Lake Michigan Management Reports - 2008

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

Having pushed the limits of the field season, the 70-year-old R/V Barney Devine returns to home port with a thick layer of ice at the end of another successful year of Great Lakes work.

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 2007. 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

We enjoyed another outstanding year of trout and salmon fishing, with an estimated harvest from Wisconsin waters of 645,000 fish, including a record harvest of 431,000 chinook salmon and an above-average harvest of 95,000 coho salmon. Brown trout and rainbow trout harvests were also higher in 2007 than in 2006.

The sport harvest of yellow perch from Green Bay declined from 692,000 in 2006 to 473,000 in 2007. That reflects a leveling off of the biomass of yearling and older yellow perch at less than 2,000,000 pounds despite five good years of natural reproduction. In Lake Michigan the 2007 sport harvest of yellow perch was 66,000, down only slightly from 68,000 in 2006. Calendar year 2005 was a banner year for natural reproduction by yellow perch in Lake Michigan, and we hope that will be reflected in increased adult yellow perch abundance in 2008.

Our program of re-introducing Great Lakes spotted musky in Green Bay has resulted in an increasingly popular sport fishery. Catch rates were excellent in 2007, with an estimated 1655 muskies caught and released compared with 455 in 2006. Other important local sport fisheries include walleye in Green Bay where the estimated sport harvest increased from 9,000 in 2005 to 58,000 in 2007 and smallmouth bass in the waters of Door County. Our creel surveys do not estimate winter and early-spring brown trout harvests, but we know that brown trout fishing has been excellent in the south, including a popular winter fishery in Milwaukee.

Menominee River (Milwaukee) winter brown trout

[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.

Commercial fishing

Whitefish remain abundant, but size-at-age remains low following over decade of decline.   Harvested fish are thinner than in the past and, because growth rates have declined, they are typically older; the average age for fish recruiting into the fishery has increased from four years in 1993 to eight years in 2007. The commercial harvest during 2006-07 commercial fishing year was 1,298,133 pounds, only a little over one-half of the total allowable commercial harvest.


The Herring Net, by Winslow Homer

The commercial harvest of bloater chubs was the lowest on record, with only 417,000 pounds taken in 2007. This reflects a lake-wide decline in chub abundance.   In the 1980's and 1990's the annual harvest routinely exceeded 1,500,000 pounds. Because the areas open to chub fishing are limited most of Lake Michigan is in effect a refuge for bloater chubs, so we are confident that the decline is not attributable to over-harvest. Bloater chub abundance has fluctuated widely in the past and it has been suggested that large long-term oscillations are normal for this species. For the present, however, the decline is hurting the commercial fishing industry.

With only minor exceptions, the commercial harvest of rainbow smelt is accomplished by trawling. The trawl harvest in 2007 was 361,000 pounds, which is close to the average of the past eight years but far below peak harvests in excess of 1,500,000 pounds in the early 1990's.   This reflects a lake-wide decline in smelt abundance, and cannot be attributed to over-harvest.

Commercial fishers harvested 61,000 pounds of yellow perch from Green Bay during 2007.   Strong yellow perch reproduction in Green Bay starting in 2002 appears to have established the basis for improved sport and commercial fishing for several years, so declines in catch-per-effort in both fisheries are puzzling. No commercial harvest of yellow perch is allowed from Wisconsin waters of Lake Michigan.

Rule changes

Major revisions to the commercial fishing regulations are nearing completion.   These changes reflect the work of a task force that included representatives of both sport and commercial fishing. They have been under development for over a decade, following the prosecution of individuals for significant over-harvest violations in the 1990's.   Implementation has required the adoption of special legislation and during 2008 we expect the necessary administrative rules to be adopted by the Natural Resources Board.

Because catch rates in both sport and commercial fisheries declined in 2007 and because the estimated abundance of yearling and older yellow perch in Green Bay did not increase in 2007, we are not presently recommending any changes to sport or commercial harvest limits. The annual commercial harvest limit for yellow perch in Green Bay was increased from 20,000 to 60,000 pounds in 2006 and then to 100,000 pounds in 2007. The sport fishing daily bag limit was increased from 10 to 15 fish in 2006. Under those rules the sport harvest has more than doubled the commercial harvest during the past three years.

Forage trends and lake-wide stocking levels

We watch trends in forage species, especially alewives, with great interest because of their importance for the health of the salmon fishery.   We rely upon surveys conducted by the USGS' Great Lakes Science Center for quantitative lake-wide assessments of forage species abundance, but our own data also provide indicators of trends. For example we monitor bloater chub abundance and as mentioned above we track commercial harvests and catch rates of bloater chubs and smelt. A significant indicator is the estimated mean weight of a 30-inch chinook salmon collected at the Strawberry Creek spawning weir, which has declined from as much as 5 kg in 1974 and to below 4 kg in the last several years. USGS surveys using bottom trawls and acoustic methods showed declines in forage abundance in 2007, but the bottom trawl survey showed an increase in alewife abundance, attributable to a strong 2005 year class.

Trends in forage abundance are among the factors that the Lake Michigan fisheries agencies track to guide stocking decisions. In 2006 chinook salmon stocking was cut substantially. Those cuts will begin to have their greatest effect starting in 2008. We have no present plans to reduce stocking further, but in light of the trends in forage abundance that will remain a possibility for the future. Complications related to preventing the spread of VHS and reconstruction of the Wild Rose SFH caused some stocking changes in 2008, including a reduction of chinook stocking in Wisconsin waters from the target level of 1,149,000 to approximately 760,000.

Viral Hemorrhagic Septicemia

This disease was documented in Lake Michigan for the first time in 2007. At this time it has been discovered in at widely spaced locations ranging from our waters of Door County to Illinois waters, and has been found in whitefish, brown trout, rock bass, round gobies, and yellow perch. Because it has been detected elsewhere in a number of other species, the Department has instituted new rules prohibiting the transport of any live fish away from or between waters of the state, except under special circumstances.

To protect our hatcheries from VHS the Department has adopted a number of internal policies that limit the movement of fish and eggs from the wild into our facilities or from one facility to another. This will affect stocking levels in 2008, but we hope to achieve most of our stocking goals in the future. Because Skamania steelhead adults must be held for several months after capture in the fall until spawning in late winter, and because there is no accepted method of disinfecting whole fish, we will not be able to sustain the Skamania program unless suitable holding facilities are found within the Lake Michigan basin.

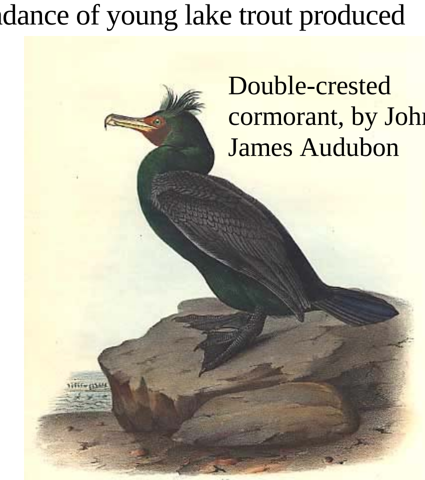
Lake trout rehabilitation

We have worked with the Lake Michigan Committee to develop a revised strategy for restoring self-sustaining populations of lake trout in Lake Michigan. That draft strategy will be presented to the public for comment in 2008, and we hope to join the other jurisdictions in adopting a final strategy before the end of the year.

The focus of lake trout restoration in Wisconsin will continue to be the mid-lake reef complex. Many years of stocking in that area has produced a large population of adult lake trout. Recently, Dr. John Janssen has initiated a program of study of the spatial distribution, genetics, and abundance of young lake trout produced by that adult spawning population.

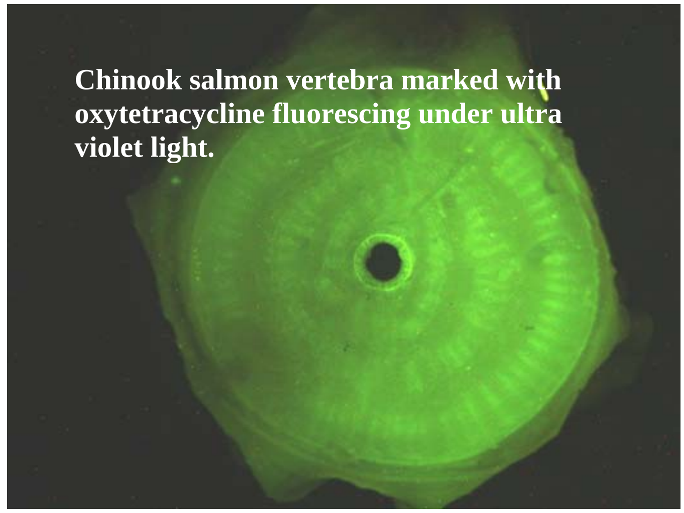
Cormorant control

A cormorant control program on Green Bay was initiated in 2007. This program was developed by Fisheries, Wildlife, and Endangered Species programs of the Department, and is carried out with Department funding by the Wildlife Services program of the US Department of Agriculture. The program relies primarily on egg-oiling to reduce the number of breeding cormorants in the Bay. The objectives are 1) to reduce the Cat Island population to from 2434 nesting pairs to 1000



Double-crested cormorant, by John James Audubon nesting pairs, 2) to reduce the northern Door County cormorant population from over 10,000 nesting pairs to 5,000 nesting pairs, and 3) to prevent the colonization of any new islands.

Mass marking



Chinook salmon vertebra marked with oxytetracycline fluorescing under ultra violet light.

A fundamental management uncertainty on Lake Michigan is the amount of natural reproduction by chinook salmon. In 2007 the four states surrounding Lake Michigan stocked over 3,200,000 fingerling chinook salmon. We know that those fish were supplemented by substantial natural reproduction, but we do not know how much. In order to estimate how many chinook salmon were naturally reproduced we worked with the other states to mark all stocked fish. In the coming years we will use recovery rates of marked and unmarked fish to estimate the fraction of adult fish that were naturally reproduced. Preliminary results indicate that natural reproduction may account for as much as 50% of the adult chinook salmon population in Lake Michigan.

SPORTFISHING EFFORT AND HARVEST

Brad Eggold and Jeff Zinuticz

The open water fishing effort was 3,061,408 hours during 2007, 9.7% above the five-year average of 2,789,708. The near-shore fishing opportunities in 2007 where phenomenal, cold water close to shore was conducive for shore fishing and small boat anglers to take part in some excellent fishing on Lake Michigan. The 2007 ramp and charter effort was above the five-year average by 14.4% and 15%.

Wisconsin Lake Michigan trout and salmon anglers had yet another extraordinary season in 2007. Although overall salmon sizes were still on the smaller side, many Chinooks were taken that exceeded the 20 lb. mark. Again Lake Michigan salmon fishing was exceptional in 2007 and is truly becoming a premier place to fish for trout and salmon in the country. Shore and boat anglers had another phenomenal season in 2007 as well, both trout and salmon were at an all time high of 645,359 fish harvested a 19% increase over the five-year average. Chinook again dominated the catch with 431,143 taken, a new harvest record and is an 11.8% increase over the five-year mean. Coho salmon also increased to 94,677 fish taken, 40.2% above the five-year mean.

The estimated open-water harvest of Yellow Perch was 567,922 a decrease from previous years (Table 2). In recent years, the harvest consisted primarily of the 1998 year-class fish that exceeded 14" in most cases. However, in 2007 the harvest also consisted of the 2002, 2003, and 2005 year-classes, which is encouraging news for the future population of Yellow Perch in Lake Michigan waters. The 2007 harvest was primarily made up of Green Bay caught perch.

Walleye harvest was estimated at 59,103 fish, an increase from previous years. Northern Pike catch was also higher than last year at 5,291 fish caught. Smallmouth Bass harvest was 13,695 fish. These higher catch numbers are encouraging signs for shore fishermen or those who are not equipped to fish trout and salmon.

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 2007 and percent change from the 5-year average (2003-2007).

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2007	1,705,712	406,200	317,730	216,544	196,723	218,489	3,061,408
% change	14.4%	8.9%	15.0%	19.9%	2.1%	-20.9%	9.7%

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2007.

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	38,384	28,058	24,712	1,655	1,386	482	**94,677**
Chinook salmon	164,120	110,957	124,769	8,465	6,158	16,674	**431,143**
Rainbow trout	26,520	17,250	14,032	910	1,730	1,807	**62,249**
Brown trout	17,296	2,732	3,836	4,189	7,099	2,795	**37,947**
Brook trout	0	0	26	26	10	0	**62**
Lake trout	7,911	5,289	5,875	195	11		**19,281**
Northern pike	4,955	0	0	0	249	87	**5,291**
Smallmouth bass	7,507	4,638	0	621	869	60	**13,695**
Yellow perch	525,202	15,985	0	12,218	6,763	7,754	**567,922**
Walleye	54,687	2,234	0	59	68	1,965	**59,013**
TOTAL	**846,582**	**187,143**	**173,250**	**28,338**	**22,957**	**31,624**	**1,291,280**

Table 3. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1994-2007.

Species	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	TOTAL
Brook Trout	7,481	1,914	419	299	159	574	199	263	144	126	1	18	17	62	38,956
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	964,302
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	1,586,206
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	4,961,700
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	1,844,808
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	1,203,385
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**	**10,599,357**
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	0.1449

Table 4. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1994-2007.

Fisheries Type	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	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	4,118,111
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	2,825,690
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	2,330,542
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	287,151
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	364,931
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	672,932
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**	**10,599,357**

Totals represent total number of salmonids harvested from 1986 – 1997.

WEIR HARVEST

Jim Thompson, 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.

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. Egg taking protocols were modified in 2007 in response to the discovery of Viral Hemorrhagic Septicemia virus (VHS) in Lake Michigan. This included additional safety measures such as double egg disinfection and the establishment of quarantine areas for egg transfer to prevent the spread of this virus. Hatchery protocols and fish rearing capabilities were also modified for specific hatcheries in response to the discovery of this disease.

Strawberry Creek Weir

Low stream flow and low Lake Michigan water level was once again a potential problem for chinook salmon harvest at SCW in the fall of 2007. However, for the seventh consecutive fall we utilized our 3,500 foot pipeline and pump to deliver approximately 1,500 – 2,000 gallons of water per minute to Strawberry Creek that greatly increased flow and attracted chinook salmon to the weir. During the fall 2007 run, 3,101 chinook salmon returned to SCW (Table 1). The 2007 return was the lowest since 1999, the last year the weir was operated without the pipeline supplement. This low return level continues the precipitous drop that began in 2005. This reduced return was not unexpected because of stocking reductions that were instituted to reduce the number of fish returning to SCW. However, stocking reductions alone cannot explain this decline. Despite the reduced number of returning chinook salmon, Wisconsin’s entire chinook salmon egg quota was once again collected at SCW in 2007 where approximately 1.726 million eggs were harvested.

For the past eight years, mean length and weight at age for chinook salmon returning to Strawberry Creek have generally followed a decreasing trend. For example, since 2001 length at age for age 2+ and 3+ male chinooks has on average decreased by 100 and 127 mm, respectively (Figure 1). Consequently, weight at age has decreased by approximately 2.5 and 4 kg for these age classes, respectively (Figure 2). The mean weight at age for male 3+ fish of 4.988 kg in 2007 was the lowest ever recorded. Meanwhile, the mean weight of 4.135 kg for 2+ fish in 2007 approximately equaled the lowest average recorded weight in 2005. To monitor changes in weight, 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 dropped slightly last year to 3.830 kg from 3.920 kg in 2006. However, this is up slightly from 3.814 kg in 2005 which was the lowest ever calculated.

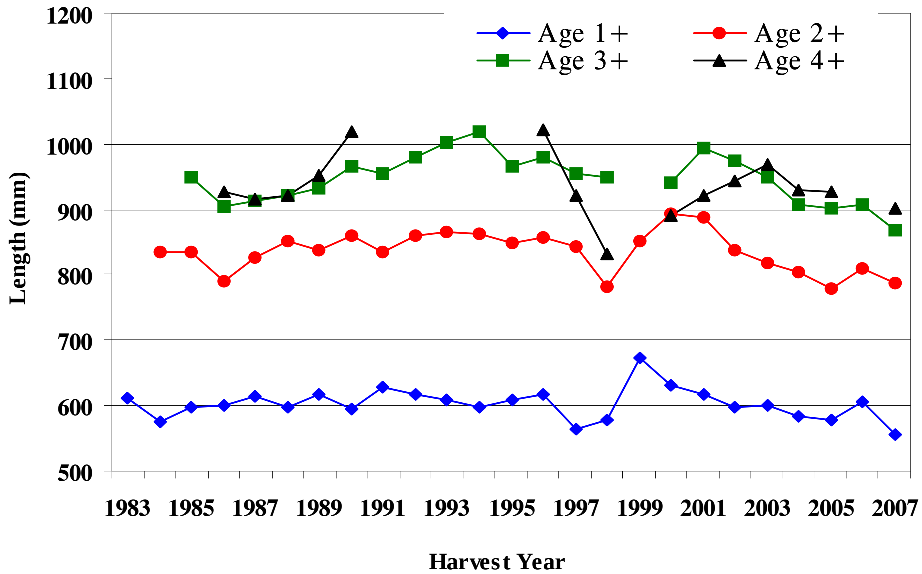


Figure 1. Length at age of male chinook salmon returning to the Strawberry Creek weir between 1983 and 2007.

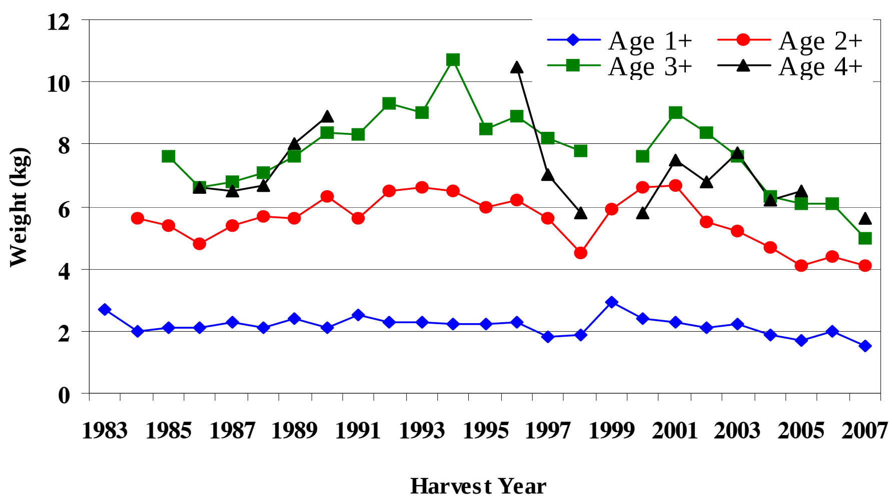


Figure 2. Weight at age of male chinook salmon returning to Strawberry Creek weir between 1983 and 2007.

Table 1. The total number of chinook salmon handled during fall migrations at Strawberry Creek (1981-2007), Besadny (1990-2007) and Root River (1994-2007) 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

[1] From 2000 through 2007 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 (1992-2007) and RRSF (1994-2007).

Year	BAFF	RRSF
1992 – Spring	3,338	
1992 – Fall	474	
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

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Table 3. The total number of coho salmon examined at BAFF (1990-2007) and the RRSF (1994-2007).

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

Besadny Anadromous Fisheries Facility

Spring Operations

Spring operations in 2007 began on April 2 and continued through April 18. During this period 431 steelhead were handled at BAFF. The run consisted of 163 Chambers Creek strain steelhead, 128 Ganaraska, 2 Skamania, and 138 unknown strain fish. The number of fish handled during the spring run in 2007 decreased from the 2006 total, and was typical of the runs of the past five years, but was far less than those observed in 1991 through 1996. The reduction in return number is likely due to the poor return rate for several year classes that were stocked between 1998 and 2002. Egg collection from BAFF in 2007 consisted of approximately 202,000 eggs from the Ganaraska strain and 268,000 eggs from the Chambers Creek strain of steelhead.

Fall Operations

Kewaunee River water levels were somewhat below normal levels during the fall of 2007. However, water temperatures were very high creating difficult conditions for holding fish. BAFF ponds were sorted thirteen times during October and November to process migrating fish. In years where egg quotas were filled at SCW, chinooks were allowed to pass above BAFF for sport fishers. However, as a measure to prevent the spread of VHS, fish were not allowed to bypass the BAFF facility in 2007.

Fifty steelhead were captured at BAFF during the 2007 summer/fall run. This was the highest total since 1999 when 145 steelhead were captured. Eighteen of the 50 steelhead had identifiable Skamania clips which was the highest number seen since 2004. Adult Skamania used as brood fish were not collected in 2007 due to VHS concerns which will result in no Skamania stocking in 2009 by Wisconsin.

Despite no fish being allowed to pass upstream, the fall 2007 chinook salmon capture at BAFF was still down over 1300 fish from 2006 (Table 1). No eggs were harvested from chinook at BAFF.

During the fall 2007 run, over 1600 more cohos returned to BAFF than in 2006 (Table 3). The return was the fourth highest since 1990. Approximately 578,000 coho salmon eggs were collected at BAFF in the fall of 2007.

Root River Steelhead Facility

Spring Operations

The spring steelhead return at RRSF in 2007 was 428 (Table 2). The majority of steelhead that returned during the spring run were likely either Chambers Creek or Ganaraska strain steelhead. The 2007 spring return was the lowest return noted since 1998 and continues the trend of declining spring returns to the RRSF that began in 2002. Approximately 290,000 eggs were collected from the Ganaraska strain and 404,000 eggs collected from the Chambers Creek strain of steelhead. Approximately 428,000 eggs were collected from Skamania strain steelhead captured in 2006 at the RRSF facility and held at the Kettle Moraine Springs Fish Hatchery.

Fall Operations

The Root River Steelhead Facility was in operation for 13 processing dates during the fall 2007 fish migration. Stream flows were very inconsistent, producing a modest run. This fall, 4,433 fish were captured and processed, mostly chinook salmon.

Only 98 steelhead were captured this fall. Previously, Skamania strain broodstock were captured at the facility for transfer to the Kettle Moraine Springs Hatchery to be used for propagation.
Due to the implementation of new protocol as a result VHS being found in the lake, adult fish can no longer be transferred from the facility, so the facility was not operational for collection of summer-run steelhead.

Chinook salmon arrived in fair numbers; 3,547 for the 13 dates.

Coho salmon were not nearly as plentiful. A total of 1,169 coho salmon returned to the RRSF in 2007 (Table 3). Approximately 475,000 coho salmon eggs were collected at RRSF.

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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 2007. 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 2). 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 fall trawling surveys (Figure 3). More recent fall trawling surveys; however, show a trend towards improved recruitment. Surveys from 2002 to 2007 indicate reasonably strong year classes and the 2003 survey indicates an extremely strong year class was produced that year (Figure 3). This report is a summary of the status of yellow perch in southern Green Bay based on annual assessments during 2007.

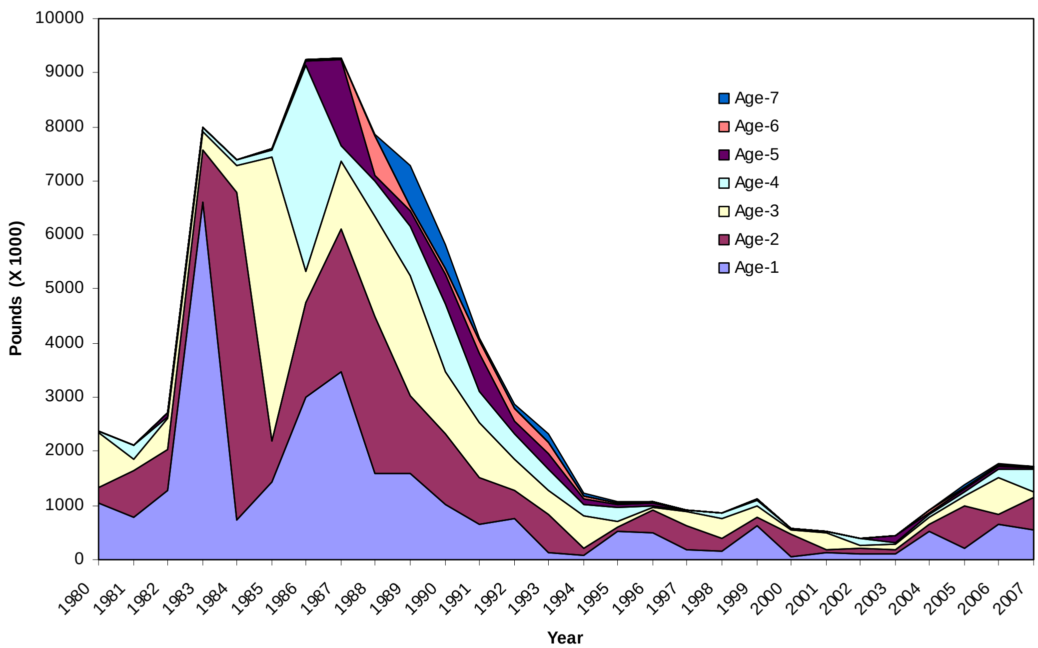


Figure 1. Estimated yellow perch population biomass in Green Bay from 1978 to 2007.

Spawning assessment

The spring spawning assessment continued for the 30th year on Green Bay at Little Tail Point (Figure 2). Double-ended fyke nets were set at three standard locations at ice-out on April 9, 2007. On that date, a templogger was deployed to record water temperature every 30 min until August. Water temperature reached 50 F on April 20th. On April 25th, over 75% of mature females sampled were ripe or spent which triggered the removal of those nets.

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. A majority

(72%) of the mature females sampled were age-2 (2005 year class) with a mean length of 158 mm, or 6.2 inches. Age-2 males were very abundant and comprised 93% of the total males sampled. In 2006, the 2004 year class (age-2) comprised the majority of the mature females (49%) with a mean length of 6.5 inches, while 81% of males were age-2. Other relatively common species captured were trout perch, spottail shiner, white sucker, and round goby. Cladophora was present beginning at water temperatures in the mid-40s, and likely reduced the efficiency of the nets throughout the survey.

Figure 2. Southern Green Bay showing the Little Tail Point spawning assessment area.

Larval sampling
In 2007, larval sampling continued for the 10th 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. Sampling occurred every two to five days from May 10 through June 5. Dense cladophora was noted in several of the tows. Samples were sent to University of Wisconsin-Milwaukee's Great Lakes Water Institute for identification and analysis.

Beach seining
Index station seining continued for the 26th year at 15 sites spread over 130 miles of Green Bay shoreline using a 25ft long seine. Seining was implemented three times per site between June 18 and July 11, 2007. 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 is placed in a tub is recorded. Catch per effort (CPE) is calculated as the mean number of YOY perch per 100ft seine haul. During the three sampling periods, the CPE was 175, 184, and 104 respectively. This was higher than 2006 which yielded CPEs of 139, 93, and 103. The site with highest abundance in 2007 was on June 28 at Skogg's Bridge just north of the Oconto River which had a CPE of 1552 and a high escapement rate

(65%). Common carp YOY dominated the catches followed by white sucker, spottail shiner, banded killifish, and quillback. A total of thirty-seven fish species were identified during the survey.

Trawling survey
Annual late summer trawl surveys continued for the 30th 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). 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 2007 produced a strong year class with the relative abundance of YOY yellow perch (1,912) ranking as the 2nd highest since the deep water sites were added in 1988 (Figure 3).

At each of the 12 locations, 100 YOY were preserved when possible and later measured and sexed. YOY from the southern sites were generally larger than YOY from the northern sites. Locations having a higher CPE tended to have smaller YOY ($r = -0.7947$, $P < 0.02$). For example, the CPE at Little River Shallow was 9,251 YOY/trawl hour and mean length was 49 mm on August 7. At Longtail Point, 34 YOY/trawl hour were captured with a mean length of 82 mm on August 16. This relationship may be a function of growth in relation to YOY density, timing of sampling, water temperature, or food availability.

While the trawling surveys are designed to assess YOY distribution and abundance, yearling and older yellow perch are also measured, weighed, sexed, and aged. Abundance of age-1 and older fish decreased at index sites from 149 in 2006 to 65 in 2007 (Figure 4). This result was the lowest since 1988 and considerably below the 20-year combined average of 616. A majority (47%) of the age-1 and older fish captured were age-1 (2006 year class) with males and females represented near equally. Common species in order of abundance captured at shallow sites were gizzard shad, spottail shiner, freshwater drum, and white sucker. Deep water trawls were dominated by adult whitefish, adult alewife, whitefish YOY, and trout perch.

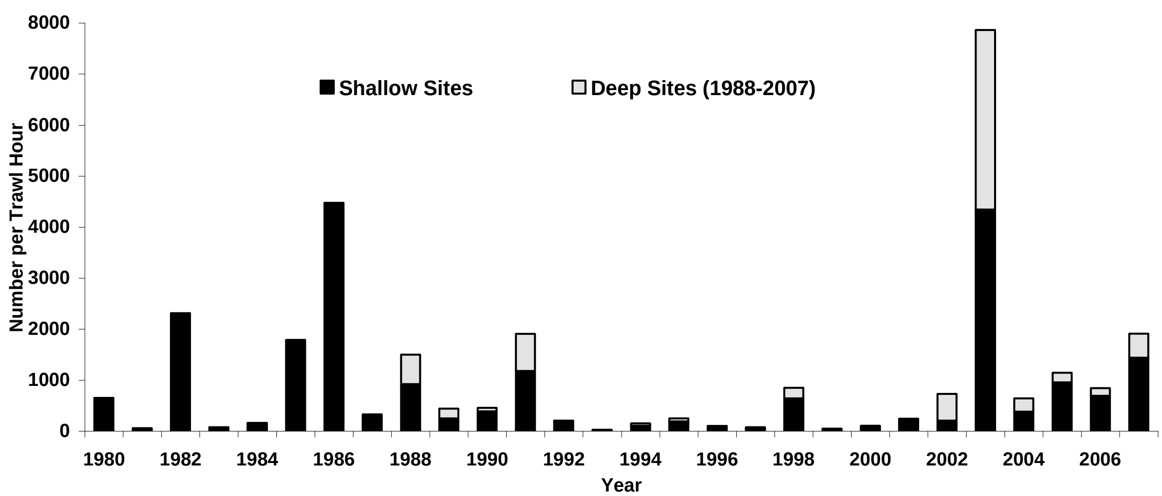


Figure 3. Relative abundance (weighted area average) of young-of-year yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2007.

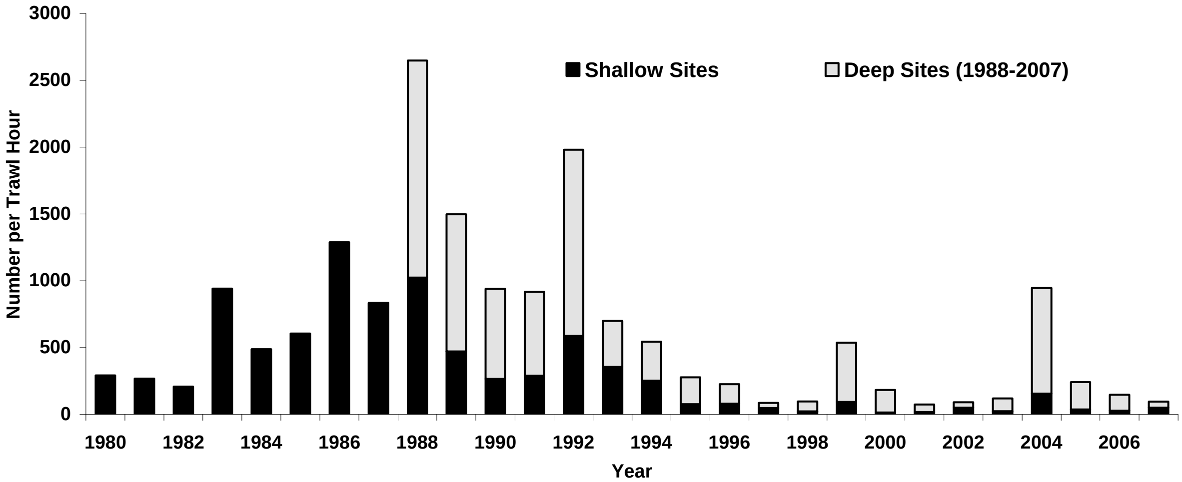


Figure 4. Relative abundance (weighted area average) of yearling and older yellow perch collected during late summer index trawling surveys in Green Bay from 1980 to 2007.

Sport harvest

Sport fishing harvest was estimated from an annual creel survey. Fish obtained through that survey were used to describe the age and size composition of the catch. Sport fishing harvest has fluctuated annually with changes in yellow perch abundance and in 2004 reached the lowest level in the 20 years of the survey (Figure 5). Open water harvest numbers of yellow perch decreased from 692,385 in 2006 to 472,597 in 2007 (Figure 5). The harvest rate (0.52/hr) and catch rate (0.87/hr) of yellow perch in 2007 also decreased from 0.79/hour and 1.12/hour in 2006. A majority of the open water harvest was from the 2003 and 2005 year classes, comprising 42% and 39% of the harvest, respectively. The mean length of open water harvested yellow perch was 8.8 inches (N = 484; SE = 0.08). 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. To remain consistent with our data analysis, the above creel estimates do not reflect the Sturgeon Bay canal sites because the statistical catch-at-age model has not yet been adjusted with those harvest estimates. This issue will need to be addressed in 2008.

Angler harvest of yellow perch during winter months has increased since 2004. Ice harvest of yellow perch doubled from 64,857 in 2006 to 129,024 in 2007. This change was mainly because fishing effort (all species) also doubled between the two winters. Harvest per hour for anglers targeting yellow perch was similar in both years (0.63/hr in 2006; 0.64/hr in 2007). The 2003 year class comprised the majority (82%) of fish harvested under the ice. The mean length of ice harvested yellow perch was 8.6 inches (N = 76; SE = 0.14).

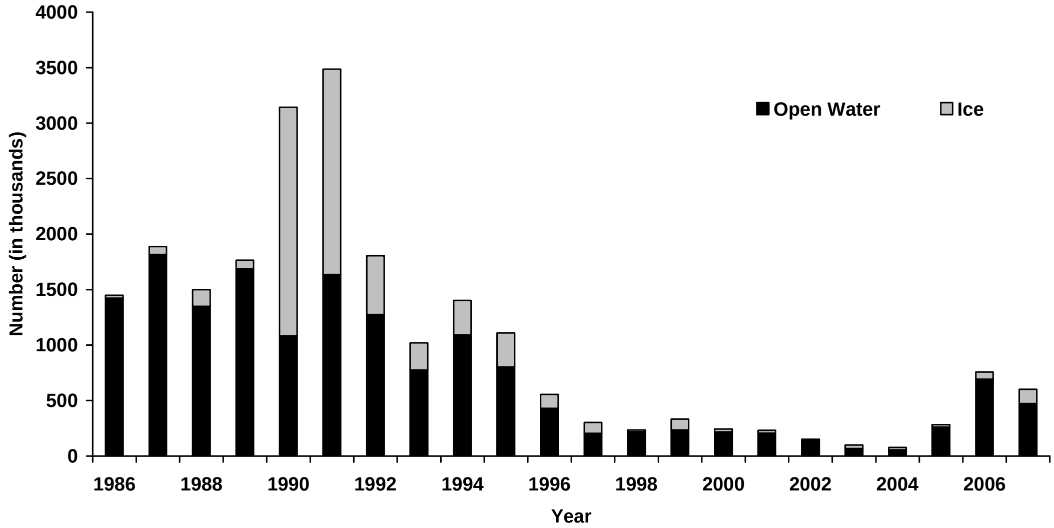


Figure 5. Estimated sport harvest of yellow perch in Green Bay from 1986 to 2007.

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.

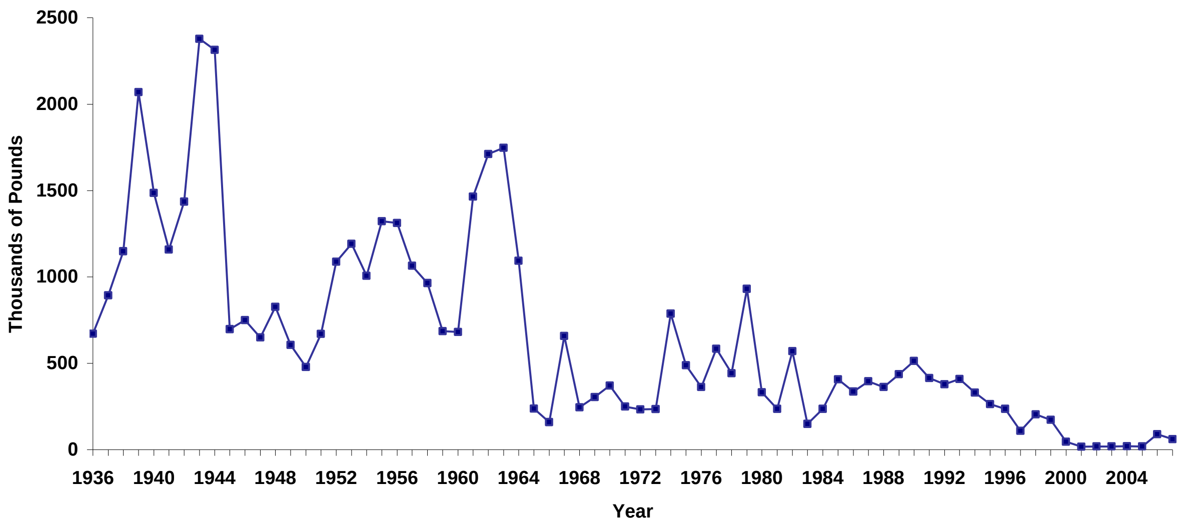


Figure 6. Commercial harvest of yellow perch in Green Bay from 1936 to 2007.

In calendar year 2007, commercial fishers harvested a total of 61,031 pounds using gill, drop, and hoop nets, compared to 89,973 pounds in 2006 (Figure 6). The commercial license year runs from July 1 to June 30. For calendar year 2006, commercial fishers had an increase in their harvest limit from 20,000 to 60,000 pounds, which took effect in the spring of 2006. By harvesting that increase before July 1 and also catching most of the new 60,000 pound harvest limit, commercial fishers were able to harvest 89,973 pounds during calendar year 2006. The harvest rate (catch/effort) for gill nets decreased from 37.0 in 2006 to 31.15 in 2007, while drop nets decreased from 45.81 to 29.11. The 2003 year class dominated the commercial fishery for the past two years, accounting for

91% and 75% of the total harvest in 2006 and 2007, respectively. Age-3 perch (2004 year class) comprised an additional 11% of the 2007 commercial catch.

Management actions

In 2007, Wisconsin DNR increased the commercial quota from 60,000 to 100,000 pounds in Green Bay. The current daily sport bag limit remained at 15 per fishermen. Wisconsin DNR annually evaluates a statistical catch-at-age (SCAA) model regarding further changes to the regulations. The 2007 decision to increase the commercial quota was mostly based on improved recruitment observed in late summer trawling surveys from 2003 to 2007. The WDNR is also trying to allocate the harvest of yellow perch more equally between the sport and commercial fishery (Figure 7) while protecting the resource from overfishing.

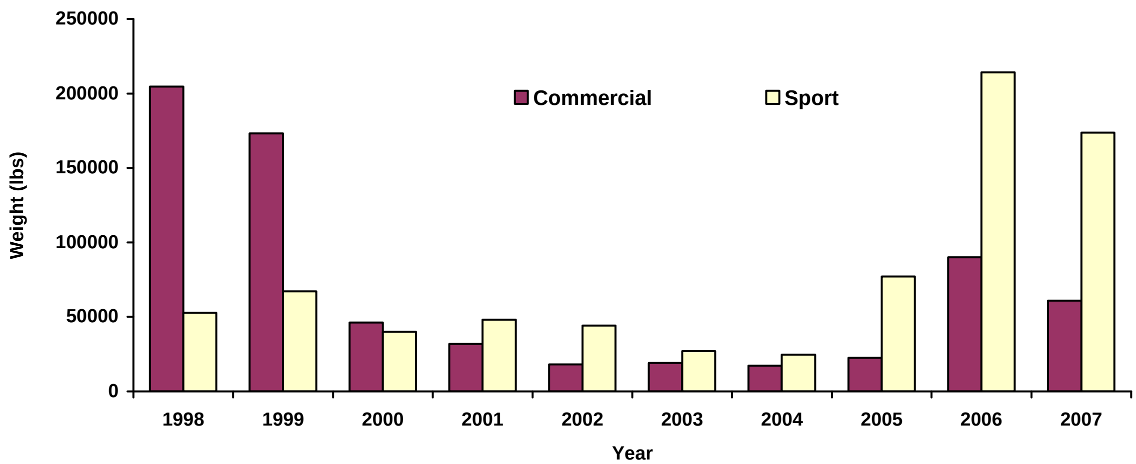


Figure 7. Commercial harvest and estimated sport harvest in Green Bay from 1998 to 2007.

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 2007-08.

Young-of-the-year Assessment

In southeastern Wisconsin, beach seining was conducted to assess young-of-the-year (YOY) yellow perch. In 2007, we sampled at 14 sites between Kenosha and Sheboygan from August 27, 2007 to September 5, 2007 using a 25' bag seine with ¼" delta mesh. Surface water temperature remained in the 70s (^{0}F) during most of the sampling period. Dense algal growth at many of the sampling sites made it impossible to seine on some days. However, we had near perfect conditions for seining with clear, calm water and very little cladophora on September 5th. We captured YOY yellow perch in 7 of the 9 sites sampled that day. Catch per effort (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. Figure 1 shows the catch per effort of YOY yellow perch for the sites in the Southeast Region (SER) since 1989. No YOY yellow perch was captured in 1994 or 1999 sampling. Our 2007 survey produced 1443 YOY yellow perch captured from 9 different locations. We sampled at 14 locations, totaling 4,300 ft of seining. The CPE calculated was 34 YOY yellow perch which was the second highest value since 1989 (Fig. 1). Based on previous experience and the current observation, we expect a good 2007 year-class to develop if they get past the first winter. We measured total length of 159 YOY yellow perch that ranged from 44mm to 76mm with an average of 58mm. The size range of YOY yellow perch from north of Milwaukee varied from 44mm to 71mm, and from south of Milwaukee varied from 46mm to 76mm. By and large, YOY alewife dominated the catch (CPE = 117) followed by YOY yellow perch, spottail shiner, and longnose dace. A total of nineteen species of fish (young and adult) were encountered during the survey.

In addition to using a standard bag seine, a 200-foot Swedish monofilament gill net (100 ft of 6 mm and 100 ft of 8 mm bar length mesh) was used to capture YOY yellow perch in the nearshore waters of Lake Michigan. The net was set on rocky bottom in approximately 6 ft of water, and allowed to fish for one night. Two index sites were sampled – Wind Point (lifted on 09/12/2007), about 17miles south of Milwaukee, and Doctor's Park/Fox Point (lifted on 8/28/2007), about 9 miles north of Milwaukee. We caught a total of 45 YOY yellow perch (32 at Wind Point set, and 13 at Doctor's Park set). Catch per 100 ft of gill net effort was 11 YOY yellow perch (Figure 1) in 2007 as opposed to 61 YOY yellow perch in our 2006 sampling effort. The average total length of YOY yellow perch caught in the gillnet was 59mm, which compared with the YOY yellow perch caught in the beach seine.

Spawning Assessment

This assessment has been conducted on the Green Can Reef and in the Milwaukee Harbor since 1990 (Table 1). The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. In 2007, the first sampling was conducted on 5/22/2007 by setting one box of 500 ft gillnet with 2, 2.5, 2.75, 3.0 and 3.25 inch mesh (100 ft each panel) in 32-35 ft of water. All ten females that were caught were ripe. On 5/30/07 two gangs were set at two different depths ranging from 34-35 ft (Gang 1), and 51-52 ft. (Gang 2), for a total effort of 1000 ft net. A total of 1064 yellow perch were captured, of which 27 were females. The deep set produced 3 times more perch than the shallow set, although the females occurred in greater proportion at the shallow water. At this time, except one green female the remaining females were either ripe (67%) or spent (30%). The bottom water temperature ranged from 47 to 49 ^{0}F. The third lift was conducted on 6/05/07. A total of 556 (19 females) yellow perch were captured in 500 ft of gill net. At this time the majority of females (79%) were spent. A total of 123 yellow perch were aged; the ages ranged from 2 to 14 years. The 1998 year-class still dominates the spawning population (35%) followed by a strong 2002 year-class (32%) and a modest 2003 year-class (17%).

Yellow perch egg deposition survey was conducted by the WDNR dive team. The survey documented successful egg deposition, recording 378 egg masses resulting in 10.81 egg mass per 1000 square meters (Figure 2). This data was similar to the 2005 and 2006 observations. Number of egg skeins per 1000 m^2 was 10.04 in 2003 and 11.53 per 1000 m^2 in 2002.

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 inches stretch on 1/4 inch increments. We added a section of 3.25 inch mesh net to gather additional data. Yellow perch begin to recruit to this assessment gear by age 2 and are almost fully recruited by age 3 (Figure 3). A total of five lifts, each with 2800' effort were taken from 11/27/2007 to 12/12/2007 at depths ranging from 60' to 80'.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1995 through 2008. 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 10 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 tapering off in recent years. In our 2007 graded mesh assessment, the 2002 year-class yellow perch emerged as a dominant group. Whereas in our 2008 assessment, the 2005 year-class dominated the catch (34%) replacing the 2002 year-class (Figure 4) which formed the second largest group comprising about 27% of the total catch. The 1998 year-class is no more the dominant player, comprising only16%. In addition, the 2003 year-class yellow perch comprised a significant proportion (11%) of the total yellow perch caught in the 2008 assessment. The data indicate that there is at least four year-classes represented in the population.

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 the 2007 survey. 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 2007 indicated that the 2002 (44%) and 2003 (38%) year-classes comprised bulk of the catch. The 1998 year-class, which was the dominant year-class for many years comprised only about 7.6%. A significant increase in sport harvest from 16,000 yellow perch in 2000 to 121,000 yellow perch in 2001 was due to the fast growing 1998 year-class which progressively decreased to only 33,000 yellow perch caught in 2005 (Table 3). Subsequent increases to 68,000 yellow perch in 2006 and 66,000 in 2007 are a reflection of strong 2002 and 2003 year-classes reaching harvestable size. Because of the decreased density, the perch seem to be growing at a faster rate and attaining larger size at age.

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 are starting to appear in substantial numbers in the population. Forty-five percent of the sport caught yellow perch in 2007 belonged to 2002 year-class, followed by 43% for the 2003 year-class. The 1998 year-class comprised only 7%. The sport harvest of 1998 year-class in Lake Michigan is gradually decreasing which is probably due to their decreasing abundance or other year-classes reaching harvestable size in significant proportions. 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. Once the model is built, a Decision Analysis component will be added to the model to aid managers in deciding how to handle the management of yellow perch in southern Lake Michigan. The outcome from the Decision Analysis Model is slated for mid-summer (2008).

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

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

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

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. Sport harvest data includes moored boat catch since 1989. [a] Commercial yellow perch fishery was closed effective September 1996. [b] Sport bag limit was reduced to 5/day effective September 1996.

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]

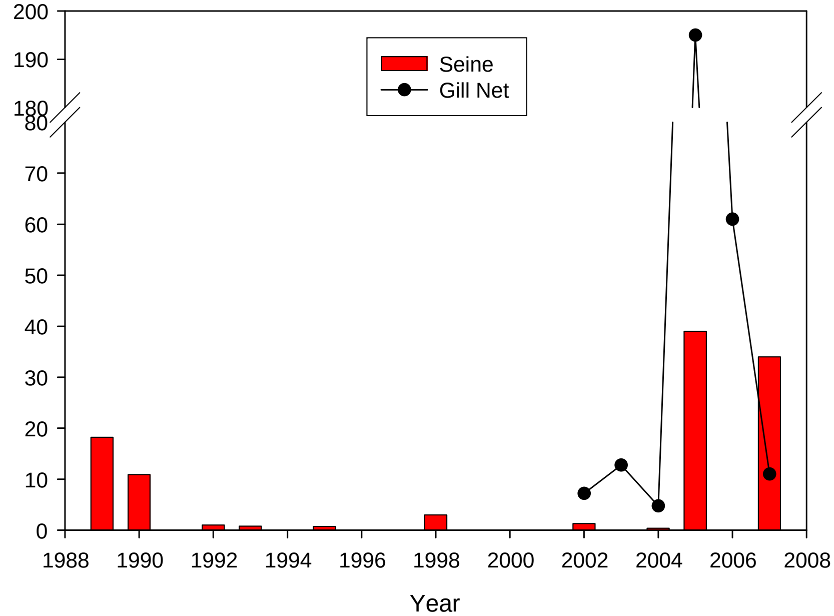


Figure 1. CPE (fish/100') of YOY yellow perch in summer beach seining and graded mesh gillnetting.

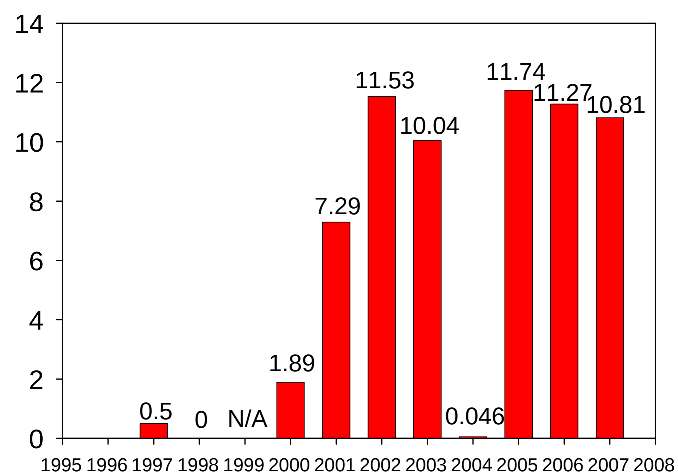


Figure 2. Number of egg skeins per 1000m^2 on Green Can Reef in annual surveys.

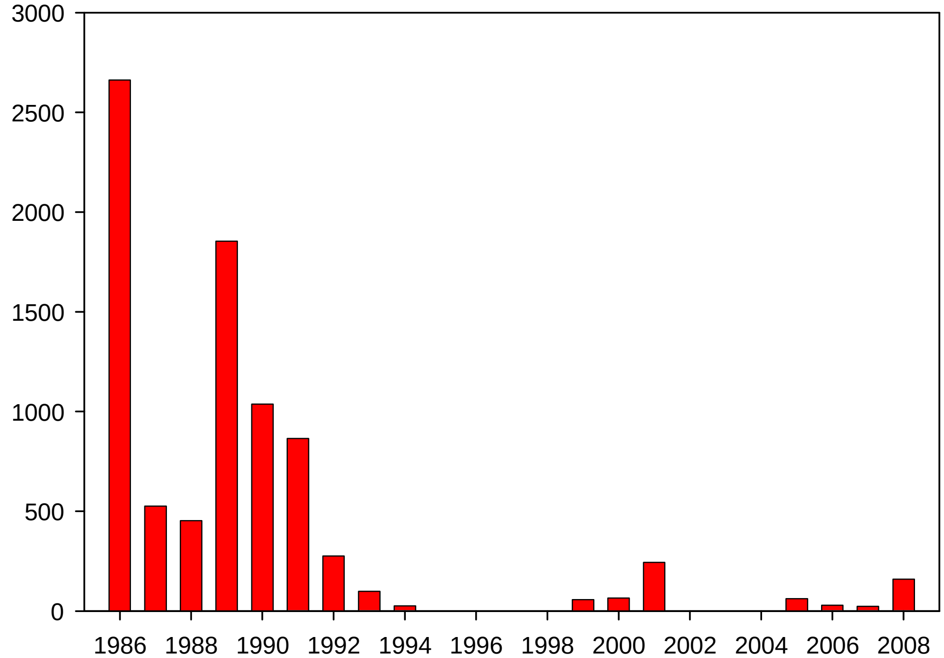


Figure 3. Age 3 yellow perch catch-per-effort in the winter graded mesh gillnetting assessment in Lake Michigan.

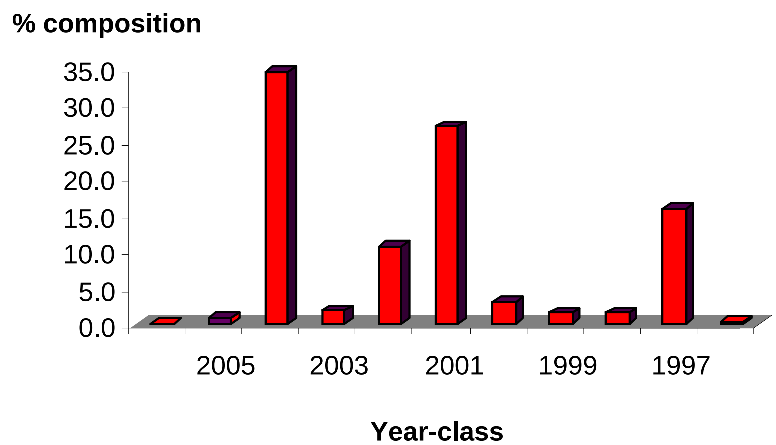


Figure 4. Age distribution represented as year-class of yellow perch in the winter graded mesh gillnetting assessment in Lake Michigan, 2008.

BLOATER CHUBS

Timothy Kroeff

The total chub harvest from commercial gill nets was 416,615 pounds for calendar year 2007, a decrease of 51% from 2006 (Tables 1 and 2). Commercial smelt trawlers harvested 84,390 pounds of unmarketable chubs incidental to the targeted smelt harvest which represents a 19 fold increase from 2006 but similar to 2005 when 74,780 pounds of unsorted chubs were reported. There were 1,330 pounds of marketable chubs reported in trawl catches in 2007.

Table 1. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gill net chub fishery 1979-2007. 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

Table 2. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2007.

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

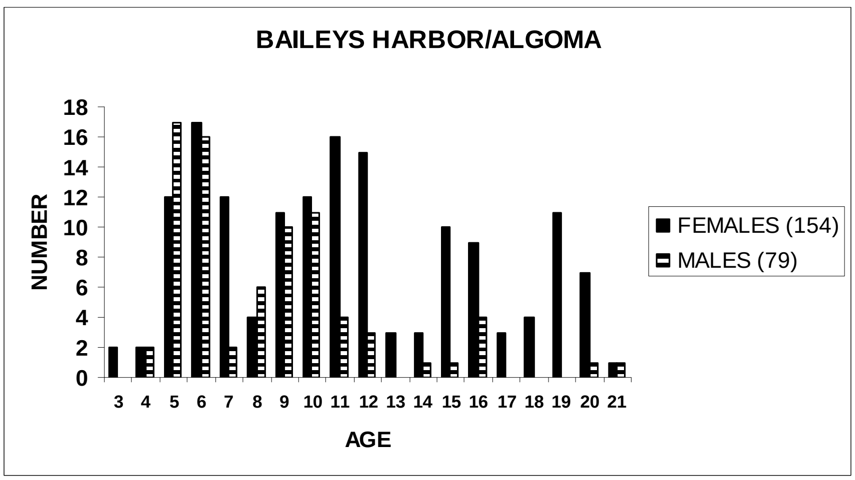
[a] For the years 81-85, 90 & 91, 98-07 totals were by calendar year.
[b] For the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.

By zone, the harvest in the south was 410,025, which was a decrease of 51% from 2006, or 14% of the allowed quota of 3 million pounds. The southern zone is basically waters from Algoma south to Illinois. In the north, 6,590 pounds were reported caught, a decrease of 82% from 2006 or 1% of the allowed quota of 600,000 pounds. The northern zone is basically waters from Baileys Harbor north to Michigan. These catches in both the north and south were the lowest since chub fishing reopened in 1979. The south showed a 30% decrease in CPE from the year before while the CPE in the north dropped by 15% from the previous year. Gill net effort in the south decreased by 28% or 5,273,000 feet while effort in the north decreased by 79% or 795,100 feet. In the south, 18 of the 43 permit holders reported harvesting chubs while in the north 2 of 18 reported harvesting chubs.

Chub assessment in 2007 marked the sixth year that otoliths, a small piece of calcified material commonly referred to as ear stones, were extracted and used to age chubs. This replaced the common scale reading method that had been used the past 25 years for aging purposes before 2002. The otolith method of aging has been found to be more accurate, especially when dealing with older populations of fish. The use of otoliths indicates that scale reading may have under-aged fish in the 1990's as chub growth slowed.

Population assessments with graded-mesh gill nets (1,300 ft. per box), were conducted off Algoma and Baileys Harbor in September and October of 2007 and off Sheboygan in January of 2008 (1 box per lift). Two lifts were made off each sight totaling 24 net nights for all sights combined. Samples of chubs were also collected from standard mesh gear but because of poor catches off Algoma and Baileys Harbor, only Sheboygan was used. At the time of this report, aging was incomplete from standard mesh off Sheboygan.

Catches from graded-mesh gill nets continue to be poor off Algoma and Baileys Harbor but improved slightly from 2006. Data was pooled for these two sites. Chubs up to 20 years of age were collected off Sheboygan and up to 21 years of age off Algoma/Baileys Harbor (Figure 1). Chubs aged from 4 to 20 were caught off Sheboygan and 3 to 21 off Algoma/Baileys Harbor. Catches off Sheboygan declined, particularly in the catch of male chubs from 2006, however, those that were caught were of younger age than females. It is believed that female chubs outlive males.



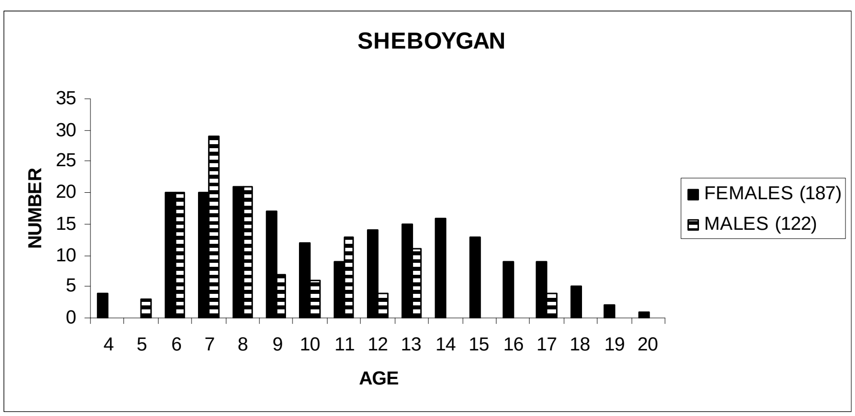


Figure1. Age composition by number and sex of chubs captured during graded mesh assessments along the Wisconsin L. Mich. shoreline, 2007-08.

Sex ratios in standard mesh continue to be high on the female side with the catch showing 88% females in 2007 compared to 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.

The following people were instrumental in varying aspects of this project: David Schindelholz for assistance with aging otoliths, Pat McKee and Cheryl Peterson for data entry and summary. Also, Mark Nelson, a commercial fisherman out of Sheboygan, was of great help in completing this assessment.

LAKE STURGEON

Michael Donofrio, Brad Eggold, and Steve Hogler

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 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. 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 supports a hook and line fishery with an extraction of 172 fish in 2005, although recent regulation restrictions reduced the harvest to 1 in 2006 and 0 in 2007. 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 in 2007 produced 132 lake sturgeon from the lower Menominee River. The sample size was 278 lake sturgeon in 2005 and 276 in 2006. Most of the fish (90%) were subjectively labeled as adults (>102 cm in total length), but several sub-adults sturgeon were observed during the surveys. The overall average total length during these sampling events was 127 cm. The smallest sturgeon was 53 cm and several fish were over 152 cm in length. The population estimate for the 42 inch and larger segment of the population was 1,527 with confidence intervals of 1,195 to 1,949 in 2007

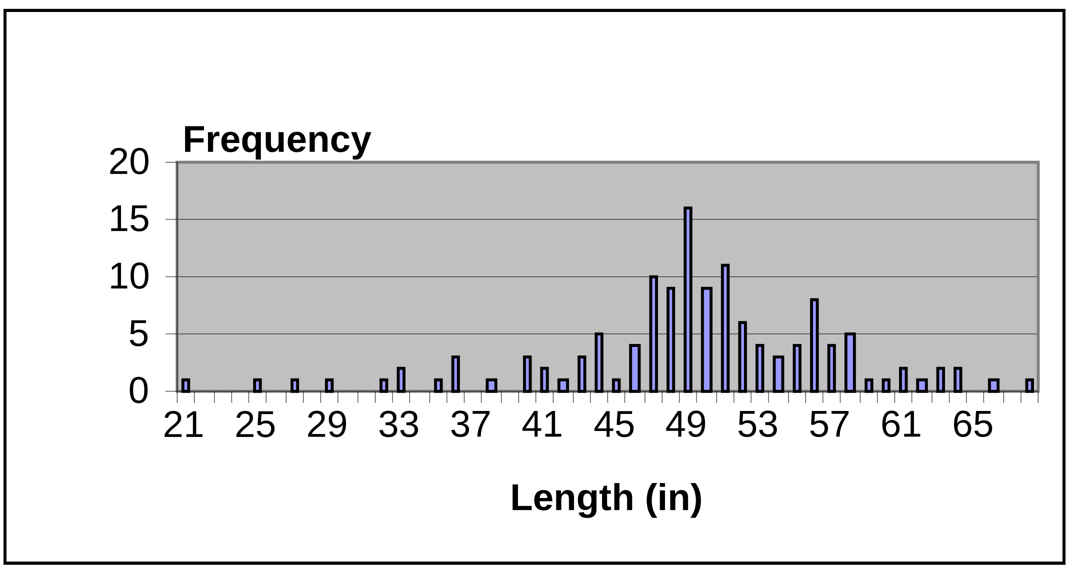


Figure 1. Length Frequency of lake sturgeon in the lower Menominee River.

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. 2005-07 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 60 adults (Menominee (57%), Peshtigo (25%), and Oconto (18%)). Their movements are monitored continuously through 2 stationery receivers in each river. Since we have recaptures from the Cedar River, we installed an additional receiver in that river. These fish were sexed 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 years.

Milwaukee River SRF

The Milwaukee SRF was deployed in 2007 on April 2, 2007 and put into service on April 20 and April 21, 2007. Wisconsin DNR personnel artificially spawned 4 females from the Wolf River and transferred those fertilized eggs to the trailer on April 20 and 21, 2007. Approximately 40,000 eggs from four females were transferred to the trailers. Eggs from each female were placed into a separate hatching jar.

By April 26, 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.

Mortality of hatched sturgeon was high. It was estimated that following hatching, there were approximately 2,000 larvae per fry tank. Numbers remained high until problems with the brine shrimp feeding system occurred which caused the number of sturgeon in each fry tank to sharply decline. Mortality remained an issue until sturgeon were transferred out of the small fry tanks into the larger fingerling tanks. Once in these larger tanks, the sturgeon could be feed a combination of brine shrimp and bloodworms. In early August we had about 550 lake sturgeon in the four fingerling tanks, however on August 7, 2007 the bypass valve on one of the sand filters was left in the on position. Over the course of that day and night water flows dropped to very low levels. By morning two tanks were not getting any water which caused total mortality of lake sturgeon in those tanks, about 330 fish.

From August 8 until the fish were stocked on October 6, only a few more fish died. Testing for VHSv in conjunction with our normal fish health screening process prior to stocking reduced the numbers by 50 which left 158 lake sturgeon left for stocking on October 6, 2007.

Manitowoc River SRF

On April 21, approximately 20,000 (10,000 per female) green eggs were delivered to the Sturgeon Rearing Facility (SRF) and placed into hatching jars. Eggs from an additional two females were received the following day.

By April 26, 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. Mortality of hatched sturgeon was high. It was estimated that following hatching, there were approximately 2,500 larvae per fry tank. Numbers remained high until a combination of under feeding and disease reduced numbers sharply by the end of May. From June through July numbers remained steady at approximately 250 fingerlings until unfavorable water conditions (high turbidity and warm temperatures) caused the number of sturgeon in each fingerling tank to sharply decline during August to 114. Length of randomly selected sturgeon from each tank was measured approximately every two weeks starting in mid-June until stocking (Figures 2).

Through the first 60 days post hatching, growth was slow as sturgeon were fed brine shrimp, but as blood worms were added to the diet, growth improved greatly. Tanks with the fewest fish had the largest fish, while the tank with the highest density had the smallest sturgeon. Increased rations in the tank with the highest density of sturgeon did not seem to improve growth for that family. Average length at the time of stocking was 216 mm.

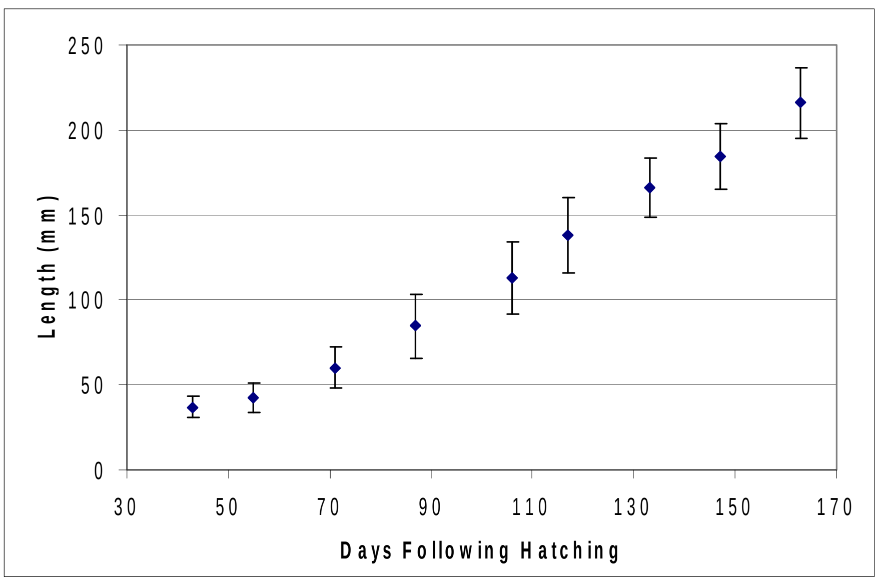


Figure 2. Average length of randomly measured sturgeon at the Manitowoc River SRF starting 40 days post hatching through stocking.

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 and 0 in 2007.

NEARSHORE RAINBOW TROUT STOCKING EXPERIMENT

Steve Hogler and Brad Eggold

There is a strong public demand for nearshore fishing opportunities on Lake Michigan. 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 the stocking of six ports with two strains of rainbow to facilitate the evaluation of the effectiveness of rainbow stocking and to identify what strain to stock in the future through direct comparison of the performance of each strain. After taking input from anglers, the Arlee strain of rainbow trout was selected to be stocked starting in 2001. Following the initial stocking of Arlee, a second strain, Kamloops rainbow trout was identified to be part of this study in 2003. The ports of Kenosha, Milwaukee, Sheboygan, Manitowoc, Algoma and Sister Bay were the locations selected for the experimental stocking of rainbow trout for this study. 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.

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
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

Table 2. Estimated angler harvest of nearshore rainbow trout by strain and fishery type from 2001 through 2007.					
	Harvest	Harvest Location			Total
Strain	Year	Boat	Pier or 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
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

Arlee Rainbow Trout

In 2007, each port stocked received 10,978 Arlee rainbow trout that were marked with a Adipose-Left Pectoral fin clip (Table 1). Size at stocking and the time of stocking in 2007 was similar to previous years. It was estimated that anglers harvested 3,797 Arlee rainbow trout in 2007 (Table 2). The estimated harvest in 2007 was 78% higher than the 2006 harvest and was the highest Arlee rainbow harvest since the inception of the project. Most of the harvested Arlee rainbow were taken by pier and shore anglers with fewer caught in the ramp and stream fisheries. Analysis of fish clips indicated that Arlee rainbow harvested in 2007 came from fish stocked since 2003. Fin clips can also help to determine how fish are growing in the lake. For example, Arlee rainbow that were stocked in 2003 have grown to average 716 mm in length and 4.0 kg in weight after 5 summers in the lake (Table 3). 2007 stocked fish averaged 356 mm in length and 0.6 kg in weight after 1 summer in the lake. The average lengths and weights from other stocking years are listed in Table 3.

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: Year Stocked	1	2	3	4	5	1	2	3	4	5
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		0.5	2.1	1.8	3.3	
2005	305		587			0.4		2.6		
2006	368	498				0.9	1.5			
2007	356					0.6				

Kamloops Rainbow Trout

In 2007, each port stocked received 10,161 Kamloops rainbow trout that were marked with a Right Ventral fin clip (Table 1). Size at stocking for Kamloops in 2007 was the largest noted during the study despite early stocking at several ports. It was estimated that anglers harvested 2,552 Kamloops rainbow trout in 2007 (Table 2). The 2007 harvest of Kamloops was similar to the 2006 harvest and was the second highest yearly harvest of Kamloops since the inception of the project. Most of the harvested Kamloops rainbow were taken by shore and pier anglers with fewer taken in the boat and stream fisheries (Table 2). Analysis of fish clips indicated that Kamloops rainbow harvested in 2007 came from each year of Kamloops rainbow stocking. Fin clips can also help to determine how fish are growing in the lake. Kamloops rainbow that were stocked in 2003 have grown to average 739 mm in length and 4.0 kg in weight after five summers in the lake (Table 4). 2006 stocked fish averaged 587 mm in length and 2.1 kg in weight after two summers in the lake. The average lengths and weights from other stocking years are listed in Table 4.

Table 4. The average length and weight of Kamloops rainbow trout after 1, 2, 3, or 4 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: Year Stocked	1	2	3	4	5	1	2	3	4	5
2003	358	424	625	699	739	0.7	0.9	2.6	3.5	4.0
2004	553	531	663	709		1.5	1.4	3.0	3.6	
2005	546	647	691			0.8	2.7	2.9		
2006	376	587				0.8	2.1			
2007	229					0.2				

Summary

The first seven years of creel survey data is encouraging and indicates that the Arlee rainbow and Kamloops rainbow 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 19,863 nearshore rainbow trout. Of that total, 9,824 (49.5%) 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 which may indicate that the rainbow trout stocked as part of this experiment have not consistently improved nearshore fishing. It also appears that the fish are growing well as anglers have caught fish of each strain over 10.0 kg in weight. Comparison of weight at age for each strain, it appears that Arlee rainbow are larger in size than Kamloops rainbow.

In years that Arlee rainbow and Kamloops rainbow were both stocked, anglers have harvested more Arlee rainbow than Kamloops rainbow in both number and standardized return rate (# per thousand stocked) (Tables 1, 2 and 3). However, before 2007, Kamloops strain fish returned at a higher rate than did Arlee, but results from 2007 reversed this trend. 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.

We do not know at this time if Arlee rainbow, which are larger in size when stocked or Kamloops rainbow, which are longer lived will ultimately provide the greater return to anglers.

Table 5. Return rates (number per thousand stocked) to creel for Arlee Rainbow Trout stocking into Lake Michigan 2001 through 2006.

	Year Stocked						
Year Harvested	2001	2002	2003	2004	2005	2006	2007
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
Total	37.3	153.5	32.3	77.0	14.7	25.4	9.2

Table 6. Return rates (number per thousand stocked) to creel for Kamloops Rainbow Trout stocking into Lake Michigan 2003 through 2006.

	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
Total	--	--	49.8	37.9	20.2	21.1	2.5

WALLEYE IN SOUTHERN GREEN BAY AND THE LOWER FOX RIVER

David C. Rowe and Rodney M. 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 1990-2007) and the lower Fox River (during late October or early November 1991-2007). In 2006, additional sites were added on the Oconto and Peshtigo Rivers as well as stations adjacent to the river mouths on Green Bay. 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 2007 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

<u>Recruitment of YOY walleye</u>. Results of our 2007 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 2007. The 2007 age 0 catch per unit effort (CPUE) from the Fox River was 16.4 YOY/hour of electrofishing which is above the 15 year average of 10.4 YOY/hour. Low water levels may have hindered an accurate assessment from lower Green Bay and the 2007 catch was 0.5 YOY/hour, which is considerably lower than the 15 year average of 7.8

YOY/hour. Stable water temperatures observed during the 2007 spawning and hatching periods likely provided good conditions resulting in a strong year class (Hansen et al. 1998). Catches from the Oconto River were 10.53 YOY/hour and in the Peshtigo River no YOY were collected (Figure 1, these index stations were established in 2006 so no comparisons to long term averages are available). 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).

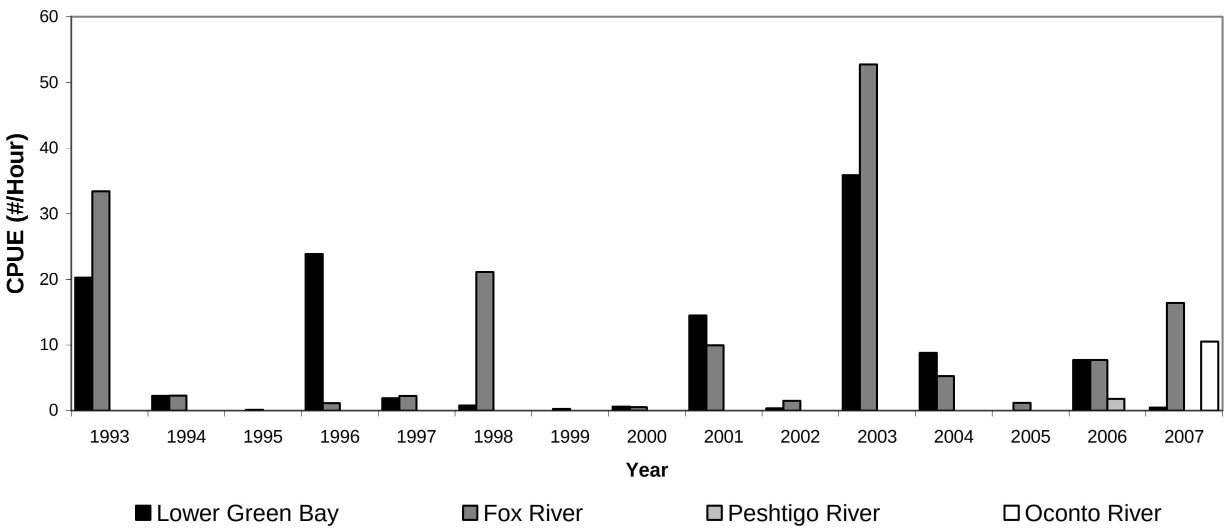


Figure 1. Relative abundance of young-of-year walleye in the lower Fox River (DePere Dam to mouth), lower Green Bay (south of a line drawn from Longtail Point to Point Sable), Peshtigo River, and Oconto River as measured by catch per unit effort (CPUE; number per hour) from data collected in electrofishing index surveys during 1993-2007.

Walleye stock size structure. In 2007, walleye captured during our electrofishing index surveys averaged 433 mm total length (range 193-644). 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 81. 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 1990-2007 (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 470 and 490 mm.

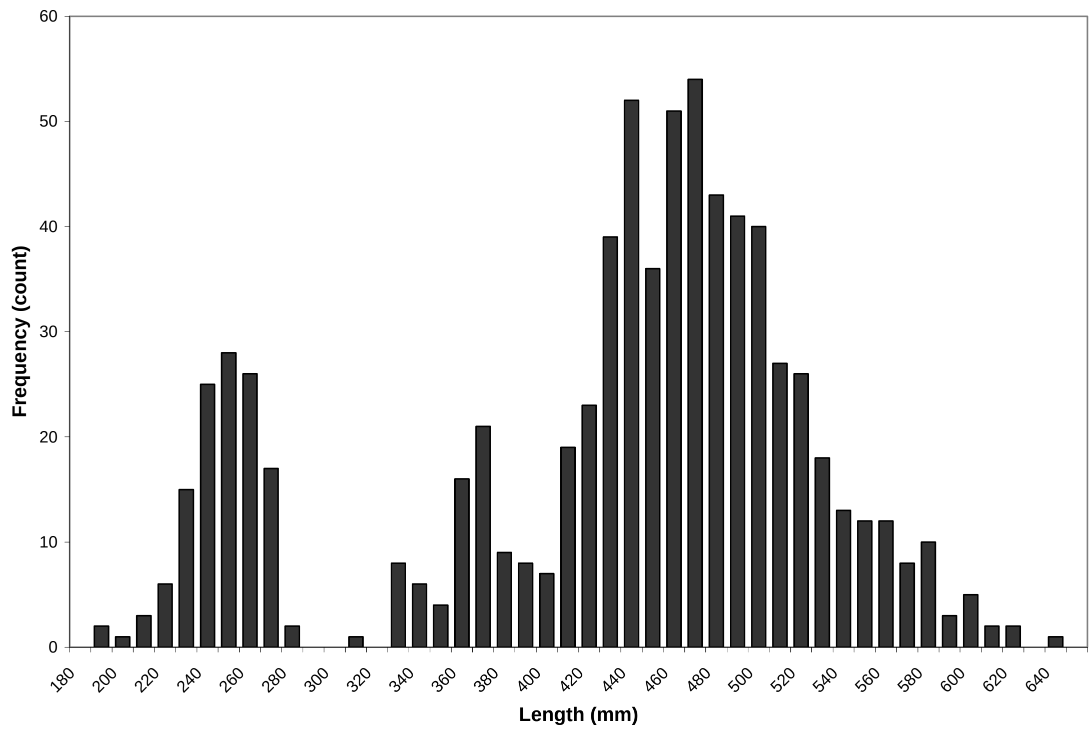
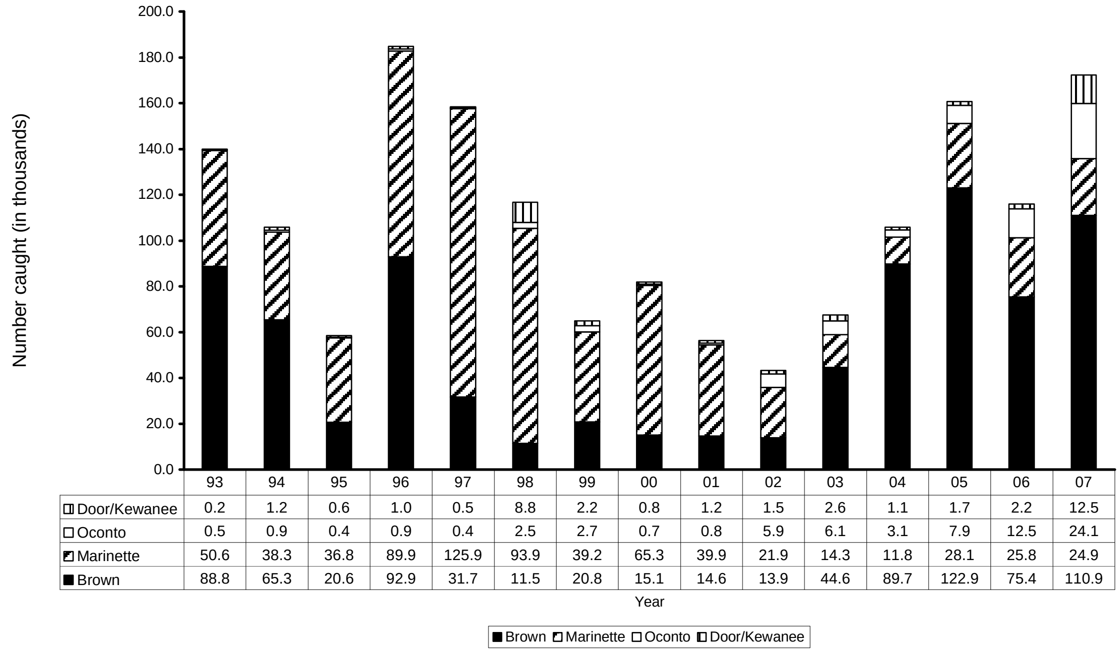


Figure 2. Length-frequency distribution of walleye sampled while electrofishing southern Green Bay and the lower Fox River during 2007.

Catch and Harvest

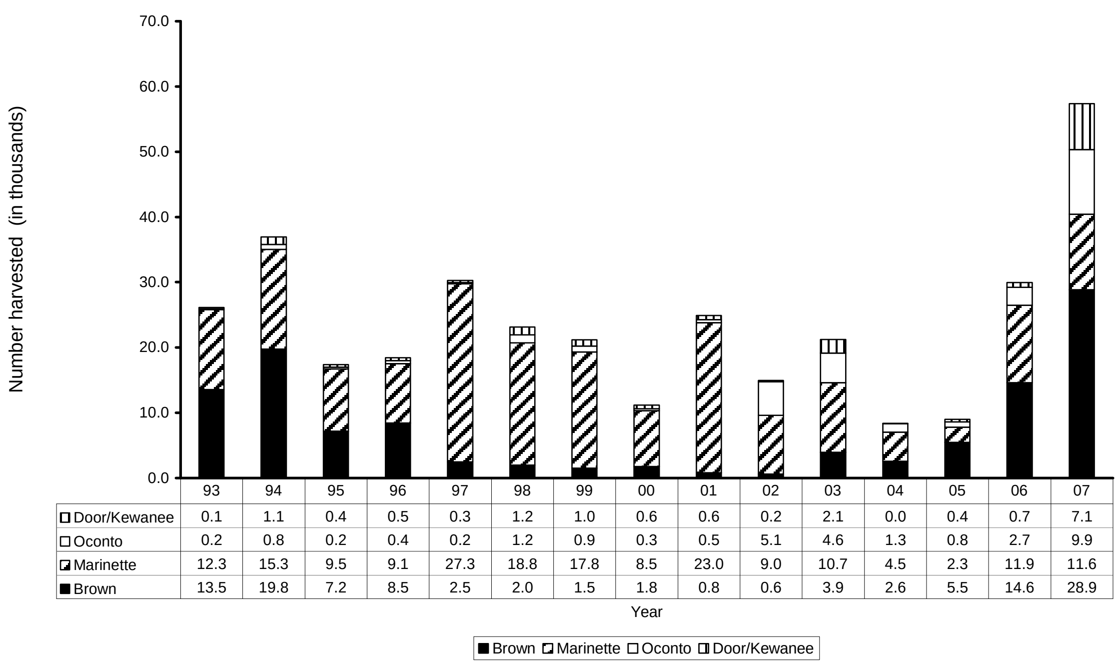
Total catch of walleye from Wisconsin waters of Green Bay was estimated at 172,341 during the 2007 open water season (March –October 31), a 48.6% increase from the estimated 115,955 caught during 2006 (Figure 3). This was 60% greater than the 15 year average of 107,680. The total catch of walleye increased in all waters during 2007 compared to 2006, except for Marinette County waters.

Total open water season harvest of walleye from Wisconsin waters of Green Bay increased from 29,959 during 2006 to 57,382 during 2007 (Figure 4) or almost doubling. Harvest increased in Door/Kewaunee, Brown and Oconto counties during 2007 compared to 2006, but stayed relatively constant in Marinette County.



	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
Door/Kewanee	0.2	1.2	0.6	1.0	0.5	8.8	2.2	0.8	1.2	1.5	2.6	1.1	1.7	2.2	12.5
Oconto	0.5	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
Marinette	50.6	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
Brown	88.8	65.3	20.6	92.9	31.7	11.5	20.8	15.1	14.6	13.9	44.6	89.7	122.9	75.4	110.9

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 1993-2007.



	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
Door/Kewanee	0.1	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
Oconto	0.2	0.8	0.2	0.4	0.2	1.2	0.9	0.3	0.5	5.1	4.6	1.3	0.8	2.7	9.9
Marinette	12.3	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
Brown	13.5	19.8	7.2	8.5	2.5	2.0	1.5	1.8	0.8	0.6	3.9	2.6	5.5	14.6	28.9

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 1993-2007.

The walleye catch has been relatively high for the last four 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.

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 1990-2007, 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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RAINBOW SMELT

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 2007, commercial trawlers reported catching 360,974 pounds of rainbow smelt during the calendar year (Figure 1). The 2007 reported harvest was above the average harvest of 340,876 pounds for the previous three years, but only 76% of the 2006 reported harvest.

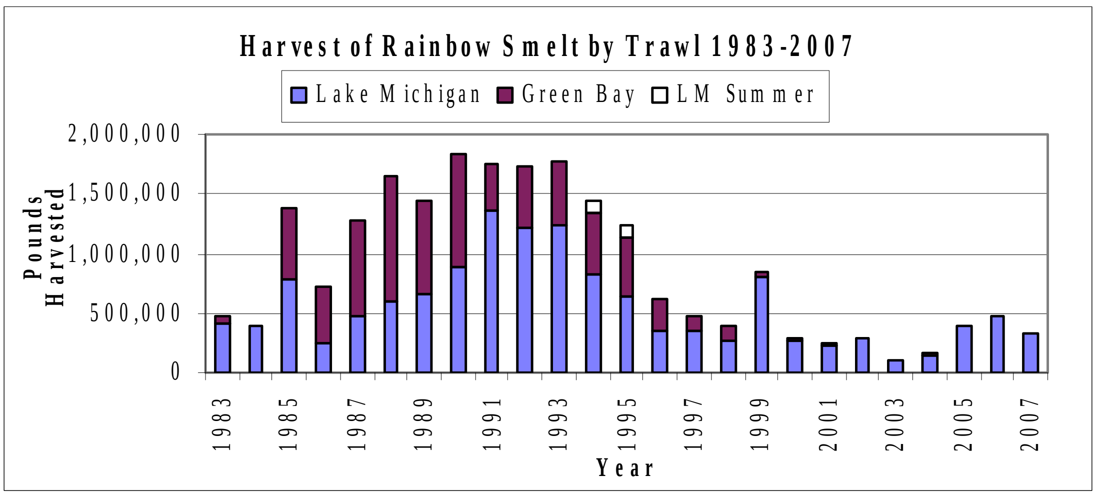

Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 2006.

In 2007 the harvest of rainbow smelt from Lake Michigan was 360,957 pounds (Figure 1), with a CPE of 295 pounds per hour trawled (Figure 2). The decline in harvest poundage in 2007 reversed the trend of increasing harvest in the commercial rainbow smelt fishery noted since 2003 (Figure 1). CPE on Lake Michigan in 2007 decreased sharply from the 616 pounds per hour reported in 2006 and was 15% lower than the average CPE of the three previous years (Figure 2).

Commercial trawlers only fished for 0.33 hours on Green Bay in 2007 catching 17 pounds of rainbow smelt. The lack of fishing effort on Green Bay in 2007 continued the trend of declining harvest, CPE and effort noted on the Wisconsin waters of Green Bay since 1991 (Figures 1 and 2).

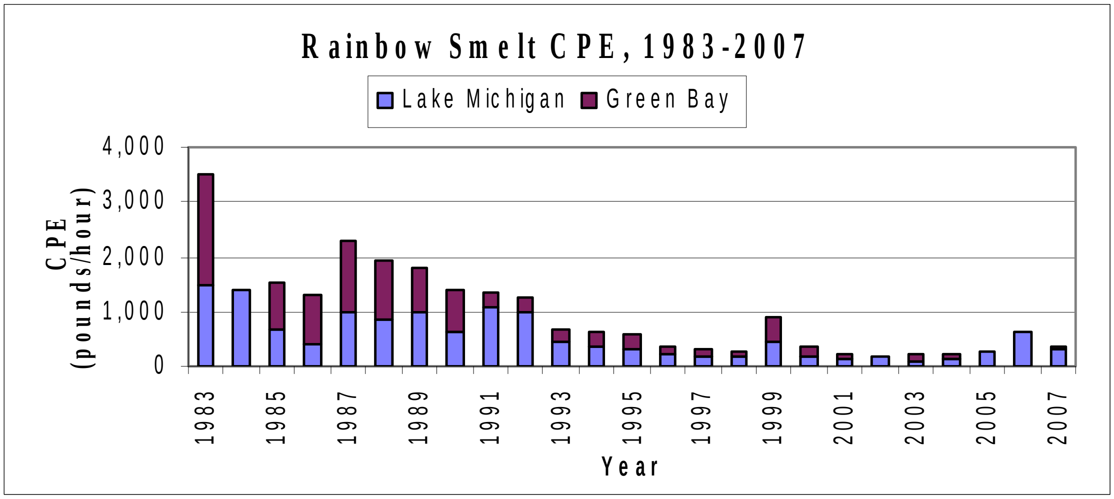

Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan and Green Bay during the years 1983 through 2006.

Commercial rainbow smelt trawlers experienced a fair Lake Michigan season in 2007. Harvest poundage decreased by 24% and CPE decreased by 52% from what was reported in 2006 indicating that fishermen had to fish longer to catch fewer rainbow smelt in 2007. In addition to poorer 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.

The decrease in rainbow smelt harvest by trawlers in 2007 was 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 2005 and 2006 indicated that in 2005 the density of rainbow smelt was the highest measured since 1993 and although the 2006 density of rainbow smelt was lower than in 2005, it was near the ten year average. In addition to the independent estimates provided by the U.S.G.S., harvest trends from the commercial fishery itself indicated that perhaps the rainbow smelt population in Lake Michigan had stabilized and was showing signs of a limited recovery. Based on these two assessments, harvest in 2007 should have been similar to what was harvested in 2006.

It appears that abundant young of year smelt in 2005 as measured by the U.S.G.S. did not translate into increased adult rainbow smelt biomass in succeeding years. The reason for the lack of adult rainbow smelt is not clear, and could be related to increased predation pressure on rainbow smelt by salmonids because alewife numbers are down, poor overwinter survival of young of year rainbow smelt, changes in lake-wide food webs or by 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.

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.

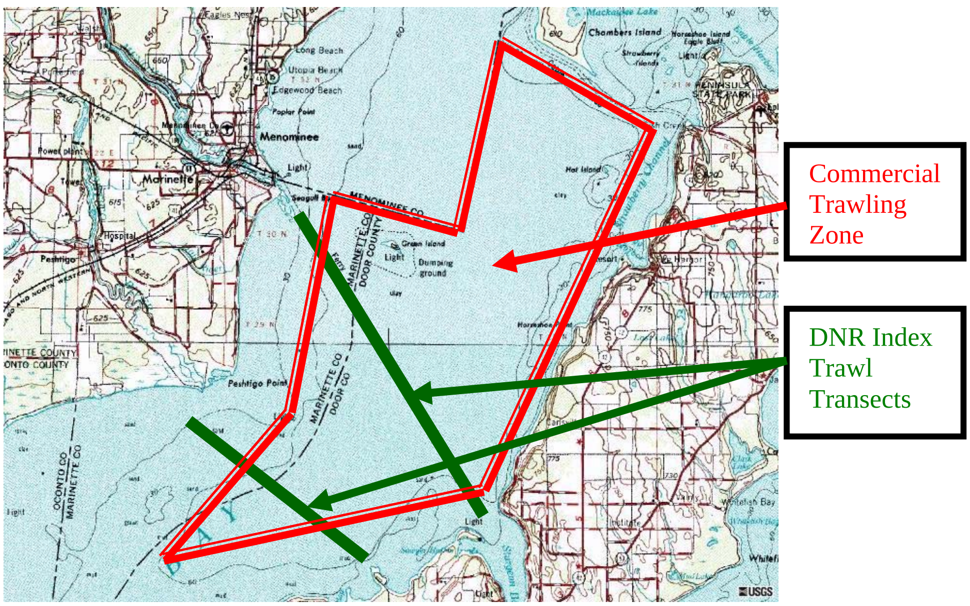

Figure 1. The location of the index trawling transects in relation to the Green Bay commercial trawling zone.

In 2007, 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) decreased with increasing depth from 50 to 70 feet, increased at 80 feet and then sharply dropped to near zero at 90 feet (Figure 2). If dreissenid mussels are removed from the catch analysis, CPE is relatively constant from 50 to 80 feet, but then declined sharply at 90 feet. These results are not consistent to previous years when catch and CPE increased with depth. At 50 feet the catch was dominated by round goby, yellow perch and rainbow smelt. Other depth strata were dominated by alewife, rainbow smelt and lake whitefish. Fish captured along the north transect and reported in the category listed as other included trout perch, smallmouth bass, white perch, walleye and spottail shiner. Dreissenid mussels were only encountered in drags at the 50 and 60 foot strata. The greatest abundance of dreissenid mussels was at 50 feet and their catch accounted for 56% of the total weight of the drag.

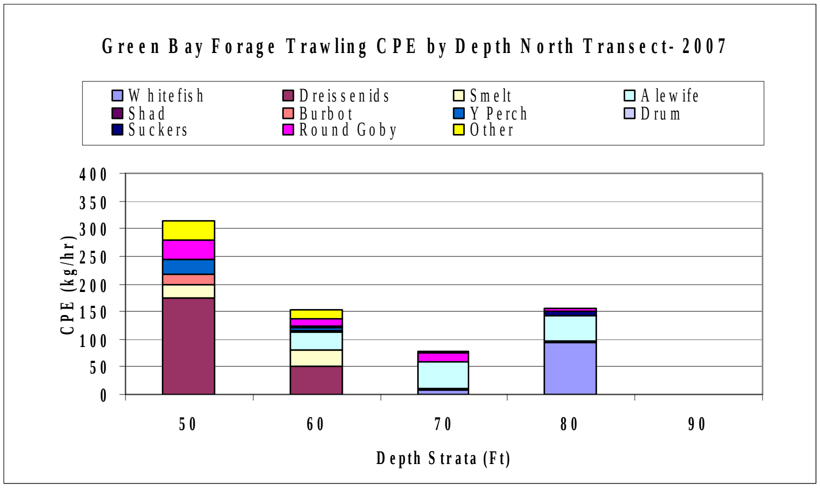

Figure 2. The 2007 CPE (kg/hr) of fish captured by species and depth strata on the north transect on Green Bay.

Unlike the north transect, CPE (kg/ hour trawled) across the south transect increased with increasing depth, although like the north transect, CPE at the deepest depth stratum was very low (Figure 3). Sucker species, primarily white sucker, and lake whitefish dominated the catch from 50 to 70 feet, while at 80 feet alewife dominated the catch. Other species that contributed substantially to the catch along this transect included rainbow smelt, yellow perch, freshwater drum and round goby. Dreissenid mussels were caught at the 50 and 60 feet strata but at a lower CPE than on the north transect.

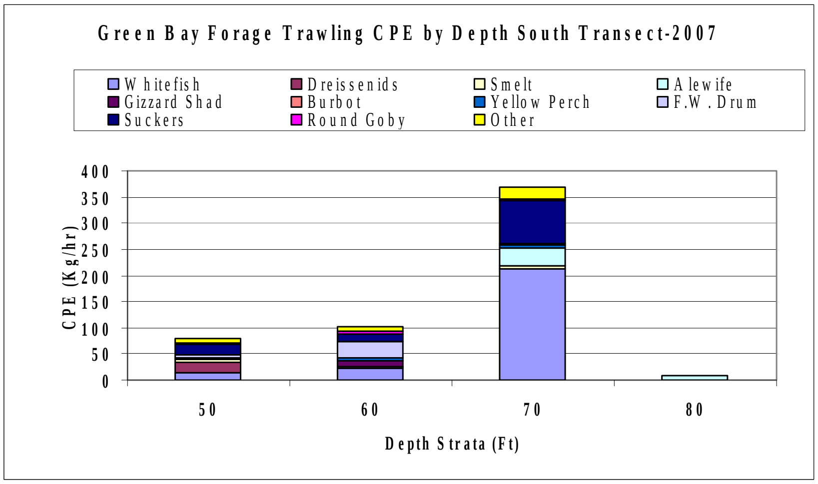

Figure 3. The 2007 CPE (kg/hr) of fish captured by species and depth strata on the south transect on Green Bay.

Five years of trawling data allows us to make general statements about the survey results. First, total catch and CPE declined in 2007 from 2006 levels. The largest declines in CPE were noted at the 70, 80 and 90 foot depth strata due to declines in the catch of suckers sp., lake whitefish and round goby.

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 4 and 5). Catch along the north transect appears to be more diverse than along the south transect which tends to be dominated by one or two species. It is likely that the diversity of fish species found along the north transect is 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).

Third, round goby CPE declined in 2007 along both transects reversing the three year trend of increasing CPE (Figure 4 and 5). The largest declines in CPE were noted along the north transect at the 60 and 70 feet water depths. Despite the reduction in overall CPE, round goby were still abundant at the 50 foot depth stratum on the north transect. The cause of the decline in round goby CPE is unknown.

Fourth, dreissenid mussels appear to be declining in abundance along the south transect while the trend along the north transect is not as clear (Figure 4 and 5). Most dreissenids were encountered in waters less than 70 feet (Figure 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 2007 after a poor 2006 catch (Figure 4 and 5).

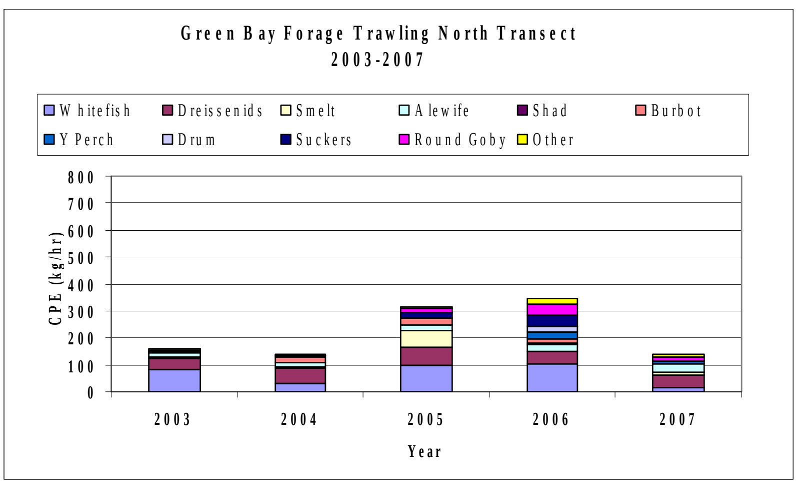

Figure 4. CPE by species for fish and mussels captured during trawling on Green Bay along the north transect, 2003-2007.

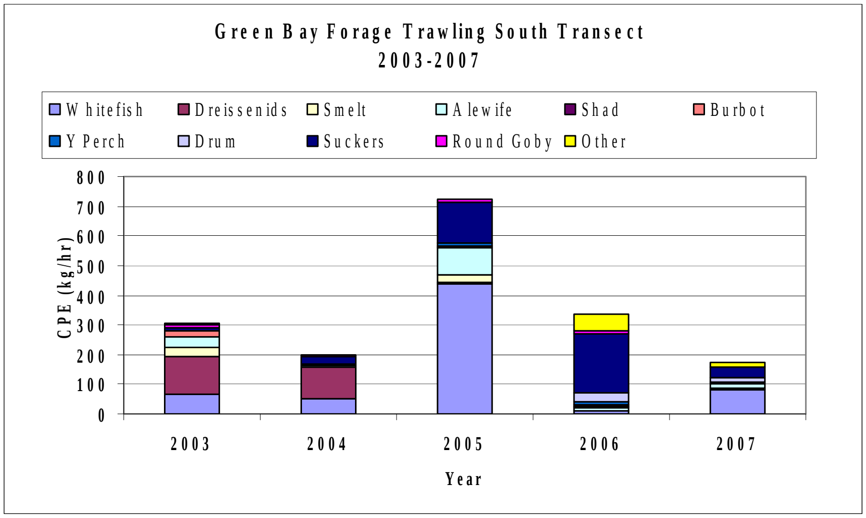

Figure 5. CPE by species for fish and mussels captured during trawling on Green Bay along the south transect, 2003-2007.

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 will affect adult rainbow smelt CPE in succeeding years.

REINTRODUCTION OF GREAT LAKES MUSKELLUNGE

David C. Rowe and Rodney M. 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 residents of Long Lake asked that the WDNR discontinue the use of Long Lake as a broodstock lake. To date there has not been a new inland broodstock lake selected to replace Long Lake. Since 2002 gametes have been collected mainly from the Fox River and hatched at Wild Rose Fish Hatchery. There has been no significant recruitment from natural reproduction of muskellunge documented in Green Bay or the Lower Fox River as of the fall of 2007.

Current Status

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 as well as fish community composition since 2000. During the fall of 2007, 7.45 hours of effort over three evenings on the lower Fox River captured muskies from 486mm (19in) to 1206mm (47.5in) in length (Figure 1). All fish less than 762mm (30in) were recently stocked yearlings identified with right pelvic fin clips and passive integrated transponder (PIT) tags. The average length of an adult fish was 1026mm (40.4 in). Most adult fish had recognizable fin clips; 8 were stocked as yearlings and 14 were fingerling stocks (some fins regenerate but those are usually deformed). To date, in fall electrofishing surveys or spring netting, there has been no definite indication of successful natural reproduction and no capture of a young of the year fish. Adult muskellunge catch per unit of effort (CPUE) was 2.95 fish per hour, the highest recorded since the index surveys began in 2002 (Figure 2). 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.

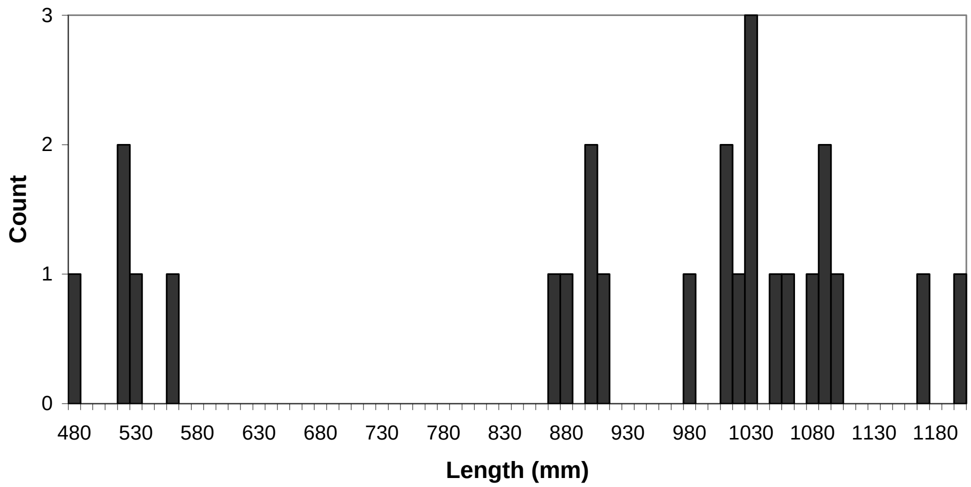

Figure 1. Length frequency of 25 muskellunge captured during fall index electrofishing survey of the lower Fox River in 2007.

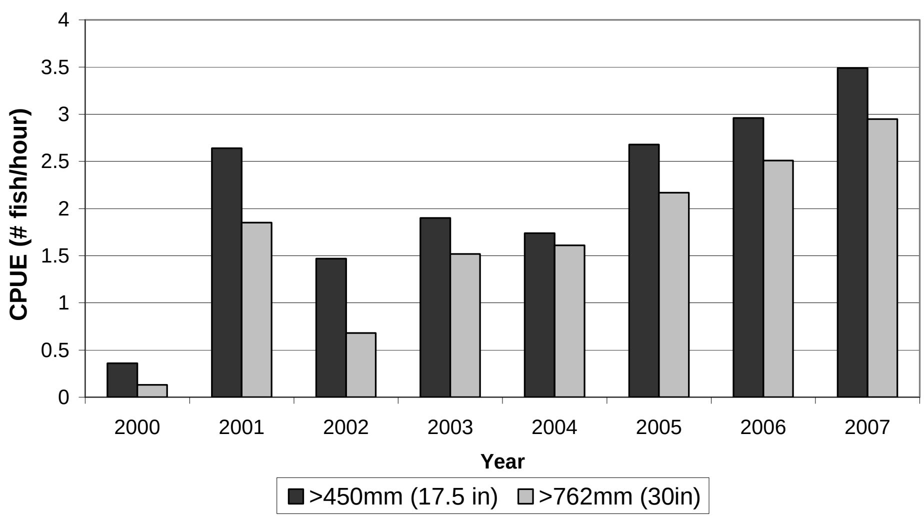

Figure 2. Catch per Unit Effort (CPUE) from night time electrofishing of Lower Fox River for muskellunge greater than 450mm (17.5in) and greater than 762mm (30in) from 2000- 2007.

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, mainly due to the increased number of eggs available from the Fox River collections and rearing pond management of the nitrogen\phosphorous (N\P) ratio (Randy Larson, personal comm.). Stocking has increased as hatchery production increased (Table 1).

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

Table 1. Stockings of great lakes strain muskellunge into the waters and tributaries of Green Bay, Lake Michigan from 1989-2007.

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. There were 640 yearling fish held over from the 2006 year class stocked at nine locations in or connected to Green Bay and an additional 219 stocked in the Winnebago system lakes. Since 2005 stockings have been distributed to a greater diversity of locations around Green Bay (Figure 3).

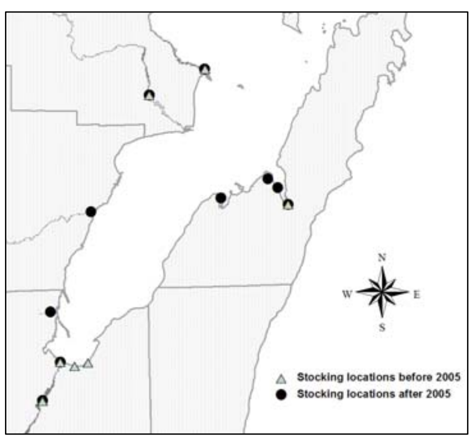

Figure 3. Stocking locations of Great Lakes spotted muskellunge in Green Bay and tributaries before and after 2005.

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.

Fishery

The reintroduction program has resulted in a muskellunge fishery that is rapidly increasing in popularity and participation. The Lake Michigan creel survey estimated a total of 35,107 hours of directed effort for muskellunge on Green Bay and the lower Fox River from March 15th through October 31st, 2007. An estimated 1655 muskies were caught and released compared to a 455 in 2006 (Meyers and Lange 2007). Catch rates were excellent. The estimated catch rate for directed muskellunge angling was 0.0422 fish/hour (23.7 hours/fish). For specifically the Fox River, the catch rate was 0.0563 fish/hour (17.8 hours/fish). In comparison, statewide specific 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).

Future

The population of adult great lakes strain muskellunge in Green Bay waters is likely increasing as documented by the fall index CPUE steadily increasing since 2000 (Figure 2). This factor is likely in response to the increases in stocking and hatchery production. A multiple period mark recapture estimate of the adult spawning population in the lower Fox River estimated 425 adult fish in 2005 (95% C.I. 173-1061, Kapuscinski et al 2007) and 2975 adult fish in 2006 (95% C.I. 1642-5199, Meyers and Lange 2007), which also indicates a growing population. Hopefully the increase will push the population over a density threshold and there will begin to be significant recruitment from natural reproduction. Efforts are continuing to increase the genetic diversity of the present Green Bay muskellunge stock by obtaining additional fish from Canadian waters of the Great Lakes. However, the recent outbreak of Viral Hemorrhagic Septicemia virus in the Great Lakes has prevented the importation of any additional fish or eggs into Wisconsin. Establishing a new inland brood source population for future spawn collection is desired if additional fish can be imported. As the population has increased the WDNR has received anecdotal reports of muskellunge spawning in Green Bay and tributary rivers. The WDNR is planning to increase efforts to document if successful natural reproduction is occurring. Identifying spawning locations and quantifying associated habitat will allow for prediction of additional locations for habitat protection, enhancement, and selection of more effective stocking locations.

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LAKE TROUT
Patrick McKee

In the spring of 2007 Wisconsin conducted its annual lake-wide assessment on Lake Michigan which targets lake trout and burbot following the protocol and procedures outlined in the lake-wide assessment plan (Schneeberger et al. 1998). Graded mesh (2 ½" to 6" by ½") multifilament nylon gill nets were fished at nearshore area sites off Sturgeon Bay and Sheboygan, and in the Midlake Reef Complex (MLR) at the East Reef. Forty-eight hundred feet of graded mesh gill net were fished at each of the above sites.

Fisheries personnel from the Milwaukee (Great Lakes Water Institute) and Sturgeon Bay field stations collected and analyzed information on captured fish. The primary objective of this survey is to determine the relative abundance measured as catch-per-unit-effort (CPE) of targeted species such as lake trout. For 2007 CPE (number per 1000' of effort) was 3.96 lake trout at Clay Banks, 16.35/1000' at Sheboygan, and 13.33 at the East Reef (Figure1).

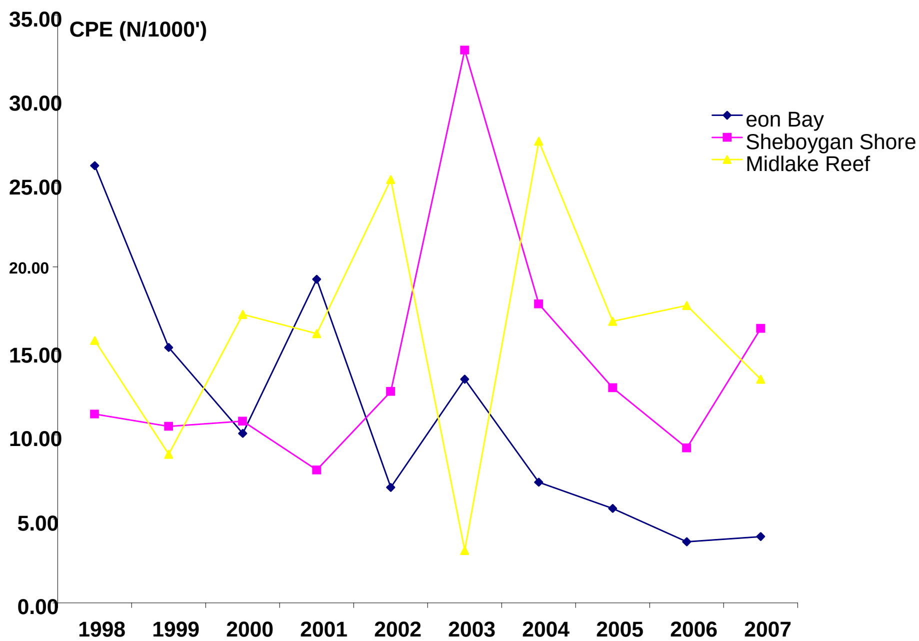

Figure 1. Total number of lake trout per 1000' of effort captured at Sturgeon Bay, Sheboygan Shore, and within the Midlake Reef Complex from 1998 to 2007.

Information was also collected to meet the secondary objectives of the assessment plan (LWAP) and included total fish length, weight, finclip. An external and internal physical examination (necropsy) was performed on all lake trout and burbot, and stomach samples were collected on a sub-sample of these species. Lamprey marks were noted and classified according to King (1980). Coded-wire-tags were extracted from lake trout bearing these tags. Age and strain determination from cwt marked lake trout, and diet analysis from stomachs collected are routinely analyzed from sampled fish and will be completed sometime after this report.

Lake trout stocks were also assessed in the fall within the MLR at the East Reef and in the Milwaukee nearshore area at the South Milwaukee Reef and the Green Can Reef. This assessment is part of the strain evaluation of MLR stocked lake trout (identified by a cwt), and also measures the size and age composition of the adult spawning population at both sites. All lake trout captured are examined for lamprey attack marks (King 1980).

Large graded mesh (4 ½" to 6" by ½") gill nets are fished in this assessment. Twenty-four hundred feet of gill net was fished on the East Reef on November 8 capturing 121 lake trout of which 110 had a cwt. Seventy-two hundred total feet of gill net was fished within the Milwaukee nearshore on 3 separate lift days ranging from October 24 to November 13. A total of 397 lake trout were captured of which 111 were cwt fish originating from MLR stockings.

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LAKE WHITEFISH

Scott Hansen

Commercial Harvest

Lake whitefish *Coregonus clupeaformis* harvest in Wisconsin's waters of Lake Michigan continued at high levels for the 2007 calendar year with 1,306,701 dressed weight pounds of fish harvested (Figure 1). The 2007 harvest is down slightly from 2006 and below the 20 year average of approximately 1.36 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 2006 – 07 commercial harvest was 1,298,133 pounds. This is the second lowest harvest on record since the last quota increase (Table 1).

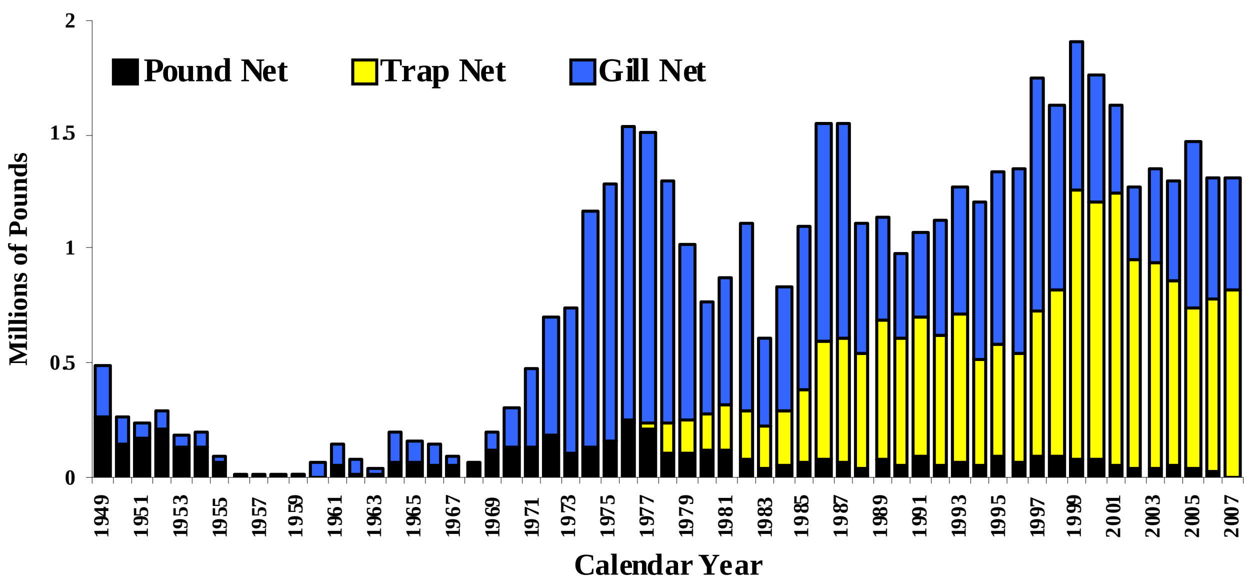

Figure 1. Lake whitefish commercial harvest reported by gear type in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay from 1949 through 2007.

Table 1. Lake whitefish harvest in Wisconsin since the last quota increased to 2.47 millions pounds, broken down by zone for the 2006-2007 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

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 2007, 63.1% of the total harvest came from trap nets, 36.9% from gill nets and no fish were harvested using pound nets (Figure 1). The percentage of trap net harvest in 2007 is the third highest since 1990.

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. Meanwhile, after a spike in 2005, gillnet effort continued to decline to slightly less than 7 million feet fished per year. Trap net whitefish catch improved in 2007 as catch per unit of effort (CPE) increased by nearly 50 pounds with decreased effort (Figure 3). This contrasts the results of 2006 where a greater effort yielded a lower CPE. Gillnet CPE increased by approximately 9 pounds per 1000 ft fished between 2006 and 2007. No pound nets were fished in 2007.

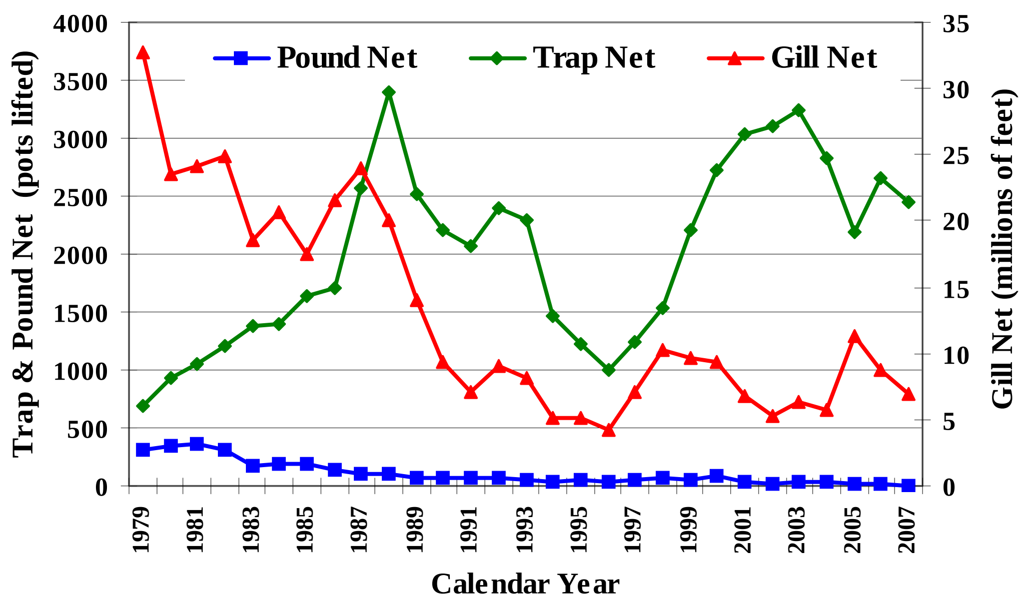

Figure 2. Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2007. Gill net effort is in millions of feet; trap and pound net effort is number of pots lifted.

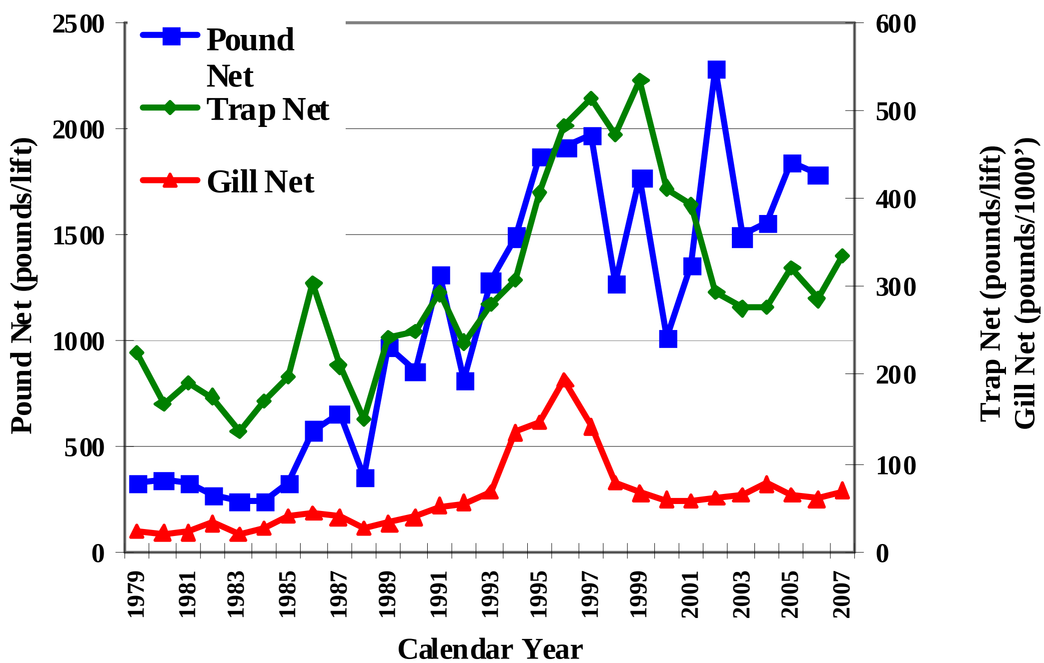

Figure 3. Trends in gill net, trap net, and pound net catch per unit of effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 – 2007. Gill net CPE is pounds of whitefish harvested per 1,000 feet lifted; trap and pound net CPE is pounds of whitefish harvested per pot lifted.

Growth

Mean length and weight at age of lake whitefish from the North-Moonlight Bay (NMB) stock have generally continued to decline (Figures 4 and 5). While still near historical lows, mean length and weight for spring sampled fish of ages three and four showed an increase since the last year of available data (2005). However, these parameters have continued to decline in age classes five through seven. As a result of these decreasing trends, the average age for fish recruiting to the commercial fishery (432 mm) has now fallen to age eight, increasing considerably from an average of age four in 1993. Obtaining a reasonable sample size for younger age classes has proven difficult in recent years during the spring months as referenced by the missing year class data in figures 4 and 5. Areas off Baileys Harbor where, historically, juvenile fish were found during the months of May and June have been devoid of fish. As a result, some 2007 spring sampling occurred in Green Bay where these younger year classes were subsequently 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.

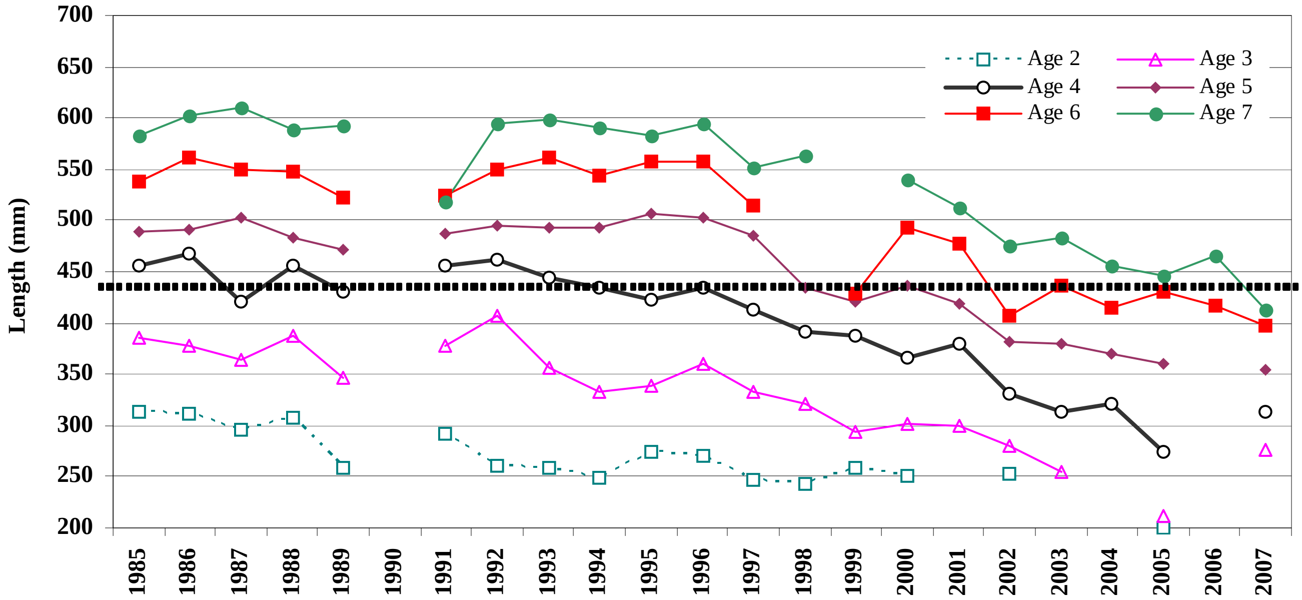

Figure 4. Mean length at age of spring sampled lake whitefish from 1985 thru 2007.

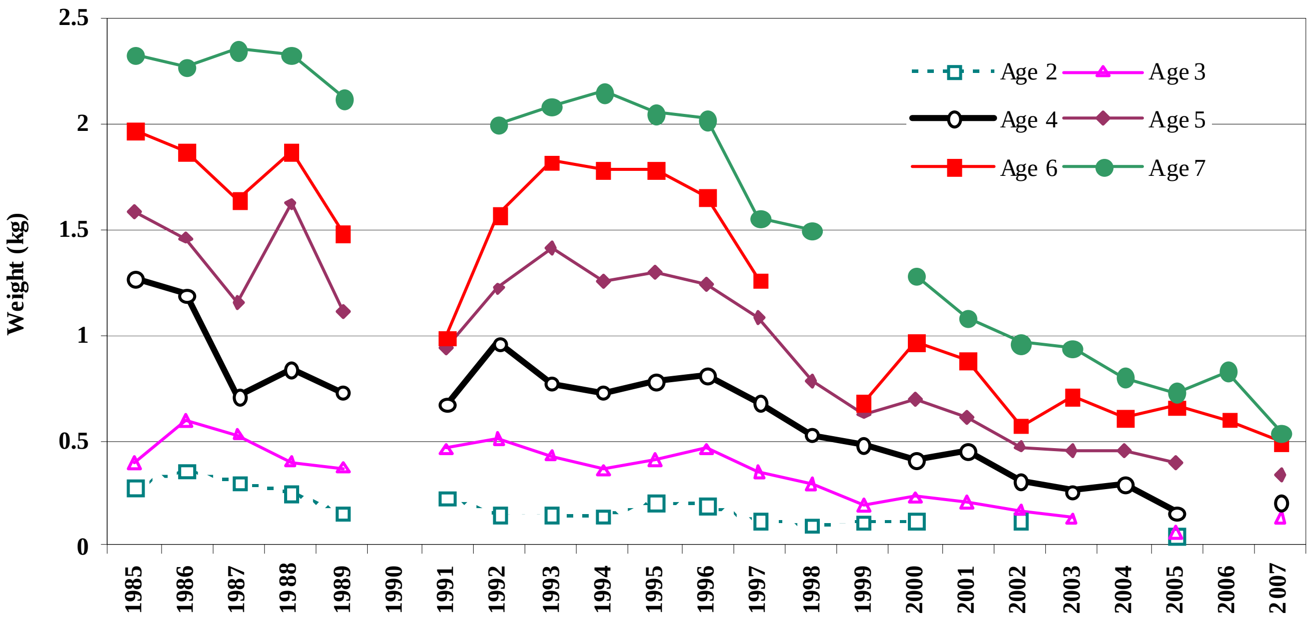

Figure 5. Mean weight at age of spring sampled lake whitefish from 1985 thru 2007.

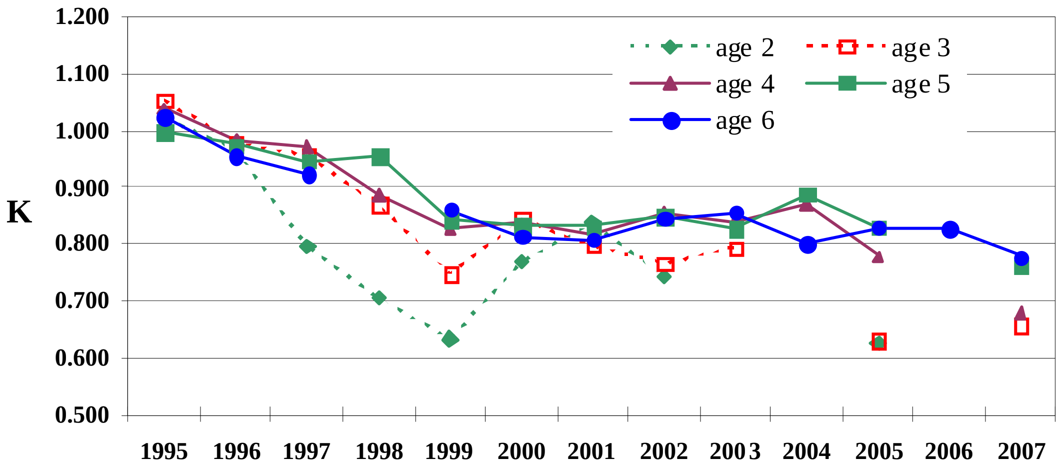

Figure 6. Annual condition indices (K) for select ages of lake whitefish captured in WI waters from 1995 thru 2007.

One method by which the condition or 'well being' of fish can be determined is through Fulton's index of body condition (K) calculated as (W/L^3) x 100,000 where *W*=fish weight and *L*=fish length. Fish with average condition coefficients of around 1.0 are generally considered in good condition. This information can best be used to describe the changes over time for specific age classes of whitefish. Since the mid-1990's, the average condition of lake whitefish has generally demonstrated a decreasing trend for age classes 2 thru 6 (Fig 3). However, the 5 and 6-year age classes have stabilized somewhat since 2000, albeit at a lower condition factor. Similar to the decrease in length and weight at age, age three K has decreased since 2005. Curiously, although length and weight at age of age four fish increased since 2005, condition actually decreased for this age class. As mentioned previously, changes in the sampling areas in 2007 may have compromised the consistency of monitoring the same stock over the long term due to potential stock mixing in Green Bay.

Stock Identification

During 2005 and 2006 WDNR cooperated with the University of Wisconsin-Stevens Point (UWSP) researching genetic identification of lake whitefish spawning aggregates in northern Lake Michigan and Green Bay (Sloss et al. 2007). This information can be used to facilitate management of genetically distinct stocks throughout these areas. Fin samples were collected from sexually mature fish sampled from commercial fishermen, WI and MI state natural resource agencies and northern Lake Michigan tribal organizations. Tissue samples were processed and genetically analyzed at the UWSP Molecular Conservation Genetics Laboratory. Twelve microsatellite DNA loci were isolated and indicated the presence of 5-7 potential genetic stocks. Six genetic stocks of lake whitefish were identified in Lake Michigan and include the following: North-Moonlight Bay stock (NMB) including the North-Moonlight Bay, Cedar River and Menominee River populations; the Big Bay de Noc stock which includes only the Big Bay de Noc population; the Northern stock which includes the Naubinway and Epoufette populations; the Northeast stock which includes the Traverse Bay and Hog Island populations; the Elk Rapids stock which includes only the Elk Rapids population; the

Southeastern stock which includes the Ludington, Muskegon, and Saugatuck populations (Figure 7). The Hog Island/Traverse Bay grouping was not a stable grouping due to an indication of gene flow between the Northern stock and Hog Island population. With the exception of the Menominee River population, all populations could be grouped geographically. It is grouped more closely with populations from the Northeast portion of Lake Michigan. The original Menominee River population was extirpated in the mid-1900s and the current colonization is believed to be developing from a founding population of individuals from other whitefish stocks.

To fully utilize this stock identification information, the next logical step would be to conduct a Mixed Stock Analysis to determine if or to what degree these spawning stocks mix throughout the lake outside the spawning season. This project has been formally proposed and approval for funding is pending.

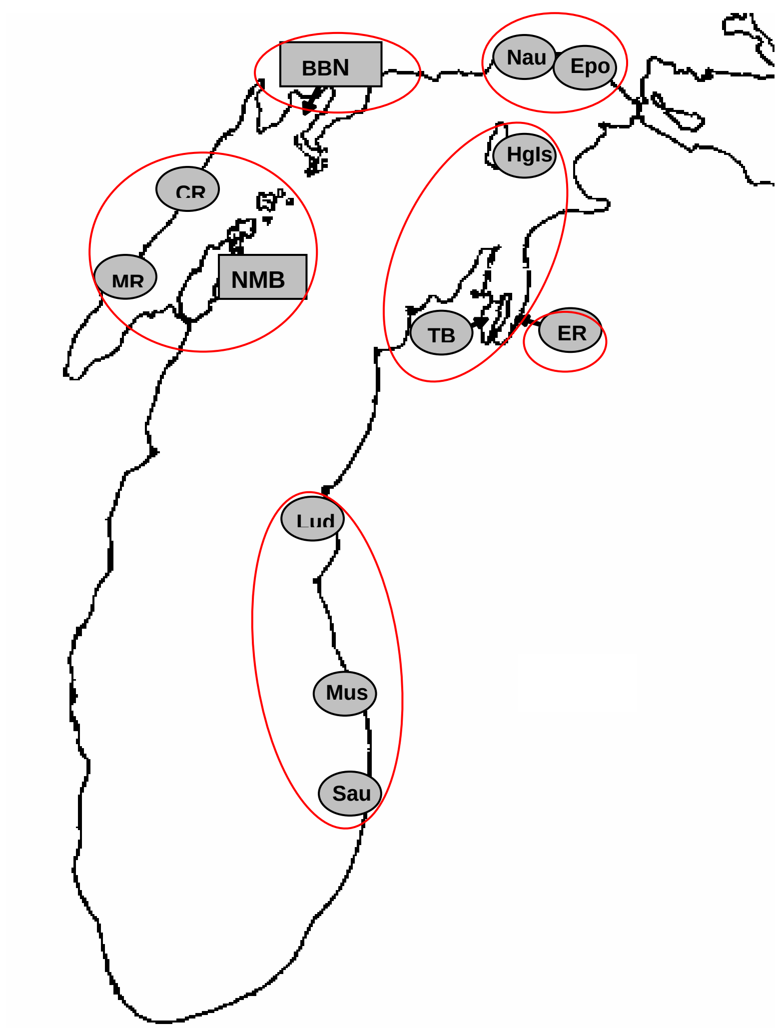

Figure 7. Lakic lake whitefish stocks (circled in red). Study sites included the lakeside of the Door County Peninsula (NMB), Big Bay de Noc (BBN), Lower Menominee River (MR), Cedar River (CR), Naubinway, (Nau), Epoufette (Epo), Hog Island (HgIs), Traverse Bay (TB), Elk Rapids (ER), Ludington (Lud), Muskegon (Mus) and Saugatuck (Sau). (Figure modified from Sloss et al. 2007)

Sloss, B.L., J.A. VanDeHey, T.M. Sutton, P.J. Peeters, and P.J. Schneeberger. 2007. Genetic stock structure of lake whitefish in northern Lake Michigan and Green Bay. Great Lakes Fishery Commission Project Completion Report.

MILWAUKEE AND MENOMONEE RIVER CREEL SURVEY

Cheryl Peterson and Pradeep Hirethota

Introduction

In an effort to rehabilitate the native walleye population in the Lower Milwaukee River and estuary, the Lake Michigan Work Unit (LMWU), Wisconsin Department of Natural Resources (WDNR) initiated an annual stocking program in 1995 (WDNR 1998 and 2005). Routine annual assessment data indicated that the stocked walleye were surviving, growing and attaining maturity. The growth rate of these walleye was greater than the state average. A substantial amount of interest was generated in the nearshore fishing community to fish for walleye in the Milwaukee harbor, Menomonee River, and the Lower Milwaukee River. In March 2006, LMWU initiated a creel survey targeting this area to collect data on fishing effort, catch and harvest rates, with a focus on walleye.

Methods

The survey area included the Lower Milwaukee River downstream from Kletzsch Park to the river mouth (10.12 river miles) and the Menomonee River downstream from 45th Street to the confluence of the Milwaukee River (4.48 river miles), including the Burnham and South Menomonee canals (Figure 1). The lower stretches of both rivers flow through highly urbanized and industrialized downtown sections of Milwaukee. For the purpose of data collection, the area was divided into three survey sites - *Milwaukee River Upstream* of the former North Avenue Dam, *Milwaukee River Downstream* of the former North Avenue Dam, and *Menomonee River*. The Milwaukee River Upstream site encompassed seven access points, while the Milwaukee River Downstream site consisted of two access points. The Menomonee River encompassed six access points. All access points were accessible from shore, and no boat ramps were included in this survey.

The survey procedure for this study was derived from the open-water creel survey design for the annual Lake Michigan creel survey (Peterson and Eggold 2007), which is conducted using a modified access-point design called the Wisconsin Hybrid. It differs from a true access-point design in that the creel clerk visits several access points per site. The fishing season for this open-water creel survey was from March 1 to June 17 and September 1 to November 30. Access points within a survey site were visited randomly, and surveys were conducted on every weekend day and holiday and on two randomly chosen days during the week. Each workday was comprised of two shifts, an AM and a PM shift. The clerk worked one shift per workday. The shifts were equal in duration, did not overlap and were sampled with equal probability. Three types of data were collected for each site sampled: counts of anglers for effort, interviews of anglers or parties for harvest rates and biological data on harvested fish.

Instantaneous angler counts were made by the creel clerk at all access points in the survey site. The count per site and the time the count was completed were recorded. Fishing effort estimates (expressed in angler hours) were derived from instantaneous counts of anglers. Counts were made at randomly computed times at each site during each visit. Angler effort and its variance were estimated within each stratum (survey site, month and day type). The variance of angler effort includes variability among days and variability within days. Formulas for two-stage surveys were used to calculate variance. For a complete description see Eggold (1995).

Angler parties were interviewed at the completion of their fishing trips. Anglers were asked if they were state residents, what time they started their fishing trip, what they fished for and the number of caught and harvested fish. Biological information was taken on harvested fish, including species, length, weight, fin clip, and tag information.

Harvest estimates were derived from interviews of anglers at all sites. The number of fish harvested and the hours fished from each interview were summed over all interviews in a stratum. The ratio of the two sums and the variance of the ratio were then calculated. The ratio was expanded by effort and summed across day types to estimate harvest. The harvest rate was obtained by dividing harvest by effort (see Eggold 1995).

Results and Discussion

Angling effort

The Milwaukee County park system extends along both banks of the Milwaukee River in the Upstream site, providing ample fishing access. In the Upstream site, from March 1st to June 17th, anglers fished a total of 7,179 hours. From September 1st to November 30th, anglers fished a total of 13,425 hours. The higher effort in the fall is likely due to the influx of spawning run salmonids.

In the Milwaukee River Downstream site, from March 1st to June 17th, anglers fished a total of 6,125 hours. From September 1st to November 30th, anglers fished a total of 5,544 hours. This section of the river generally receives less fishing pressure as most of it runs through the downtown Milwaukee area.

In the Menomonee River site, from March 1st to June 17th, anglers fished a total of 4,786 hours. From September 1st to November 30th, anglers fished a total of 3,831 hours. The clerk noted that the demography of anglers and the composition of fish in this area are quite different from the Milwaukee River sites.

In the Milwaukee River Upstream site, the greatest angling effort was directed toward salmonids followed by smallmouth bass and walleye (Table 1). Rainbow and brown trout were the most targeted species in the Milwaukee River Downstream location (Table 2). A considerable amount of effort was directed at yellow perch, and less effort at Chinook and coho salmon. Directed walleye effort in the Downstream site was similar to the Upstream site. In contrast, Menomonee River anglers spent more time fishing for walleye than any other species (Table 3).

Catch composition

Annual WDNR assessments show that a variety of fish species exists in the study area (Hirethota et al. 2005). Resident species primarily targeted by anglers included smallmouth bass, yellow perch, walleye and northern pike. However, upstream migrations of salmonids in the spring and fall drive sport angling in the area.

The Milwaukee River Upstream site represents the most riverine habitat and supports a wide range of fish species. In the Milwaukee River Upstream location, Chinook salmon dominated the catch contributing about 60% of the total catch. A strong fall spawning run of Chinook salmon contributes to the higher catch. Smallmouth bass was the second most commonly caught species making up about 20%, followed by rainbow trout (13%) and walleye (3%). While all of the Chinook salmon were caught in the fall, the rainbow trout were caught throughout the year with greater numbers appearing in the spring. Smallmouth bass were caught in each month of the survey except November, whereas walleye were caught in each of the survey months. As an interesting observation, lake trout were caught in the Upstream section in the fall, which is uncommon for this lake dwelling species.

In the Milwaukee River Downstream site, yellow perch were the most commonly caught species (53%) followed by brown trout (24%). This survey area encompasses two very different habitat types. The Erie Street/River mouth access point is dredged and channelized for navigation, representing harbor-like habitat. The majority of yellow perch and brown trout were caught at this access point. Portions of the upriver area, especially along the Caesar's Park access point, are not channelized and represent semi-riverine conditions. Rainbow trout accounted for 9% of the catch followed by smallmouth bass (7%) and Chinook salmon (4%). Walleye comprised only 2% of the overall catch, all of which were caught in September-October. Walleye tend to exhibit a seasonal movement pattern wherein they move to the Downstream location from the harbor in the fall (Hirethota and Burzynski 2007). Furthermore, during the spring walleye move upstream for spawning and would be less likely to be caught in this area.

In the Menomonee River site, Chinook salmon were the dominant species caught (32%) followed by rainbow trout at 25%, walleye at 16% and white perch at 13%. Smallmouth bass comprised only 7%. Brown trout, yellow perch, northern pike and coho salmon comprised 6% combined. The 45th Street access point is sparsely used by anglers, while the Miller Park access point receives greater fishing pressure. The river at Miller Park is riverine and relatively shallow. Whereas, the downstream portion of the Menomonee River and the canals are generally deeper and channelized, more like the harbor environment. The water temperature in this area is also impacted by the warm water discharge from a local power plant. It appears that walleye move to this area during the winter because of the warm water, which is evident from the increased walleye catch in Spring and Fall. Chinook salmon and rainbow trout are primarily caught in the Miller Park area. The public access provided by the Milwaukee Metropolitan Sewerage District (MMSD) office is popular with anglers where most of the white perch are caught.

Walleye catch and harvest rates

Data on walleye directed angling effort, catch, harvest, catch rate and harvest rate are summarized in Table 4. The annual catch rate of walleye was the highest in the Menomonee River (0.0326 fish per hour) followed by the Milwaukee River Upstream (0.0158 fish per hour) and Downstream (0.0051 fish per hour) sites. In the Milwaukee River Upstream site, the highest catch rate occurred in Spring, which coincides with the walleye spawning migration upriver. The walleye catch rate in the Menomonee River was the highest in November.

During this survey an estimated 326 walleye were caught in the Milwaukee River Upstream site, 60 in the Milwaukee River Downstream site, and 281 in the Menomonee River, for a total of 667 walleye in the survey area (Table 4). The annual walleye population assessment conducted by WDNR in 2006 estimated 7,066 walleye (juvenile and adult combined) in the study area (unpublished data, WDNR).

The greatest percentage of walleye harvest occurred in the Milwaukee River Downstream site, where 60% of the total catch was harvested (36 of 60 fish, Table 4). Conversely, only 5% of the catch (15 of 326 fish) was harvested from the Milwaukee River Upstream and 14% (39 of 281 fish) from the Menomonee River. Overall, walleye harvest rates were low at all sites throughout the year, indicating primarily a catch and release fishery. The angler caught walleye ranged from 10 to 22 inches and 1 to 3 pounds, with an average length of 16.08 inches and 1.56 pounds.

Survey limitations

Although we attempted to follow the standard Lake Michigan creel survey protocol for this study, we were limited by several obstacles due to the special nature of the survey area. However, our main objective of gathering additional species specific data, especially for walleye, was accomplished. The following is a list of these limitations that should be considered before another creel survey is conducted:

- The safety of the creel clerk became an issue as the season progressed due to the nature of the urban environment. Hence, in the fall the shift times ended earlier in the evening, which may have limited data collection.
- Limited funding also restricted the survey in that shift times were shorter in duration than the standard Lake Michigan creel survey. Also, the winter months were not included in the survey.
- Although there is a boat launch on the Milwaukee River, this survey was completed solely from shore fishing access points throughout the area and did not incorporate data from boat anglers.
- The angler community in the survey area consists of multiple ethnic backgrounds. Often a language barrier limited data collection.

Management implications

Results from this survey showed that in 2006 the overall angler harvest of walleye in the survey area was minimal in relation to the estimated population size. However, the harvest of undersized walleye has been an issue for local conservation wardens (personal communication, Supervisor, Milwaukee/Waukesha warden team, WDNR). An increased law enforcement presence as well as public education may help in implementing fishing regulations more effectively. The current regulations for walleye in the lower Milwaukee River system are a minimum length of 15 inches and a daily bag limit of 5 fish, and the season is open all year. There is no hook and line fishing allowed at night from September 15th to the first Saturday of the following May, which may have an impact on overall walleye catch and harvest.

A dam just downstream from the North Avenue bridge was breached in 1990, facilitating fish movement. However, the Estabrook Park dam, which is further upriver, remains an impediment to fish migration. This not only limits fishing opportunities upstream of the dam but also prevents walleye from reaching potential spawning habitat upriver. Either removal of this upstream impediment or designing a proper fish passage system should be explored.

In general, walleye recruitment, angler catch and harvest, and population estimates are highly variable. Therefore, a follow up creel survey, with modifications based on this report, should be conducted to evaluate angler impacts on the walleye population in the Milwaukee River estuary. Recently WDNR has constructed a reef on the Milwaukee River to enhance walleye spawning habitat (WDNR 2006). This reef, augmented by improved water quality, may facilitate restoration efforts. WDNR continues to monitor the walleye population and assess natural reproduction

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Table 1. Annual directed angling effort, catch, and harvest by species for **Milwaukee River Upstream** in 2006.					
Species	Total effort (hrs)	Total catch [SD]	Catch rate (fish/hr)	Total harvest [SD]	Harvest rate (fish/hr)
Coho salmon	3016	18 [18]	0.0009	18 [18]	0.0009
Chinook salmon	11218	6469 [1294]	0.3140	1492 [358]	0.0724
Rainbow trout	8463	1363 [682]	0.0662	173 [128]	0.0084
Brown trout	4058	51 [31]	0.0025	24 [24]	0.0012
Brook trout	0	0	0	0	0
Lake trout	647	147 [90]	0.0071	29 [29]	0.0014
Northern pike	590	128 [56]	0.0062	0	0
White perch	0	0	0	0	0
Smallmouth bass	3245	2191 [460]	0.1063	51 [36]	0.0025
Yellow perch	161	55 [55]	0.0027	18 [18]	0.0009
Walleye	1687	326 [127]	0.0158	15 [16]	0.0007

Note: Catch, catch rate, harvest and harvest rate are calculated based on overall angling hours. SD = standard deviation

Table 2. Annual directed angling effort, catch, and harvest by species for **Milwaukee River Downstream** in 2006.					
Species	Total effort (hrs)	Total catch [SD]	Catch rate (fish/hr)	Total harvest [SD]	Harvest rate (fish/hr)
Coho salmon	931	0	0	0	0
Chinook salmon	1982	115 [45]	0.0099	74 [32]	0.0063
Rainbow trout	7142	238 [93]	0.0204	201 [82]	0.0172
Brown trout	7801	645 [174]	0.0553	521 [141]	0.0446
Brook trout	0	6 [6]	0.0005	0	0
Lake trout	25	0	0	0	0
Northern pike	178	23 [18]	0.0020	8 [8]	0.0007
White perch	0	0	0	0	0
Smallmouth bass	963	187 [105]	0.0160	0	0
Yellow perch	2979	1433 [287]	0.1228	533 [112]	0.0457
Walleye	1713	60 [31]	0.0051	36 [18]	0.0031

Note: Catch, catch rate, harvest and harvest rate are calculated based on overall angling hours. SD = standard deviation

Table 3. Annual directed angling effort, catch, and harvest by species for **Menomonee River** in 2006.					
Species	Total effort (hrs)	Total catch [SD]	Catch rate (fish/hr)	Total harvest [SD]	Harvest rate (fish/hr)
Coho salmon	372	15 [16]	0.0017	0	0
Chinook salmon	971	543 [179]	0.0630	114 [56]	0.0132
Rainbow trout	2275	429 [163]	0.0498	45 [23]	0.0052
Brown trout	963	56 [25]	0.0065	35 [21]	0.0041
Brook trout	0	0	0	0	0
Lake trout	75	0	0	0	0
Northern pike	375	23 [13]	0.0027	5 [5]	0.0006
White perch	70	226 [84]	0.0262	62 [31]	0.0072
Smallmouth bass	504	125 [43]	0.0145	0	0
Yellow perch	357	22 [16]	0.0026	22 [16]	0.0026
Walleye	3287	281 [79]	0.0326	39 [20]	0.0045

Note: Catch, catch rate, harvest and harvest rate are calculated based on overall angling hours. SD = standard deviation

Table 4. Directed angling effort for walleye in Milwaukee River Upstream, Milwaukee River Downstream and Menomonee River in 2006.							
Survey area		Mar/Apr	May	Jun	Sept/Oct	Nov	Annual
Mil. R. Upstream	Effort (hrs)	358	476	146	444	263	1687
	Catch	81	83	15	138	9	326
	Catch rate	0.0232	0.0437	0.0084	0.0115	0.0062	0.0158
	Harvest	0	0	15	0	0	15
	Harvest rate	0	0	0.0084	0	0	0.0007
Mil. R. Downstream	Effort (hrs)	201	87	71	1223	131	1713
	Catch	0	0	0	60	0	60
	Catch rate	0	0	0	0.0163	0	0.0051
	Harvest	0	0	0	36	0	36
	Harvest rate	0	0	0	0.0098	0	0.0031
Menomonee R.	Effort (hrs)	937	556	10	1379	405	3287
	Catch	107	30	0	104	40	281
	Catch rate	0.0356	0.0283	0	0.0331	0.0582	0.0326
	Harvest	0	0	0	26	13	39
	Harvest rate	0	0	0	0.0083	0.0189	0.0045
Total for the survey	Effort (hrs)	1496	1119	227	3046	799	6687
	Catch	188	113	15	302	49	667
	Catch rate	0.0164	0.0304	0.0052	0.0161	0.0123	0.0163
	Harvest	0	0	15	62	13	90
	Harvest rate	0	0	0.0052	0.0033	0.0033	0.0022

Note: Catch, catch rate, harvest and harvest rate are calculated based on overall angling hours.

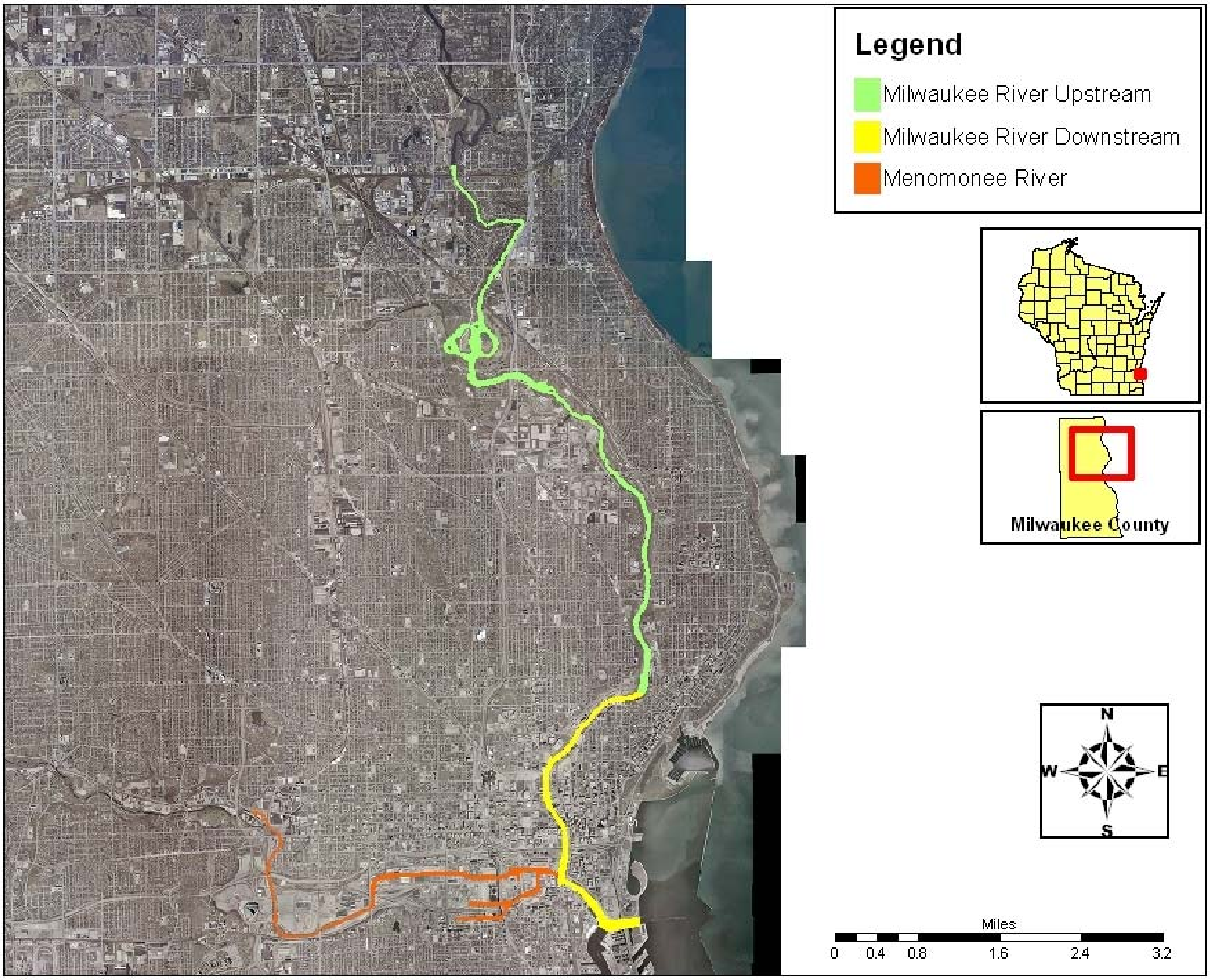


Figure 1. Overview of creel survey area, Milwaukee County, Wisconsin.

FISH HEALTH HIGHLIGHTS

Sue Marcquenski

2007 was a busy year. Viral hemorrhagic septicemia virus was isolated from four locations in Wisconsin: 1) freshwater drum undergoing a fish kill from late April through mid May in Little Lake Butte des Morts and Lake Winnebago. These waters are connected to each other and to the Fox River, a tributary to the bay of Green Bay. The fish had pop-eye and eye and slight skin hemorrhages, enlarged spleens and hemorrhages in the liver. 2) smallmouth bass sampled May 8 in Sturgeon Bay (northern Green Bay) as part of our VHS surveillance program. Forty-four SMB were sampled (8, 5-fish pools and one 4-fish pool) and CPE was detected during the blind pass, indicating at least 2 pools contained tissues from infected fish. The kidney and spleen were enlarged and some fish had pop-eye with eye hemorrhages 3) a brown trout found dead on the beach near Algoma on May 14 (Lake Michigan proper). The fish had white gills, liver hemorrhages and an enlarged spleen. 4) lake whitefish submitted by concerned commercial fishermen on May 22 who were fishing in northern Green Bay. These fish had pop-eye and eye and skin hemorrhages, hemorrhages on the liver, mesenteric fat, swim bladder, kidney, body cavity and muscle. The lake whitefish had the greatest number and severity of clinical signs of VHS compared to the other fish infected with VHS in Wisconsin.

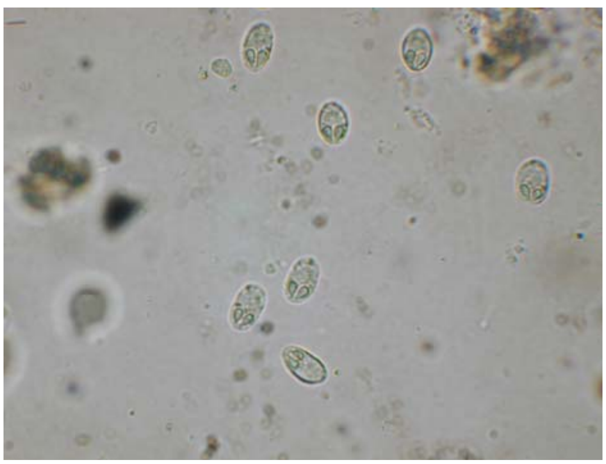
In January 2007, Michigan DNR detected VHSv in walleye and lake whitefish from northern Lake Huron and we know the fish freely move from Lake Huron to Lake Michigan. It was not unexpected that our first VHS “hits” were in the northern part of Lake Michigan. Although we will never know for sure how the drum in Lake Winnebago became exposed to VHSv, we do know there are many anglers who fish/boat in the Lake Winnebago system and also drive to Lake Erie each spring to fish for walleye. VHS caused tremendous drum fish kills and was also detected from many other species in May 2006 in Lake Erie. It is possible that boat related actions introduced the virus to Lake Winnebago (water in the boats/livewells, brought back with live bait or live fish, etc.).

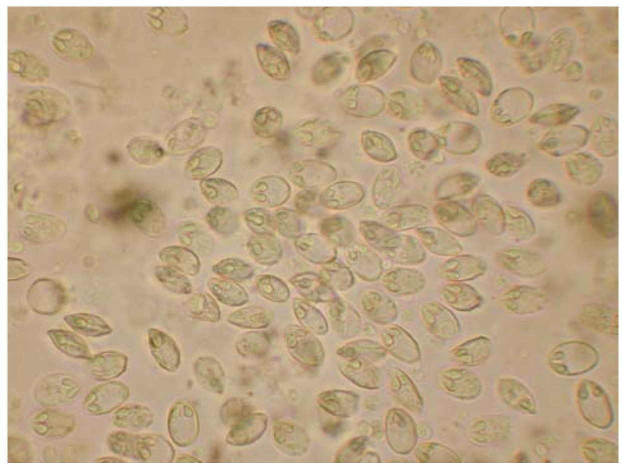
We sampled many walleyes from Lake Winnebago and connected waters with skin lesions similar to photos of the walleye from Coneseus Lake in New York that died from VHS in August 2006, but did not isolate any virus. This points out the need for two additional diagnostic tools for VHSv: a method to detect antibodies and an *in situ* hybridization method to identify virus in histopathology sections. Similarly, we sampled freshwater drum from the Wisconsin River that had exactly the same clinical signs of disease as the drum from Lake Winnebago, but we did not detect any virus. By the time (late May, early June) the fish mentioned above were sampled, water temperatures may have been outside the range for virus replication. We currently rely on culturing the virus as the sole diagnostic tool to detect VHS virus.

With the tremendous help and cooperation from the La Crosse Fish Health Center and the Wisconsin Veterinary Diagnostic Lab, we sampled many populations and individual fish for VHS, including ovarian fluids from walleye, musky, northern pike, lake sturgeon and white suckers, and fathead minnows purchased to feed muskies and walleyes at our hatcheries. The labs detected fathead minnow nidovirus from white sucker ovarian fluids from one lake and golden shiner virus from several lots of fathead minnows and the muskies that fed on them. PCR is used to confirm these viral infections and both labs have the protocols.

VHS surveillance was also undertaken in Lake Superior in 2007 with the help of the MN DNR and the La Crosse Fish Health Center. Emerald shiners, round gobies, yellow perch, walleye, lake whitefish, and lake trout were sampled from Duluth/Superior, Chequamegon Bay and the Apostle Islands. VHS virus was not detected in any fish.

However, during annual assessments of emerald shiner populations in August near Superior, our biologist Dennis Pratt observed emerald shiners with distended abdomens and skin hemorrhages. At necropsy, opaque, white "fat-like" material was examined under magnification (400X total) and we observed what may be a new myxosporidan parasite that infects the gonads, mesenteries and possibly the surface of the other organs. Here are a couple of photos:





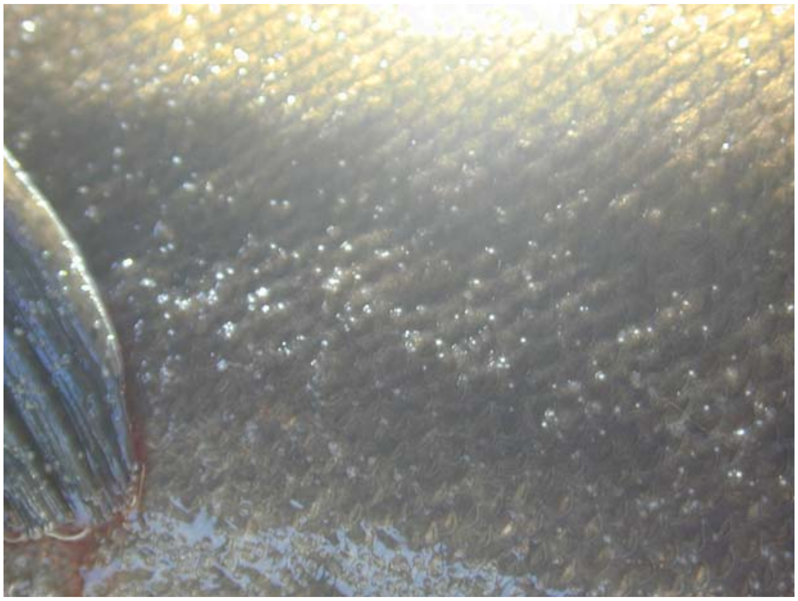
This is the same group of parasites that causes whirling disease. Dennis had not observed fish with these signs until 2007 and he found the highest prevalence of fish with clinical signs in sites closer to Superior, compared to sites farther east along the shore. In 2007, water levels in Lake Superior were very low. This parasite may be new to Lake Superior, or in 2007, fish may have been forced into new locations due to low water conditions, and were exposed to the parasites they may naturally occur. Dr. Jerri Bartholomew at Oregon State University is a world expert on this group of parasites and has offered assistance to help us identify the parasite, which will tell us whether or not it is an exotic species.

The rest of our VHSv surveillance has been summarized and reported to Gary Whelan and the Great Lakes Fish Health Committee.

Because WDNR obtained walleye and northern pike eggs from Lake Puckaway (a lake connected via the Fox River 60 miles upstream from Lake Winnebago), our Dept of Agriculture Trade and Consumer Protection (DATCP) decided there was a possibility that the broodfish might have been exposed to VHSv and issued a quarantine order for three of our hatcheries that reared eggs from these fish. Coho were also reared at one of these hatcheries, and due to the quarantine, we could not make our usual transfers of Coho to other rearing facilities. This created crowded, stressful conditions and BKD developed in the fish in late July. To address this, about 100,000 Coho were euthanized and the remainder treated with Aquamycin. So, for the 2007 year class of Coho, we will stock about 75% of our usual quota of 498,000 fish. VHS was not detected at any of the quarantined hatcheries.

WDNR and DATCP developed emergency rules related to VHS in 2007. DNR rules address the risks of dispersal of the virus in bait, in live fish caught in Wisconsin, and in water transported between waters of the state by boaters (see http://dnr.wi.gov/fish/vhs/ for more information). We now issue bait harvest permits as a way to keep track of where bait is being harvested. WDNR and DATCP are developing fish health standards for wild harvested baitfish. Under DATCP's new rules, for hatcheries, fish that are on the APHIS list of VHS susceptible species must be tested for VHSv before they are stocked in state waters if wild fish or eggs of any species were brought into the hatchery within the previous 12 months.

In Fall 2007, we tested Chinook, Coho, Lake trout and Seeforellen BNT broodfish weekly throughout the spawning period- up to 60 fish were lethally sampled and ovarian fluids collected from up to 150 fish each week. No VHS was detected. However, we had a very high prevalence of Aeromonas salmonicida averaging 40% in the Coho from both the Root River and Besadny weirs; we also had high prevalences of R.s.- 50% at Besadny and 17% at the Root River. The fish did not have clinical signs of BKD, however they had severe Ich infections on the skin. This is a first occurrence at our weirs. The infection persisted throughout the Coho spawning run and affected the Seeforellen BNT as well, even into December (though intensity declined). The Ich infection stressed the fish osmotically as well as providing an entry point for bacteria – thus the high prevalences of A.s. and R.s. The white spots on the photo are all Ich parasites. The extremely warm Fall water temps may have been responsible for the infection.



I observed a new type of cyst on the internal organs of Chinook, Coho and bloater chubs that are similar to the vesicles Mohamed Faisal saw on the swim bladder of spotted muskies from Lake St Clair in 2005 or 2006. Here are photos from the bloaters- vesicles/fluid filled cysts attached to intestine and on surface of the swim bladder:

This one is from a Chinook- the vesicles are on the surface of the swim bladder:

None of these fish tested positive for VHS and we are not sure what other organisms produce this type of cyst or vesicle, but will keep working on this as time allows.

With changing forage and water conditions in Lake Michigan and Lake Superior, fish may become unduly stressed in 2008, leading to new or recurring fish health problems. Please communicate early and often with your local fish health specialist to document the cause of the problem.

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