. Following the initial stocking of Arlee rainbow trout in 2001, a second rainbow trout strain, Kamloops, was identified to be part of this study in 2003. Both strains were stocked from 2003 through 2007. In 2008, only Arlee strain rainbow trout were stocked and the stocking distribution was altered from equal stocking at six ports to stocking 9 ports, three with 10,000 fish each and six at 5,000 fish per port for an average stocking rate of 6,665 per port (Table 1).

2008 Results

Arlee Rainbow Trout

In 2008, a total 59,987 Arlee rainbow trout marked with a Left Pectoral fin clip were stocked into Wisconsin waters of Lake Michigan (Table 1). Stocking size and timing in 2008 were similar to those of previous years of this experiment.

Table 1. Stocking history of nearshore rainbow trout stocked into Wisconsin's waters of Lake Michigan since 2001.

Strain	Year Stocked	Number per Port	Number of Ports	Fin Clip	Average Length	Average Weight	Stocking Dates
Arlee	2001	12,000	6	ALP	174 mm	55 g	April 16 through May 1
	2002	7,500	2	LP	170 mm	55 g	April 9
	2003	10,150	6	ALP	182 mm	74 g	April 27 through May 9
	2004	5,000	6	LP	199 mm	108 g	April 12 through April 19
	2005	10,590	6	ALP	178 mm	72 g	March 30 through April 19
	2006	10,000	6	LP	178 mm	59 g	April 4 through April 20
	2007	10,978	6	ALP	173 mm	55 g	March 26 through April 25
	2008	6,665	9	LP	178 mm	62 g	April 8 through April 15
Kamloops	2003	10,300	6	ARP	148 mm	32 g	April 17 through April 19
	2004	10,066	6	RV	147 mm	36 g	April 20 through April 27
	2005	8,500	6	LV	152 mm	29 g	April 21 through April 27
	2006	9,762	6	RV	145 mm	28 g	March 23 through April 7
	2007	10,161	6	RV	178 mm	55 g	March 26 through April 25

It was estimated that anglers harvested 2,285 Arlee rainbow trout in 2008 (Table 2). The estimated harvest in 2008 was 39.8 % lower than the 2007 harvest but still was the second best harvest of Arlee rainbow trout since 2001. Most of the harvested Arlee rainbow were taken by pier and shore anglers with fewer caught in the ramp and stream fisheries.

Table 2. Estimated angler harvest of nearshore rainbow trout by strain and fishery type from 2001 through 2008.

	Harvest	Harvest Location			Total
Strain	Year	Boat	Pier and Shore	Stream	Harvest
Arlee	2001	62 (5%)	1,262 (95%)	0	1,324
	2002	1,259 (78%)	285 (18%)	61 (4%)	1,605
	2003	46 (5%)	813 (95%)	0	859
	2004	250 (26%)	585 (61%)	118 (12%)	953
	2005	600 (43%)	201 (14%)	600 (43%)	1,401
	2006	426 (20%)	1,193 (52%)	511 (24%)	2,130
	2007	911 (24%)	2,126 (56%)	760 (20%)	3,797
	2008	635 (28%)	1,015 (44%)	635 (28%)	2,285
Kamloops	2003	0	267 (100%)	0	267
	2004	73 (11%)	513 (78%)	73 (11%)	659
	2005	875 (50%)	525 (30%)	350 (20%)	1,750
	2006	1,111 (43%)	855 (33%)	600 (24%)	2,566
	2007	740 (29%)	1,199 (47%)	613 (24%)	2,552
	2008	1,644 (57%)	1,011(35%)	254 (8%)	2,909

Analysis of fish clips indicated that Arlee rainbow harvested in 2008 came from fish stocked since 2003 with those stocked in 2006 and 2004 being the most common. Fin clips can also help to determine how fish are growing in the lake. For example, Arlee rainbow that were stocked in 2004 have grown to average 622 mm in length and 3.1 kg in weight after 5 summers in the lake (Table 3). 2006 stocked fish averaged 534 mm in length and 1.8 kg in weight after 3 summers in the lake. The average lengths and weights from other stocking years are listed in Table 3.

Kamloops Rainbow Trout

It was estimated that anglers harvested 2,909 Kamloops rainbow trout in 2008 (Table 2). The 2008 harvest of Kamloops rainbow trout was the highest since Kamloops rainbow stocking began in 2003. Most of the harvested Kamloops rainbow were taken by boat anglers with fewer taken in the other fishery types (Table 2).

Analysis of fish clips indicated that Kamloops rainbow harvested in 2008 came from all stocking years. Kamloops rainbow stocked in 2004 were the most commonly harvested followed by those stocked in 2006. Fin clips can also help to determine how fish are growing in the lake. Kamloops rainbow that were stocked in 2004 have grown to average 691 mm in length and 4.0 kg in weight after five summers in the lake (Table 4). 2006 stocked fish averaged 536 mm in length and 1.6 kg in weight after three summers in the lake. The average lengths and weights from other stocking years are listed in Table 4.

Table 3. The average length and weight of Arlee rainbow trout after 1,2,3,4 or 5 summers in Lake Michigan for

each stocking year. Fish that spent 1 summer in the lake were stocked that year in spring.

	Length (mm)					Weight (kg)				
summers in lake:	1	2	3	4	5	1	2	3	4	5
year stocked										
2001	330	547	658	688	681		2.3	3.1	4.5	3.1
2002	566	610	655	709	711	1.7	2.4	2.6	3.5	4.0
2003	414	521	559	612	716	1.1	1.5	2.2	2.5	4.0
2004	323	592	556	635	622	0.5	2.1	1.8	3.3	3.1
2005	305		587	572		0.4		2.6	3.3	
2006	368	498	534			0.9	1.5	1.8		
2007	356	534				0.6	1.6			
2008	419					0.8				

Table 4. The average length and weight of Kamloops rainbow trout after 1,2,3, 4, or 5 summers in Lake Michigan for each stocking year. Fish that spent 1 summer in the lake were stocked that year in spring.

	Length					Weight				
summers in lake:	1	2	3	4	5	1	2	3	4	5
year stocked										
2003	358	424	625	699	739	0.7	0.9	2.6	3.5	4.0
2004	553	531	663	709	69	1.5	1.4	3.0	3.6	4.0
2005	546	647	691	660		0.8	2.7	2.9	3.5	
2006	376	587	536			0.8	2.1	1.6		
2007	229	559				0.2	1.6			

Summary

The first eight years of creel survey data is encouraging and indicates that Arlee and Kamloops rainbow trout may be benefiting nearshore anglers although the results are not clear cut. Since the inception of this project, it is estimated that anglers have harvested 25,057 nearshore rainbow trout. Of that total, 11,850 (47.3%) have been harvested by anglers fishing from piers or from the shore. However, the percent harvested by pier and shore anglers has varied greatly from a high of near 100% in 2003 to a low of 23% in 2005. Since 2006 pier and shore anglers have accounted for 45.6% of the nearshore harvest which may indicate that the rainbow trout stocked as part of this experiment have not consistently improved nearshore fishing.

In the years that Arlee and Kamloops rainbow trout were both stocked, anglers have harvested more Arlee rainbow than Kamloops rainbow in both number and standardized return rate (# per thousand stocked) (Tables 2, 5 and 6). It appears that for both strains, fish stocked in stocked in 2003 and 2004 have returned well, while fished stocked in 2005 have returned poorly.

Table 5. Return rates (number per thousand stocked) to creel for Arlee Rainbow Trout stocked into Lake Michigan 2001 through 2008.

	Year Stocked							
Year Harvested	2001	2002	2003	2004	2005	2006	2007	2008
2001	18.3	--	--	--	--	--	--	
2002	6.8	74.4	--	--	--	--	--	
2003	3.7	17.7	9.8	--	--	--	--	
2004	6.1	9.7	4.8	2.5	--	--	--	
2005	2.4	23.3	2.9	17.5	2.8	--	--	
2006	0.0	28.4	9.8	11.4	0.0	12.8	--	
2007	0.0	0.0	5.0	45.6	11.9	12.6	9.2	
2008	0.0	0.0	2.1	21.2	6.0	10.6	5.8	2.1
Total	37.3	153.5	34.4	98.2	20.7	36.0	15.0	2.1

Table 6. Return rates (number per thousand stocked) to creel for Kamloops Rainbow Trout stocked into Lake Michigan 2003 through 2007.

	Year Stocked						
Year Harvested	2001	2002	2003	2004	2005	2006	2007
2001	--	--	--	--	--	--	--
2002	--	--	--	--	--	--	--
2003	--	--	4.3	--	--	--	--
2004	--	--	8.3	2.4	--	--	--
2005	--	--	19.8	5.6	3.4	--	--
2006	--	--	12.5	20.0	5.0	5.7	--
2007	--	--	4.9	9.9	11.8	15.4	2.5
2008	--	--	4.1	18.8	12.4	10.8	4.1
Total	--	--	53.9	56.7	32.6	31.9	6.6

It also appears that the fish are growing well as anglers have caught fish of each strain over 10.0 kg in weight. From comparisons of length and weight at age for each strain, it appears that Arlee rainbow are larger in size than Kamloops rainbow during their first two summers in lake, but after three summers, Kamloops are larger in size. We do not know at this time if Arlee rainbow or Kamloops rainbow will ultimately provide the greater return to anglers and be selected to continue this project.

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 1,000,000 pounds, of which no more than 25,000 pounds could be harvested from Green Bay.

During 2008, commercial trawlers reported catching 179,216 pounds of rainbow smelt during the calendar year (Figure 1). The 2008 reported harvest was well below the average harvest of 409,500 pounds for the previous three years and was only 50% of the 2007 reported harvest.

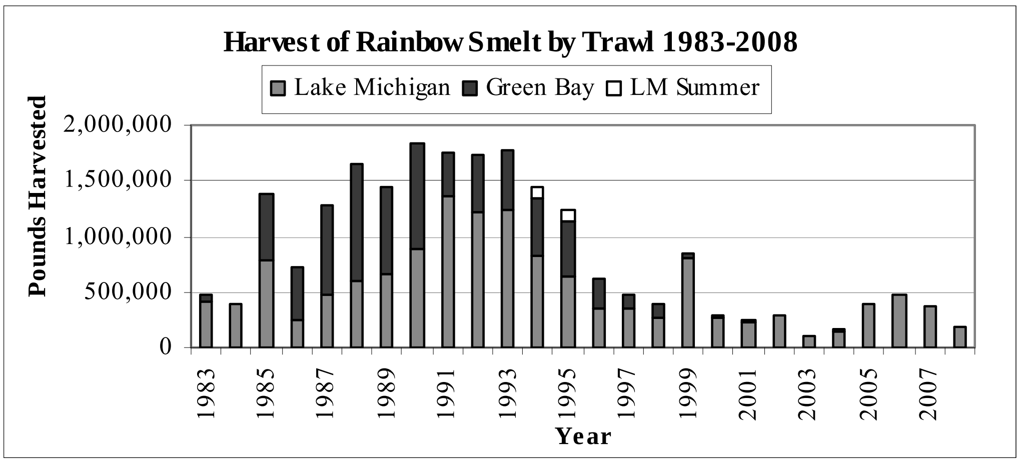

Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 2008.

In 2008, trawlers harvested 179,216 pounds of rainbow smelt from Lake Michigan (Figure 1) with a CPE of 171 pounds per hour trawled (Figure 2). The 2008 rainbow smelt harvest on Lake Michigan was the third lowest on record since mandatory reporting began in 1983 and was only 13% of the record harvest of 1,366,419 pounds in 1991 (Figure 1). Similarly, CPE in 2008 declined sharply from previous years and was the fourth lowest on record (Figure 2).

Commercial trawlers did not fish on Green Bay in 2008 making it the third year in the last four that rainbow smelt were not harvested by commercial trawl during the summer season. The lack of fishing effort on Green Bay in 2008 continued the trend of declining harvest, CPE and effort noted on the Wisconsin waters of Green Bay since 1991 (Figures 1 and 2).

Commercial rainbow smelt trawlers experienced a poor Lake Michigan season in 2008. Harvest poundage decreased by 50% and CPE decreased by 48% from what was reported in 2007 indicating that fishermen harvested fewer fish with similar effort in 2008 as compared to the previous year. In addition to the low harvest of rainbow smelt from Lake Michigan, 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.

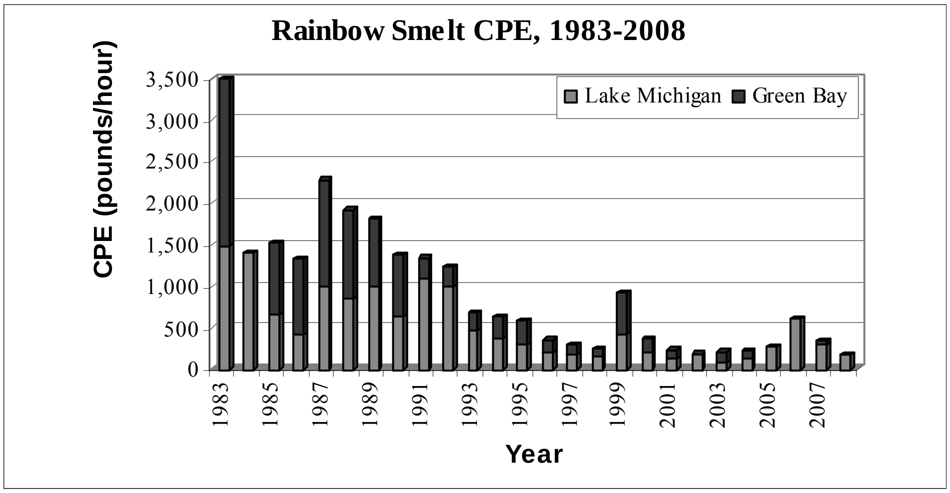

Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan and Green Bay during the years 1983 through 2006.

The decrease in rainbow smelt harvest by trawlers in 2008 was not unexpected. Historically, increases or decreases in the rainbow smelt harvest by trawlers have been broadly predicted by U.S.G.S. biomass estimates based on fall forage surveys. Surveys conducted by the U.S.G.S. in 2006 and 2007 indicated a decline in rainbow smelt biomass from 2006 to 2007. The decline in rainbow smelt biomass was estimated to be 63% with a bottom trawl (Madenjian et al. 2008) and 73% by acoustic sampling (Warner et al. 2008) which was similar to the 50% reduction of commercial harvest in 2008.

It appears that the trend of increasing abundance of rainbow smelt measured in 2004-2006 U.S.G.S. surveys and by increasing commercial harvest did not translate into a long term increase in rainbow smelt biomass. The reason for the decline in harvest in the commercial rainbow smelt fishery the past two years is not clear, and could be related to increased predation pressure on rainbow smelt by salmonids, patchy distribution of adult rainbow smelt in Lake Michigan, poor overwinter survival of young of year rainbow smelt, changes in lakewide food webs or from other unknown causes. Since the status of the rainbow smelt population in Lake Michigan and Green Bay remains uncertain, the viability of the commercial smelt fishery also is unknown.

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LAKE STURGEON

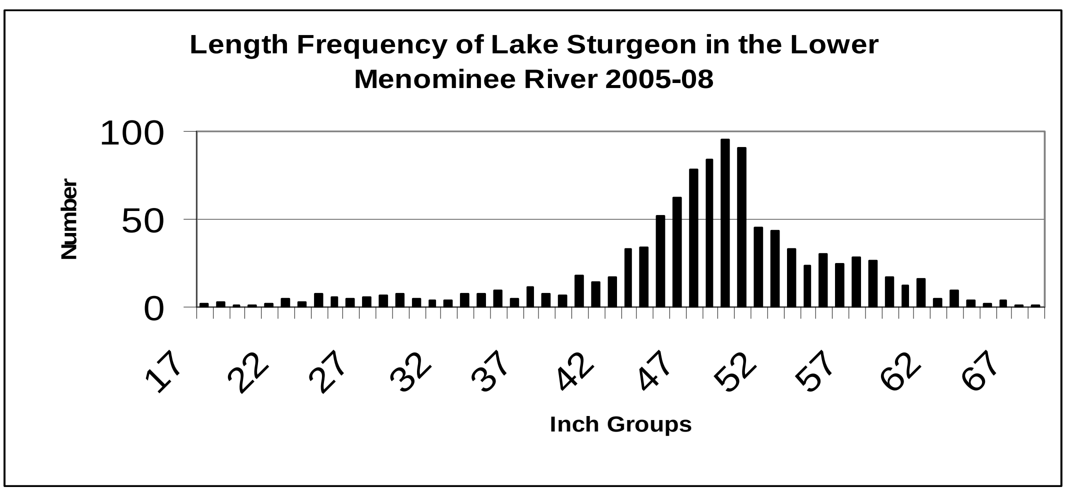
Mike Donofrio, Brad Eggold, and Steve Hogler

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, 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 15 years and natural reproduction currently occurs on the Menominee, Peshtigo, Oconto, and Fox Rivers. These populations are self sustaining without benefit of stocking. The results of tagging studies and genetic analysis indicate a distinction between the Fox and Oconto River sturgeon and another population on the northern tributaries of Green Bay (Menominee and Peshtigo). The Menominee River contains the largest population in Lake Michigan waters with mixing from Wisconsin's Peshtigo River and Michigan's Cedar and Whitefish rivers. The Menominee River supported a hook and line fishery from 1946 to the present. The exploitation was highest in 2005 at 172, although recent regulation restrictions reduced the harvest to 1 in 2006, 0 in 2007, and 1 in 2008. Lake sturgeon stocking is occurring on the Milwaukee and Manitowoc rivers and recovering is dependent on those stocking efforts and continued habitat improvements.

Menominee River Population Assessment

Field sampling, 2 one day electrofishing surveys with 2 electrofishing boats, in 2008 produced 194 lake sturgeon from the lower Menominee River. Similar efforts produced 132 fish in 2007, 278 lake sturgeon in 2005 and 276 in 2006. From 2005-8, most of the fish (85%) were subjectively labeled as adults (>107 cm in total length), but several sub-adults sturgeon were observed during the surveys. The overall average total length during these sampling events was 122 cm. The smallest sturgeon was 53 cm and several fish were over 172 cm in length. The population estimate for the 42 inch and larger segment of the population was 2,614 with confidence intervals of 1,400 to 4,668 in 2008



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 grants. That research indicated that Fox and Oconto river populations are closely associated with linkage to the Lake Winnebago population. The Menominee and Peshtigo rivers form one population and ranged north to the

Cedar and Whitefish rivers in Michigan's Upper Peninsula. That theory is supported by movement studies from Menominee River recaptured lake sturgeon. 2005-08 recaptured sturgeon from the Menominee River originated in the Peshtigo River (10%), Cedar River (5%), Green Bay (2%) and Whitefish River (1%).

We proceeded with our movement study through ultrasonic transmitters implanted in lake sturgeon at the Menominee, Peshtigo and Oconto rivers. We currently have sonic tags in 62 adults (Menominee (57%), Peshtigo (25%), and Oconto (18%)). Their movements are monitored continuously through 2 stationery receivers in each of those 3 rivers. Since we have recaptures from the Cedar and Fox rivers, we installed additional receivers in those rivers. These fish were labeled as 11% F2, 5% F3, 34% F4, and 50% M2. The average length of the females was 60.6 inches and males were 54.9 inches. The movements between rivers will be monitored for 3-5 years.

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 harvest in that year was 19 sturgeon and 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, and 210 in 2003. 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 harvest in 2005 was recorded as 172 lake sturgeon with 136 stemming from waters below the Menominee Dam.

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 one lake sturgeon in 2006, 0 in 2007, and 1 in 2008.

Milwaukee River SRF

The Milwaukee SRF was deployed in 2008 on April 7, 2008 and put into service on April 24, 2008. Wisconsin DNR personnel artificially spawned 4 females from the Wolf River and transferred those fertilized eggs to the trailer on April 24, 2007. Approximately 30,000 eggs from four females were transferred to the trailers. Eggs from each female were placed into a separate hatching jar.

By May 1, lake sturgeon larvae began to hatch and could be seen in the incubation jars. Over the course of the next seven days hatching continued until all larvae were in the smaller fry tanks. During the month of May and into June, sturgeon were fed brine shrimp followed by grated blood worms and finally whole blood worms. Eggs from one female did not hatch so surplus larvae from the other 3 females were combined to create a fourth tank of sturgeon

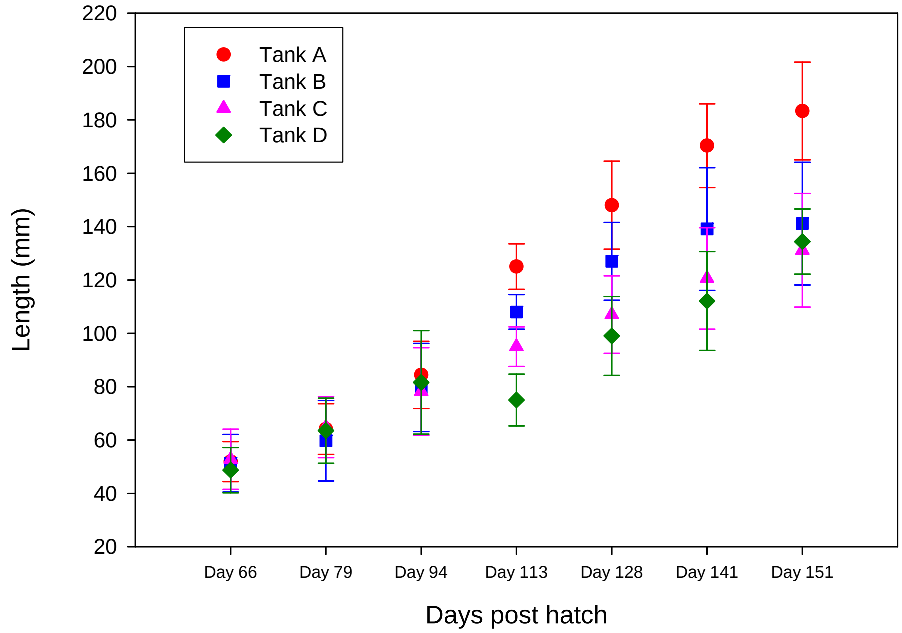
It was estimated that following hatching, there were approximately 666 – 4,000 larvae per fry tank. Numbers of larvae were lowered to 1,500 fish in three tanks and 666 in the fourth tank. The number of lake sturgeon in each tank was set at 1,500 because of issues encountered last year with high densities in the tanks which caused excessive mortalities. However, once again we did see some high mortalities of fish in the three tanks that started at 1,500 but much lower mortalities in the fourth tank. This indicates that a starting level of 1,500 fish may be too high and next year a lower amount will be started in each tank.

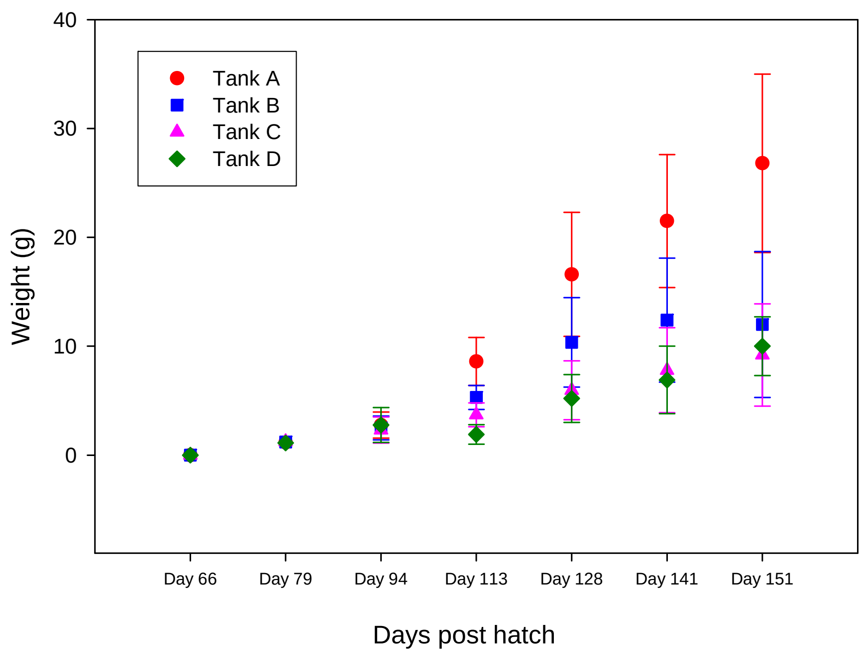
From August 1 until the fish were stocked on October 4 only a few more fish died. Testing for VHSv in conjunction with our normal fish health screening process prior to stocking reduced the numbers by 50 which left 767 lake sturgeon left for stocking on October 4, 2008. Total length and weight were measured 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 first 75 days. At that point, some lake sturgeon in each tank were able to grow longer and heavier probably due individual feeding rates of these fish. On day 101 post hatch, similar sized fish were grouped together in the 4 tanks with the larger fish going into Tank A. This allowed the smaller fish in Tanks B – D to be grouped with similar sized fish and hopefully positively impact the final size at stocking. Results from this grouping appear to be positive. Lake Sturgeon placed in Tanks B – D did grow faster especially those placed in Tank B. Grouping of similar sized fish will be done again in 2009.

Manitowoc River SRF

The Manitowoc SRF did not operate in 2008 because an alternate location for trailer operation was not resolved. Several alternative locations were identified for future deployment of the SRF. The top selection, the Branch River, a tributary to the Manitowoc River was not selected because we could not obtain a Wisconsin discharge permit for the SRF because the Branch River is considered an exceptional water resource by Wisconsin DNR code. The second choice, the Kewaunee River was then identified as the site that Wisconsin DNR would like to deploy the SRF beginning in 2009. The Kewaunee River location has several advantages. These advantages include being located at the Besadny Anadromous Fishery Facility (BAFF) which has staff permanently stationed there, preexisting utility hook-ups, the ability to temporarily augment river water with well water if an emergency arises, spawning and nursery habitat for sturgeon just downstream of the facility and better water quality and cooler water temperature than the Manitowoc River.

Average length and weight of Lake Sturgeon
at the Milwaukee Streamside Rearing Facility, 2008





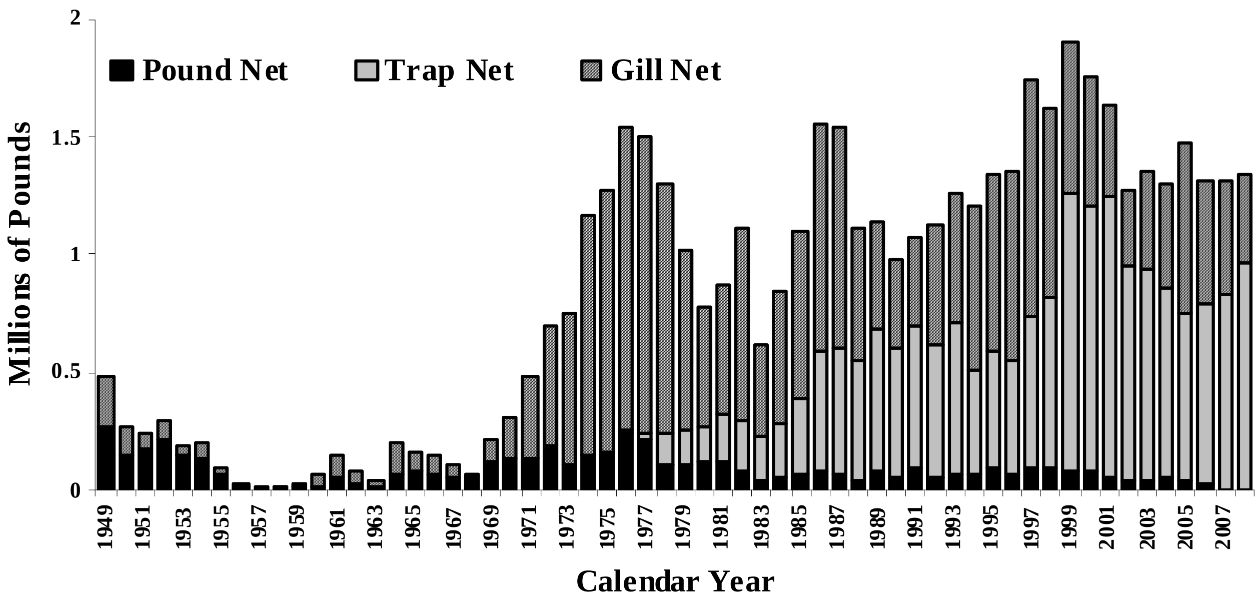
Sturgeon were grouped by size on day 101. The largest fish were grouped into Tank A.

LAKE WHITEFISH

Scott Hansen

Commercial Harvest

Lake whitefish *Coregonus clupeaformis* harvest in Wisconsin's waters of Lake Michigan continued at high levels for the 2008 calendar year with 1,337,277 dressed weight pounds of fish harvested (Figure 1). The 2008 harvest is up slightly from 2007 but just below the 20 year average of approximately 1.37 million pounds. Commercial whitefish harvest in Wisconsin is regulated though quota years beginning in July through June with a closed period during spawning. 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 and has remained there since. The 2007 – 08 commercial harvest was 1,334,068 pounds. This ranks as the fourth lowest harvest on record since the last quota increase (Table 1).



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 increased steadily since 1990 and on average has annually accounted for over 50 percent of the whitefish harvest. For the calendar year 2008, 71.6% of the total harvest came from trap nets, 28.4% from gill nets and no fish were harvested using pound nets (Figure 1). The percentage of trap net harvest in 2008 is the third highest since 1990.

Table 1. Lake whitefish harvest in Wisconsin since the last quota increased to 2.47 millions pounds, broken down by zone through the 2007-2008 quota year. Quotas for zones 1 thru 3 were 225,518, 2,029,662, and 214,820, respectively.

Quota Year	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

While trap net gear continues to be the primary gear type for whitefish harvest its effort has generally declined since 2003 (Figure 2). Although there was a considerable increase of 452 pots lifted between 2005 and 2006, effort declined by nearly 200 pots lifted by 2007 and by 2008 had decreased by another 186 pots lifted. Meanwhile, after a spike in 2005 to approximately 11.4 million feet fished per year, gillnet effort has declined and remains just above 7 million feet. Trap net whitefish catch improved again in 2008 as catch per unit of effort (CPE) increased by over 87 pounds per lift with decreased effort (Figure 3). Gillnet CPE on the other hand decreased by over 15 pounds per 1000 ft fished between 2007 and 2008. No pound nets were fished in 2008.

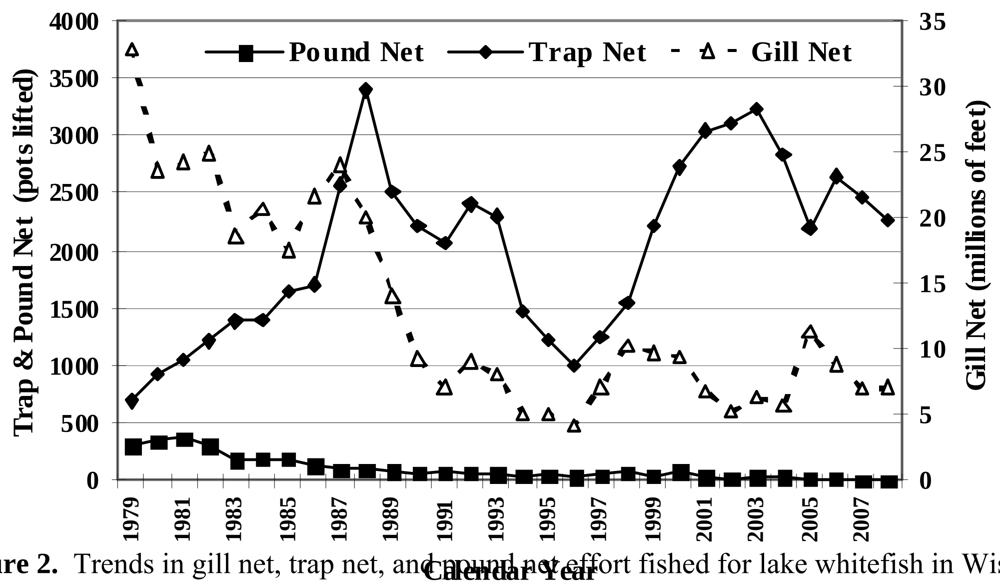


Figure 2. Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2008. Gill net effort is in millions of feet; trap and pound net effort is number of pots lifted.

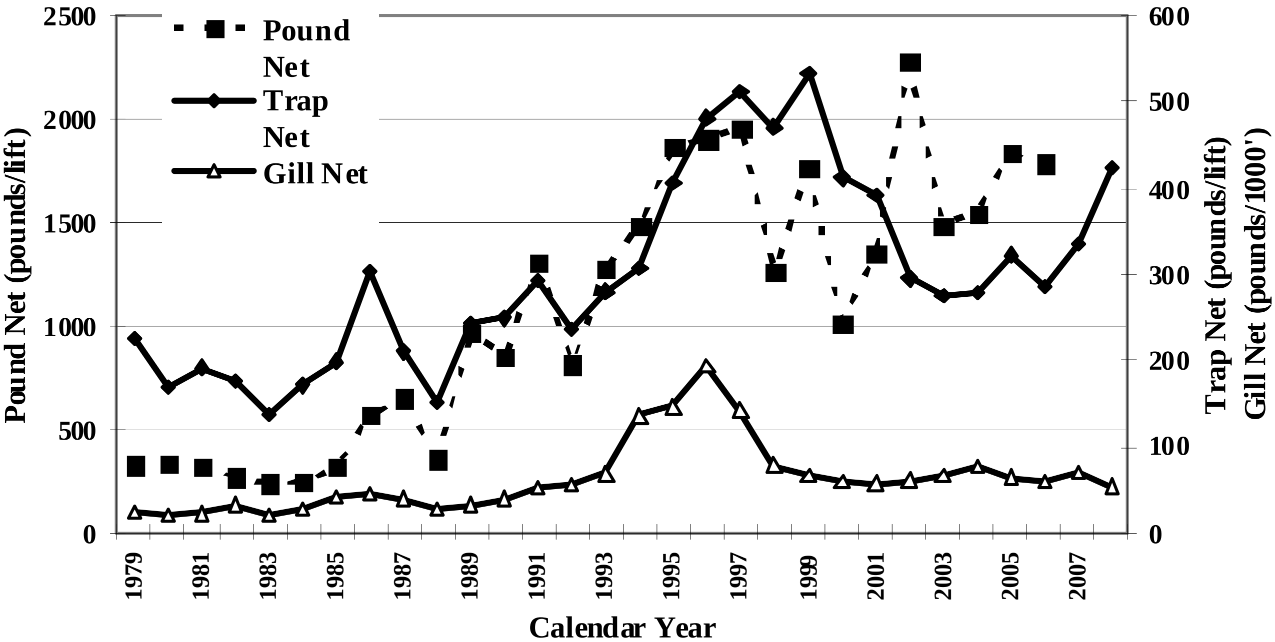


Figure 3. Trends in gill net, trap net, and pound net catch per unit of effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2008. Gill net CPE is pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE is pounds of whitefish harvested per pot lifted.

Growth

Mean length and weight at age of lake whitefish from the North-Moonlight Bay (NMB) stock have demonstrated a general decline since around 1995 (Figures 4 and 5). While still near historical lows, mean length and weight for spring sampled fish generally increased between 2007 and 2008. As a result of the increase in size at age of older fish, the average age for fish recruiting to the commercial fishery (432 mm) moved from age eight to age seven. However, size at age declined between the last two years for some of the younger age classes (data not shown). In the past 5 -10 years, obtaining a viable sample size of younger whitefish age classes near NMB has diminished considerably and once again proved difficult during the spring months in 2008. Areas off Baileys Harbor where juvenile fish were historically found during the months of May and June have been devoid of young fish. As in the past two years, in 2008 we again sampled locations in Green Bay where these younger year classes are being found. However, mixing of whitefish stocks from MI waters is known to occur in Green Bay, therefore the consistency in measuring growth of NMB fish may have been compromised as fish from other stocks may have been sampled.

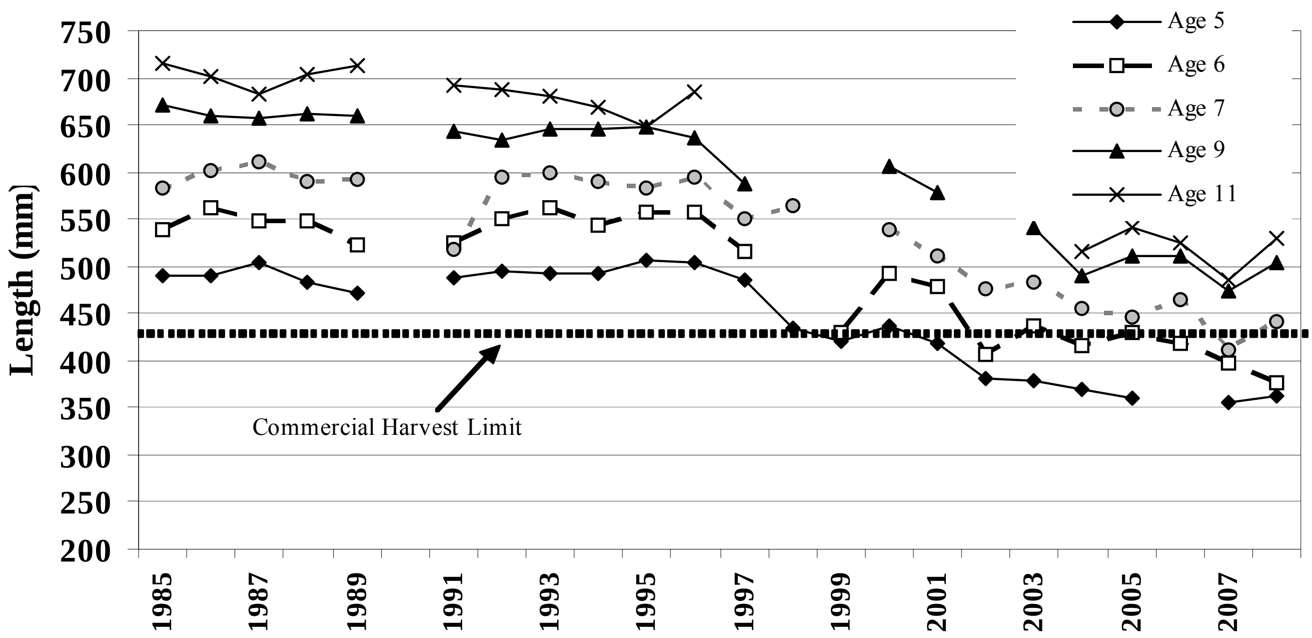


Figure 4. Mean length at age of spring sampled lake whitefish from 1985 thru 2008.

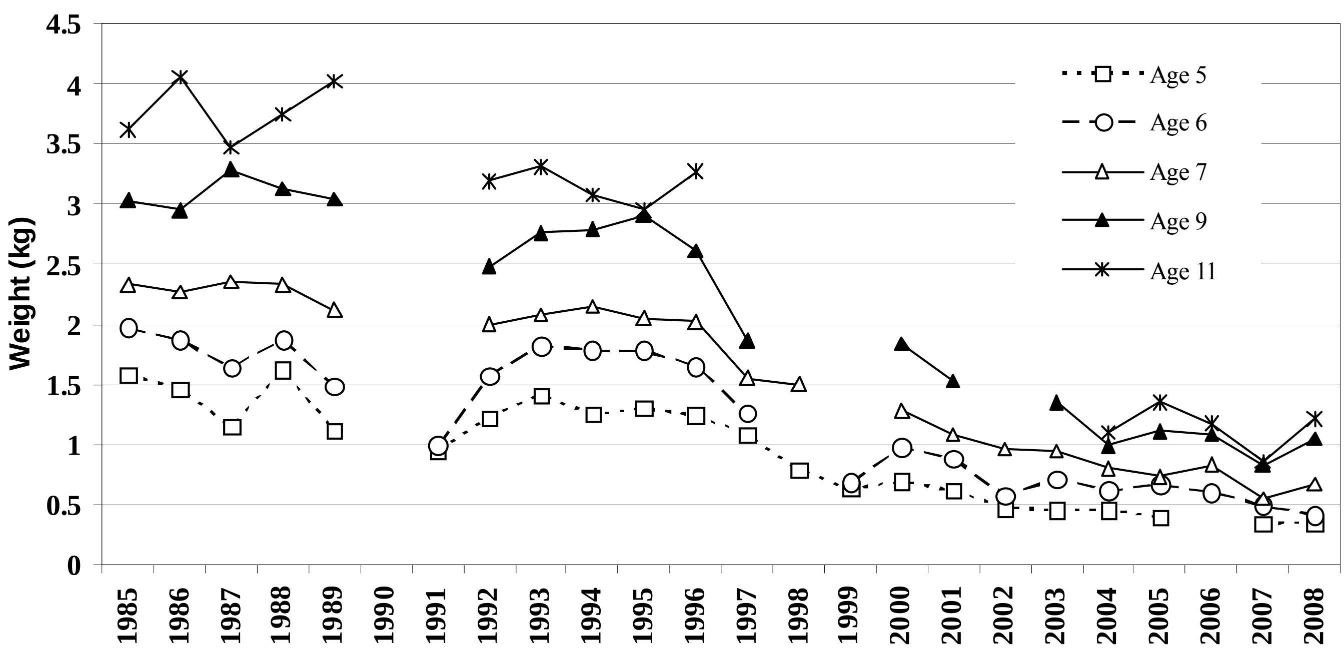


Figure 5. Mean weight at age of spring sampled lake whitefish from 1985 thru 2008.

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 and are designed primarily to assess the winter perch fishery. Because popular fishing areas for whitefish and perch do not necessarily overlap, lake whitefish sport harvest may be underestimated. For the winter of 2008, estimated whitefish harvest increased substantially to 61,746 fish. Angler directed effort toward whitefish increased from 4,089 hours in 2007 to 28,114 hours in 2008. Harvest rates specific for whitefish in 2008 were 0.623, 0.245, and 0.685 fish per hour of fishing for January, February, and March, respectively The overall average harvest rate for the winter of 2008 was 0.489 fish harvested per hour of whitefish fishing.

North-Moonlight Bay Statistical Catch at Age Model

Lake whitefish in Wisconsin waters of Lake Michigan are managed as a single stock that spawns offshore proximate to North Bay and Moonlight Bay along the eastern shoreline of Door County. A statistical catch at age (SCAA) model was developed as a stock assessment tool to manage the North/Moonlight Bay (NMB) whitefish stock. The SCAA model for the NMB stock was patterned off models developed by the Chippewa Ottawa Resource Authority (CORA) and State of Michigan to manage lake whitefish stocks in the 1836 Treaty waters of Lake Michigan, Lake Huron, and Lake Superior (Ebener et al. 2005). Fishery dependent and independent data were used in the model beginning in 1989, the first year that Wisconsin implemented its individually transferable quota system, through the 2008 calendar year. The model generally fit the data well and evaluation diagnostic results from Markoff Chain Monte Carlo Simulations and retrospective analyses indicate the model produced viable estimates. This model will be used as a tool to set the total allowable catch forWisconsin harvest of the whitefish from the NMB stock. The recommended total allowable catch Wisconsin commercial catch, calculated for the 2010 fishing year, is currently under WDNR review and public hearing processes.

Model Results

Estimates of whitefish recruitment to age-3 more than doubled from 2002 to 2003 increasing from 4.1 million fish to 8.7 million (Figure 6). Since then recruitment has increased somewhat and maintained this comparatively high level.

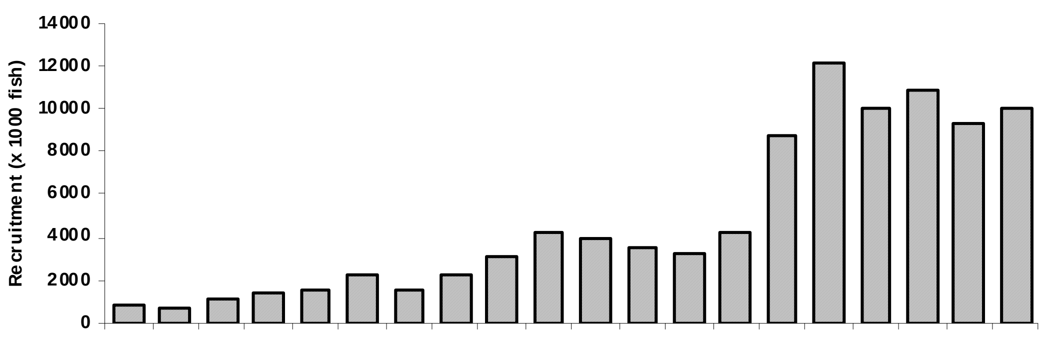


Figure 6. Recruitment of age-3 lake whitefish to the North/Moonlight Bay stock between 1989 and 2008.

Total and spawning stock biomass of lake whitefish have steadily increased between 1989 and 2002

(Figure 7). Spawning stock biomass estimates ranged from 2.2 million pounds in 1989 to 13.2 million pounds in 2002. Spawning stock biomass estimates dipped somewhat in 2003 and again in 2004. However, biomass increased again in 2005 and has shown a dramatic increase the past several years averaging 29.1 million pounds in the four years since then.

Figure 7. North/Moonlight Bay stock lake whitefish total biomass (age-3 and older) and spawning stock biomass estimated for 1989 – 2008.

Total instantaneous mortality rates have followed a general decreasing trend since 1989 (Figure 8.) Mortality rates peaked in 1989 at 0.62 y^{-1} and remained relatively high through 1993. Mortality then dropped off somewhat over the next four years ranging from 0.39 to 0.41 y^{-1}. Mortality increased again in 1998 and declined gradually until 2002 where it has remained fairly stable overall. Mortality rates for the 2008 calendar fishing year are at an all time low of around 0.33 y^{-1} for the time series. Much of the overall decrease in mortality over this time period can be attributed to the decrease in gill net fishing mortality.

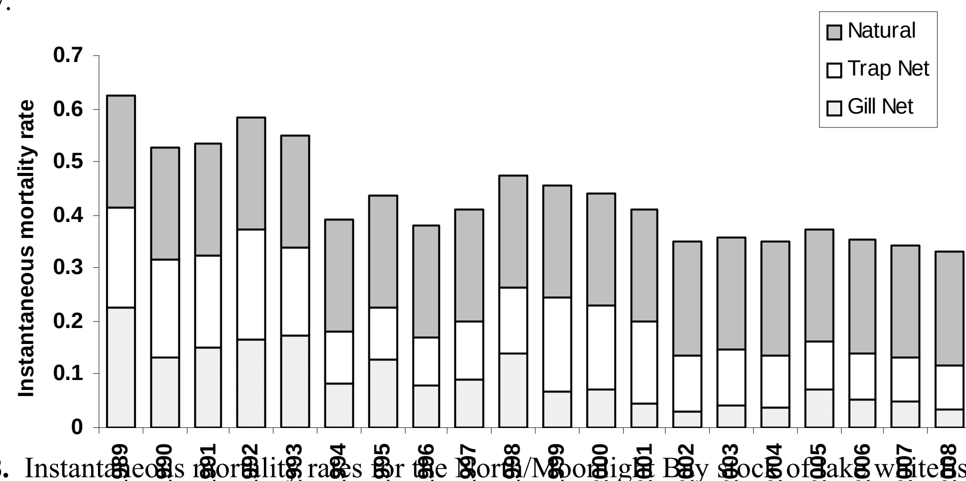


Figure 8. Instantaneous mortality rates for the North/Moonlight Bay stock of lake whitefish between 1989 and 2008.

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COMMERCIAL CHUB FISHERY AND CHUB STOCKS

Timothy Kroeff and Dave Schindelholz

The total chub harvest from commercial gill nets was 250,968 pounds for calendar year 2008, a decrease of 40% from 2007 (Tables 1 and 2). Commercial smelt trawlers harvested 91,965 pounds of unmarketable chubs incidental to the targeted smelt harvest. There were 1,542 pounds of marketable chubs reported in trawl catches in 2008.

Table 1. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gill net chub fishery 1979-2008. 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

Table 2. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2008.

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

[a] For the years 81-85, 90 & 91, 98-08 totals were by calendar year.
[b] For the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.

By zone, the harvest in the south was 227,026, which was a decrease of 45% from 2007, or 8% of the allowed quota of 3 million pounds. The 2008 chub catch for this zone is the lowest on record since chub fishing reopened in 1979. The southern zone is basically waters from Algoma south to Illinois. In the north, 23,942 pounds were reported caught, an increase of over 3-1/2 times that of 2007 but still only about 4% of the allowed quota of 600,000 pounds. Although this catch is up from the previous year, it is still the second lowest catch since chub fishing reopened in 1981. The northern zone is basically waters from Baileys Harbor north to Michigan. The southern zone showed a 22% decrease in CPE from the year before while the CPE in the north dropped by 7% from the previous year. Both of these catch rates are the lowest since fishing reopened in both zones. Gill net effort in the south decreased by 29% or 4,014,200 feet while effort in the north increased almost 4 times or 629,000 feet. In the south, 20 of the 39 permit holders reported harvesting chubs while in the north 5 of the 18 reported harvesting chubs.

Population assessments with graded-mesh gill nets (1,300 ft. per box), were conducted off Algoma and Baileys Harbor in September and October of 2008 and off Kenosha in January of 2009 (1 box per lift) set along with standard 2-1/2 inch gill nets. Two assessment lifts were made off both Algoma and Baileys Harbor while one was made off Kenosha. Net nights totaled 19 for all sights combined. Samples of chubs were collected out of standard mesh gear at all sights and aging results were combined.

Catches from graded-mesh gill nets continue to be poor off Algoma and Baileys Harbor. Because of such poor catches data was pooled off these two sites. Chubs up to 19 years of age were collected off Kenosha and up to 20 years of age off Algoma/Baileys Harbor (Figure 1). Chubs aged from 6 to 19 were caught off Kenosha and 4 to 20 off Algoma/Baileys Harbor. An unusual finding out of Kenosha was the male chubs outnumbering females. Most of these male chubs were of younger age than many of the females. It is believed that female chubs outlive males. Due to a lack of chub fishing effort out of Sheboygan during this assessment time, an active fisher was contacted out of Kenosha and this assessment was moved there.

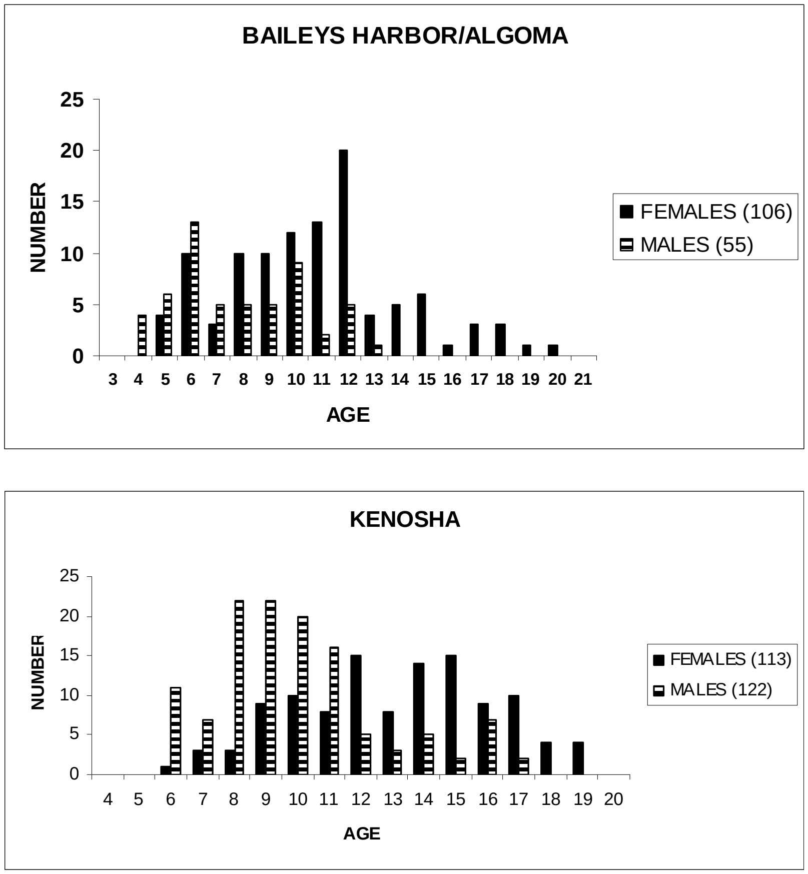

Figure 1. Age composition by number and sex of chubs captured during graded-mesh assessments along the Wisconsin L. Mich. shoreline, 2008-09.

Catches of chubs in standard 2-1\2 inch mesh were poor off Algoma/Baileys Harbor and for reporting means were combined with standard mesh caught fish off Kenosha. Ages from standard mesh ranged from 6 to 20 years of age (Figure 2). Sex ratios continue to be high on the female side with the catch showing 80% females in 2008 compared to 88% in 2007, 80% in 2006, 90% in 2005 and 80% in 2004. 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 months.

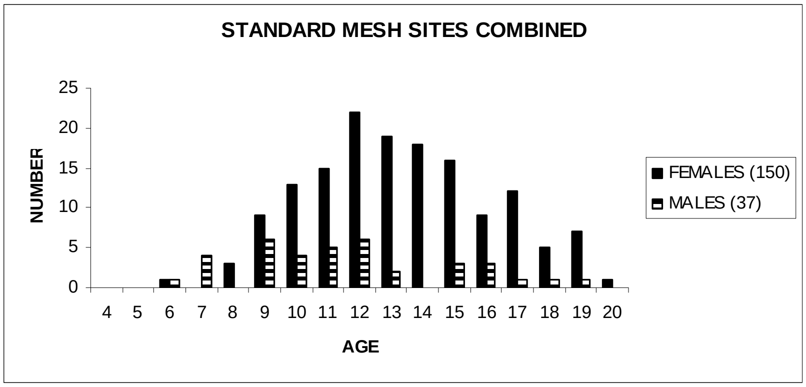

Figure 2. Age composition by numbers and sex caught from standard mesh gill nets off Algoma/Baileys Harbor and Kenosha combined.

The following people were instrumental in varying aspects of this project: Pat McKee and Scott Hansen for compilation of data and constructing figures. Also, we are grateful to Phil Anderson, a commercial fisherman out of Kenosha, for setting and lifting of assessment nets essential to the completion of this project.

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