Lake Michigan Committee
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Lake Michigan Management Reports

Lake Michigan Fisheries Team
Wisconsin Department of Natural Resources

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INTRODUCTION

These reports summarize some of the major studies and stock assessment activities by the Wisconsin Department of Natural Resources on Lake Michigan during 2000. They provide specific information about the major sport and commercial fisheries, and describe trends in some of the major fish populations. The management of Lake Michigan fisheries is conducted in partnership with other state, federal, and tribal agencies, and in consultation with sport and commercial fishers. Major issues of shared concern are resolved through the Lake Michigan Committee, made up of representatives of Michigan, Indiana, Illinois, Wisconsin, and the Chippewa Ottawa Resource Authority. These reports are presented to the Lake Michigan Committee as part of Wisconsin's contribution to that shared management effort.

For further information regarding any individual report, contact the author at the address, phone number, or e-mail address shown at the end of the report, or contact the Department's Great Lakes Fisheries Specialist, Bill Horns, at 608-266-8782 or **hornsw@dnr.state.wi.us**.

SPORT FISHING EFFORT AND HARVEST

Overall fishing effort during the open-water season by various angler groups is shown in Table 1. Effort decreased to 2,282,763 hours during 2000, down 23% from the five-year mean of 2,962,234. The largest changes were in the moored-boat fishery (down 52% from the five-year mean), the stream fishery (down 22%) and the launched-boat fishery (down 20%). Low water levels were responsible for much of the decline in moored-boat effort. Prior to 2000, total fishing effort had remained relatively stable since 1996, following a sharp decline of nearly 1.7 million hours between 1988 and 1993.

The salmonid harvest in Wisconsin was also down, but better than might be expected, given the strong decline in effort. Trout and salmon harvest was 370,137 during 2000, down 1.6% from 376,059 fish during 1999, and 14% below the five-year average (Table 3). Rainbow trout and lake trout declined for the second year in a row. Rainbow trout harvest was 25% below the five-year average (Table 3) while the lake trout harvest was a record-low of 31,360, 45% below the five-year average (Table 3). Harvest of brown trout and coho salmon were 5% and 4% above the average, respectively.

The estimated open-water harvest of yellow perch was 291,675 fish, an increase of 22,670 over 1999. Northern pike harvest was estimated at 4,053, while smallmouth bass and walleye were 18,195 and 11,319, respectively.

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2000.

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2000	1,178,964	247,862	239,016	139,644	169,673	307,604	2,282,763
% change	- 20%	- 52%	+ 9%	- 12%	- 17%	- 22%	- 23%

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2000.

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
Coho salmon	42,644	15,307	27,173	351	1,046	1,682	88,203
Chinook salmon	60,372	23,796	32,743	816	7,404	11,855	136,986
Rainbow trout	33,301	19,053	15,788	366	286	3,484	72,278
Brown trout	23,299	3,440	3,973	2,762	5,198	2,439	41,111
Brook trout	57	0	94	22	26	0	199
Lake trout	12,094	7,276	11,894	85	11	0	31,360
Northern pike	3,120	-	-	158	62	713	4,053
Smallmouth bass	6,619	9,724	-	1,130	262	460	18,195
Yellow perch	213,792	54,881	-	10,785	7,735	4,482	291,675
Walleye	8,172	374	-	163	0	2,610	11,319
TOTAL	403,470	133,851	91,665	16,638	22,030	27,725	695,379

Table 3. Total number of fish harvested by year by species across all angler groups in Wisconsin waters of Lake Michigan, 1986-1999.

Species	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Brook Trout	4,587	1,369	5,148	2,192	5,927	1,659	4,431	1,967	7,481	1,914	419	299	159	574	199	38,325
Brown Trout	68,806	82,397	59,397	55,036	45,092	59,164	51,554	64,546	52,397	49,654	38,093	43,224	27,371	37,187	41,111	775,029
Rainbow Trout	26,483	56,055	60,860	87,987	51,711	67,877	79,525	104,769	114,776	117,508	77,099	94,470	110,888	84,248	72,278	1,206,534
Chinook Salmon	356,900	396,478	176,294	189,251	111,345	139,080	103,564	87,365	99,755	162,888	183,254	130,152	136,653	157,934	136,986	2,567,899
Coho Salmon	127,919	111,886	136,695	105,224	64,083	44,195	70,876	74,304	110,001	65,647	104,715	138,423	59,203	56,297	88,203	1,357,671
Lake Trout	96,858	113,930	89,227	94,614	75,177	85,841	52,853	61,123	53,989	69,332	36,849	57,954	82,247	39,819	31,360	1,041,173
TOTAL	681,553	762,115	527,621	534,304	353,335	397,816	362,803	394,074	438,399	466,943	440,429	464,522	416,521	376,059	370,137	6,986,631

Table 4. Total number of salmonids harvested by year by angler group in Wisconsin waters of Lake Michigan, 1986-2000.

Fisheries Type	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Ramp	255,559	266,036	222,428	173,224	118,439	150,840	111,260	145,689	167,388	193,752	176,085	190,976	155,953	141,903	171,767	2,641,299
Moored	186,611	225,586	98,908	184,011	97,206	103,633	111,441	110,507	134,315	128,743	125,017	129,332	141,538	100,078	68,872	1,945,798
Charter	124,282	150,249	133,861	125,969	85,773	88,490	71,113	81,490	81,909	84,898	86,346	94,556	84,867	73,622	91,665	1,459,090
Pier	47,643	44,280	26,527	7,548	6,946	8,701	10,867	9,144	15,130	14,621	6,218	5,002	4,200	4,614	4,402	215,843
Shore	27,947	30,043	22,945	13,268	14,538	16,830	16,602	13,645	16,370	17,676	19,676	16,726	8,997	12,685	13,971	261,919
Stream	39,511	45,921	22,952	30,284	30,433	29,322	41,520	33,599	23,287	27,253	27,087	27,930	20,966	43,157	19,460	462,682
TOTAL	681553	762115	527621	534304	353335	397816	362803	394074	438399	466943	440429	464522	416521	376059	370137	6986631

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WISCONSIN'S 2000 WEIR HARVEST

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 primary egg collection station for three strains of steelhead *O. mykiss*, coho salmon *O. kisutch*, and brown trout *Salmo trutta*. 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 primary egg collection station for the three strains of steelhead, and serves as a backup for coho and chinook salmon egg collection.

Strawberry Creek is a rather small creek with no public land above the SCW. As a result all fish returning to SCW are harvested. Surplus eggs are sold under contract to a bait dealer and salmon carcasses are removed. The Kewaunee River is a rather large tributary to Lake Michigan and there is a considerable amount of public frontage below and above the BAFF. As a result salmonids captured at BAFF but not needed for hatchery egg production are released for the sport stream fishery. A large sport stream fishery has developed on the Root River, and salmonids captured at the RRSF but not needed for hatchery egg production are also released.

Salmonid egg harvest quotas vary from one year to the next based on projections to satisfy WDNR hatchery needs and accommodate egg requests from other agencies. In 2000 the projected salmonid egg quotas were: 3.7 million chinook salmon eggs, 2.0 million coho salmon eggs, 1.5 million steelhead eggs, and 0.8 million Seeforellen brown trout eggs.

During the fall of 2000, 6,649 chinook salmon weighing an estimated 75,400 pounds were processed at SCW (Table 1). This was up dramatically from 1,934 in 1999 (only 998 salmon were harvested live from SCW in 1999 and most of these were age 1+). The lower return of chinook salmon to SCW in 1999 was no doubt influenced by low Lake Michigan conditions and very low, flow rates in Strawberry Creek. As a result of the inhospitable conditions, many of the larger age 2+ and 3+ chinook were either unable to enter Strawberry Creek, or were stranded and died attempting to negotiate Strawberry Creek. The smaller age 1+ precocious males even had a difficult time negotiating Strawberry Creek and entering the SCW. Strawberry Creek flow and water levels were even lower in 2000 than they were in 1999. However, the WDNR installed a 3500 foot pipeline and pump capable of pumping approximately 1500 gallons of water per minute to deliver water above the SCW and create an artificial flow. As a result SCW was able to operate despite the low water conditions and the entire chinook salmon egg quota was collected at SCW in 2000. Over the last 19 years the average number of chinook salmon processed at SCW has been 4,194.

Table 1. Yearly summary of chinook salmon returns at Strawberry Creek, 1981-2000.					
Harvest Year	Total number of Live and Dead fish	Number of adipose clipped fish	Total Weight (pounds)	Hatchery Egg Production[1]	
				Number	Pounds
1981	4,314	-	74,209	9,786,000	9,786
1982	3,963	-	60,206	7,728,000	7,728
1983	3,852	48	66,091	6,954,000	6,954
1984	5,208	64	76,905	7,652,000	7,652
1985	5,601	582	90,860	7,085,000	7,058
1986	4,392	322	53,700	5,052,000	5,052
1987	7,624	701	99,100	4,929,000	4,929
1988	3,477	408	43,645	3,997,000	3,997
1989	1,845	301	20,849[2]	1,350,000	1,350
1990	3,016	501	47,091[2]	2,378,000	2,378
1991	3,009	377	43,630[2]	1,649,000	1,649
1992	4,099	382	51,878[2]	1,677,100	1,677
1993	4,377	582	66,094[2]	2,156,666	2,156
1994	4,051	733	63,195[2]	3,426,026	3,426
1995	2,381	408	30,001[2]	2,221,446	2,221
1996	6,653	1,185	97,134[2]	4,720,000	4,720
1997	4,850	969	78,085[2]	4,060,944	4,606
1998	5,035	1,092	61,427[2]	3,489,144	3,489
1999[3]	1,934	535	21,081[2]	633,000	633
2000[4]	6,649	2,201	75,400[2]	3,672,771	3,673

1 Chinook salmon eggs harvested for hatchery production (does not include eggs sold for bait).
2 Annual average weight per fish used to estimate total weight (2000 average weight was 11.34 pounds).
3 During 1999 extreme low flow conditions persisted throughout the summer and fall in Strawberry Creek, and these conditions are known to have limited the ability of chinook to return to the weir. All values for 1999 were affected by these low flow conditions.
4 During 2000 extreme low stream flow and low lake levels persisted. However, because of a pipeline which delivered approximately 1500 gallons of water per minute,

The chinook salmon return to BAFF during the fall of 2000 was down sharply to 2,774 (Table 2). The decrease was no doubt related to the low flow conditions of Northeast Wisconsin streams during the fall of 2000. No chinook salmon eggs were collected at BAFF in the fall of 2000 as the full chinook egg quota was collected at the primary chinook facility (SCW). The only chinook salmon that were not passed upstream when captured, were those with adipose fin clips indicating that they were part of a coded wire tag study, and those fish that were in poor enough condition that recovery was unlikely.

Table 2. Yearly summary of chinook returns at the Besadny Anadromous Fisheries Facility, 1990-2000.

Year	Number of fish harvested	Number of fish passed upstream	Dead fish	Hatchery transfer	Total number of fish examined	Adipose clipped	Number of eggs harvested
CHINOOK SALMON							
1990	1,307	1,797			3,104	214	1,081,000
1991	2,390	966			3,356	21	1,880,000
1992	2,254	995	625		3,874	120	2,148,000
1993	2,180	726	354		3,260	241	880,000
1994	813	847	62		1,722	452	471,000
1995	1,182	1,362	77		2,621	737	1,360,000
1996	952	2,029	212		3,193	629	700,000
1997	144	1,139	235		1,518	148	0
1998	695	2,858	452		4,005	72	1,155,080
1999	1,803	3,189	806		5,798	496	3,291,346
2000	720	1,733	321		2,774	741	0

The coho salmon return to BAFF in the fall of 2000 was 1,629 (Table 3). The ten year average coho salmon return prior to 2000 was 2,073. Approximately 1.1 million coho salmon eggs were collected at BAFF in the fall of 2000. Low flow in the Kewaunee River no doubt affected the coho return in 2000.

Table 3. Yearly summary of coho salmon returns at the Besadny Anadromous Fisheries Facility, 1990-2000.

Year	Number of fish harvested	Number of fish passed upstream	Dead fish	Hatchery transfer	Total number of fish examined	Adipose clipped	Number of eggs harvested
COHO SALMON							
1990	1,889	1,813		185	3,887		1,374,000
1991	780	287		73	1,140		790,000
1992	307	596			958		163,000
1993	448	130	326	725	1,671		529,000
1994	433	185	97		746		350,000
1995	698	2,744	325		3,767		535,000
1996	632	989	248		3,328[1]	54	688,000
1997	773	337	52		1,162	251	524,000
1998	847	1,518	67		2,432	299	607,898
1999	809	536	143	150	1,638		1,445,423
2000	768	656	205		1,629		1,115,000

1 Coho salmon total includes 1,459 fish sacrificed for disease control

The steelhead return to BAFF in 2000 was 347 (Table 4), with the majority returning in the spring as Chambers Creek and Ganaraska strains. This was the lowest steelhead return since BAFF was utilized for steelhead egg collection. Low flow could be partially responsible for the low return, but other factors are likely contributing. During the previous eight years an average of 2,322 steelhead have been processed each year at BAFF. About 259,000 steelhead eggs were collected at BAFF in 2000.

Table 4. Yearly summary of steelhead returns at the Besadny Anadromous Fisheries Facility, 1990-2000.

Year	Number of fish harvested	Number of fish passed upstream	Dead fish	Hatchery transfer	Total number of fish examined	Adipose clipped	Number of eggs harvested
STEELHEAD							
1992 – Spring		2,892	446		3,338		
1992 – Fall		66		408	474		
1993 – Spring		2,096	177		2,273		
1993 – Fall		30		175	205		
1994 – Spring		2,804	164		2,968		
1994 – Fall		321		200	521		
1995 – Spring		1,696	151		1,847		756,000
1995 – Fall		457	9	121	587		
1996 – Spring		1,964	180		2,144		454,000
1996 – Fall		24	18	151	193		
1997 – Spring		1,955	136		2,091		780,000
1997 – Fall		85	6	40	131		50,600
1998 – Spring		746	130		876		400,000
1998 – Fall		41	2	7	50		15,000
1999 – Spring		608	124	0	732		508,000
1999 – Fall		61	7	77	145		100,000
2000 – Spring		340	0	0	340		259,000
2000 – Fall		2	0	5	7		0

A record number of 7,375 chinook salmon were captured and examined at the RRSF in the fall of 2000. Unlike the drought like conditions in Northeast Wisconsin, adequate rainfall over Southeast Wisconsin contributed to good stream flow conditions and no doubt encouraged the record salmon run. The majority of the chinook (6,965 or 94 percent) were passed upstream (Table 5). No chinook salmon eggs were collected at RRSF in the fall of 2000 as all chinook eggs were collected at SCW during the fall of 2000.

A total of 3,408 coho salmon were also examined at the RRSF in the fall of 2000 (Table 5). The majority of coho salmon (2,921 or 86 percent) were passed upstream. Approximately 1.2 million coho eggs were harvested at BAFF in the fall of 2000.

Table 5. Yearly summary of salmon returns at the Root River Steelhead Facility, 1994-2000.

Year	Number of fish harvested	Number of fish passed upstream	Dead fish	Hatchery transfer	Total number of fish examined	Adipose clipped	Number of eggs harvested
CHINOOK SALMON							
1994	129	1,726	3		1,858	3	
1995	300	2,663	16		2,979	1	1,020,000
1996	62	5,440	87		5,589		644,000
1997	76	3,974	52		4,102		0
1998	127	3,845	5		3,977	2	93,000
1999	338	5,381	303		6,022		800,000
2000	267	6,9657	143		7,375		0
COHO SALMON							
1994	285	513	15		813		
1995	199	2,115	1,040		3,321	3	330,000
1996	161	3,940	305		4,406		2,200,000
1997	65	6,909	16	655	7,645		1,750,000
1998	90	3,336	246	328	4,000	1	760,000
1999	60	978	5	107	1,150		150,000
2000	75	2,921	181	231	3,408		1,200,000

Steelhead return at RRSF in 2000 was 2,390 (Table 6). Most of these steelhead (2,171 or 91 percent) returned in the spring and were likely either Chambers Creek or Ganaraska strain. The steelhead returning in fall (219 or 9 percent) were primarily Skamania strain. Approximately 1.5 million steelhead eggs were collected at RRSF in 2000.

Table 6. Yearly summary of steelhead returns at the Root River Steelhead Facility, 1994-2000.

Year	Number of fish harvested	Number of fish passed upstream	Dead fish	Hatchery transfer	Total number of fish examined	Adipose clipped	Number of eggs harvested
STEELHEAD							
1994 – Fall		583	47	218	848	2	200,000
1995 – Spring	120	2,582	18		2,720	2	1,008,000
1995 – Fall		208		330	538	1	300,000
1996 – Spring	150	2,970	49		3,169		775,000
1996 – Fall		105		248	353		240,000
1997 – Spring	2	2,918	125		3,045		777,000
1997 – Fall		228	2	408	638		500,000
1998 – Spring		382			382		320,000
1998 – Fall		64	1	86	151		184,000
1999 – Spring		2,131			2,263		
1999 – Fall		19	1	50	70		
2000 – Spring	64	2,107	0	0	2,171		1,552,476
2000 – Fall	0	59	0	160	219		0

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STATUS OF THE COMMERCIAL CHUB FISHERY AND CHUB STOCKS IN WISCONSIN WATERS OF LAKE MICHIGAN

The total reported chub harvest from commercial gill nets was 955,877 pounds for calendar year 2000, a decrease of 28% from 1999 (Tables 1 and 2). Commercial smelt trawlers harvested an additional 222,349 pounds incidental to the targeted smelt harvest.

By zone, the harvest in the south was 878,066 pounds, a 26% decrease compared to the 1999 harvest, while in the north 77,811 pounds were reported caught, an approximate 42% decrease compared to 1999. The harvest in the south in 2000 represented about 29% of that zone's quota while the harvest in the north amounted to about 13% of that zone's quota. CPE decreased further in the south by 17% from 1999, while in the north CPE dropped significantly by 56% and was the second lowest CPE since chub fishing re-opened there in 1981. Effort for the year in the north showed a slight increase over 1999 but still remains low when compared to earlier years, while in the south effort decreased about 11%. In the south, 36 of the 41 chub permit holders reported harvesting chubs while in the north 14 of 21 reported chubs.

Table 1. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gillnet chub fishery 1979-2000. 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	EFF. (X1000)	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

Table 2. Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2000.

YEAR	HARVEST	QUOTA	FISHERS	EFF.(x1000)	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

[a] For the years 81-85, 90 & 91, 98-00 totals were by calendar year.
[b] For the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.

In 2000, population assessments using graded-mesh gill nets (GMGN) were conducted off Baileys Harbor (Grid 707) and Algoma (1004) from mid to late September and Sheboygan (1802) in late November (Table 3). Catch rates by age were fairly similar off Baileys Harbor and Algoma with the same ages being represented at both sites. Catch rates by age were highest off Sheboygan, particularly ages six through nine. Two additional age classes, although small, were also caught off Sheboygan but not at the two northern sites. This was the first year that no age three chubs were caught off either Algoma or Baileys Harbor. As in recent years, age three fish were almost non-existent in these surveys and relative abundance of ages four and five was low, indicating continued poor recruitment. The mean age of chubs caught in GMGN from 1988 to the present has gradually increased but seems to have leveled off or is slightly decreasing (Figure 1).

Age composition of chubs caught in standard mesh commercial gill nets were similar between ports with ages seven and eight dominating the harvest (Figure 2). Catch rates in the commercial harvest will probably continue to decline or begin to level off based on continued weak recruitment as seen in the GMGN surveys.

Table 3.- Catch rate by age group for chubs from graded mesh gill nets fished in the Northern and Middle (Central) Areas * of Wisconsin Lake Michigan from 1980-87, Baileys Harbor (706) and Algoma (1004) from 1988-2000, Northern Green Bay (507) from 1994-96, and Milwaukee (2002, 1802) from 1995-98 and Sheboygan (1504) from 1998 and 2000.

		Age Group (No./ standard efforts **)										
YEAR		1	2	3	4	5	6	7	8	9	10	11
1980	Middle	21.1	461.0	452.8	30.2	3.7	3.4	0.2	-	-	-	-
	North	2.1	542.7	683.9	64.9	9.1	7.1	0.3	-	-	-	-
1981	Middle	10.9	280.4	593.6	234.4	9.0	0.6	-	-	-	-	-
	North	10.7	296.8	818.5	246.4	9.3	0.6	-	0.5	-	-	-
1982	Middle	-	547.7	1119.5	720.4	127.8	1.5	-	-	-	0.2	-
	North	-	262.7	282.2	188.2	37.4	0.9	1.2	-	-	-	-
1983	Middle	2.6	192.9	965.7	832.2	262.1	6.9	-	0.5	-	-	-
	North	2.4	120.3	649.4	398.0	117.3	18.6	-	-	-	-	-
1984	Middle	5.0	253.9	650.6	818.3	397.0	45.8	-	-	-	-	-
	North	9.0	145.6	293.3	361.7	88.2	14.2	0.7	-	-	-	-
1985	Middle	4.4	135.1	419.1	457.6	336.2	54.6	1.5	-	-	-	-
	North	2.0	250.1	676.4	565.4	598.5	137.0	2.0	0.2	-	-	-
1986	Middle	1.8	48.5	364.3	685.8	381.0	213.6	18.6	3.6	-	-	-
	North	-	111.0	274.1	576.3	199.7	152.4	9.3	0.3	-	-	-
1987	Middle	-	17.0	100.0	233.3	221.2	110.2	26.2	5.3	-	-	-
	North	-	105.6	197.2	390.1	376.8	115.9	47.7	3.4	-	-	-
1988	Algoma	-	30.8	85.1	292.1	312.6	211.7	39.5	-	-	-	-
	Baileys Harbor	-	6.8	140.1	285.2	471.6	270.1	48.2	7.7	-	-	-
1989	Algoma	-	28.5	164.2	242.9	340.6	449.7	116.5	14.2	-	-	-
	Baileys Harbor	-	65.2	102.6	204.1	270.9	263.2	152.7	5.2	5.2	-	-
1990	Algoma	-	21.5	85.1	169.6	180.8	255.5	68.4	10.4	-	-	-
	Baileys Harbor	-	49.3	69.5	343.3	348.3	250.4	197.5	49.3	-	-	-

Table 3. continued- Catch rate by age group for chubs from graded mesh gill nets fished in the Northern and Middle (Central) Areas * of Wisconsin Lake Michigan from 1980-87, Baileys Harbor (706) and Algoma (1004) from 1988-2000, Northern Green Bay (507) from 1994-96, and Milwaukee (2002, 1802) from 1995-98 and Sheboygan (1504) from 1998 and 2000.

		Age Group (No./ standard efforts **)										
YEAR		1	2	3	4	5	6	7	8	9	10	11
1991	Algoma	-	14.6	44.9	138.5	259.9	307.4	107.3	62.0	22.1	-	-
	Baileys Harbor	-	19.2	119.3	194.3	304.1	332.0	221.3	125.8	6.1	-	-
1992	Algoma	-	7.5	90.2	189.0	324.0	339.8	152.9	37.2	0.5	-	-
	Baileys Harbor	-	12.4	84.1	170.9	197.0	146.3	93.0	21.5	-	-	-
1993	Algoma	-	5.6	72.7	277.3	418.4	260.3	258.2	81.8	5.6	-	-
	Baileys Harbor	-	11.4	115.1	208.1	300.2	306.8	212.	53.6	-	-	-
1994	Algoma	-	-	10.4	53.3	125.9	226.8	209.5	146.4	30.0	-	-
	Baileys Harbor	-	-	48.4	129.8	374.5	341.5	313.4	185.9	21.0	-	-
	N. Green Bay	-	6.9	37.3	124.0	75.5	65.9	43.7	13.5	1.9	1.6	-
1995	Milwaukee	-	-	57.6	755.2	440.8	679.2	364.1	201.0	68.0	17.8	
	Algoma	-	4.2	29.2	66.7	166.4	217.6	158.1	44.9	14.7	-	-
	Baileys Harbor	-	18.9	20.6	154.9	339.9	448.1	209.0	159.4	65.8	18.2	-
	N. Green Bay	-	7.2	19.9	65.3	159.6	52.2	94.6	25.6	5.8	2.9	2.9
1996	Milwaukee	-	-	14.5	78.7	331.0	275.1	355.8	220.6	36.6	5.2	-
	Algoma	-	2.5	5.0	38.3	70.3	130.2	97.6	39.4	7.9	10.1	-
	Baileys Harbor	-	-	8.4	84.6	165.9	356.3	274.3	239.9	39.0	14.3	-
	N. Green Bay	-	1.5	-	4.4	19.6	24.1	9.1	2.6	1.8	-	0.9
1997	Milwaukee	-	-	14.9	104.5	433.6	557.8	579.2	481.3	298.5	35.0	-
	Sheboygan	-	-	14.4	32.6	76.8	211.1	149.5	223.9	70.9	30.2	11.8
	Algoma	-	4.1	3.8	49.4	105.0	216.3	130.1	120.6	14.6	13.5	-
	Baileys Harbor	-	-	-	84.4	103.6	260.5	225.3	261.4	59.2	18.5	3.5
1998	Milwaukee	-	-	-	24.4	50.5	180.8	238.7	307.5	195.8	83.7	24.0
	Sheboygan	-	-	-	7.5	78.1	183.4	256.9	257.6	124.5	60.2	15.6
	Algoma	-	-	3.5	18.0	102.4	231.1	191.3	180.0	109.2	40.0	3.5
	Baileys Harbor	-	-	-	21.3	40.0	104.8	171.3	146.0	56.9	31.4	-
1999	Algoma	-	-	-	23.6	100.8	234.5	250.6	207.7	56.7	14.6	-
	Baileys Harbor	-	-	3.2	19.3	41.8	135.8	167.1	151.9	27.5	12.0	-
2000	Algoma	-	-	-	23.4	119.1	209.2	193.2	156.0	19.5	12.7	-
	Baileys Harbor	-	-	-	26.8	72.5	159.4	177.1	118.1	49.6	11.3	-
	Sheboygan	-	-	6.9	44.7	86.2	240.8	262.1	262.1	162.9	77.8	34.3

* Northern Area = Baileys Harbor (707) & Washington Island (609) combined. Middle (Central) Area = Algoma (1004-05) & Two Rivers (1304) combined.

** Standard Effort = 1000 feet each of 1.5, 1.75, 2.0, 2.25, 2.5, 2.75 and 3.0 stretch measure fished for one night.

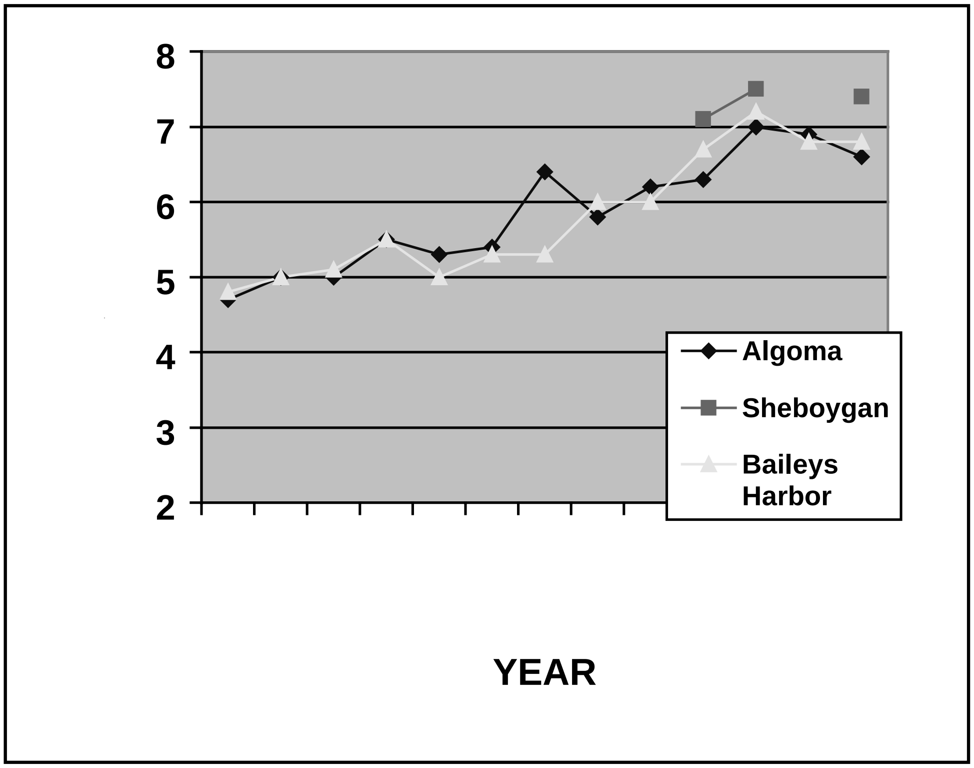

Figure 1. Mean age of chubs caught in GMGN off Algoma and Baileys Harbor from 1988-2000 and Sheboygan 1997, 1998 and 2000.

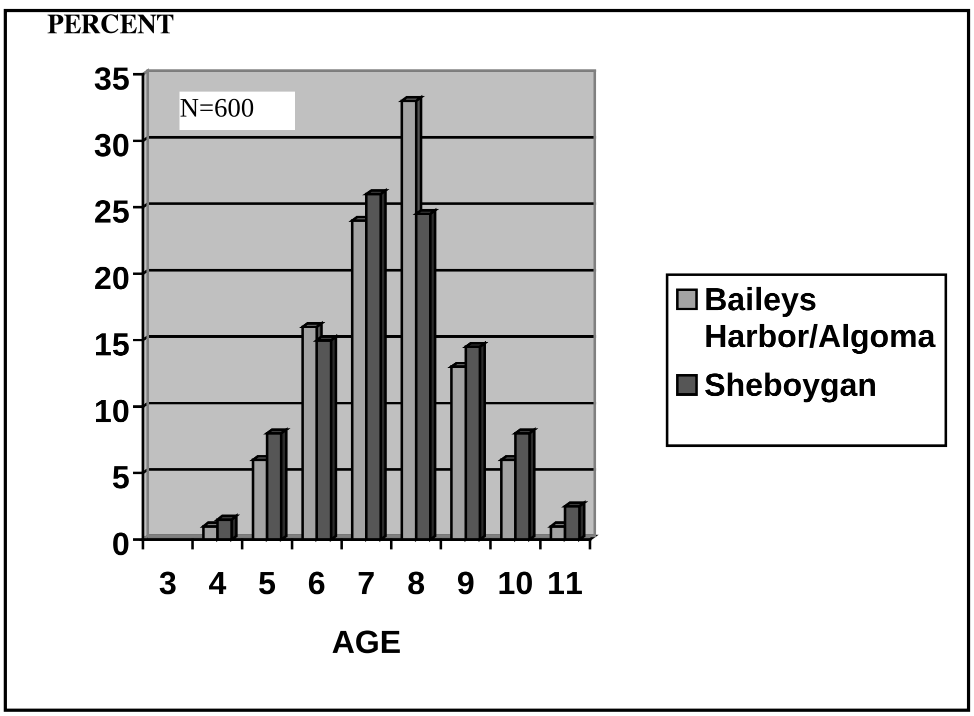

Figure 2. Age composition of chubs caught in standard mesh commercial chubs lifts in September and November, 2000.

The substantial shift in sex ratios that began about 1980 continued in the chub population sampled during 2000 (Figure 3). In the early 80's when younger fish (ages 2-5) dominated the chub population, the sex ratio was about 50:50. Now, with a greater range of year classes in the population, dominated by older fish, longer-lived females predominate. The one advantage of the female dominated population to the industry is that commercial fishers have profited through the sale of abundant eggs to the caviar market during late fall and winter months. With the decrease in chub poundage being landed, chub prices have increased substantially during the past year.

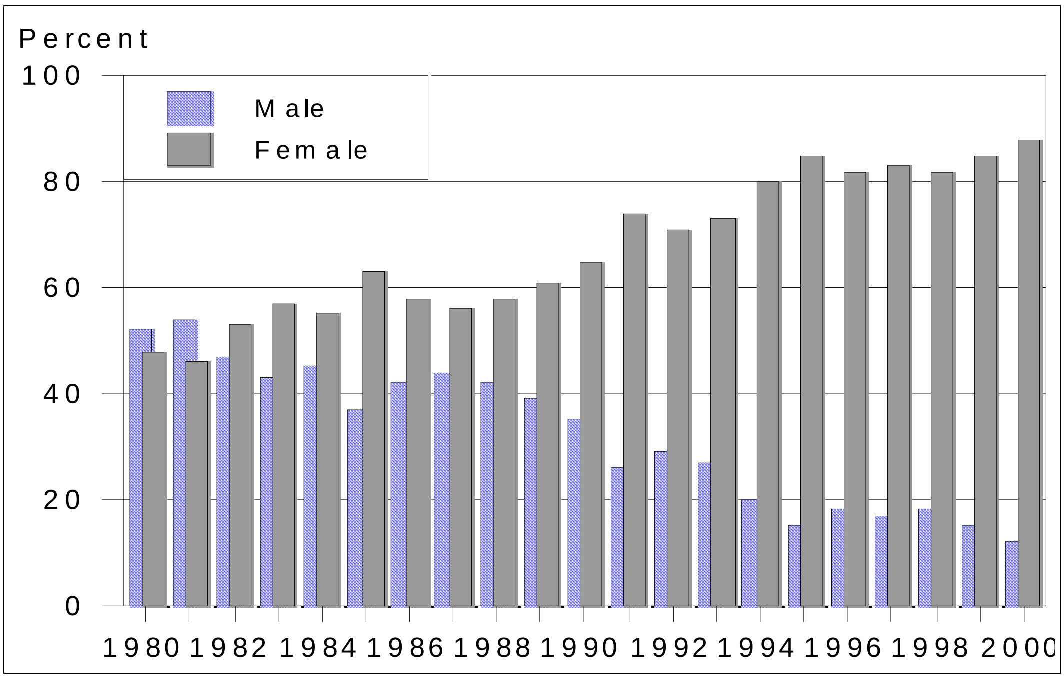

Figure 3. Sex ratio trends of chubs caught in GMGN from Algoma and Baileys Harbor during 1980-2000 and combined chubs from southern Lake Michigan surveys in 1996-1998, 2000.

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STATUS OF THE LAKE WHITEFISH POPULATION
WISCONSIN WATERS OF LAKE MICHIGAN

The reported commercial harvest of lake whitefish *Coregonus clupeaformis* from the Wisconsin waters of Lake Michigan (Figure 1) during quota year 1998-99 was a record setting 1,800,316 pounds with 4.8 percent of the total harvest from pound nets, 51.1 percent in trap nets, and 44.1 percent in gill nets. Whitefish harvest dropped two percent in quota year 1999-00 to 1,768,436 pounds. During the 1999-00 quota year, 4.9 percent of the total harvest occurred in pound nets, trap net harvest increased to 69.1 percent, and gill net harvest decreased to 26 percent. The total annual quota of whitefish for Wisconsin commercial fisherman has been increased four times since it was first established at 1.15 million pounds in quota year 1989-90 and is currently at 2.47 million pounds.

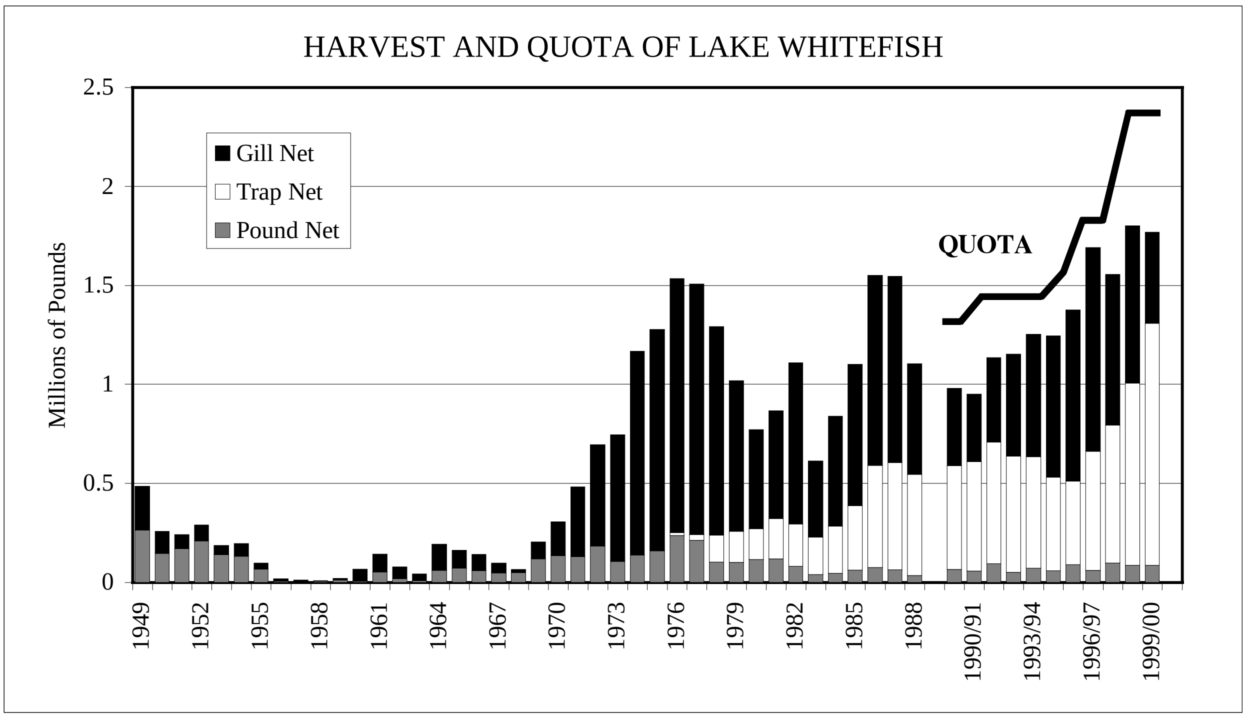

Figure 1.-Lake Whitefish reported commercial harvest by gear in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay, from 1949 through 2000. (Calendar years 1949 through 1988; quota years 1989-90 through 1999-2000).

Whitefish mean length and weight at age (ages 2-5) in spring 1999 were the lowest documented since 1985 and the condition of whitefish, ages two through five, has decreased. As a result of the decreased length and weight at age, the age at which whitefish are fully recruited to the commercial fishery has increased from age four to age five.

Concurrent with the decline of mean length and weight at age, there has marked decline in the condition of whitefish in the NMB population (Figure 2). Condition as used in this context is a measure of the relative plumpness of the fish. From 1995 through 1999, ages two through six exhibited a distinct downward trend in condition. In the spring of 2000, ages two and three demonstrated a reversal of this trend.

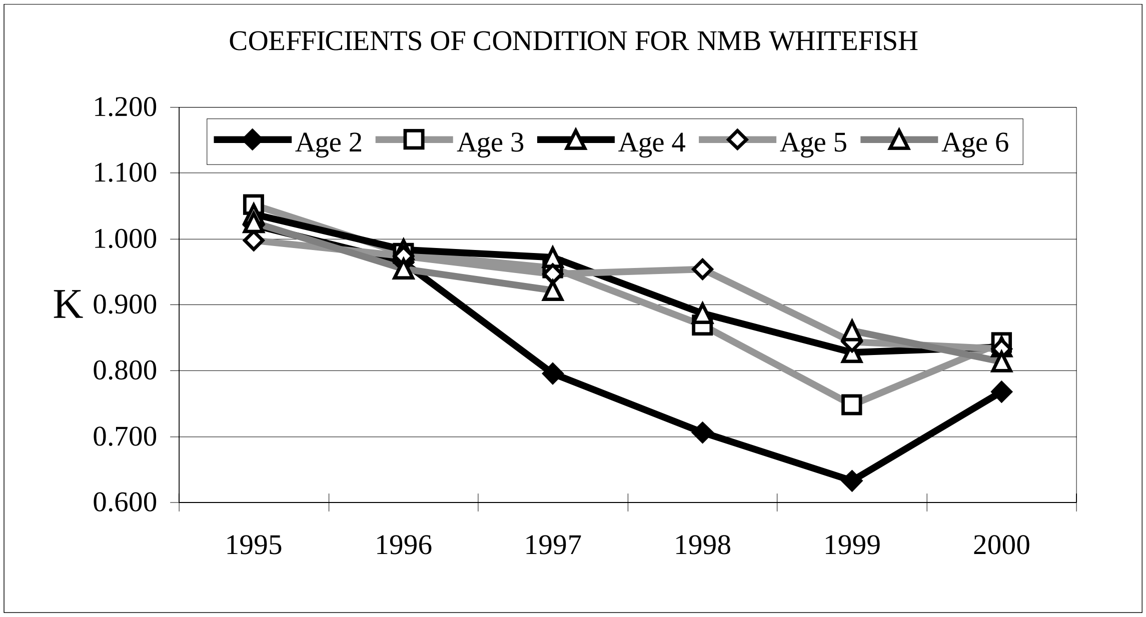

Figure 2.-Condition of lake whitefish from the NMB stock 1995 through 2000. Condition (K) as used in this context is a measure of the relative plumpness of the fish. To avoid possible variations caused by gonad development or condition, only whitefish sampled in spring were utilized for this analysis. Calculations were based on whitefish caught on Lake Michigan near Baileys Harbor and whitefish sampled during commercial monitors.

The spring graded mesh gill net (GMGN) juvenile whitefish survey conducted over the past two years has been a near bust. This survey typically provides the first indication of whitefish year class strength, two or more years before they show up in the commercial fishery. Recently, the 1991, 1993, 1994, 1995, and 1997 cohorts seem to be particularly strong, and the 1992 and 1996 cohorts seem to be weaker than most. Not enough information is available to evaluate the 1998 year class.

Based on the fall GMGN survey there has been a continued progression of moderate to strong year classes of the NMB stock of whitefish recruiting to the commercial fishery. In addition to no missing year classes in the NMB whitefish population currently vulnerable to the fall GMGN survey, there continues to be good survival to age seven and older. Observations from the fall GMGN survey support those from the spring juvenile survey in that the 1992 year class that showed up as weaker than most in the juvenile surveys is also weaker than most in the fall surveys. The 1996 year class first captured at age three in the fall of 1999 (although not fully vulnerable to the gear) was captured at a lower rate than all other cohorts.

The kill of incidental fish in the Wisconsin commercial whitefish fishery has gone up slightly over the last six years, but this is primarily a result of increased levels of commercial effort and not an increase in the rate of kill of incidental species. The three most common salmonids species killed during commercial whitefish operations are lake trout *Salvelinus namaycush*, chinook salmon *Oncorhynchus tshawytscha*, and brown trout S*almo trutta*. Gill netting is responsible for a much larger share of the incidental kill than either trap nets or pound nets. During the last two license years gill nets have accounted for approximately 35 percent of the whitefish harvest but 96 percent of the incidental kill of lake trout and 94 percent of the incidental kill of chinook salmon. Trap nets on the other hand have accounted for nearly 60 percent of the whitefish harvest during the same time period and have accounted for 3 percent of the incidental kill of lake trout and 6 percent of the chinook salmon.

Total annual mortality (A), based on pooled samples of whitefish collected during fall GMGN assessment (1997-1999) was 57.2 percent for ages 5-12. Mortality has increased slightly over the past decade for these commercially vulnerable ages as a group. Annual mortality for the youngest segment of the exploitable population, ages 5-8, was 53.7 percent. For this group, which contributed most to the commercial harvest, mortality has decreased slightly over the last decade.

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SMELT WITHDRAWAL BY THE COMMERCIAL TRAWL FISHERY

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 harvest quota set at 2.358 million pounds, of which no more than 830,000 pounds could be caught in Green Bay. During 1999, a new quota was established that reduced total harvest to 1,000,000 pounds, of which no more than 351,993 pounds could be harvested from Green Bay.

By utilizing the required biweekly catch reporting forms, it can be determined that commercial smelt trawlers reported catching 297,671 pounds of rainbow smelt during 2000 (Figure 1). This reported catch was sharply lower than the reported 1999 harvest of 844,739 pounds and the lowest reported harvest since the early 1980's. The 2000 rainbow smelt harvest continued the trend of declining harvest first observed in 1994.

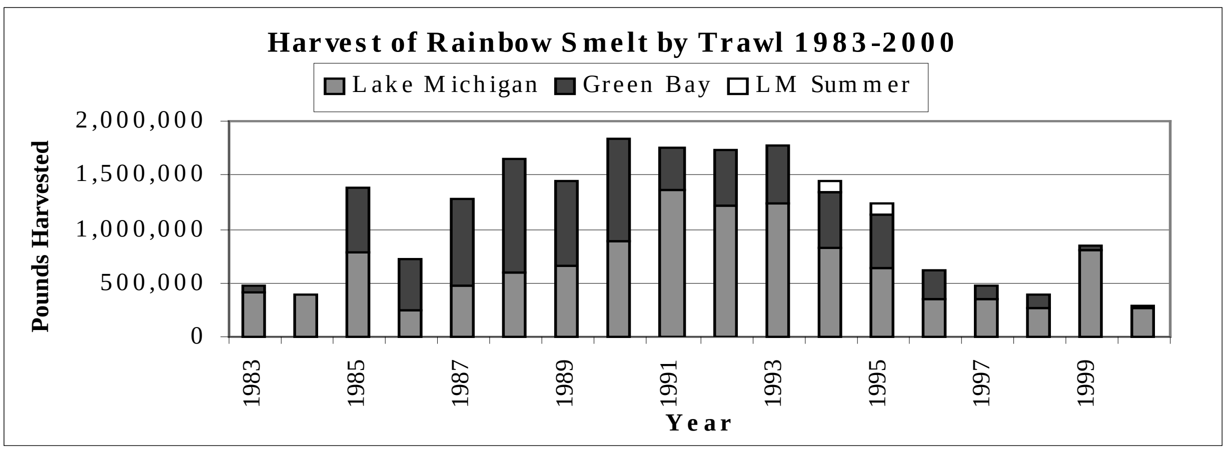

Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 2000.

The harvest of rainbow smelt from Lake Michigan was 263,800 pounds (Figure 1), with an average CPE of 202 pounds per hour trawled (Figure 2). The 2000 Lake Michigan rainbow smelt harvest was the lowest reported since 1986 when 239,340 pounds was harvested. CPE on Lake Michigan, which declined by greater than 50% from 1999 levels, dropped to a similar level as those observed in 1996 through 1998.

Commercial trawlers on Green Bay reported a rainbow smelt catch of 33,871 pounds (Figure 1), with a CPE of 161 pounds per hour trawled (Figure 3). The 2000 rainbow smelt harvest on Green Bay was the lowest ever reported. CPE on Green Bay, which had remained relatively stable from 1991 through 1998, increased sharply in 1999 and in 2000 declined just as sharply to pre-1999 levels.

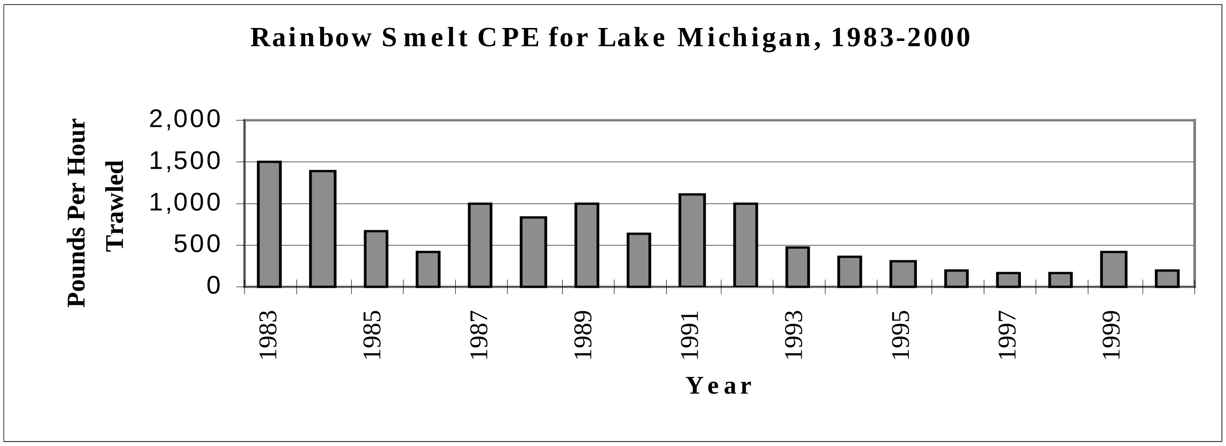

Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan during the years 1983 through 2000.

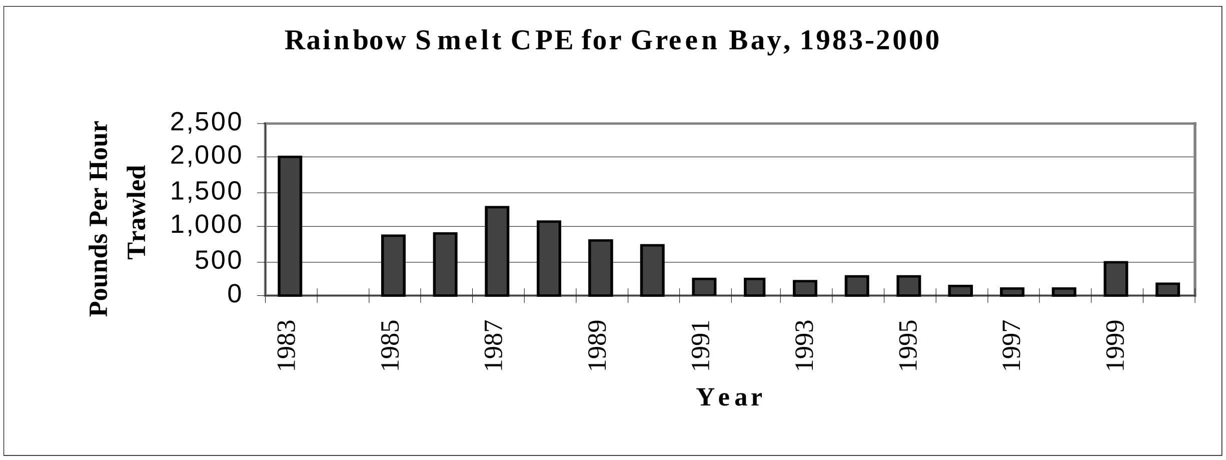

Figure 3. Rainbow smelt CPE in pounds per hour trawled on Green Bay during the years 1983 through 2000.

Generally, the harvest of rainbow smelt by commercial trawlers has been similar to population trends determined by U.S.G.S. index trawling. In 1999 increased harvest by trawlers was not predicted by U.S.G.S. trawling. It was unknown if increased 1999 harvest by commercial trawlers was an indication of increased in rainbow smelt numbers, or if trawlers were fishing a localized concentration of fish not indicative of lakewide populations or from U.S.G.S. sampling difficulties in 1998 that underestimated rainbow smelt biomass. Sharp declines in rainbow smelt harvest and CPE in 2000 by trawlers seem to indicate that 1999 was an unusual harvest year and that lakewide rainbow smelt numbers remained depressed from past levels.

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WALLEYE RESTORATION IN THE LOWER MILWAUKEE RIVER AND HARBOR

The Lower Milwaukee River and the harbor provides a great potential for nearshore fisheries development, especially in light of the removal of first major impediment, the North Avenue Dam on Milwaukee river. The decline of yellow perch as a primary source of nearshore fishing opportunity in the 90s has stimulated more interest in enhancing alternate cool/warm water species for increased fishing opportunities.

Experimental walleye stocking

The Wisconsin DNR (WDNR) has attempted to improve stocks of native species like northern pike, walleye and smallmouth bass by stocking fry and fingerlings since the mid 1980s (Table 1). Fry stocking in the harbor has not produced measurable results. In 1995, The Lakeshore Fisherman Sports Club, The Lake Ridge Boat Club, and the DNR initiated an experimental stocking of 10,000 extended growth walleye fingerlings in the Lower Milwaukee river as part of a walleye restoration effort. The WDNR has continued stocking walleye since that time (Table 2).

YEAR	NUMBER	SIZE	STOCKING SITE
1986	2,000,000	FRY	Milwaukee River
1988	2,920,000	FRY	Milwaukee Harbor
1990	2,500,000	FRY	Milwaukee Harbor
	1,000	YLG	Milwaukee Harbor
	1,000	YLG	South Milwaukee
	1,000	YLG	Fox Point
	1,000	YLG	Milwaukee South Shore Yacht Club
	1,000	YLG	Milwaukee Black Can Reef
1991	550	AGE 2	Milwaukee Harbor
1992	2,300,000	FRY	Milwaukee Harbor

Table 1. Historical stocking of walleye in Milwaukee harbor area.

YEAR	NUMBER	SOURCE	FIN CLIP	OTHER MARK
1995	7,626	Thompson SFH (Spooner)	right perctoral fin	red elastomer
1996	9,972	Thompson SFH (Spooner)	left pectoral fin	green elastomer
1997	0			
1998	3,155	private hatchery	right ventral fin	blue elastomer
1999	7,700	Kettle Morraine Springs SFH	none	none
2000	9,880	Thompson SFH (Spooner)	left ventral fin	orange elastomer

Table 2. Current stocking of extended growth fingerlings of walleye below previous North Ave. Dam site in Milwaukee River. Extended growth fingerlings were stocked in 1995, 96, 98 and 2000 and regular fingerlings in 1999.

Assessment of predation on chinook salmon smolts

A portion of our angling community was concerned that stocked walleye would adversely impact the stocked salmon smolts due to predation. Approximately 140,000 chinook salmon smolts are being stocked in the Milwaukee River annually. In order to examine the worst case scenario of predation impact of walleye on stocked chinook salmon smolts, the WDNR, in the first two years of the study, stocked both chinook salmon smolts and walleye at the same location. During our survey immediately following the stocking of chinook smolts, we found that during the initial two weeks period there was a significant proportion of walleye with 1 to 3 chinook smolts in their stomach (Figure 1). At this time, the WDNR developed alternative strategies of stocking chinook salmon in order to reduce predation impact. The stocking location of chinook salmon was relocated to McKinley Marina from immediately below the former North Ave. Dam (Figure 2) (Hirethota and Coffaro 1998). Furthermore, the Milwaukee Area Great Lakes Sports Fisherman Club provided net pens to hold smolts for two nights in the Marina water for better acclimatization before they were released. The public input meetings overwhelmingly supported continued stocking of extended growth walleye in the river.

As part of our continued monitoring effort to assess predatory impact on stocked chinook salmon smolts following stocking, we electroshocked the immediate vicinity and captured all the predatory species. The results consistently indicated that none of the predators had any chinook smolts in their stomachs following stocking of chinook smolts (Figure 1). This suggests that the change of stocking location was effective in reducing predation impact.

Table 3 summarizes the 2000 survey of caught predatory species in the area. In the entire sample of 76 stomachs, only one identifiable salmonid (brown trout) was found in the stomach of a largemouth bass. The items, which are categorized as 'unidentified fish parts', included vertebral columns, fins, skin and other bony parts. These items did not have any resemblance to a salmonid smolt body. One spottail shiner was found in the stomach of a northern pike. A close look at the stomach contents of the predatory fish in the area sampled indicated that alewife formed the dominant food item.

Table 3. Summary of number of fish captured by location and stomach samples collected in the Milwaukee Harbor, May 2000.

Boom shocking location	Species captured	# captured	# stomach samples	# fish not sampled
Summerfest lagoon – outside	Walleye	2	2	0
	Smallmouth bass	3	3	0
Summerfest lagoon – inside	Walleye	3	3	0
	Smallmouth bass	31	30	1
	Largemouth bass	17	17	0
	Brown trout	7	7	0
	Northern pike	1	1	0
Art Museum	Smallmouth bass	1	1	0
Veterans' Park	None			

Boom shocking location	Species captured	# captured	# stomach samples	# fish not sampled
McKinley Marina – slips	Largemouth bass	5	5	0
	Brown trout	2	1	1
	Northern pike	2	2	0
McKinley Marina – pier and breakwall	Smallmouth bass	1	1	0
	Brown trout	1	1	0

Growth

Each extended growth walleye stocked is marked with either a fin clip or an elastomer mark which helps to identify the year-class (Table 2). Figure 3 shows that the stocked walleye are growing relatively fast in the Milwaukee harbor. One of the factors could be less competition due to the small population size. There is sufficient food available in the form of alewife, gizzard shad, shiners, and stickleback, etc. In general, the average annual growth of these walleye is 4 inches, which compares to 3 inches of annual growth in the Fox River population. The average weight of a walleye that has spent four summers in the river was 3.8 lbs.

Movement

Because of the removal of the North Ave. Dam, several additional river miles have opened fish movement between the river and the harbor. In order to clearly delineate seasonal and spatial movement patterns of the walleye, we have launched a radiotelemetry study since 1999. Another important aspect of this study is to identify if there are any defined spawning areas used by walleyes during their spawning run. The preliminary results suggest that there is a clear seasonal movement pattern in which the walleye disperse widely in the early summer months, followed by more concentration in the harbor toward late summer. This movement may be triggered by warmer river water. Eventually in the late fall, as the river and portion of the harbor freeze over, these fish appear to take refuge in the warmer Menomonee River canals. The water in these canals does not freeze due to warm water discharge from a local power plant. It is also possible that this area attracts good number of forage fish. This may be an added factor for relatively greater size at age for these fish. We will continue to follow these fish through this spring 2001 and beyond to better understand their habitat use.

In summary, the restoration effort so far has yielded positive results in many areas. Anglers seem to enjoy catching these walleye. From general observation and creel information, most anglers follow catch-and-release methods. We have not yet documented any natural reproduction. The measures to reduce predation impact seem to be effective. We will continue to stock and monitor Great Lakes strain extended growth walleye fingerlings through 2004 in the lower Milwaukee River and harbor.

Reference

Hirethota, P. S. and Coffaro, M. 1998. Analysis of stomach content and population estimation of walleye in the lower Milwaukee River and Harbor. Wisconsin DNR.

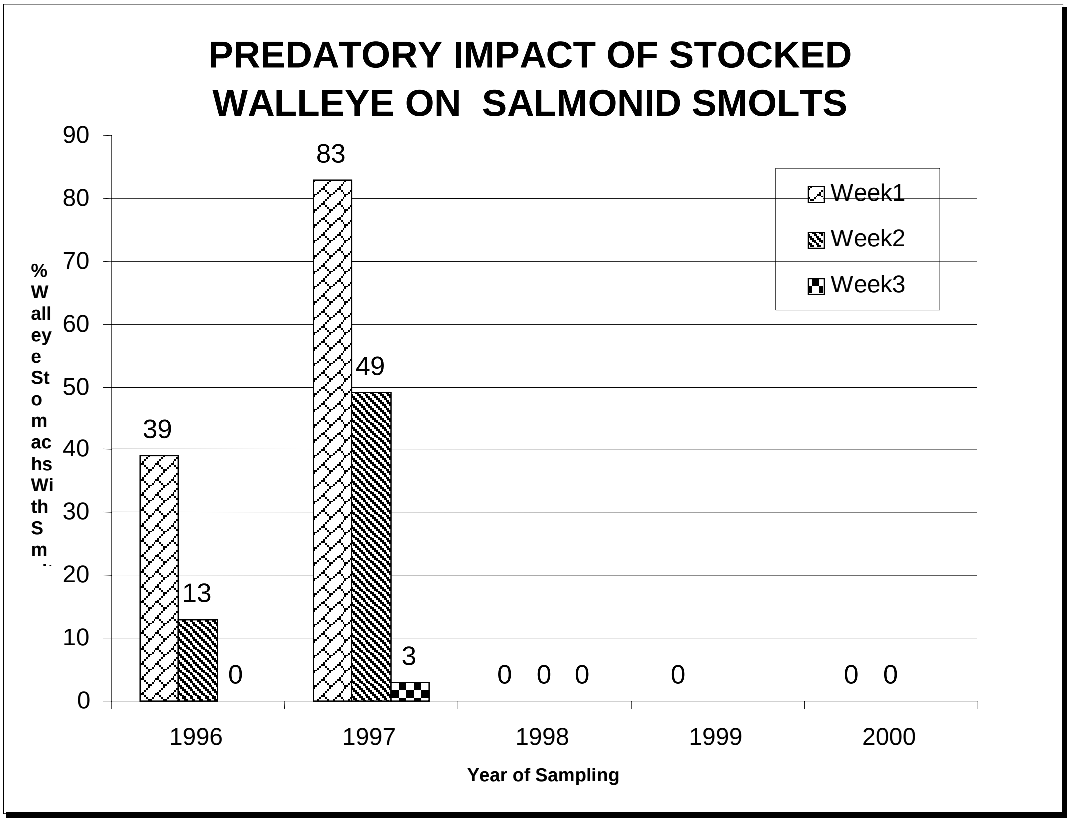

Figure 1. Predation impact by stocked walleye on stocked chinook salmonids, 1996-2000.

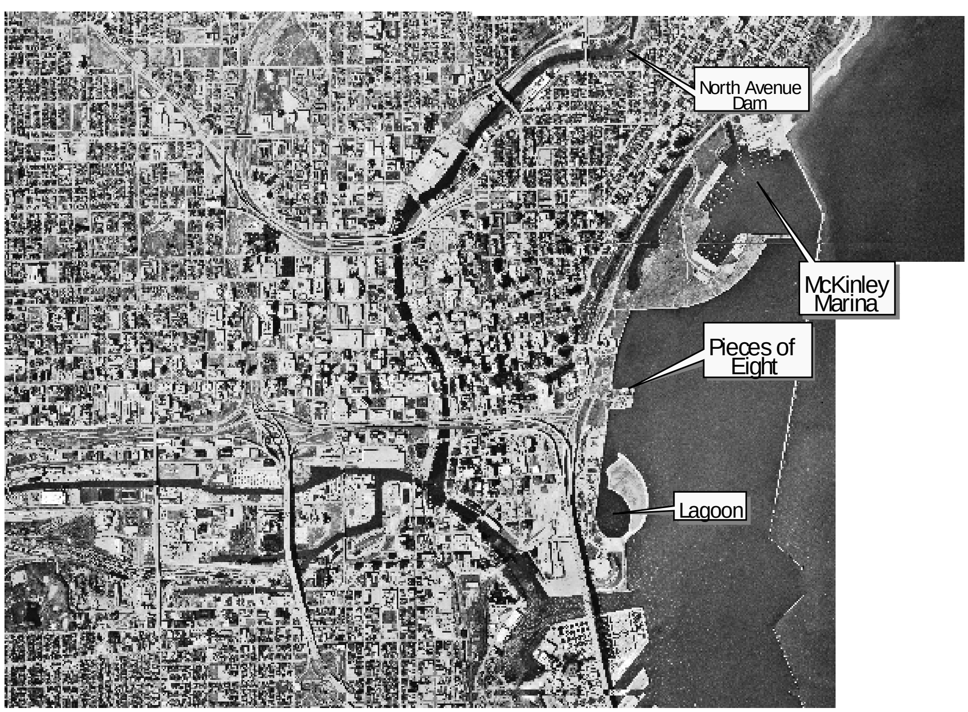

Figure 2. Stocking and sampling locations in the Milwaukee River and Harbor.

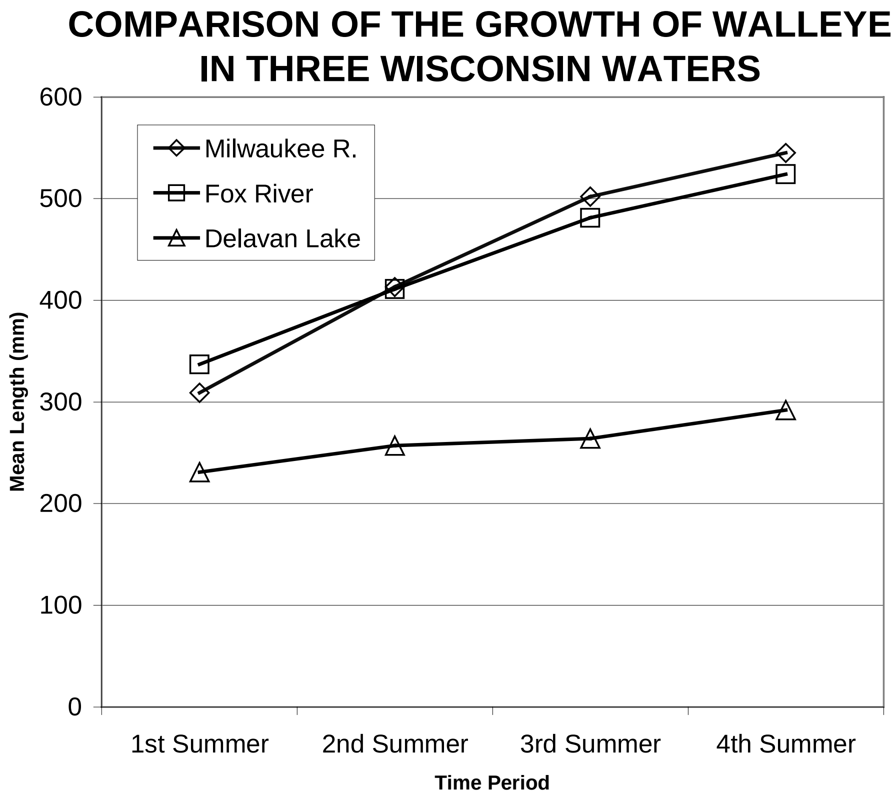

Figure 3. Growth rates of walleye at the end of each summer during subsequent years from different water bodies in Wisconsin.

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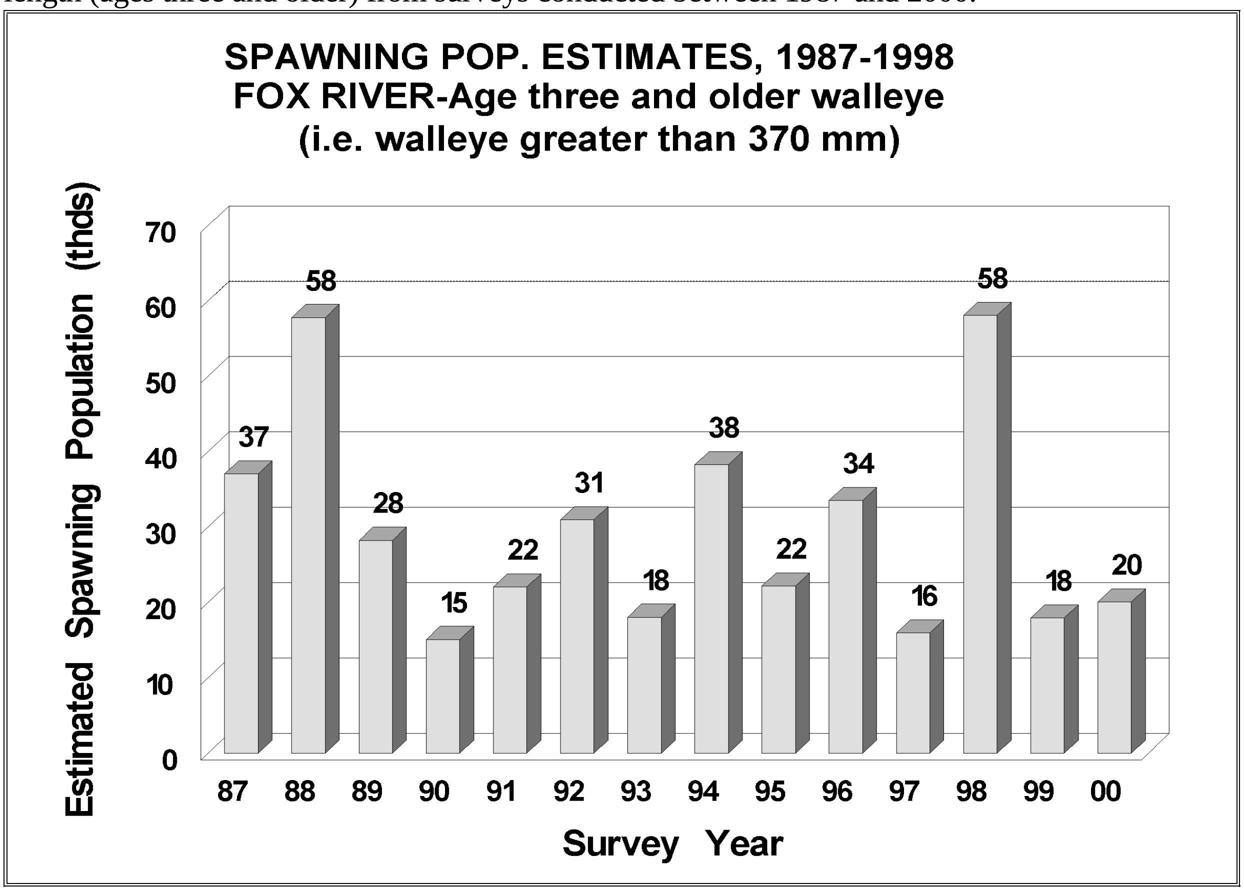
STATUS OF WALLEYE STOCKS-GREEN BAY

Fox River

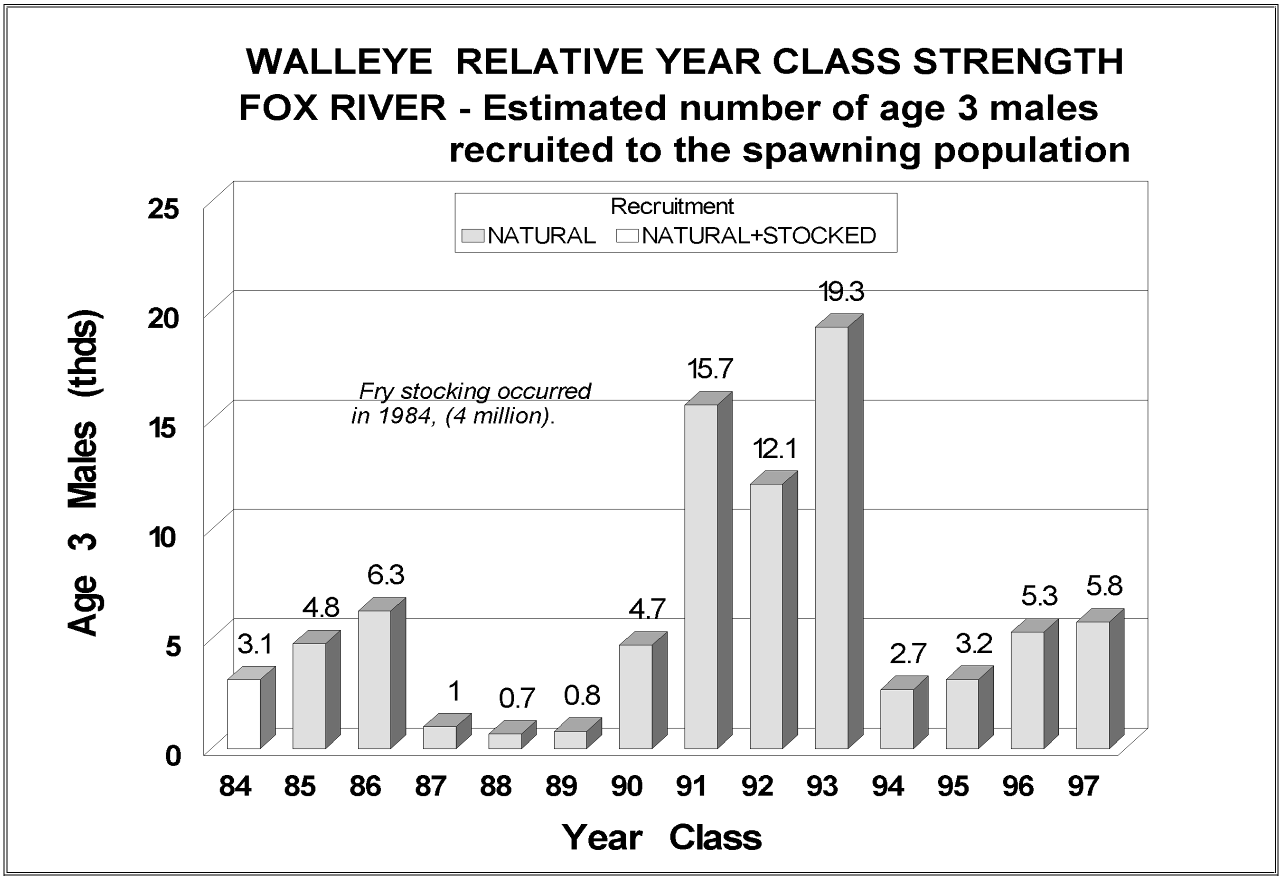
The estimated adult spawning population in the Fox River (age 3 and older; and greater than 370 mm) rose to 20,0068 (95% CI 13,252-31,927) a ten percent increase from 1999 (Figure 1). Although significantly higher than 1999, abundance is still substantially lower than the ten year average of 27,700 adult walleye. As was the case in 1999, historically low water levels on Green Bay have compromised our ability set nets in appropriate locations. This may be effectively limiting adequate sampling of the entire population occupying the river. At this point the lower population abundance does not warrant concern because exploitation on the population is not high. Assuming a majority of the walleye are spawning in the river, then less than ten percent of population is being harvested (see catch and harvest discussion).

Figure 1. Spawning population estimates of Fox River adult walleye greater than 370 mm in length (ages three and older) from surveys conducted between 1987 and 2000.



The 1997 year class recruited an estimated 5,789 male walleye to the spawning population in the survey year 2000 (Figure 2.). This marked the third consecutive year of an increase in three year old, male walleye, recruitment. With the exception of the 1994 year class and the 1990 year class, the relationship between the abundance of fall fingerlings (measured by fall electrofishing surveys, Figure 3.) and the abundance of three year old male cohorts in the spawning population appears to be positively correlated. If possible we will analyze the size and condition of fall fingerlings captured in our fall surveys to determine if this correlates to their over winter survival and future numbers in the adult population. As of now, the fall fingerling abundance at least appears to be qualitatively if not quantitatively predictive in most years.

Figure 2. Relative year class strength of Fox River walleye as measured by the estimated number of age three walleye recruited to the adult spawning population from surveys conducted in 1987-2000.



Age three cohorts dominated the male spawning population in 2000, representing 48.7% of all males (Table 1.). However, notable was the abundance of age two was of the 1998 year class, they represented an unusually high 11.5 % of the population

Age five and six females represented 27.9% and 27.3%, respectively, of adult females (Table 2.). There were, however, a significant number of four-year-old female walleye, the 1996 year class, and represented 26.1% of the population.

Table 1. Age Distribution (%) of Male Spawning Walleye – Fox River 1998-2000

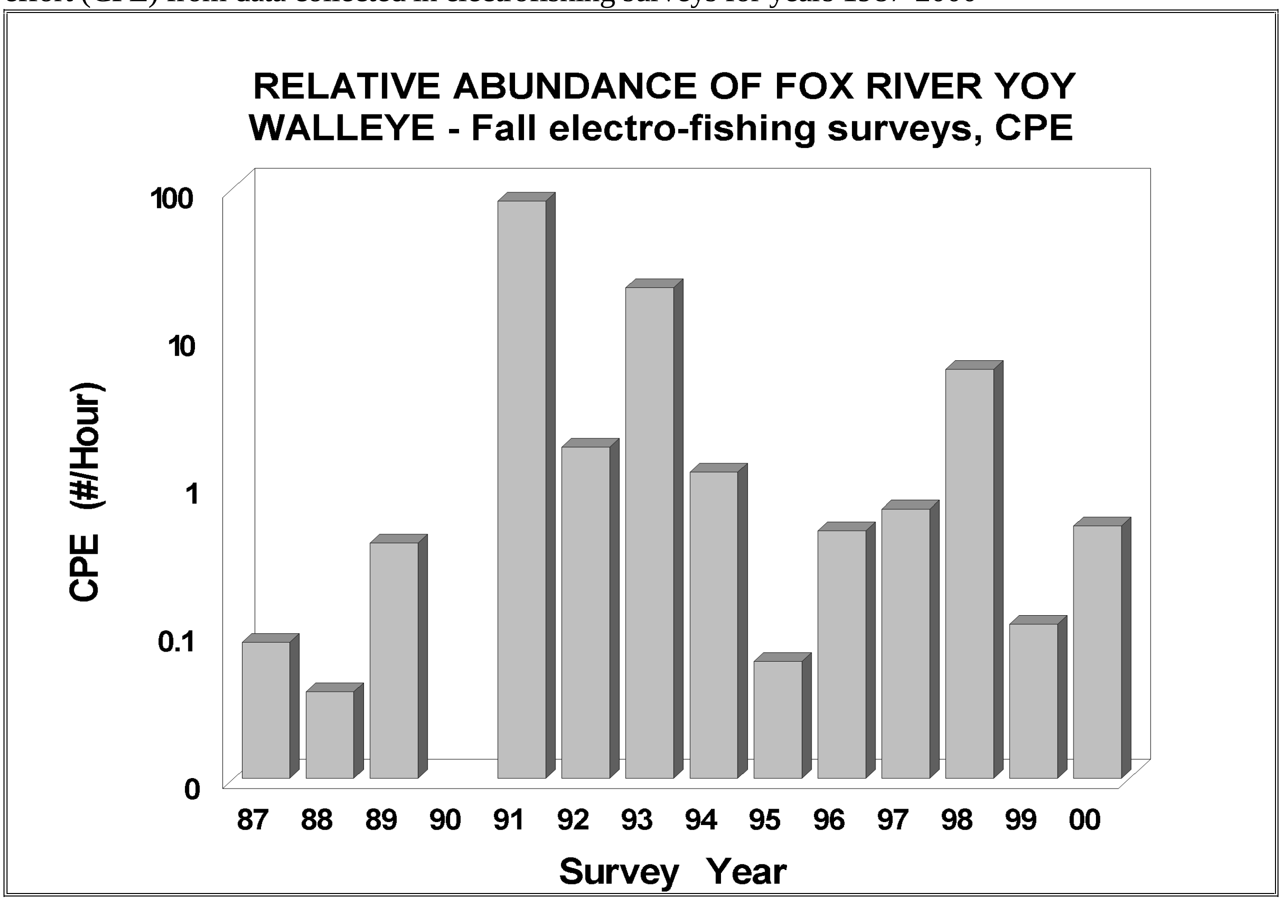
Age	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+
1998	**2.0**	**16.8**	**35.5**	**37.2**	**6.2**	**1.6**	**0.4**	**0.0**	**0.1**	**0.1**		
1999	**3.3**	**53.2**	**10.4**	**20.5**	**9.5**	**2.0**	**1.0**					
2000	**11.5**	**48.7**	**26.3**	**9.7**	**3.1**	**0.5**	**0.2**					

Table 2. Age Distribution (%) of Female Spawning Walleye – Fox River 1998-2000

Age	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+
1998		**1.0**	**14.1**	**25.3**	**30.6**	**15.3**	**5.2**	**2.6**	**3.4**	**1.0**	**0.5**	**0.9**
1999			**4.0**	**32.9**	**22.1**	**19.1**	**8.9**	**4.6**	**2.7**	**3.8**	**1.3**	**0.5**
2000		**1.8**	**26.1**	**27.9**	**27.3**	**10.9**	**2.6**	**0.9**	**1.7**	**0.6**		

Results of the fall electrofishing surveys showed higher abundance of fall fingerlings than in 1999. The catch per unit effort was 0.50 per hour, substantially higher than the 0.11 per hour captured in 1999 (Figure 3.). If as previously discussed, this index serves well as a method of predicting the recruitment of males to the spawning population the 1998 cohorts should be very abundant in the spring of 2001.

Figure 3. Relative abundance of YOY walleye in the Fox River as measured by catch per unit effort (CPE) from data collected in electrofishing surveys for years 1987-2000

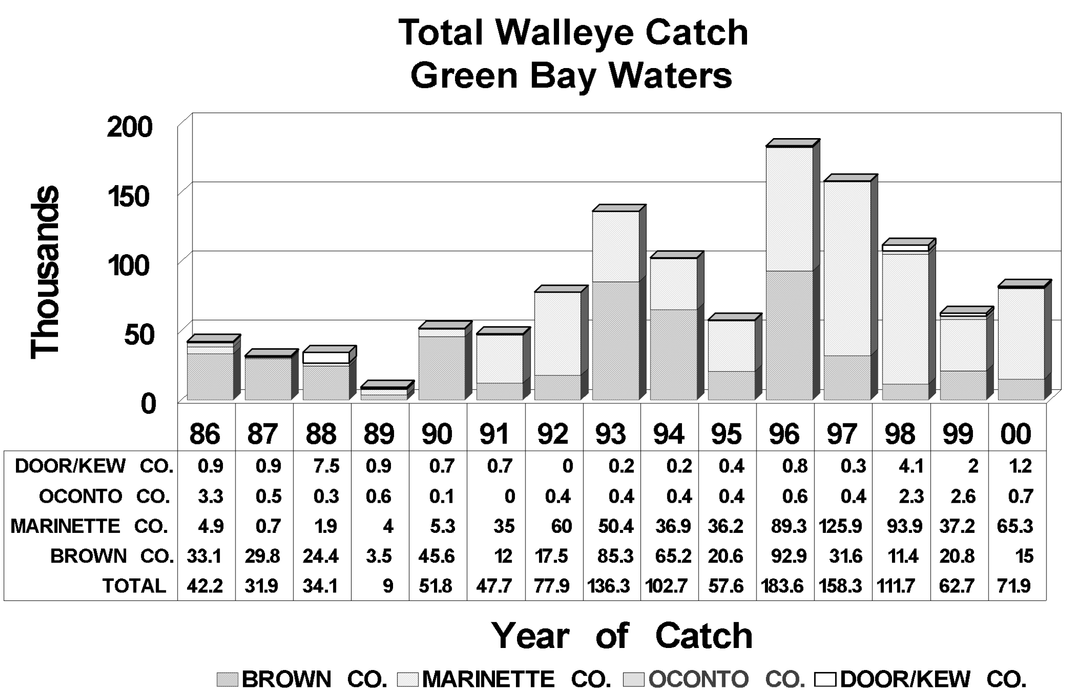


Catch and Harvest

The walleye catch for Wisconsin waters of Green Bay increased to 71,900 walleye in year 2000 from the 62,700 caught in 1999 (Figure 4.). Door/Kewaunee, Brown and Oconto Counties showed a reduction in catch while Marinette County had an increase. Brown County's catch decreased by 28% dropping from 20,800 to 15,000. Door/Kewaunee and Oconto County's dropped by 40% and 73%, respectively. All of the increase was made in Marinette County waters that rose by more than 75% from 37,200 to 65,300.

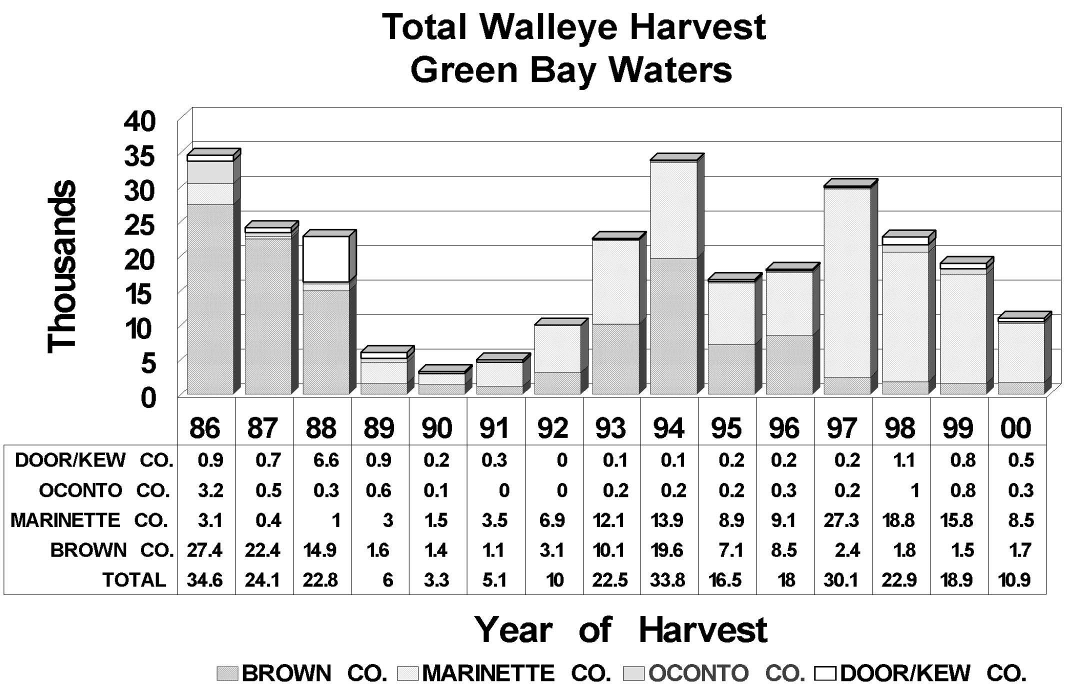
In contrast, harvest decreased in all areas of the Bay except for a small increase in Brown County waters (Figure 5.). Green Bay harvest decrease from 18,900 to 10,900 walleye, a 42% reduction. Marinette County harvest dropped by 7300 walleye accounting for 91% of Green Bay's reduction.

Figure 4. Total walleye catch for Wisconsin waters of Green Bay by County for the years 1986-2000.



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
DOOR/KEW CO.	0.9	0.9	7.5	0.9	0.7	0.7	0	0.2	0.2	0.4	0.8	0.3	4.1	2	1.2
OCONTO CO.	3.3	0.5	0.3	0.6	0.1	0	0.4	0.4	0.4	0.4	0.6	0.4	2.3	2.6	0.7
MARINETTE CO.	4.9	0.7	1.9	4	5.3	35	60	50.4	36.9	36.2	89.3	125.9	93.9	37.2	65.3
BROWN CO.	33.1	29.8	24.4	3.5	45.6	12	17.5	85.3	65.2	20.6	92.9	31.6	11.4	20.8	15
TOTAL	42.2	31.9	34.1	9	51.8	47.7	77.9	136.3	102.7	57.6	183.6	158.3	111.7	62.7	71.9

Figure 5. Total walleye harvest for Wisconsin waters of Green Bay by County for the years 1986-2000



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00
DOOR/KEW CO.	0.9	0.7	6.6	0.9	0.2	0.3	0	0.1	0.1	0.2	0.2	0.2	1.1	0.8	0.5
OCONTO CO.	3.2	0.5	0.3	0.6	0.1	0	0	0.2	0.2	0.2	0.3	0.2	1	0.8	0.3
MARINETTE CO.	3.1	0.4	1	3	1.5	3.5	6.9	12.1	13.9	8.9	9.1	27.3	18.8	15.8	8.5
BROWN CO.	27.4	22.4	14.9	1.6	1.4	1.1	3.1	10.1	19.6	7.1	8.5	2.4	1.8	1.5	1.7
TOTAL	34.6	24.1	22.8	6	3.3	5.1	10	22.5	33.8	16.5	18	30.1	22.9	18.9	10.9

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STATUS OF YELLOW PERCH STOCKS – SOUTHERN GREEN BAY

Yellow perch abundance in Green Bay increased steadily through the 1980's, and has declined since then. The population growth was fueled by the production of strong year classes in 1982, 1985, 1986, 1988 and 1991 (Figure 1). Since 1991 the only moderately strong year class appeared in 1998. The estimated total biomass of yearling and older yellow perch rose from under 1,000,000 pounds in 1980 to over 10 million pounds in 1988, only decline during the 1990's to an estimated biomass for the year 2000 of less than 500,000 pounds (Figure 3).

Population assessment

The Green Bay yellow perch population has been monitored for over 20 years. Annual late-summer trawl surveys at designated index sampling locations are used to monitor trends abundance and to estimate mortality rates of individual year classes. There are presently 78 index trawling stations, the number having been expanded in 1988 with the addition of 32 deep-water stations. The annual sport harvest is estimated using a creel survey, and fish obtained through the survey are used to describe the age and size composition of the catch. The annual commercial harvest is reported by fishers, and fish sampled at the dock from commercial landings are used to describe the age and size composition of the catch. Data from all these sources are combined using virtual population analysis (Megrey 1989, Walters and Punt 1994) to provide annual estimates of the biomass of each year class in the population (Figure 3).

The decline in the population during the 1990's can be attributed to poor reproduction of young-of-year fish, as assessed in late summer of each year (Figure 1). Following over a decade of good production of young fish, we have seen only one reasonably strong year-class (1998) since 1991. The hopeful 1998 year class was abundant as one-year-old fish in 1999, but did not appear as abundant in 2000 as had been hoped (Figure 2).

Harvests

Wisconsin sets an annual commercial harvest limit for yellow perch from Green Bay. Over the past 20 years, that limit has ranged from 200,000 pounds to 500,000 pounds, tracking the trend in abundance shown in Figure 3. During the last complete commercial fishing year, commercial fishers were not able to reach the annual harvest limit of 200,000 pounds, and during the present commercial fishing year, which began July 1, 2000, the harvest has been particularly poor, with less than 20,000 pounds harvested during July through December.

Sport fishing harvests have also risen and fallen with as yellow perch abundance has changed. Sport harvests peaked at over 3,000,000 pounds in both 1990 and 1991, when unusual ice conditions and large numbers of fish allowed the harvest of approximately 2,000,000 yellow perch through the ice each year. By 2000 the sport harvest had declined to 191,000 yellow perch in total, with only 27,318 being taken through the ice.

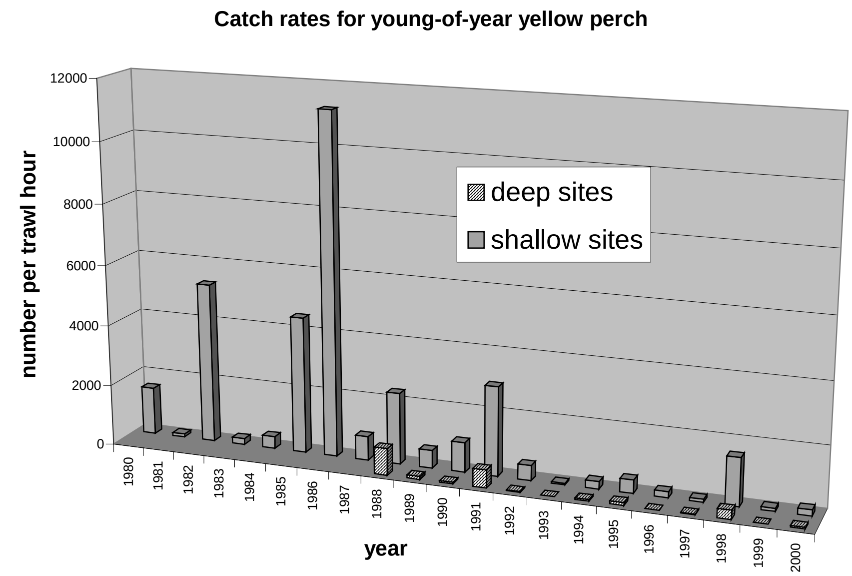

Figure 1. Catch rates of young-of-year yellow perch at index trawling stations. 78 trawling stations have been sampled since 1988, when 32 deep-water sites were added. Trawling occurs during late summer.

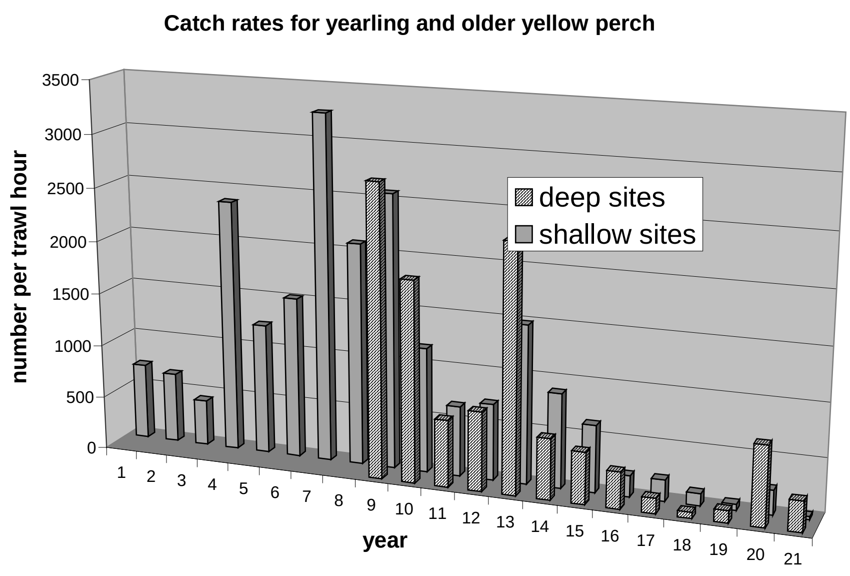

Figure 2. Catch rates of yearling and older yellow perch at index trawling stations. 78 trawling stations have been sampled since 1988, when 32 deep-water sites were added. Trawling occurs during late summer.

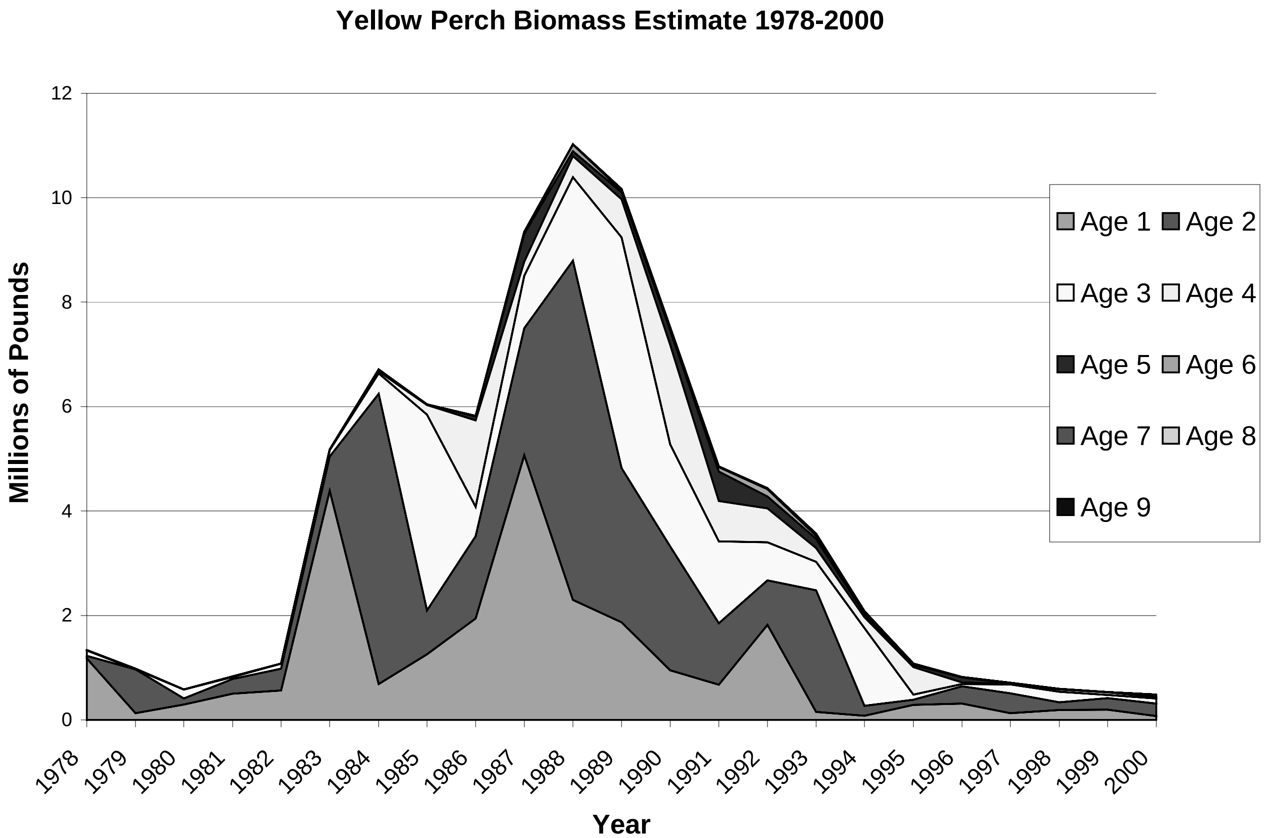

Figure 3. Estimated total biomass of yearling and older yellow perch in Green Bay.

References

Megrey, B.A. 1989. Review and comparison of age-structured stock assessment models from theoretical and applied points of view. Amercian Fisheries Society Symposium 6:92-101

Walters, C., and A. Punt. 1994. Placing odds on sustainable catch using virtual population analysis and survey data. Canadian Journal of Fisheries and Aquatic Sciences. 51:946-958.

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STATUS OF YELLOW PERCH STOCKS - LAKE MICHIGAN

The yellow perch population decline continues to be a major concern in Lake Michigan. Strict harvest regulations are still in place in order to protect the remaining adult population in Wisconsin waters as well as lake-wide. Research work as identified by the Yellow Perch Task Group is progressing to understand the cause of the perch decline. This report is a summary of the status of young and adult perch in Lake Michigan, based on annual assessments in Wisconsin waters during 2000-2001.

Seining

In southeastern Wisconsin, beach seining was done for young of the year (YOY) yellow perch at 20 sites between Kenosha and Sheboygan from August 21 to September 18, 2000 using a 25' bag seine. The bag seine was found to be the preferred sampling gear in this area because the uneven bottom and hard substrate are not conducive for trawling. 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 perch were captured in 1994 sampling as well as 1999 sampling. In our 2000 survey, we captured only two YOY perch with an overall CPE of 0.02, which suggests another year of poor reproductive success.

Spawning Assessment

This assessment has been conducted on the Green Can Reef and in the Milwaukee harbor since 1990. The objective is to quantify the relative abundance of mature female perch in previously identified spawning areas. The sampling effort lasted from May 24 to June 20, 2000. A total of 855 yellow perch were captured. One of the objectives was to assist in Sea Grant funded research on early life history. We were able to obtain necessary biological data and provide sufficient number of spawning individuals to the research team. Ripe male yellow perch dominated the catch, while the females comprised 15.5 percent of the total catch, which is greater than the female proportions found since 1994 (Table 1). The majority of the females were green and some were spent.

Graded Mesh Gill Net Assessment

The WDNR conducts standardized graded mesh gill net assessments annually in January, primarily in grids 1902 and 2002 off Milwaukee. The mesh sizes used in these assessments run from 1 inch to 3 inches on 1/4 inch increments. Yellow perch begin to recruit to this assessment gear by age 2 and are fully recruited by age 3. The winter assessment was extended from December 2000 through February 2001 due to inclement weather conditions. Each lift produced a very small number of fish.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1988 through February of 2001. The data show variability in catch rates by calendar year. These data show very low CPEs of older fish and higher CPEs of younger fish until in the late 80s, and the opposite was true from 1993 through 1998. Although ages 1 to 5 were not represented in 1996 samples at all, the samples from 1997 to 2001 had fair number of 2-5 year old perch. Data on the age and size distribution of yellow perch from the 1999 and 2001 winter survey indicated that smaller and younger perch (ages 2 to 5) were represented in these samples in significant proportions (Table 2). Age 2 and age 3 perch dominated the catches in the 2000 and 2001 assessments, respectively (Figure 2). At this point the proportion of age 5 and older perch was extremely reduced. This was probably due to a combination of poor recruitment and mortality of older fish. The fast growing 1998 year-class seems to have recruited to the fishery at the end of age 2. Once again, poor reproduction in 1999 is showing up as an extremely small year-class. However, since 1999 the sex ratio for the entire sample has been more balanced compared to the previous years.

Figure 3 shows average length-at-age for ages 2 to 10 captured from 1986 to 2001. It appears, based on the mean length-at-age, that both the older as well as younger perch in the population exhibit increased growth rates after 1995. This coincides with the greatly depressed population compared to the late 80s and early 90s. Increased individual growth may be a function of reduced competition for food as a result of increased harvest in the preceding years, or a natural compensation mechanism. Sport anglers also reported catching larger individuals than usual in the last two years. Obviously, the yellow perch in this part of the lake do not seem limited by food. In the last two years, we also noticed smaller and younger fish (compared to previous years) which had mature gonads, another characteristic of a recovering population.

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 to 1995 and earlier. Sport harvest is monitored by a contact creel survey. The sport bag limit has been reduced to 5 fish/day in recent years, which is reflected in the total harvest (Table 3).

Tagging

A lake-wide tagging program was initiated as part of the research effort to understand the movement of yellow perch and their stock structure. A total of 9,633 yellow perch were tagged from 1997 to 1999 during the spawning assessment off Milwaukee as part of the lake-wide yellow perch movement study. These individually numbered floy tags also carry the address where anglers can return the tags. Tag return information is being compiled by the Illinois Natural History Survey. The reduced sport bag limit may have an impact on the angler tag return.

Management Actions

All yellow perch assessment and harvest data from the Wisconsin waters of Lake Michigan show weak year classes beginning with the 1990 year class. However, there appears to be a measurable year class produced in 1998. These observations are consistent with data collected by other agencies throughout the lake. In June 1995 interim rule changes were implemented, as part of an agreement among four Lake Michigan states, in an attempt to protect the remaining stock of yellow perch in Lake Michigan. No improvement in the recruitment was noticed in the

1996 survey data. Consequently, more stringent regulations were implemented effective September 1996. Commercial fishing was closed in the Wisconsin waters of Lake Michigan and daily sport bag limit was reduced to 5 fish with the month of June closed to fishing. These rule changes are implemented to benefit the perch population by reducing impact on spawning stocks.

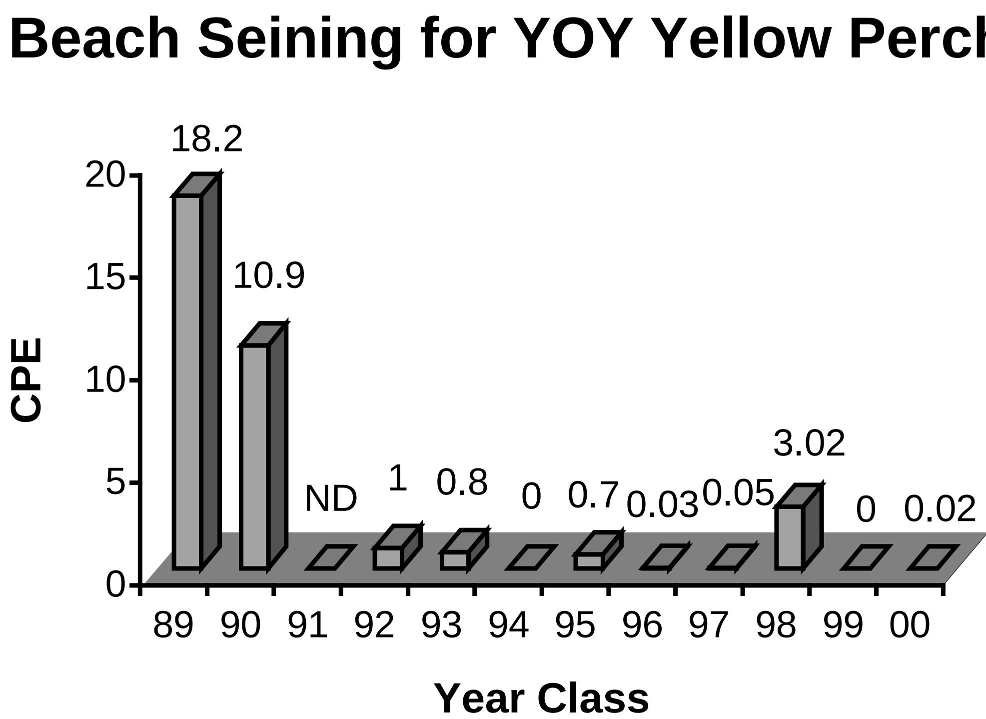

Figure 1. CPE (fish/100' seine haul) of YOY yellow perch in summer beach seining.

Table 1. Yellow perch spawning assessment in Milwaukee waters (Green Can Reef) of Lake Michigan - 1990-2000.

Year	Total	Males	Females	Sex-unknown	% Females	Total effort[1]
1990	2,212	1,922	290	1	13	19,200
1991	3,474	2,600	874	2	25	14,400
1992	7,798	5,242	2,556	1	33	14,400
1993	2,085	1,188	897	0	43	14,400
1994	401	330	71	0	18	9,600
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

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

Table 2. Catch per Effort (fish/1000ft./night), and the percent of each sex, of yellow perch caught in standardized assessment graded mesh gill net sets conducted in January each year, WDNR, Lake Michigan Work Unit.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	464	626	724	159	49	60	0	0	0	0	0	42	323	1
3	453	1854	1037	865	276	98	25	0	0	4	2	57	65	243
4	386	1012	938	323	715	402	58	28	0	14	6	215	9	20
5	701	1563	394	327	281	757	218	65	0	11	29	93	27	2
6	324	1880	381	83	181	165	141	120	19	18	35	57	2	2
7	12	155	90	82	126	49	48	76	51	77	20	45	0	1
8	3	1	0	32	73	16	11	65	71	251	43	63	8	2
9	0	0	0	0	14	0	0	24	31	109	110	44	9	1
10	0	0	0	0	0	0	0	2	12	15	60	33	11	1
11	0	0	0	0	0	0	0	0	3	0	15	9	1	1
12	0	0	0	0	0	0	0	0	0	0	4	7	0	0
%Male	56	69	61	72	82	86	89	90	95	89	80	58	36	36
%Female	44	31	39	28	18	14	11	10	5	11	20	42	64	64

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

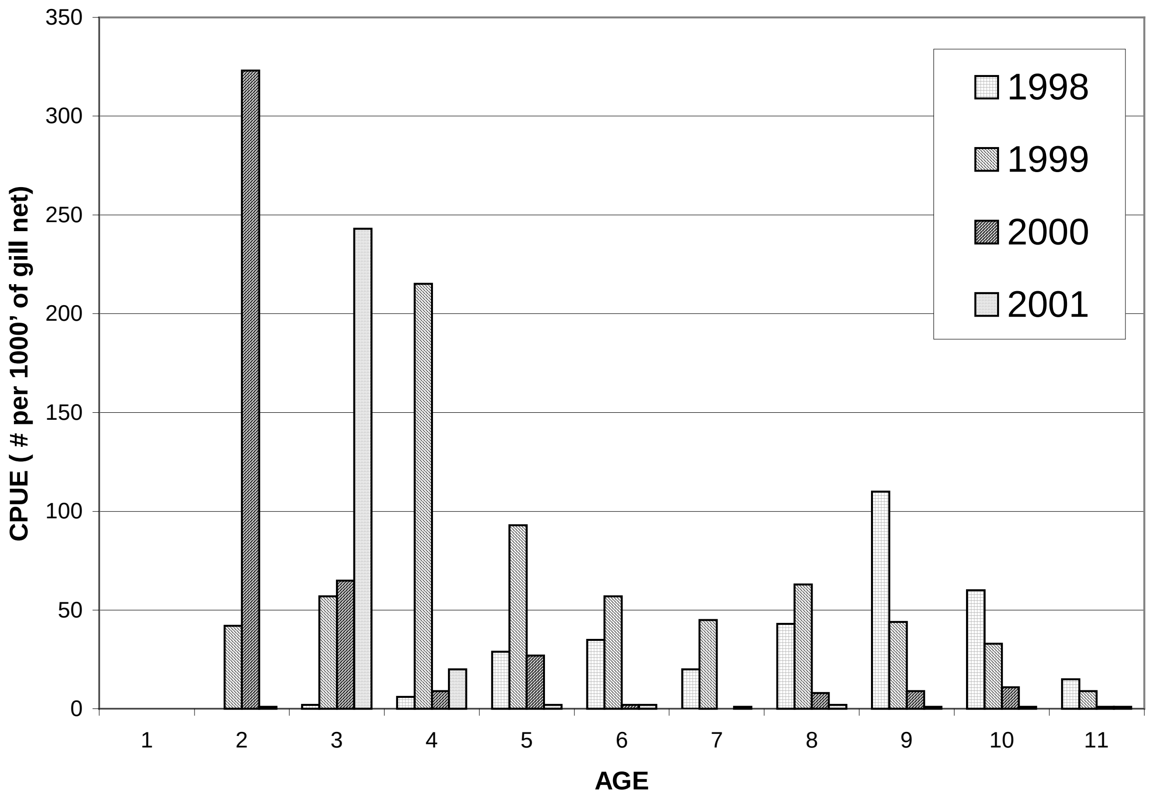

Figure 2. Comparison of Catch at Age for Yellow Perch in Wisconsin Waters of Lake Michigan, 1998-2001.

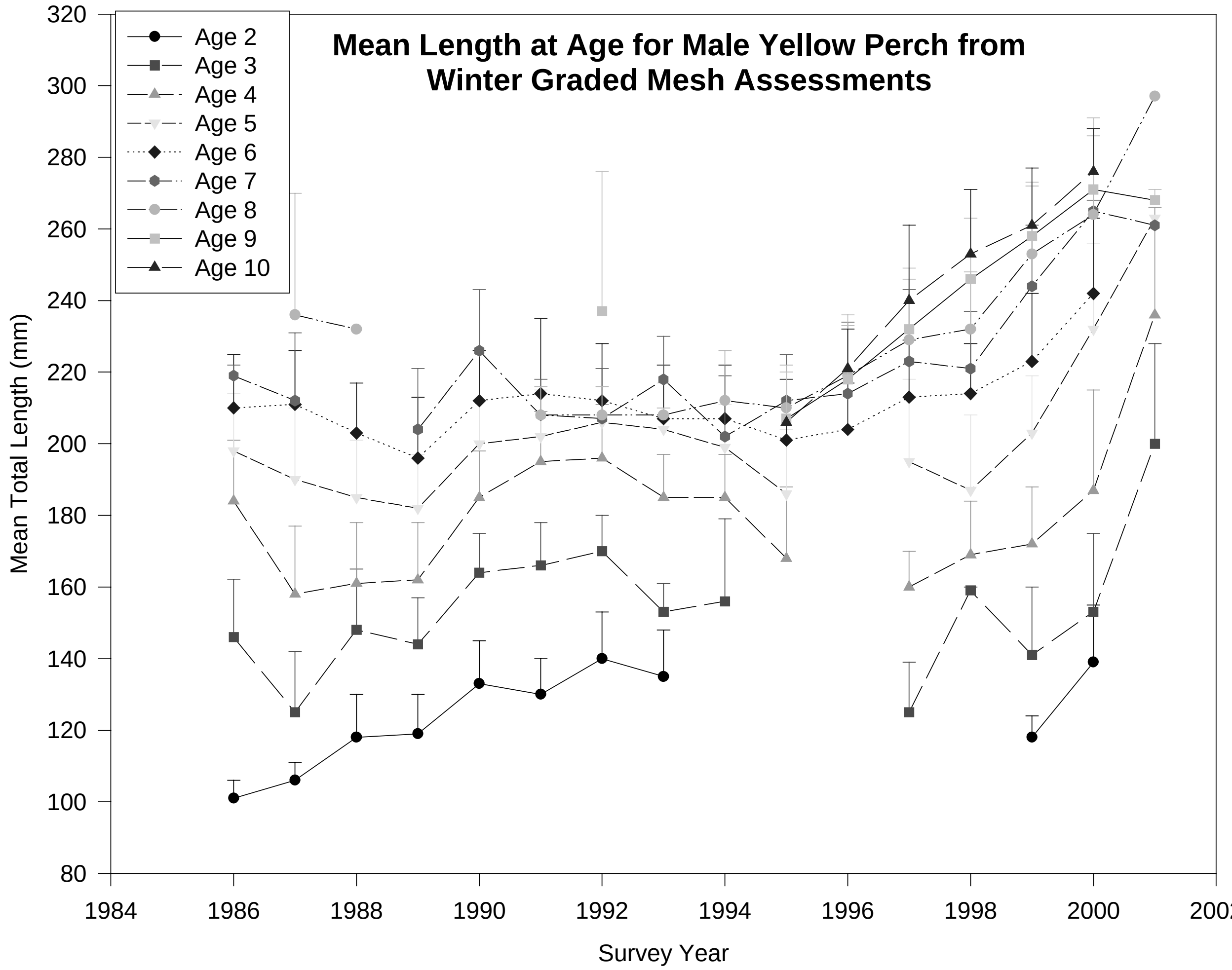

Figure 3. Average length-at-age of male yellow perch captured during winter graded mesh assessment in Milwaukee (the vertical bar extending from each data point represents standard deviation).

Table 3. Reported commercial Lake Michigan yellow perch harvest, in thousands of pounds, and sport harvest, estimated in thousands of fish, by calendar year.

Year	Commercial harvest (lb. x 1000)	Sport harvest (number x 1000)
1986	373	411
1987	550	639
1988	431	932
1989	267	681.5
1990	256	615.8
1991	326	841.4
1992	282	844
1993	267	496.6
1994	254	258
1995	128	237
1996	15[a]	85.5[b]
1997	closed	22.7[b]
1998	closed	24.1[b]
1999	closed	32[b]
2000	Closed	73 [b]

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

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EXPANDED FISHERIES WITH DAM REMOVALS IN THE SOUTHEAST REGION

With the removal of barriers to their upstream migration, angling opportunities for anadromous Lake Michigan trout and salmon continue to expand. Recent regulation changes have allowed trout and salmon fishing on the tributaries to both the Milwaukee and Menomonee Rivers.

The populations of native cool water game fish species such as northern pike, walleye, and especially smallmouth bass have increased as a direct result of improved habitat associated with the dam removals. Anglers are now successfully targeting these species in free flowing sections of the rivers that previously held very few fish.

Milwaukee River

Two dams on the Milwaukee River were removed recently, and given the right conditions fish can now migrate 30.7 miles up the Milwaukee River from Lake Michigan to the State Highway 60 dam in Grafton.

The North Avenue dam in the City of Milwaukee (river mile 3.4) was breached in 1990 and removed in 1997. An extensive habitat improvement project was completed upstream of the former dam site, including placement of 500 tons of limestone rip rap and 120 tons of fieldstone boulders. In addition, approximately 300 feet of riverbank was livestaked with dogwood and willow cuttings to provide bank stabilization, and 30 willow trees were used to enhance bank cover.

Stream electroshocking surveys conducted upstream of the former North Avenue dam site indicate a vast increase in the diversity of resident fish species (Figure 1). Prior to the removal of the dam, only eight different species were captured, six of which were native to the Milwaukee River basin. In the 1999 survey, 29 different species were found, 28 of which were native. The decline in the number of total species from 1999 to 2000 can be attributed to high flows at the time of sampling in 2000.

Secondly, the Chair Factory dam in the Village of Grafton (river mile 30.1) was removed in January 2001. Follow up surveys will be conducted to assess the fishery in the future.

While there are four dams still located along the Milwaukee River between the former North Avenue dam in Milwaukee and the Grafton dam (STH 60 dam in Grafton), these structures are not completely limiting to the upstream migration of Lake Michigan trout and salmon. With regards to these four remaining dams, the gates of the Estabrook Park dam in Shorewood (river mile 6.9) are routinely opened and the pool lowered during October or November and closed again by the following June. The Kletzsch Park dam (river mile 10.4) is a fixed low head weir and is frequently submerged during moderate and higher stream flows. Under these flow conditions, it is not a barrier to migrating trout and salmon. The Thiensville dam in Thiensville (river mile 19.7) includes a “fish ramp” along the east embankment. Although the ramp was intentionally constructed to enable fish passage, it appears to be effective only during higher river flow conditions. The Lime Kiln dam in Grafton (river mile 29.7) does not appear to be a complete barrier to salmon and trout migration under higher river flow conditions according to a previous inspection by SER Lake Michigan Fish Unit staff. There are unverified angler reports regarding catches of trout or salmon upstream of this structure.

Potential angling opportunities could also be found on the tributaries to the Milwaukee River including Lincoln, Beaver, Brown Deer and Indian creeks in Milwaukee County and Ulao, Trinity and Cedar creeks in Ozaukee County. Furthermore, the DNR is planning to partner with the City of Mequon to enhance northern pike spawning habitat in Trinity Creek.

Menomonee River

The Menomonee River has also seen an expansion of angling opportunities. In 2000 a concrete drop structure that was 5.1 river miles upstream was removed by the Milwaukee Metropolitan Sewerage District (MMSD). This will allow Lake Michigan trout and salmon to travel all the way to the Lepper dam in the village of Menomonee Falls in Waukesha County, a distance 21.9 miles from the Menomonee's confluence with the Milwaukee River.

Additionally, in cooperation with the Department of Natural Resources, MMSD has removed 1000 feet of concrete channel lining and replaced it with a natural channel substrate including riffle, pool, and run channel features.

Tributaries to the Menomonee which will potentially offer more angling opportunities include: Honey and Dretzka creeks in Milwaukee County, the Little Menomonee River in Milwaukee and Ozaukee Counties, and Lilly and Butler creeks and Nor-X-Way Channel in Waukesha County.

Summary

While migratory anadromous Lake Michigan trout and salmon have greatly benefited from dam removals, native cool water game fish species such as northern pike, walleye, and smallmouth bass along with non-game and forage type species have benefited as well. The habitat improvement created by returning rivers to a natural flowing state is a benefit to the entire ecosystem.

Number of Native Species vs. Total Species Captured

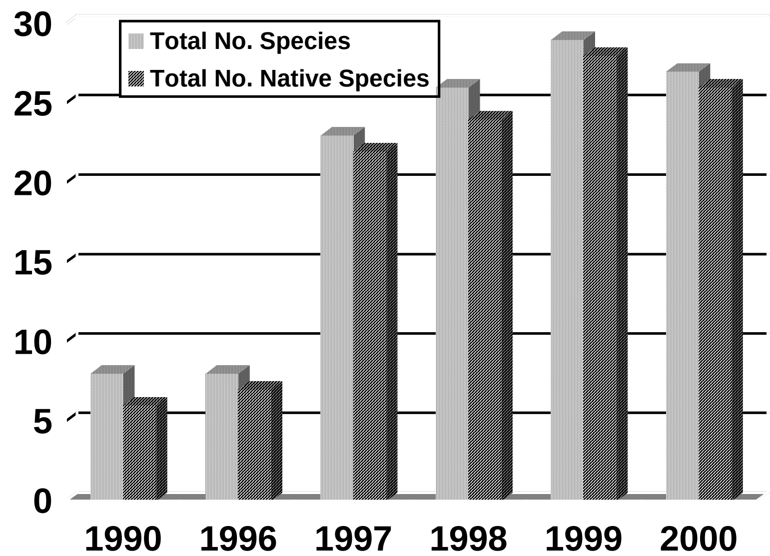

Figure 1. Number of native species vs. total number of species captured in Milwaukee River electroshocking surveys upstream of the former North Avenue dam.

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PHOTONIC MARKING
AN EXPERIMENTAL METHOD OF MARKING SALMONID FINGERLINGS

In the spring of 1999 the Wisconsin Department of Natural Resources (WDNR) initiated a project to evaluate a relatively new technique of marking salmonid fingerlings.

The new technique named photonic marking developed by New West Technologies involves injecting fluorescent microsperes into the fins of salmonid fingerlings before stocking. The WDNR is studying this technique of marking salmonid fingerlings in the hope that it could replace fin clipping and coded wire tagging (CWT).

In the study initiated in 1999 three lots of chinook salmon fingerlings were each marked with uniquely coded CWTs and an adipose fin clip. One of the lots received no other mark. The second lot received a RV fin clip (in addition to the CWT and adipose fin clip). The third lot was marked with a photonic mark in the anal fin (in addition to the CWT and adipose fin clip). The photonic lot was further subdivided into three lots (all with the same CWT lot number in 1999) so that three different colors of photonic mark could be evaluated.

Photonic marked chinook salmon fingerlings, stocked by WDNR at Strawberry Creek, Door County, Wisconsin, spring 1999.

Photonic marking would appear to be comparable in cost to CWT marking, considering the materials and manpower required to apply the marks. And, although the equipment required to apply the photonic mark is fairly expense, it is considerably cheaper then CWT equipment. However, it was hoped that the biggest advantage of photonic marking over CWT application (if it works) would come with mark recovery. To recover a CWT, the fish must be sacrificed, the head saved and stored (generally frozen) for later CWT extraction, and then WDNR personnel must invest the time to extract and then decode CWTs, none of which is cheap. If photonic marking works as advertised, mark recognition would be instantaneous, similar to fin clips, but without the negative drawbacks of fin clipping. No fish would have to be sacrificed, and nothing would have to be stored for later analysis. Time and cost savings could be substantial.

In the fall of 2000, a total of 786 age 1+ precocious male chinook, associated with this study were recovered at Strawberry Creek, as part of the normal salmon harvesting procedures. All adipose clipped, age 1+ chinook handled at the Strawberry Creek weir in the fall of 2000 were checked for a colored mark on the anal fin. Under ambient light conditions, none of the chinook had any obvious color showing. The first hundred or so adipose clipped chinook were also viewed in a darkened room with an ultraviolet light source. Still no fluorescent color was visible. As a final check, anal fins (of all age 1+ fish with an adipose fin clip) were cut near the base and viewed under an ultraviolet light source in a darkened room. At this point many of the cut edges literally lit up under the ultraviolet light source in one of the three colors that they had been marked with.

The fluorescent microspheres had remained embedded in the anal fin, but were not visible through the dark pigmented flesh of the anal fin even under an ultraviolet light source in a darkened room. All of the data has not been evaluated at this time, but it would appear that the hope of using the photonic system of marking chinook fingerlings for later identification would have significant limitations. A more complete evaluation of this marking technique will be available at a later date.

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