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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 2001. 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.

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SPORT-FISHING EFFORT AND HARVEST

Open-water fishing effort was 2,740,250 hours during 2001, within 1 % of the five-year average of 2,764,013 (Table 1). The shore and pier fisheries reversed long-term downward trends in effort (above the 5-year average by 31 and 28 %, respectively). The moored-boat fishery increased substantially from the record low effort of 2000, but was still 25 % below the five-year average. Other fishery types were within 10% of the average.

The salmonid harvest in Wisconsin was down slightly. Trout and salmon harvest was 378,798 during 2001, 7.9 % below the five-year average (Tables 2-4). Coho salmon harvest is typically a strong component of the harvest from Manitowoc south. However, during 2001 coho numbers were markedly reduced in all ports north of Milwaukee, and total harvest was 47 % below the 5-year average. Harvest of other salmonid species was also much reduced (17 to 29 %) with the exception of chinook salmon. Chinook harvest was 28% above the 5-year mean, and the highest recorded since 1987.

The estimated open-water harvest of yellow perch was 339,769 fish, an increase of 48,094 over 2000 (Table 2). Walleye harvest was estimated at 25,038, while smallmouth bass and northern pike harvests were 17,723 and 2,577, respectively.

Table 1. Fishing effort (angler hours) by various angler groups in Wisconsin waters of Lake Michigan and Green Bay during 2001 and percent change from the 5-year average.

YEAR	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	TOTAL
2001	1,327,914	343,565	232,038	181,129	260,253	395,351	2,740,250
% change	- 3%	- 24%	+ 3%	+ 28%	+ 31%	+ 7%	- 1%

Table 2. Sport harvest by fishery type and species for Wisconsin waters of Lake Michigan and Green Bay during 2001.

SPECIES	RAMP	MOORED	CHARTER	PIER	SHORE	STREAM	**TOTAL**
Coho salmon	23,003	10,238	12,162	214	1,070	787	**47,474**
Chinook salmon	76,795	41,171	37,183	2,890	9,899	23,440	**191,378**
Rainbow trout	30,224	20,437	13,348	746	1,721	6,378	**72,854**
Brown trout	9,981	1,944	1,853	3,425	5,486	3,732	**26,421**
Brook trout	85	0	13	42	70	53	**263**
Lake trout	16,382	11,645	12,309	10	62	0	**40,408**
Northern pike	1,463	-	-	183	826	105	**2,577**
Smallmouth bass	7,656	7,445	-	1,388	427	807	**17,723**
Yellow perch	231,998	23,005	-	42,049	42,051	666	**339,769**
Walleye	16,370	845	-	1,268	0	6,555	**25,038**
TOTAL	**413,957**	**116,730**	**76,868**	**52,215**	**61,612**	**42,523**	**763,905**

Table 3. Trout and salmon harvest by species in Wisconsin waters of Lake Michigan during 1986-2001.

Species	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
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	263
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	26,421
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	72,854
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	191,378
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	47,474
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	40,408
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	378,798

Table 4. Trout and salmon harvest by angler group in Wisconsin waters of Lake Michigan during 1986-2001.

Fisheries Type	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
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	156,470
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	85,435
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	76,868
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	7,327
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	18,308
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	34,390
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	378,798

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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 2001 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.

Low Stream flow and low Lake Michigan water level was a potential problem for chinook harvest at SCW again in the fall of 2001. However, the 3,500 foot pipeline and pump capable of pumping approximately 1,500 gallons of water per minute, that was installed in the early fall of 2000 was utilized again during fall 2001. This pump and pipeline delivered water to Strawberry Creek above the SCW and created an artificial flow sufficient for attracting and harvesting chinook. 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 2001. During the fall of 2001, 8,125 chinook salmon weighing an estimated 119,438 pounds were processed at SCW (Table 1). This was a record harvest (number and weight) despite the low stream flow and low Lake Michigan lake level.

Table 1. Yearly summary of chinook salmon returns and egg collection at Strawberry Creek, 1981 through 2001.

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
2001[4]	8,125	2,566	119,438[2]	3,775,982	3,776

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 (2001 average weight was 14.7 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 and 2001 extreme low stream flow and low lake levels persisted. A pipeline was installed which delivered approximately 1500 gallons of water per minute, and allowed weir operation

The chinook salmon return to BAFF during the fall of 2001 was up dramatically to 5,092 (Table 2). No chinook salmon eggs were collected at BAFF in the fall of 2001 as the full chinook egg quota was collected at the primary chinook facility (SCW). Chinook salmon 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 were not passed upstream when captured.

Table 2. Yearly summary of chinook returns and egg collection at the Besadny Anadromous Fisheries Facility, 1990 through 2001.

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
2001	4,322	1,066	48		5,092	2,063	0

The coho salmon return to BAFF in the fall of 2001 was 175 (Table 3). This represents an all time low and is well below the eleven year average of 2,033. Approximately 0.1 million coho salmon eggs were collected at BAFF in the fall of 2001. Low flow in the Kewaunee River no doubt affected the coho return, but is not likely the only factor responsible for the near failure of coho at BAFF in 2001.

Table 3. Yearly summary of coho salmon returns and egg collection at the Besadny Anadromous Fisheries Facility, 1990 through 2001.

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
2001	124	34	17		175		109,000

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

The steelhead return to BAFF in 2001 was 426 (Table 4), with the majority returning in the spring as Chambers Creek and Ganaraska strains. This was the second 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 nine years an average of 2,102 steelhead have been processed each year at BAFF. About 269,000 steelhead eggs were collected at BAFF in 2001.

Table 4. Yearly summary of steelhead returns and egg collection at the Besadny Anadromous Fisheries Facility, 1990 through 2001.

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		220	120	0	340		259,000
2000 – Fall		2	0	5	7		0
2001 – Spring		324	89	0	413		269,000
2001 – Fall		6	0	7	13		Unknown

A record number of 10,213 chinook salmon were captured and examined at the RRSF in the fall of 2001. The majority of the chinook (9,697 or 95 percent) were passed upstream (Table 5). No chinook salmon eggs were collected for hatchery production at RRSF in the fall of 2001 as all chinook eggs were collected at SCW during the fall of 2001. Eggs were collected at RRSF in 2000 and 2001 from a sample of fish for a cooperative chinook salmon experiment project.

A total of 1,327 coho salmon were also examined at the RRSF in the fall of 2001(Table 5). The majority of coho salmon (942 or 71 percent) were passed upstream, and 291 coho were transferred to a WDNR hatchery for holding until the fish ripened and gametes could be collected. Approximately, 0.8 million coho eggs were collected.

Table 5. Yearly summary of chinook and coho salmon returns and egg collection at the Root River Steelhead Facility, 1994 through 2001.

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	6,972	143		7,382		No data
2001	288	9,697	228		10,213		No data
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
2001	71	942	23	291	1,327		800,000

Steelhead return at RRSF in 2001 was 1,349 (Table 6). Most of these steelhead (859 or 64 percent) returned in the spring and were likely either Chambers Creek or Ganaraska strain. The steelhead returning in fall (490 or 36 percent) were primarily Skamania strain. Approximately 0.8 million steelhead eggs were collected at RRSF in spring 2001 and at this time the egg take from fall steelhead has not been completed.

Table 6. Yearly summary of steelhead returns and egg collection at the Root River Steelhead Facility, 1994 through 2001.

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		145,922
2001 – Spring	69	790			859		788,000
2001 – Fall		176		314	490		No data

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STATUS OF THE COMMERCIAL CHUB FISHERY

The total reported chub harvest from the commercial gill nets was 1,077,703 pounds for calendar year 2001, an increase of 13% from 2000 (Tables 1 and 2). Commercial smelt trawlers harvested an additional 266,169 pounds incidental to the targeted smelt harvest. Of this take, 43,854 pounds were sorted as marketable catch and 222,315 pounds were unsorted.

By zone, the harvest in the south was 1,041,066 pounds, a 19% increase compared to the 2000 harvest, while in the north 36,637 pounds were reported caught, a decrease of 53% compared to 2000. The harvest in the south in 2001 represented about 35% of that zone's quota while the harvest in the north amounted to about 6% of that zone's quota. CPE was almost identical in the south for the year compared to 2000 while in the north CPE increased slightly. Effort in the south increased about 20% from the previous year while effort in the north dropped by 56% to its lowest point since chub fishing reopened in 1981. In the south, 36 of the 44 chub permit holders reported harvesting chubs while in the north 9 of 21 reported harvesting chubs.

Table 1.-Harvest, quota, number of fishers and effort (feet) for the Wisconsin Southern Zone gillnet chub fishery 1979-2001. 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
2001	1,041,066	3,000,000	44	26,922.8	38.7

Table 2.-Harvest, quota, number of fishers and effort (feet) for the Wisconsin Northern Zone gill net chub fishery 1981-2001.

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	2	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

[a] For the years 81-85, 90 & 91, 98-01 totals were by calendar year.
[b] For the years 86-89 & 92-97 the totals were through Jan. 15 of the following year.

Annual population assessments with graded-mesh gill nets were conducted in fall 2001 off Algoma, Baileys Harbor and Sheboygan and we collected scale samples and a small number of otoliths. However, we did not age all of the scales and report catch at age as in past years in this report. In comparing ages from a small number of paired scales and otoliths from individual fish, we believe that we may have been underestimating chub ages in the past using scales only, especially for older ages. Consequently, we recently collected another large sample of chubs in a graded mesh net and removed a scale sample and otoliths from each fish. We are currently comparing ages from these scales and otoliths to better understand the relative accuracy of using each structure for aging chubs. We are also planning on sharing and discussing our information with staff from Illinois Department of Natural Resources who have several years experience in aging chubs using otoliths. Catch rates, particularly off Algoma and Baileys Harbor in the 1-1/2 and 1-3/4 inch mesh panels were very low, probably indicating continued poor recruitment that began a decade ago in Lake Michigan.

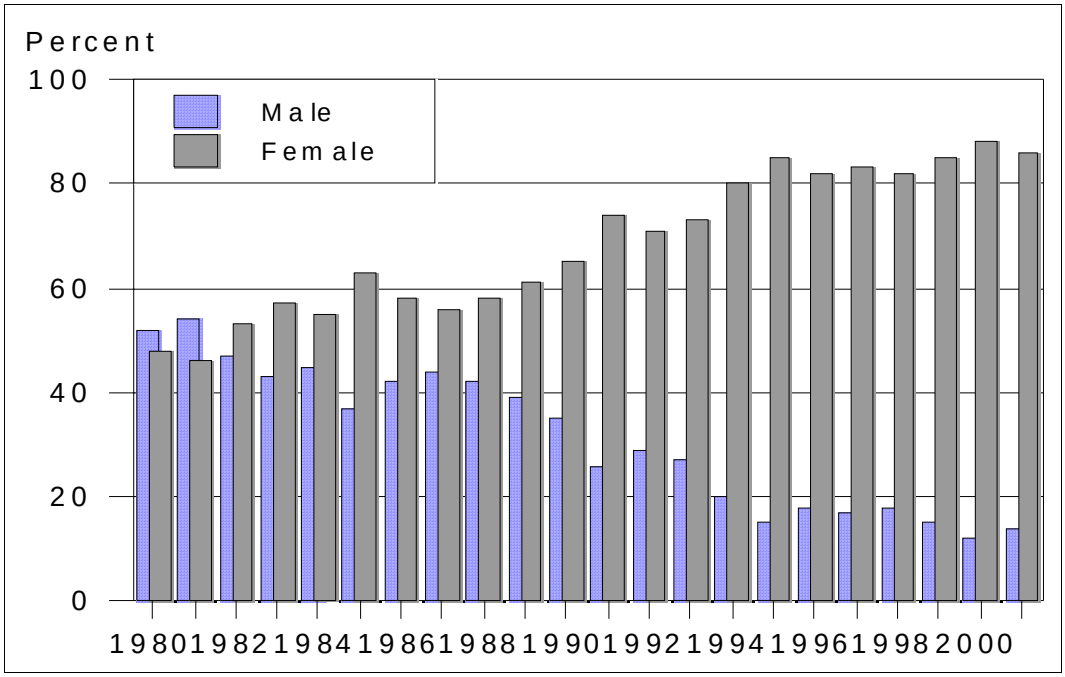

Figure 1.Sex ratio trends of chubs caught in GMGN from Algoma and Baileys Harbor during 1980-2001 and combined chubs from southern Lake Michigan surveys in 1996-1998, 2001.

The substantial shift in sex ratios that began about the mid 1980's continued to show a predominance of females in the population (Figure 1). The sex ratio of chubs captured in graded-mesh gill nets fished off the three ports above showed that 86% of the catch was females. The chubs sampled from commercial standard-mesh gill nets during these assessments consisted of 93%females.

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. Chub prices have also increased during the last couple of years as a result of the decline in harvest.

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STATUS OF THE LAKE WHITEFISH POPULATION

The reported commercial harvest of lake whitefish *Coregonus clupeaformis* from the Wisconsin waters of Lake Michigan (Figure 1) during quota year 2000-01 was 1,616,198 pounds with 4.4 percent of the total harvest from pound nets, 67.2 percent in trap nets, and 28.4 percent in gill nets. 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.

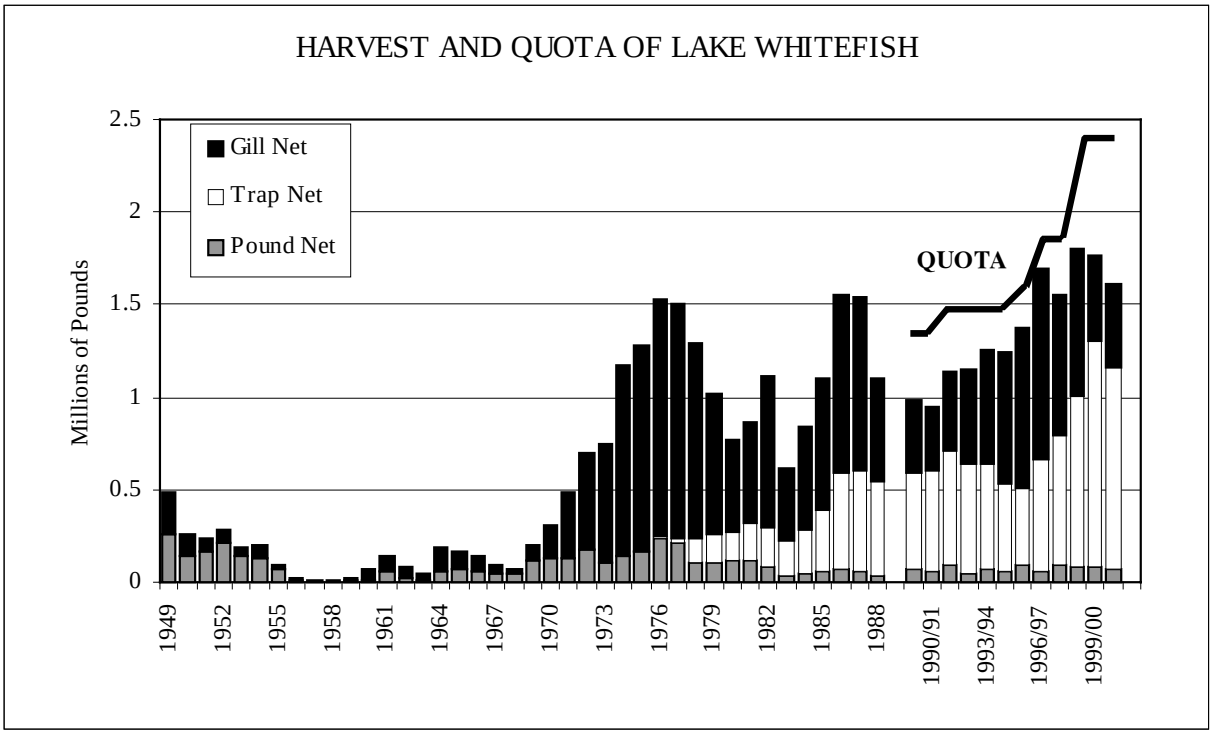

Figure 1.-Lake Whitefish reported commercial harvest by gear in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay, from 1949 through 2001. (Calendar years 1949 through 1988; quota years 1989-90 through 2000-01).

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 and over the last 12 years has accounted for almost 50 percent of the whitefish harvest. Over the last two years trap nets have accounted for over 68 percent of the lake whitefish harvest which is a direct result of more trap net effort and less gill net effort (Figure 2). Trap net effort is up to over 2,700 pot lifts per year, and gill net effort is down to less than 8 million feet per year. Catch per effort (CPE) has shown a general downward trend over the last three to five years in all types of commercial gear (Figure 3), but, changes in seasonal whitefish distribution may have contributed to this decline.

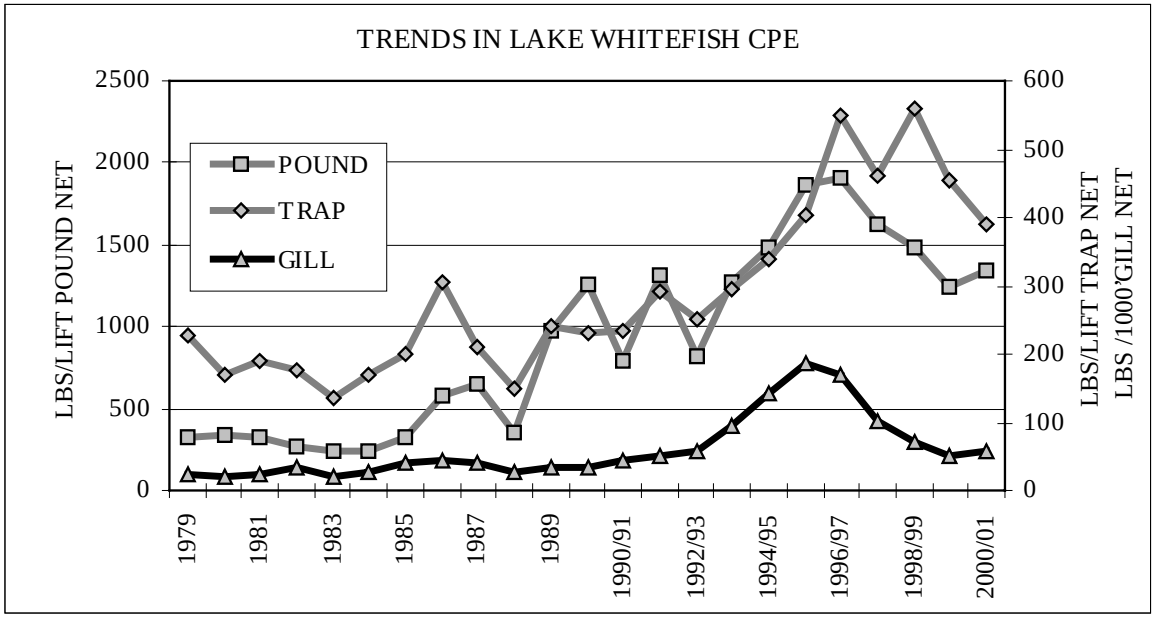

Figure 2.-Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan, including Green Bay, 1979 through 2001. (Gill net effort = millions of feet; trap net and pound net effort = number of pots lifted).

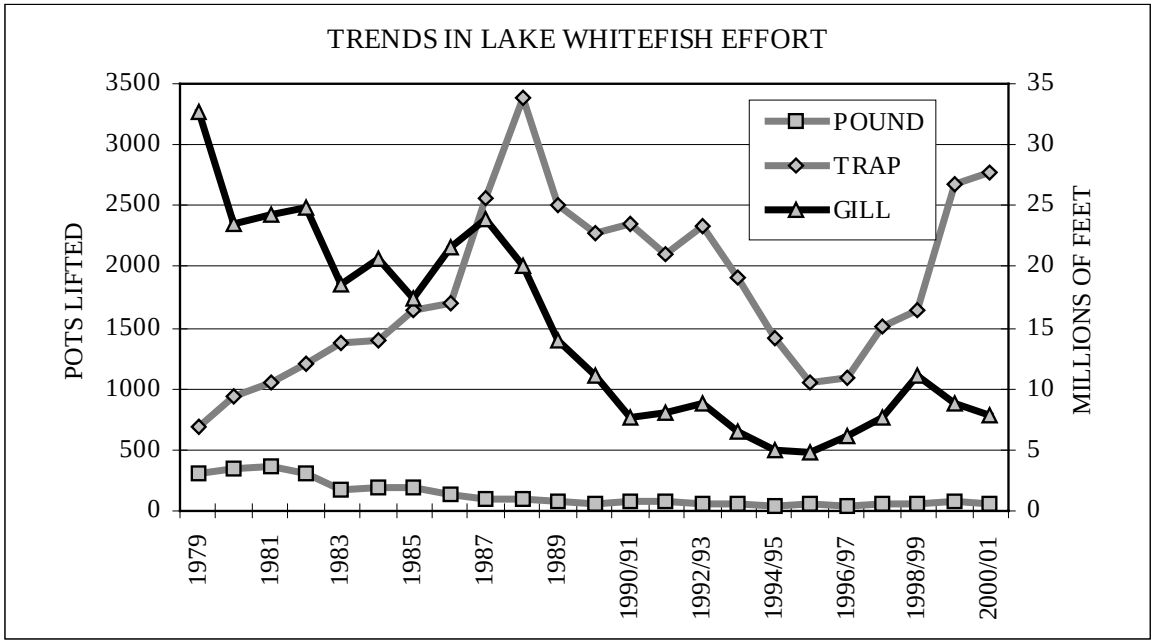

Figure 3.-Trends in gill net, trap net, and pound net lake whitefish commercial catch per effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 through 2001. (Gill net CPE = pounds of whitefish harvested per 1,000 feet lifted; trap net and pound net CPE = pounds of whitefish harvested per pot lifted).

Initially, trap nets used by commercial fishermen in the Wisconsin waters of Lake Michigan and Green Bay, were restricted to waters less than 13 fathoms (78 feet). Meanwhile, Wisconsin

commercial fishermen in Lake Superior, and Michigan commercial fishermen were allowed to fish trap nets to depths of 15 fathoms (90 feet). Whitefish catch per effort (CPE) in trap nets increased steadily through 1996, but then during 1997 and 1998, Wisconsin commercial trap net fishers started to experience seasonal difficulty catching whitefish at depths where whitefish had been traditionally caught (Figure 4). Whitefish CPEs during the months of May, June, July, and August, dropped 36%, 60%, 69%, and 39% respectively from 1996 to 1998. There was a perception among the commercial industry that the reason for decreased trap net CPEs was the movement of whitefish to deeper waters. Concurrent with these changes was the rapid expansion of the zebra mussel population and noted increase in water clarity, increase in double crested cormorant numbers, and decline in diporeia numbers.

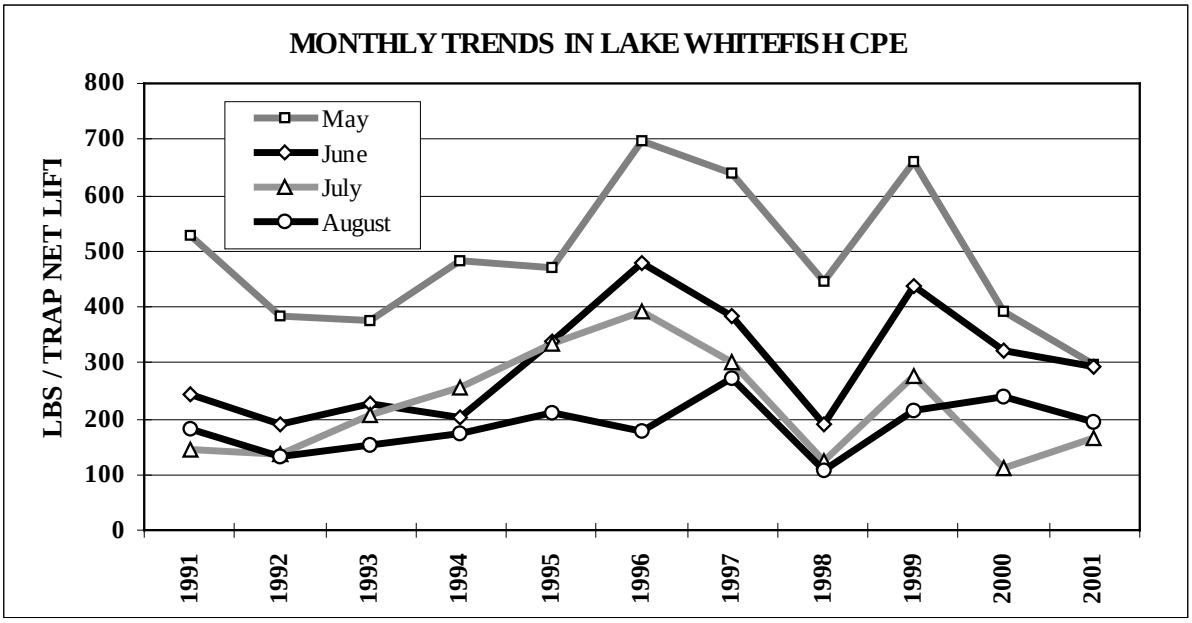

Figure 4.-Monthly trends in Wisconsin commercial trap net CPEs 1991 through 2001. In the Wisconsin waters of Lake Michigan and Green Bay, trap nets were restricted to water less than 78 feet 1991 through 1998, and water less than 90 feet 1999 through 2001.

In response to requests for deeper trap net sets the Wisconsin Department of Natural Resources (WDNR), in cooperation with Wisconsin commercial fishers, conducted a study to evaluate the impacts of fishing trap nets to depths of 150 feet. A final report on that study is in progress. Based on preliminary analysis of that study, the WDNR has initiated a rule change proposal, which will permit the use of trap nets to depths of 150 feet.

Whitefish mean length and weight at age (ages 2-5) in spring 2001 were near the lowest values documented since 1985. 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 been a marked decline in the condition of whitefish in the North/Moonlight Bay (NMB) population (Figure 5). 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 and 2001, ages two and three demonstrated a reversal of this trend and ages four through six leveled off.

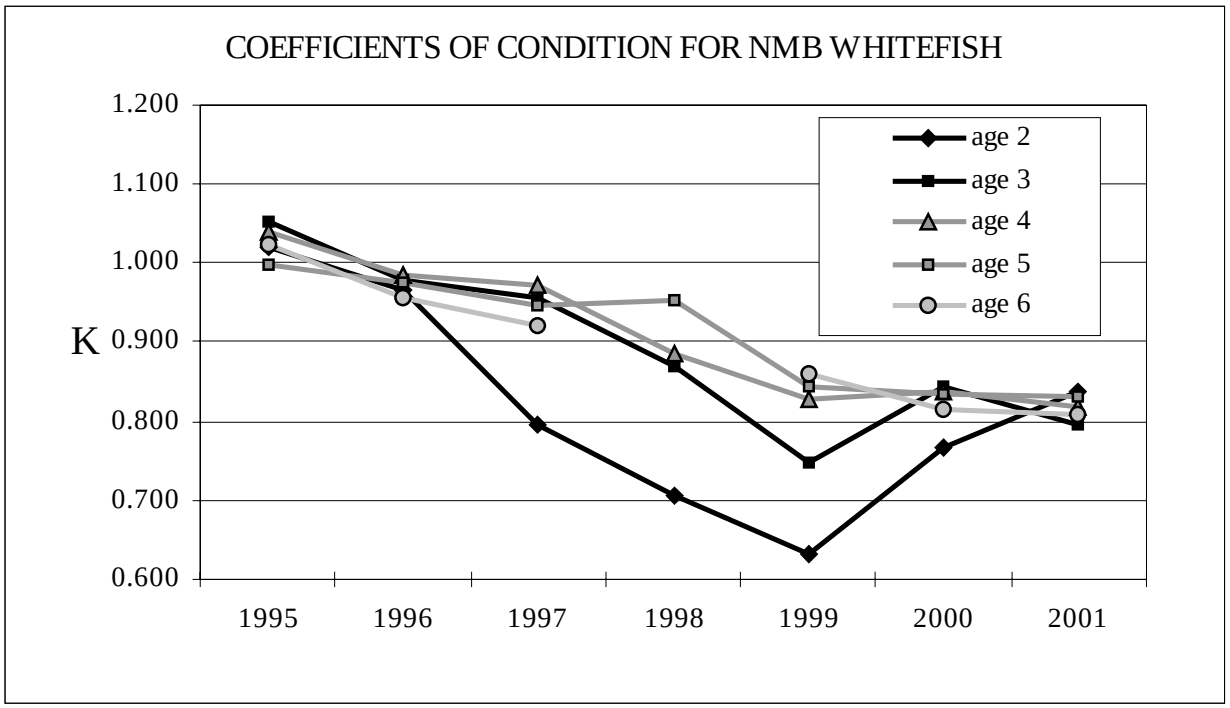

Figure 5.-Condition of lake whitefish from the NMB stock 1995 through 2001. Condition (K) as used in this context is a measure of the relative plumpness of the fish. To avoid possible variations caused by gonad development or condition, only whitefish sampled in spring were utilized for this analysis.

The spring graded mesh gill net (GMGN) juvenile whitefish survey conducted by WDNR over the past three 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 of the NMB 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 conducted by WDNR 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.

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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 246,170 pounds of rainbow smelt during 2001 (Figure 1). This reported catch was 17% lower than the reported 2000 harvest of 297,671 pounds and was the lowest reported harvest since the early 1980's. The 2001 rainbow smelt harvest continued the trend of declining harvest first observed in 1994.

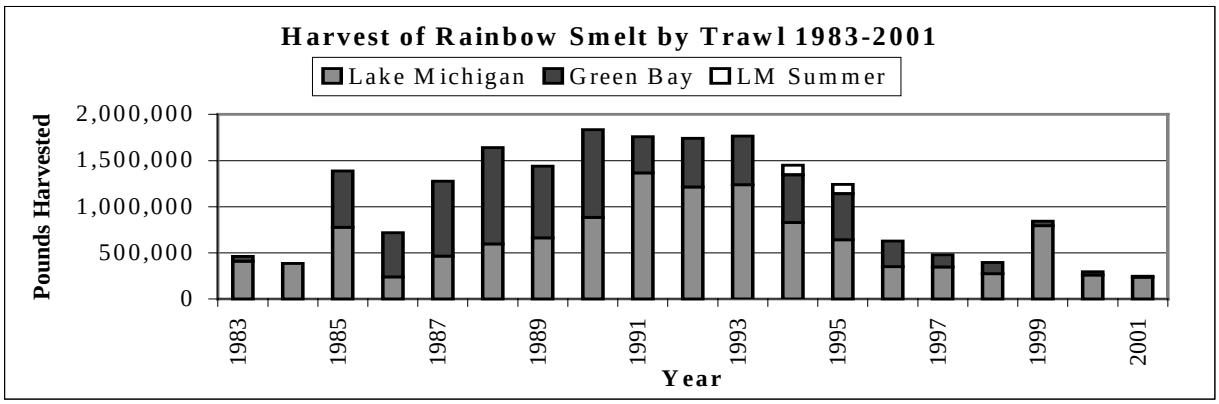

Figure 1. Reported rainbow smelt harvest by trawl from the Wisconsin waters of Lake Michigan for the years 1983 through 2001.

The harvest of rainbow smelt from Lake Michigan was 234,505 pounds (Figure 1), with an average CPE of 131 pounds per hour trawled (Figure 2). The 2001 Lake Michigan rainbow smelt harvest was the lowest reported since 1986 when 239,340 pounds was harvested. CPE on Lake Michigan, which declined to 131 pounds per hour trawled, was the lowest on record. However, total effort, the number of hours fished increased by 37% from 2000 levels and continued the trend of increasing effort since 1996.

Commercial trawlers on Green Bay reported a rainbow smelt catch of 11,665 pounds (Figure 1), with a CPE of 105 pounds per hour trawled (Figure 3). The 2001 rainbow smelt harvest on Green Bay was the lowest ever reported. CPE on Green Bay decreased 35% from 2000 levels. Total fishing effort declined to 111 hours in 2001 continuing the trend of decreasing effort on Green Bay.

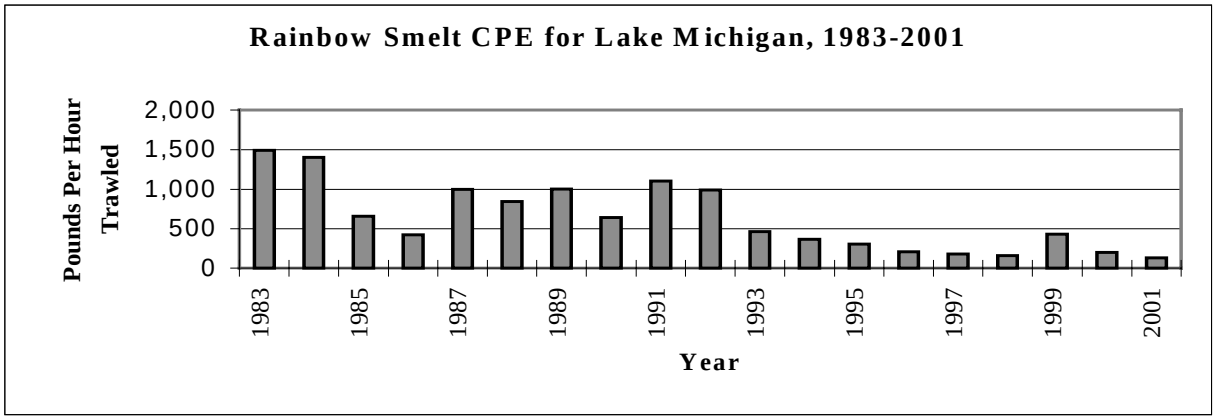

Figure 2. Rainbow smelt CPE in pounds per hour trawled on Lake Michigan during the years 1983 through 2001.

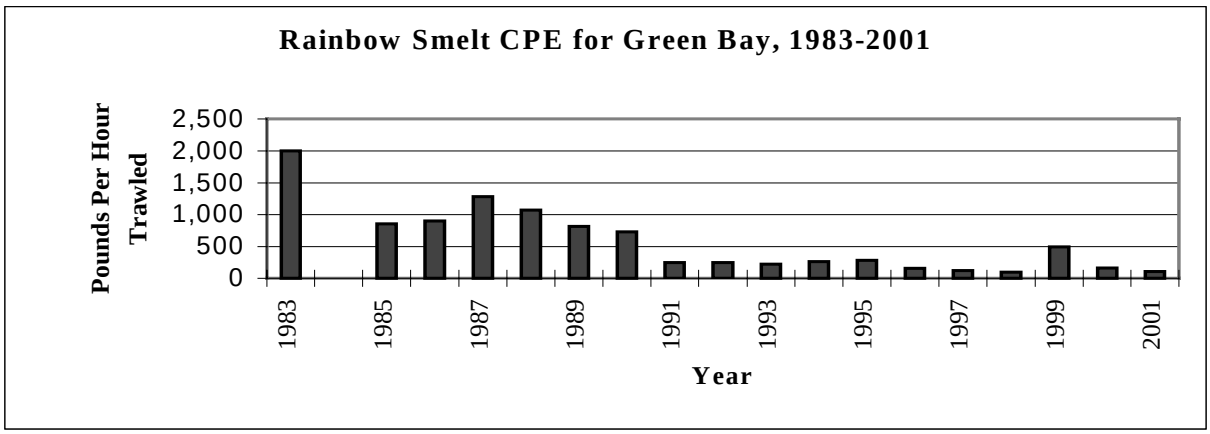

Figure 3. Rainbow smelt CPE in pounds per hour trawled on Green Bay during the years 1983 through 2001.

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 and 2001 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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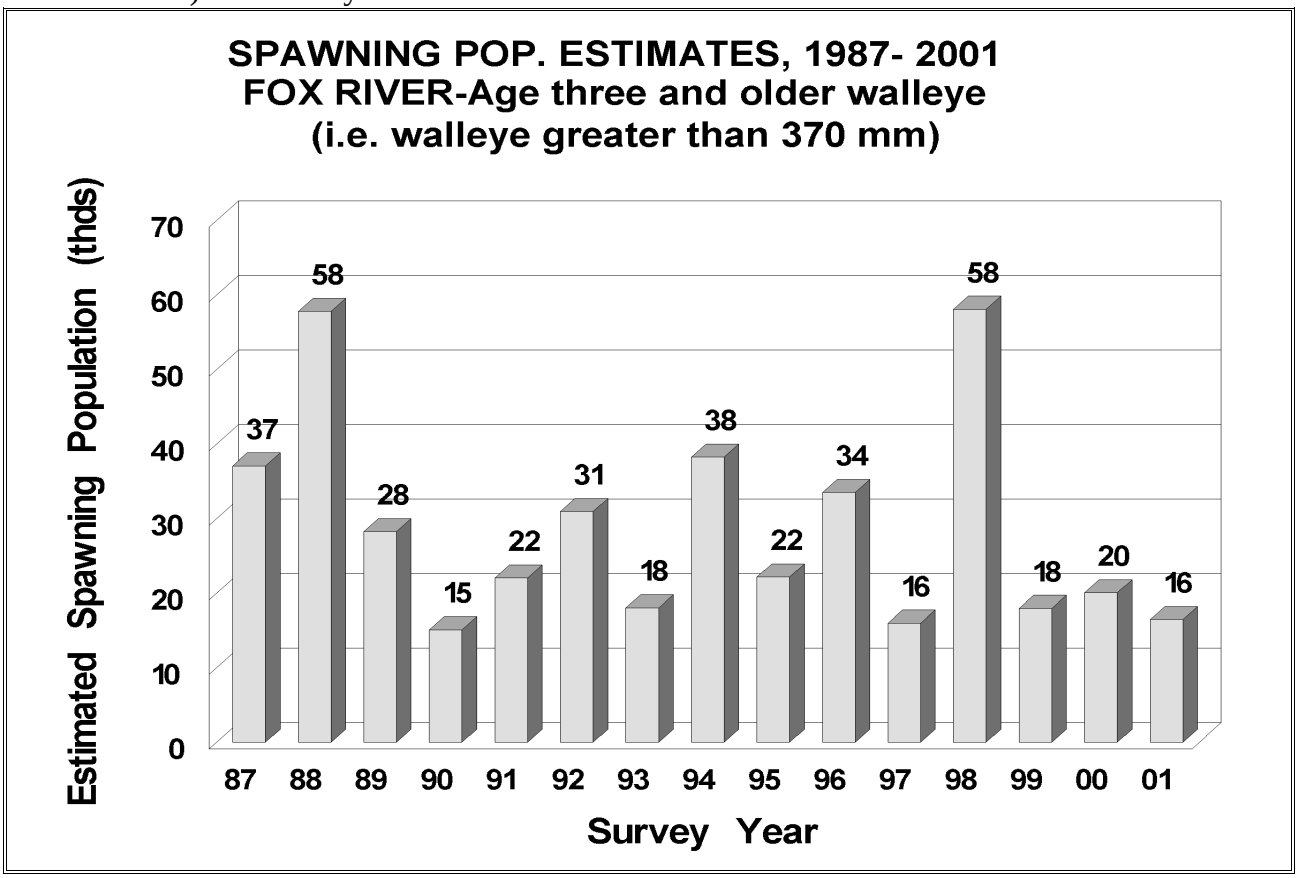
STATUS OF WALLEYE STOCKS-GREEN BAY

Fox River

Abundance

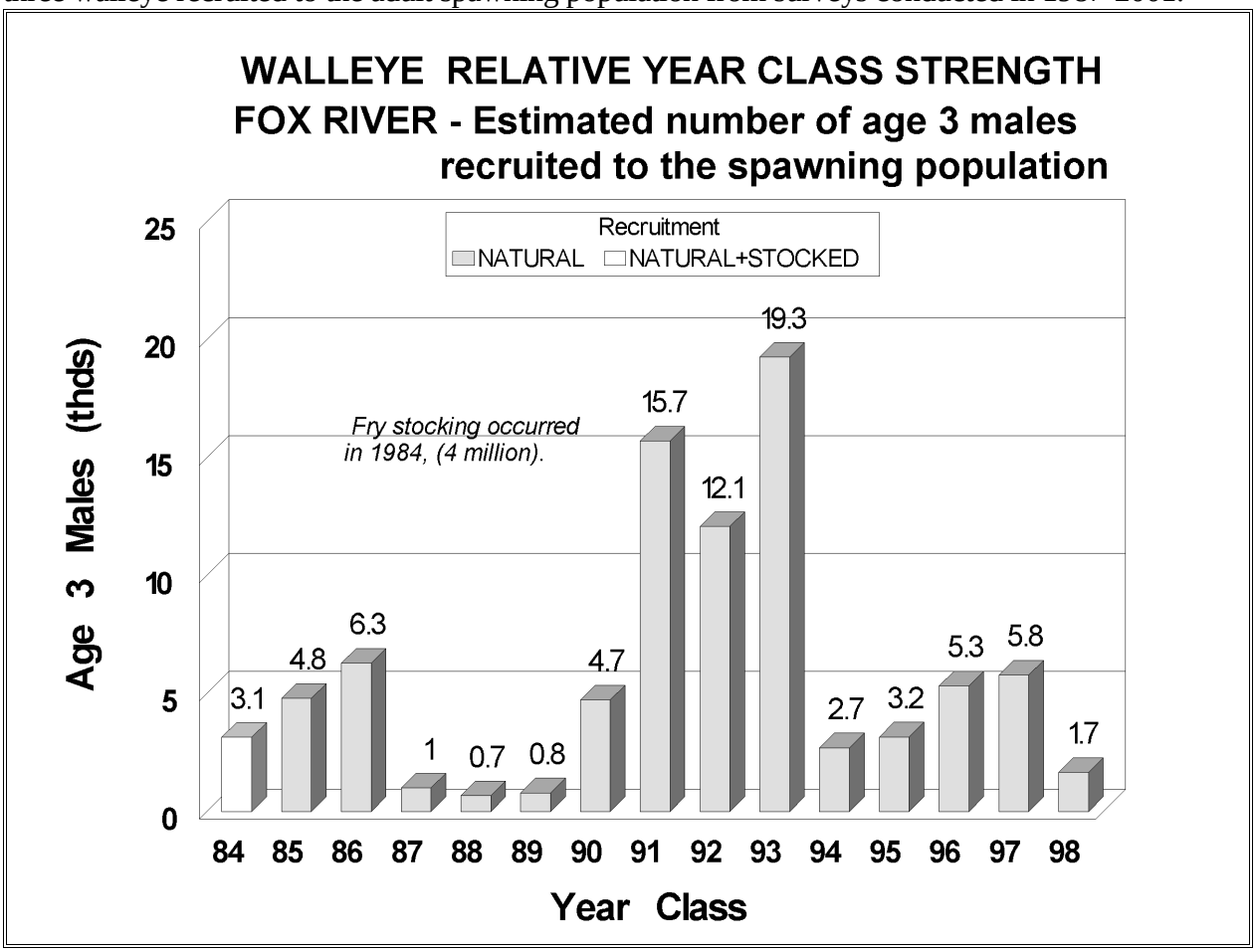
The adult spawning population of walleye in the Fox River for the spring of 2001 (age 3 and older; and greater than 370 mm, Figure 1) was estimated at 16,492 (95% CI 11,418 – 24,739). Population levels for the past three years have remained relatively stable but are substantially lower than the ten year average of 27,700 adult walleye. Continued 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. Assuming a majority of the walleye from lower Green Bay and the Fox River are spawning in the river, less than ten percent of population is being harvested (see catch and harvest discussion). Because of the low level of exploitation, reduced walleye abundance currently does not pose much concern.

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 2001.



We estimated that 1,663 male walleye were recruited to the spawning population in survey year 2001 (Figure 2.). This falls far short of our expectations. On the basis of our fall YOY index surveys w had expected the 1998 year class to contribute substantially to the spawning population in 2001. These fall surveys had suggested that this year class was the third most abundant since we had initiated the surveys (see Figure 3.)

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 1987-2001.



Age Structure

The age structure of males and females in the spawning population for 1998-2001 are shown in Tables 1 and 2. Age three cohorts dominated the male spawning population in 2000, representing 48.7% of all males, but three year old males represented only 20.5 % of the male population in 2001. As previously discussed, we had expected the 1998 year class (age three) to much higher in abundance, not only because it was abundant as YOY in 1998 but also because it was strongly represented as two year olds in the spawning survey in 2000. There is little information to explain the drop in abundance of this year class from year 2000 to 2001.

Just as confusing is the relatively high abundance of age three females. Maturation of females normally does not begin until age four and not complete until age five.

Table 1. Age Distribution (%) of Male Spawning Walleye – Fox River 1998-2001

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					
2001	0.4	20.5	41.6	20.3	12.0	3.4	0.6	0.4	0.6	0.2		

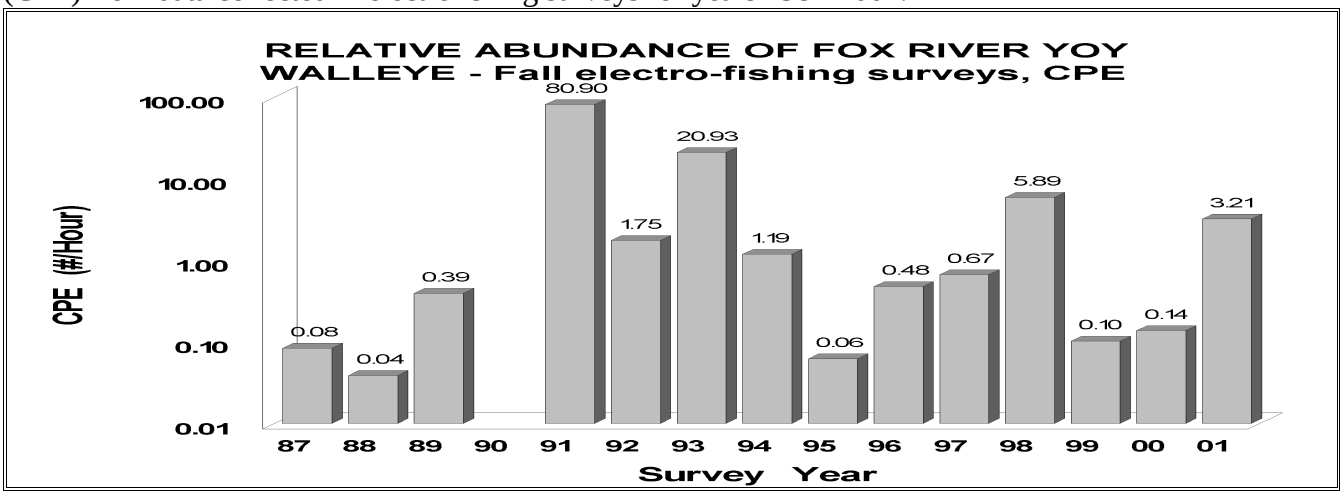
Table 2. Age Distribution (%) of Female Spawning Walleye – Fox River 1998-2001

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		
2001		6.0	10.8	33.6	16.3	9.8	10.0	6.0	2.7	2.7	1.6	0.5

Recruitment

Results of the fall electrofishing surveys showed a much higher abundance of fall fingerlings than in 2000. The 2001 year class appears to be in the same range of magnitude as the 1998 year class (Figure 3). Based on these survey data, 2001 cohorts are the fourth most abundant, exceeded only by the 1998, 1993 and 1991 year classes. However, both the 1991 and 1993 year classes were an order of magnitude higher in abundance on a catch per unit effort basis.

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 1987-2001.

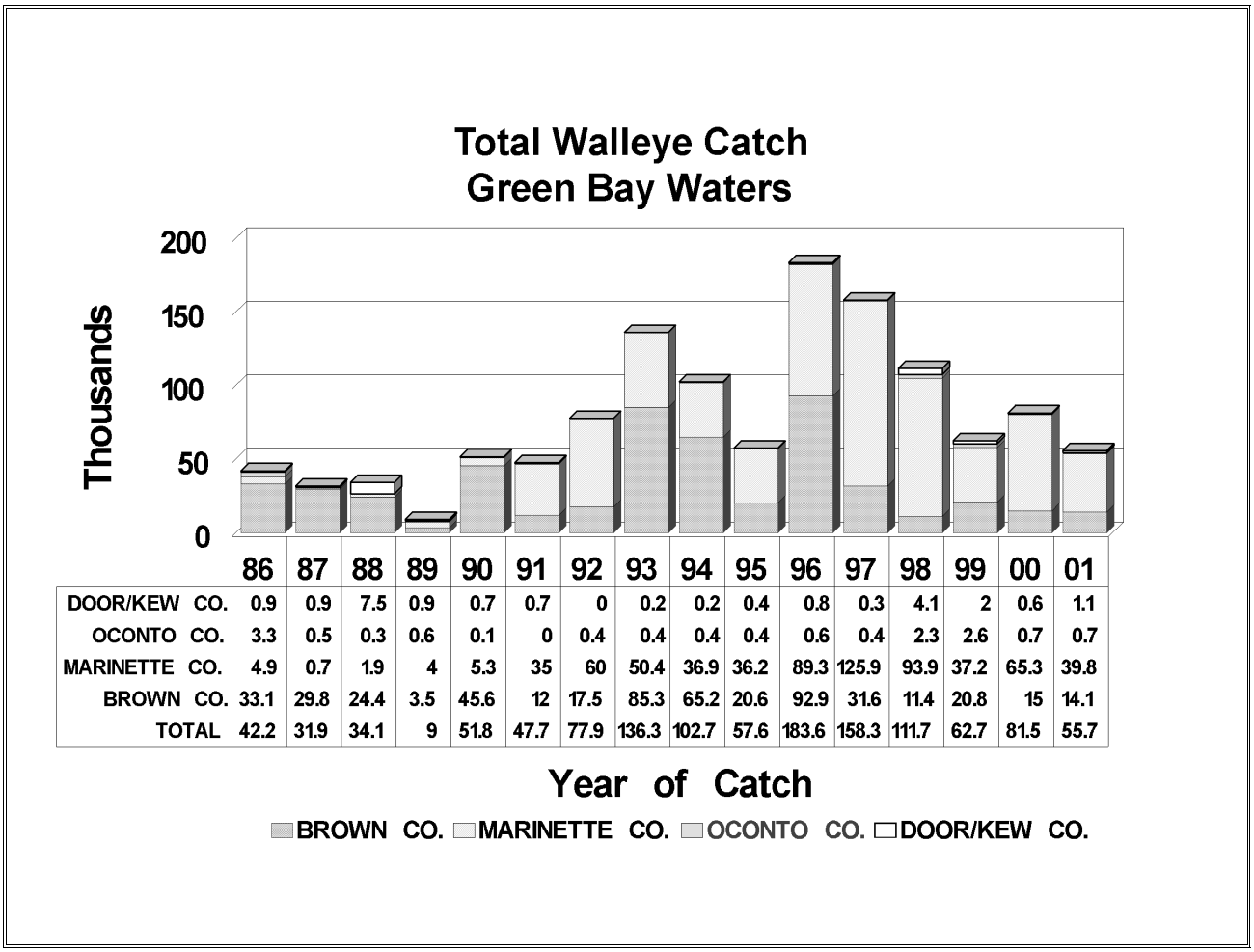


Catch and Harvest

The walleye catch for Wisconsin waters of Green Bay was estimated at 55,700 walleye during the open water season in year 2001 down from 81,500 caught in 2000 (Figure 4.). Brown and Marinette Counties showed a reduction in catch, 6% and 39% respectively, while Door/Kewaunee and Oconto County showed an increase. The reduction in catch of over 25,000 walleye from Marinette waters accounts for almost all of the change in total catch for Green Bay. Door/Kewaunee's catch more than doubled with a catch in 2001 of 1140 walleye, up from 562 in 2000. Oconto County's increased only 3% from a low level of 659 walleye in 2000.

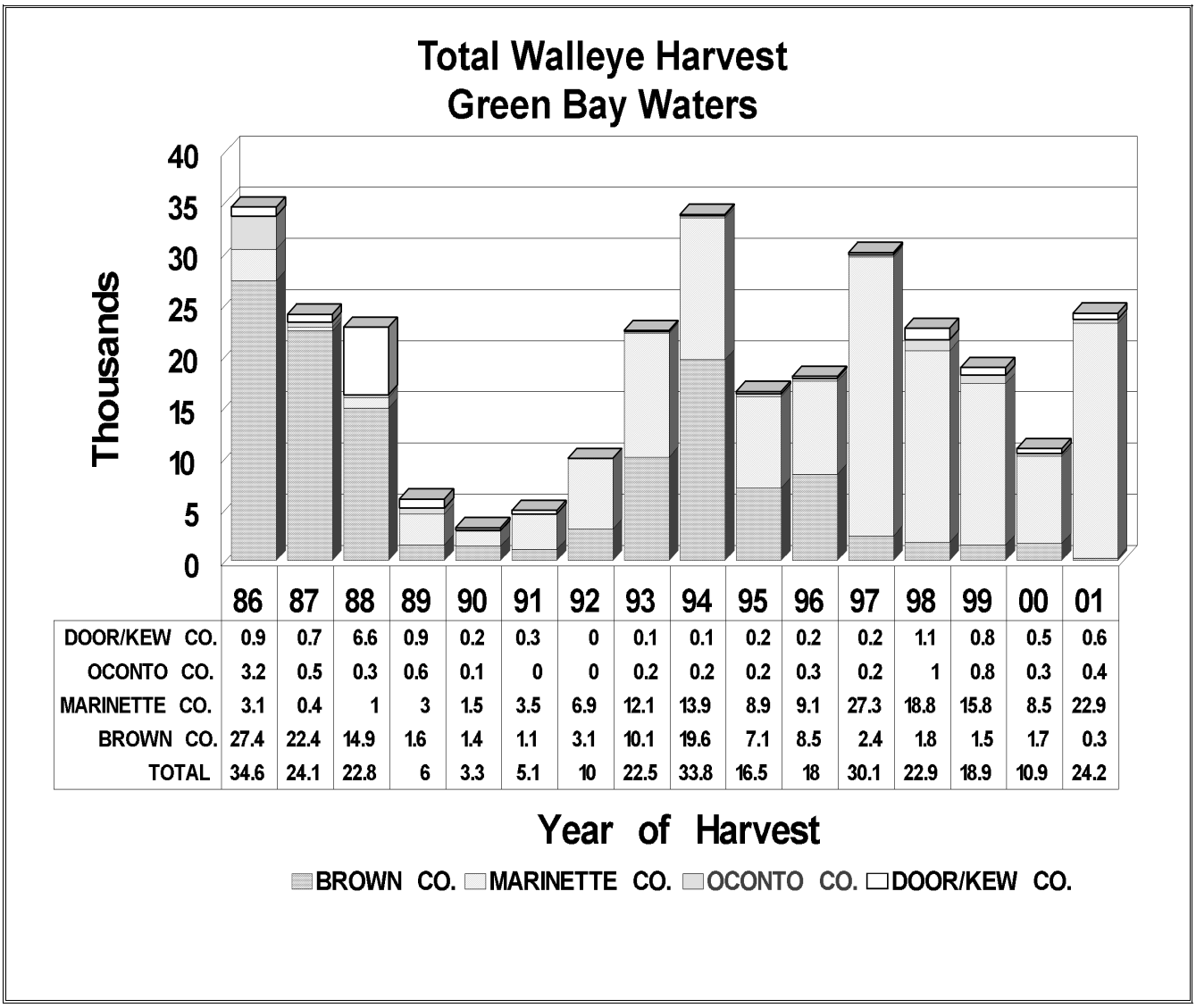
In contrast, total harvest on Green Bay more than doubled, increasing from 10,945 walleye in 2000 to 24,193 in 2001. Most of this increase occurred in Marinette County waters where the harvest almost tripled from 8,511 walleye to 22,937 (Figure 5.). Only in Brown County did the harvest decrease, from 1688 walleye to 263 walleye.

Figure 4. Total walleye catch for Wisconsin waters of Green Bay by County for the years 1986-2001.



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
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	0.6	1.1
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	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	39.8
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	14.1
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	81.5	55.7

Figure 5. Total walleye harvest for Wisconsin waters of Green Bay by County for the years 1986-2001



	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
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	0.6
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	0.4
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	22.9
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	0.3
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	24.2

Sturgeon Bay

Introduction

In 1973 the Department of Natural Resources began efforts to rehabilitate walleye stocks in and around the waters of Sturgeon Bay. Walleye fry and fingerling were stocked on an annual basis for five and seven consecutive years, respectively (Table 1). Fingerlings were also stocked in 1981 and in 1984. Maintenance stocking of fingerlings resumed in the Sturgeon Bay/Little Sturgeon area in 1994.

Annual spring spawning surveys were conducted from the mid 1980's until 1996 to determine the composition of the walleye population and to document any evidence of natural reproduction. Four years later, in the spring of 2000, a survey with fyke nets was conducted to determine the current age composition, population size and relative survival of stocked walleye since stocking resumed in 1994.

Table 1. Summary of walleye stocking in the lower Fox River/Green Bay 1973 – 1984, 94, 96 - 99

YEAR	LOCATION	NUMBER STOCKED	SIZE
1973	STURGEON BAY	46,070 4 MILLION	FINGERLINGS FRY
1974	STURGEON BAY	149,938 4.9 MILLION	FINGERLINGS FRY
1975	STURGEON BAY	330,910 5 MILLION	FINGERLINGS FRY
1976	STURGEON BAY FISH CREEK STURGEON BAY	133,775 16,650 5 MILLION	FINGERLINGS FINGERLINGS FRY
1977	STURGEON BAY FOX RIVER FISH CREEK STURGEON BAY S. GREEN BAY	248,080 58,850 50,600 8.9 MILLION 1.4 MILLION	FINGERLINGS FINGERLINGS FINGERLINGS FRY FRY
1978	STURGEON BAY PESHTIGO RIVER FOX RIVER	56,802 40,573 8 MILLION	FINGERLINGS FINGERLINGS FRY
1979	STURGEON BAY PESHTIGO RIVER FOX RIVER	332,738 39,800 10 MILLION	FINGERLINGS FINGERLINGS FRY
1980	S. GREEN BAY FISH CREEK FOX RIVER	267,406 89,000 10 MILLION	FINGERLINGS FINGERLINGS FRY
1981	STURGEON BAY FOX RIVER	472,222 10 MILLION	FINGERLINGS FRY
1982	S. GREEN BAY FISH CREEK FOX RIVER	229,640 115,556 5 MILLION	FINGERLINGS FINGERLINGS FRY
1983	PENSAUKEE R. OCONTO R. FOX RIVER S. GREEN BAY	329,360 164,950 6 MILLION 4 MILLION	FINGERLINGS FINGERLINGS FRY FRY
1984	STURGEON BAY FOX RIVER	381,951 4 MILLION	FINGERLINGS FRY

MONTH/YEAR	LOCATION	NUMBER STOCKED	SIZE
7/94	SAWYER HARBOR LT. STURGEON BULLHEAD PT. MEMORIAL DR.	10,000 20,040 19,000 11,248	FINGERLINGS

9/94	STURGEON BAY LT. STURGEON SAWYER HARBOR BULLHEAD PT.	19,900 20,580 12,000 12,000	FINGERLINGS
9/96	STURGEON BAY	1,638	FINGERLINGS
8/97	BULLHEAD PT.	41,000	FINGERLINGS
6/98	SAWYER HARBOR BULLHEAD PT. BRIDGE LT. STURGEON	45,325 45,325 45,325 45,329	FINGERLINGS
6/99	LT. STURGEON SAWYER HARBOR	78,000 80,400	FINGERLINGS
6/00	POT. PARK BULLHEAD PT. LT. STURGEON	62,806 62,806 62,806	FINGERLINGS

Methods

Standard 3' by 6', 1 ½ " stretch mesh fyke nets were fished within the Sturgeon Bay area from April 12, 2000 to May 4, 2000. Nets were set along a 2 mile stretch of shoreline beginning at the old railroad trestle in Sturgeon Bay and continuing northwest to the Hills Point Light area located Southeast of Potawatomi State Park. The number of nets fished each day during this period ranged from 3 – 8, for a total effort of 149 net nights. Nets were lifted each day (excluding some weekends and weather days). Each walleye captured was measured to the nearest mm, visually sexed and tagged with a yellow uniquely-numbered floy tag with a Sturgeon Bay DNR address. Dorsal spines rather than scales were collected on a representative sub-sample of the walleye population for aging purposes. Spines were determined to be a better choice in aging older, adult walleye especially past the age of eight. A length at age key was then created from the aged spines to age all the fish captured. A population estimate based on recaptures was made using the Chapman adjusted Schnabel census method. The percent survival rate of stocked cohorts (to the age of 3) was estimated for the males. The male percentage was calculated by multiplying the percent total of age 3 males by their estimated population number divided by the 1997 stocking total for that area. The percentage was then doubled to provide an estimated total percent survival rate since the percent survival for males was assumed to be the same for females.

Results and Discussion

A total of 1,104 walleye (776 males, 328 females) were captured during the spring survey. Although the majority of the spine-aged fish (59%) were less than age 10, there was a good representation of older aged fish, indicating a healthy walleye population (Table 2). The estimated age composition of the Sturgeon Bay walleye population, based on a total of 305 dorsal spines (190 male, 115 female) that were collected during the spring survey, ranged from 2- to 19-years-old (Table 3).

Males in the population ranged in age from 2- to 16-years-old, with ages 3, 6 and 12 dominating. The abundance of 3 and 6-year-olds suggest good survival from stockings in 1994 and 1997. Ages 7 through 14 had to originate either from natural reproduction in the area or emigration into the area from elsewhere in Green Bay since there was no stocking in the Little Sturgeon/ Sturgeon Bay area

from 1985 through 1993. The relatively large number of 12-year-old males further suggests that the 1988 year class was very strong.

Males ranged in total length from approximately 322mm to 700mm. Sexual maturity is reached by the age of 3. In comparison to the statewide averages, the mean lengths at age of the Sturgeon Bay male walleyes were 1- 4 inches larger for ages 2-16 (Figure 1).

Females sampled ranged in age from 4- to 19-years-old. The predominance of 6-year-old females, similar to males, also suggests good survival from the stocking in 1994. As with males, females from age 7 through 14 originated from natural reproduction or emigration into the area. Fish 15 years and older are probably survivors from stocking in the area during the early 1980's.

Females ranged in length from 487mm to 807mm. Most females were visually mature by the age of 4. Although the mean lengths at age for the Sturgeon Bay females, ages 4-7, were larger in comparison to the statewide averages, the older adult population of females, ages 11-15, were similar to the statewide length at age averages (Figure 2).

Table 2. Estimated age composition of Sturgeon Bay Walleyes based on a length at age key developed from spine aged walleyes taken in the Spring of 2000.

AGE	MALES		FEMALES	
	TOTAL NO.	% COMP. Of MALES	TOTAL NO.	% COMP. Of FEMALES
2	**36**	**5%**	**-**	**-**
3	**159**	**20%**	**-**	**-**
4	**39**	**5%**	**6**	**2%**
5	**45**	**6%**	**10**	**3%**
6	**203**	**26%**	**177**	**54%**
7	**7**	**1%**	**13**	**4%**
8	**7**	**1%**	**-**	**-**
9	**26**	**3%**	**-**	**-**
10	**66**	**8%**	**-**	**-**
11	**30**	**4%**	**7**	**2%**
12	**95**	**12%**	**8**	**2%**
13	**37**	**5%**	**13**	**4%**
14	**23**	**3%**	**33**	**10%**
15	**-**	**-**	**21**	**6%**
16	**3**	**<1%**	**26**	**8%**
17	**-**	**-**	**1**	**<1%**
18	**-**	**-**	**12**	**4%**
19	**-**	**-**	**1**	**<1%**
TOTAL NO.	**776**		**328**	

Figure 1. Mean length at age for male walleye in Sturgeon Bay.

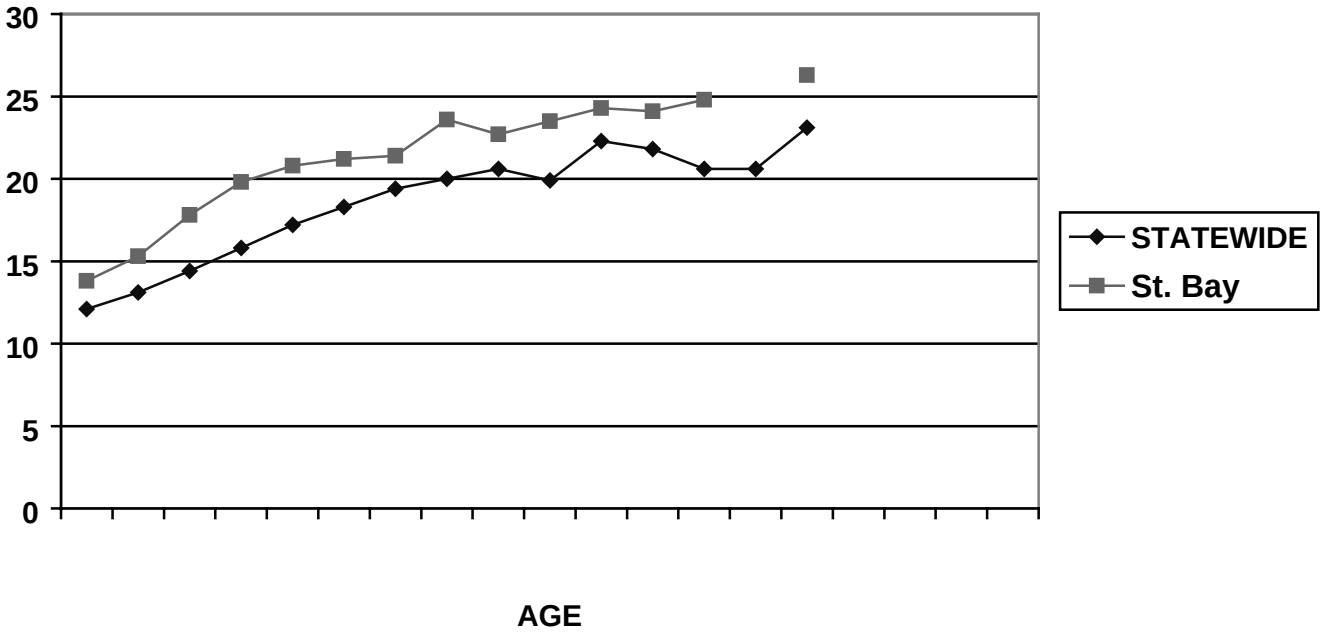
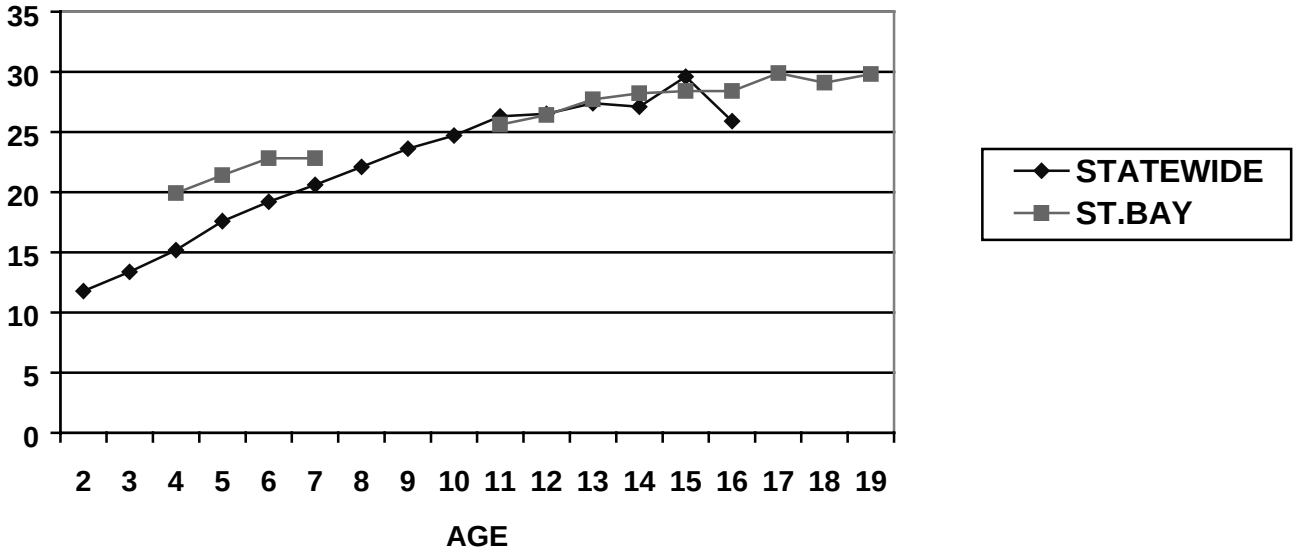


Figure 2. Mean length at age for female walleye in Sturgeon Bay.



To estimate the size of the spawning population, all fish captured (marked and unmarked) that were equal to or greater than 370mm (mean length for age 3 males) were used in the final calculation. Based on these returns, a population of 4,428 walleye (95% confidence interval of 3,721-5,267) was estimated to be utilizing these waters during the spring spawning period (Table 3). The number of sexually mature males was estimated to be 3,011 with age 3 males making up 16% (482) of the total.

Table 3. Estimated walleye spawning population in Sturgeon Bay, 2000

M	F	Total No.	Recap.	Pop. Est. Male and Female	95% Confidence Interval
695	329	1024	125	4,428	3,721 - 5,267

For both males (1.2%) and females (1.2%) combined, the estimated survivability of stocked cohorts to the age of 3 was 2.4% (Table 4).

Table 4. Estimated percent survival of stocked walleye (male and female) to age 3

Male Pop. Est.	% Age 3 Males	Est. No. of Age 3 Males	Year, Area and No. Stocked	Size when Stocked	Survival Of stocked Cohorts to age 3 Males and Females
3,011	16%	482	1997 Bullhead Pt. 41,000	Fingerling 200/lb. Ave.=2.7 in.	2.4%

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STATUS OF YELLOW PERCH STOCKS - 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 there has been only one moderately strong year class that 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, and then declined through the 1990's to an estimated biomass in the year 2000 of less than 500,000 pounds (Figure 2).

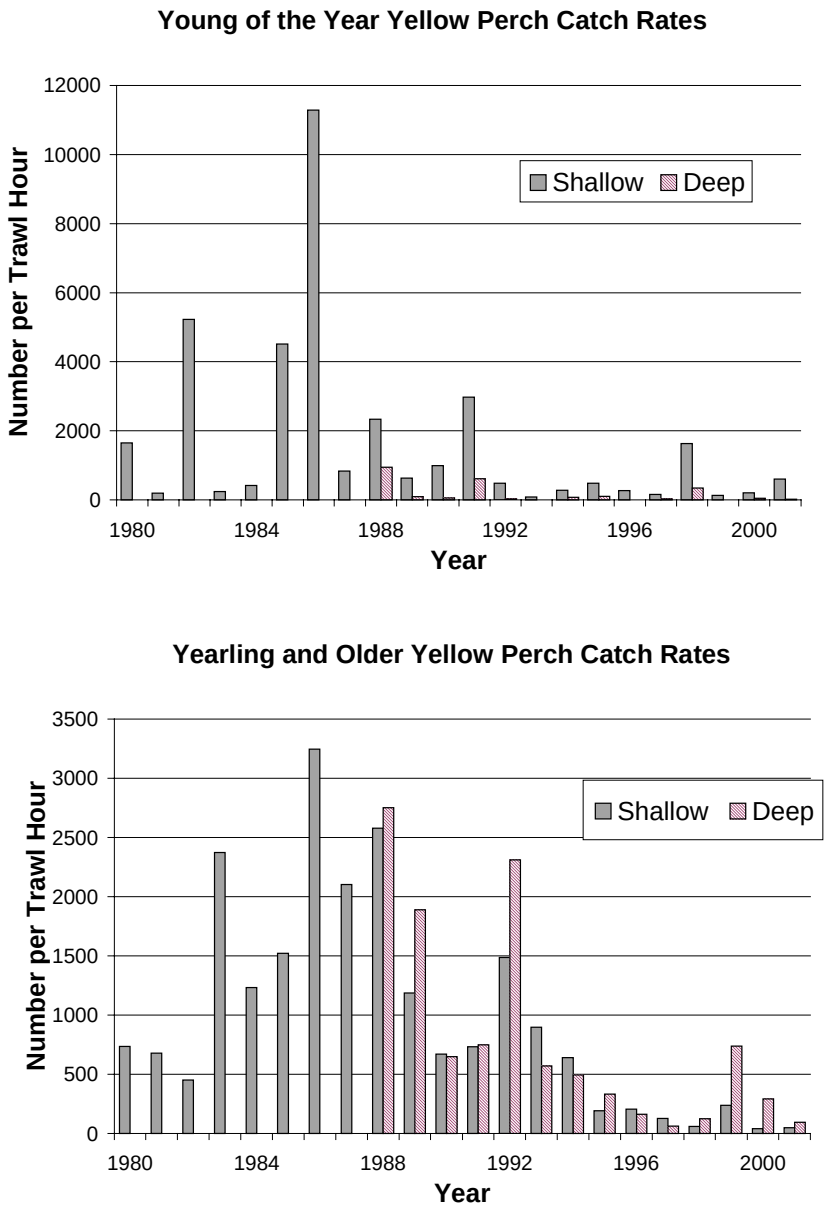

Figure 1. Trawl catch rates of young-of-year (top panel) and older (lower panel) yellow perch from 78 index trawl stations in Green Bay. Each bar represents the average over all trawl stations.

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 in abundance and to estimate mortality rates of individual year classes. There are presently 78 index trawling stations, an expansion of 32 deep-water sites were added in 1988. 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 the annual estimates of the biomass of each year class in the population (Figure 2).

The decline in the population during the 1990's can be attributed to poor recruitment of young-of-the-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 less abundant than hoped in 2000, however during 2001 the 1998 year class made up the majority of the sport and commercial harvest.

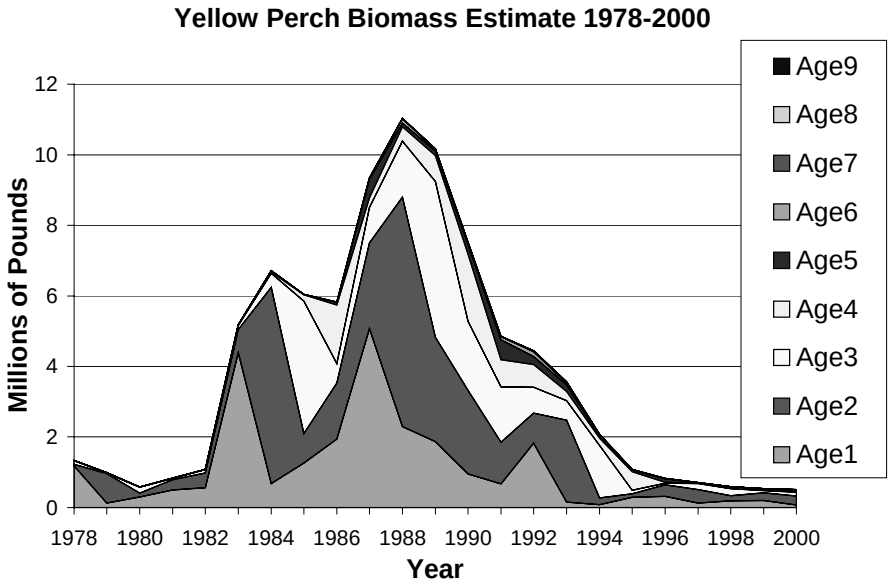

Figure 2. Estimated total biomass of age-1 and older yellow perch in Green Bay.

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 commercial fishing year 2000/2001 commercial fishers were not able to reach the annual harvest limit of 200,000 pounds they only harvested 34,387 pounds. Because of concerns over the health of the yellow perch population in Green Bay an emergency rule was put into place in July of 2001 to lower the commercial quota from 200,000 pounds to 20,000 pounds, this rule has been extended to be in place for another 2 years.

Sport fishing harvests have also risen and fallen with changes in yellow perch abundance. Sport harvest peaked at over 3,000,000 pounds in 1990 and 1991, when unusual ice conditions and large numbers of fish allowed the estimated harvest of 2,000,000 yellow perch through the ice each year. By the year 2000 the sport harvest had declined to an estimated 191,000 yellow perch in total, with only 27,318 being taken through the ice. During 2001 similar catches were found 210,489 yellow perch in total with only 24,891 being taken through the ice. Because of our major concerns over the health of the yellow perch population in Green Bay an emergency rule was put into place in July of 2001 to lower the daily sport bag limit from 25 yellow perch to 10 yellow perch, this rule has been extended to be in place for another 2 years to allow for further investigations into the current yellow perch population problems.

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STATUS OF YELLOW PERCH STOCKS - LAKE MICHIGAN

Stringent harvest regulations are still in place in order to protect remaining adult yellow perch population in Wisconsin waters as well as lake-wide. Although 1998 year-class raised some hopes of rebounding, the recruitment of yellow perch following 1998 has been extremely minimal. This report is a summary of the status of young and adult perch in Lake Michigan assessed through several annual assessments in Wisconsin waters during 2001-2002.

Seining

In southeastern Wisconsin, beach seining was done for young of the year (YOY) yellow perch at 18 sites between Kenosha and Sheboygan from August 15 to September 18, 2001 using a 25'bag seine. The bag-seine was found to be an effective gear in this area due to uneven bottom and hard substrate not conducive for trawling. However, some of the sites were modified due to lowered lake water level. Consequently some sites were eliminated due to unsuitable seining conditions. 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 2001 survey, we captured only one YOY perch with an overall CPE of 0.01, which indicates another year of poor reproductive success. By and large, alewife, longnose dace and spottail shiner dominated the catch.

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. In 2001, three lifts were taken on 5/30/2001, 5/31/2001 and 6/7/2001, each lift consisting of 1800' of gillnet (3 boxes of 600') effort, set overnight. We used 2 ¾" (400' per box) and 3" (200' per box) stretch mesh gillnets to fish. The nets were set at three depth ranges, shallow (33'-36'), mid (45'-56') and deep (59'-65'). A total of 993 adult male yellow perch and 438 female yellow perch were captured. One of the objectives was to assist in Sea Grant funded research on early life study. We were able to obtain necessary biological data and provide sufficient number of spawning individuals to the research team. Females comprised 31 percent of the total catch, which is greater than the female proportions found since 1994 (Table 1).

Graded Mesh Gill Net Assessment

The WDNR conducts standardized graded mesh gill net assessments annually in the winter, 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. Yellow perch begin to recruit to this assessment gear by age 2 and are fully recruited by age 3. A total of five lifts, each with 2800' were taken in December 2001 (12/4, 12/5, 12/11, 12/14 and 12/18) at depth ranges from 40' to 70'. This year, in order to compare catchability of two types of netting material – nylon and monofilament - used in the industry, we doubled the effort by replicating the nets yet keeping the mesh sizes and location of sampling consistent between the two types on nets. In addition to standard 2800' effort per lift, we deployed another 1400' of net to each day at different location to fish in deeper water ranging from 90' to 125'. This additional effort was made to test the hypothesis if the yellow perch population have moved to deeper water in light of the changed lake conditions. These deep set nets did not produce any yellow perch suggesting that there is no shift in their depth range. The

comparison of catch per effort of yellow perch between the two types of nets (monofilament vs. nylon) did not show any significant difference indicating that catchability was not influenced by the netting material.

Table 2 shows the relative abundance as catch per effort of perch, by age, for this assessment from 1988 through 2002. 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 the late 80s. Almost the entire 90s had very low numbers of age 3 and under, while the population was skewed toward older male perch. However, data on age and size distribution of yellow perch from 1999 onward represented smaller and younger perch (ages 2 to 4) in significant proportions, essentially from 1998 year-class (Table 2). The proportion of age 5 and older perch has been extremely reduced (Fig. 2). 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 since 1998 is showing up as extremely weak year-classes. However, since 1999 the sex ratio of the yellow perch population has shifted toward predominantly female, influenced by the 1998 year-class.

Figure 3 shows average length-at-age for ages 2 to 10 captured from 1986 to 2002. 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. Such response of 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.

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 5 fish/day in recent years, which is reflected in the total harvest (Table 3). Our creel survey data on the sport caught yellow perch indicated that the majority of catch consisted of a single year-class. The 1998 year-class dominated the sport harvest in 2001 representing 86.5% of the catch. Similar trend is evident from the 2002 winter graded mesh assessment that the1998 year-class comprised 89.5% of the catch. Because of the decreased density, the perch seem to be growing at a faster rate and attaining larger size at age, and hence the larger individuals in the angler harvest. This has caused some concern in both sportfishing community as well as the biologist that the adult perch may be getting removed from the population before they had a chance to spawn.

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, there appears to be a measurable year class produced in 1998. 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 with the month of June closed for fishing. These rule changes are implemented to benefit the perch population by reducing impact on spawning stocks. Currently, sport fishery seems to be dominated by a single year-class of 1998 comprising more than 86% in 2001, predominantly large female. The WDNR, sharing the concern of sport anglers, is proposing a season closer to include the entire month of May and extending till June 15 so that the fish are not

harvested prior to and during the peak spawning period.

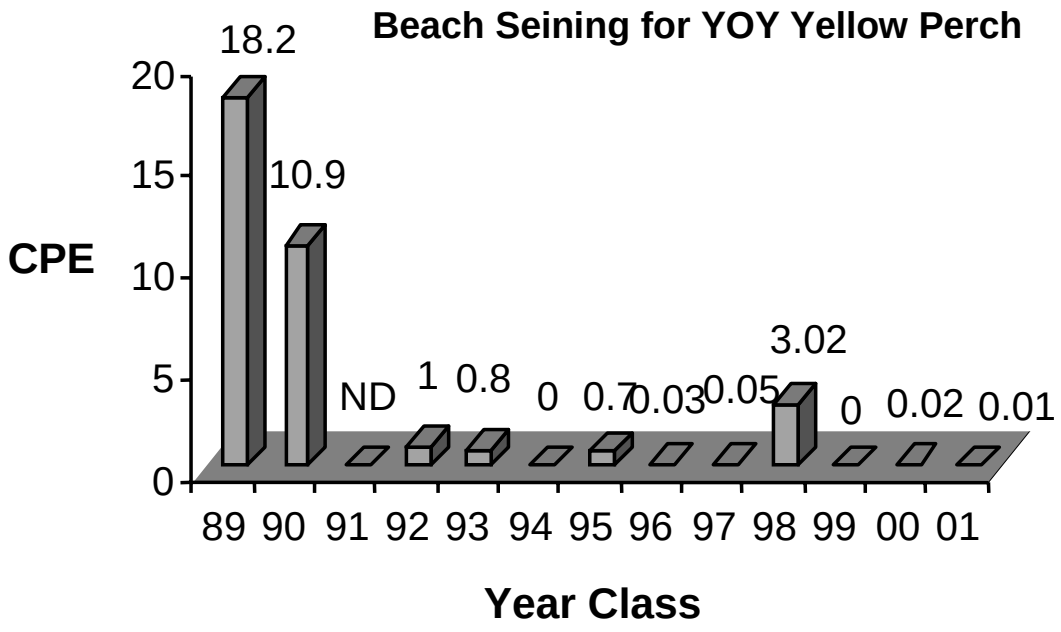

Figure 1. CPE (fish/100' seine haul) of YOY yellow perch in summer beach seining.

Table 1. Yellow perch spawning assessment in Milwaukee waters (Green Can Reef) of Lake Michigan - 1990-2001.

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
2001	1431	993	438	0	31	5,400

[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	2002
1	0	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	0
3	453	1854	1037	865	276	98	25	0	0	4	2	57	65	243	4
4	386	1012	938	323	715	402	58	28	0	14	6	215	9	20	118
5	701	1563	394	327	281	757	218	65	0	11	29	93	27	2	4
6	324	1880	381	83	181	165	141	120	19	18	35	57	2	2	3
7	12	155	90	82	126	49	48	76	51	77	20	45	0	1	1
8	3	1	0	32	73	16	11	65	71	251	43	63	8	2	0
9	0	0	0	0	14	0	0	24	31	109	110	44	9	1	0
10	0	0	0	0	0	0	0	2	12	15	60	33	11	1	0
11	0	0	0	0	0	0	0	0	3	0	15	9	1	1	1
12	0	0	0	0	0	0	0	0	0	0	4	7	0	0	1
%Male	56	69	61	72	82	86	89	90	95	89	80	58	36	36	38
%Female	44	31	39	28	18	14	11	10	5	11	20	42	64	64	62

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

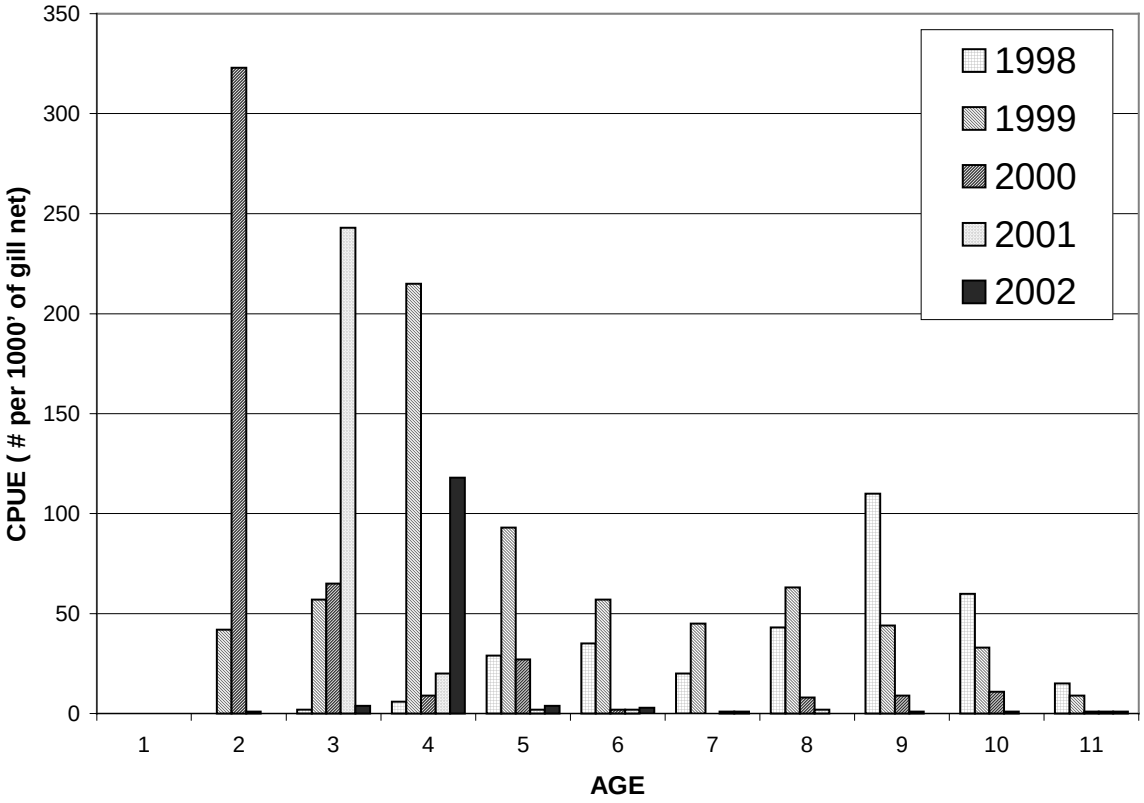

Figure 2. Comparison of Catch at Age for Yellow Perch in Wisconsin Waters of Lake Michigan, 1998-2002.

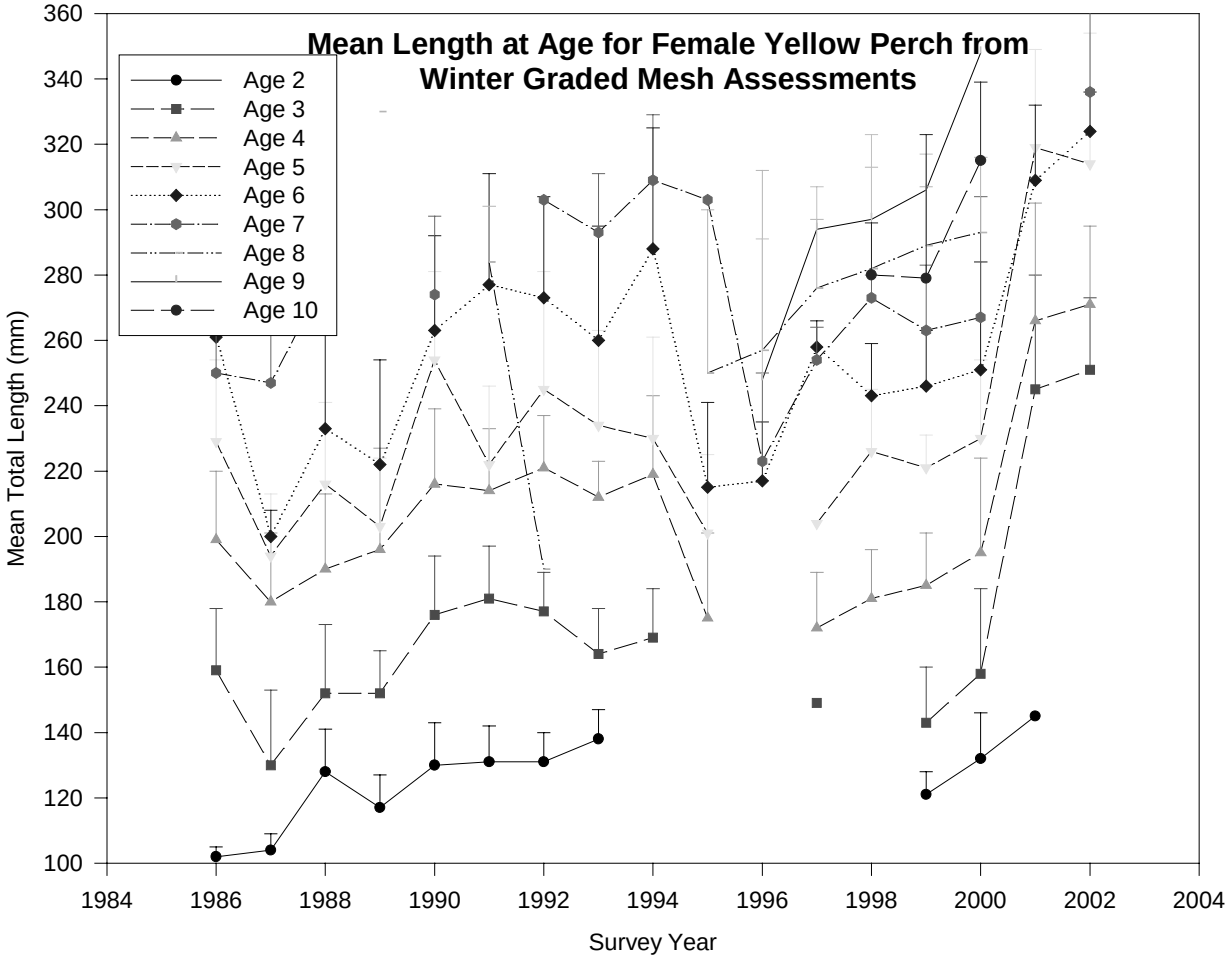

Figure 3. Average length-at-age of female yellow perch captured during winter graded mesh assessment in Milwaukee (the vertical bar extending from each data point represents standard deviation).

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

Year	Commercial harvest (lb. x 1000)	Sport harvest (number x 1000)
1986	373	411
1987	550	639
1988	431	932
1989	267	719
1990	256	649
1991	326	887
1992	282	960
1993	267	546
1994	254	290
1995	128	247
1996	15[a]	95[b]
1997	closed	31[b]
1998	closed	38[b]
1999	closed	34[b]
2000	Closed	75[b]
2001	Closed	134[b]

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

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CHINOOK SALMON MARKING TECHNIQUE STUDY

The Wisconsin Department of Natural Resources (WDNR) began using coded wire tags (CWTs) as a technique of marking chinook salmon back in 1982. Since that time the WDNR has marked and released in excess of one million CWT chinook salmon. The various CWT studies have added much to our knowledge of chinook salmon in Lake Michigan and have allowed the WDNR to improve our chinook rearing and management techniques. Although the CWT technique of marking chinook fingerlings has been reliable and effective, it is also expensive and labor intensive. CWTs and the necessary equipment to apply and detect them are currently purchased from a sole vendor who has kept the price of utilizing CWTs high. Another drawback to the CWT technique is the lethal technique required to retrieve the CWT for decoding. Another drawback to CWTs is the high expense associated with the necessary manpower to collect salmon heads, extract the CWTs from the fish heads, and then finally decode the extracted CWTs. Large scale projects such as those conducted by the WDNR in recent years also require the maintenance of large freezer capacities for the storage of salmon heads for processing. This project was set up to evaluate alternate ways of marking chinook fingerlings for future studies that would be both effective and more reasonably priced.

Standard fin clipping is much less expensive and provides instant recognition. With instant recognition, the costs associated with head collection, storage, extraction, and decoding could be eliminated. However, fin clips have the disadvantage of possible fin regeneration and a limited number of clips available which must be coordinated and shared with other Great Lakes states conducting chinook salmon research. Additionally, there have been studies conducted on Pacific salmon by the state of Washington (personal communication, Thompson, Washington Department of Fish and Wildlife) which indicated reduced survival of salmonid fingerlings marked with fin clips, especially when any of the paired fins were removed.

Recently, a rather promising technique of fish marking was developed by NEWWEST Technologies. The technique known as photonic tagging involves the use of compressed air to dispense a precisely measured amount of “tag” under pressure. The tag is actually a liquid suspension of microscopic fluorescent microspheres, which can be supplied, in a wide variety of colors (wavelengths). The fluorescent microspheres can be injected into whatever fin the researcher decides. In theory, fish marked by this technique can be identified by simply passing a marked fish under an UV light source of the appropriate wavelength (365) and the tag is fluoresced and visible. By using a combination of different colored tags and various marking locations (different fins) a large number of uniquely marked fish seemed possible. The “tags” for the photonic tagging technique were comparable in price to current CWT costs. However, the equipment to mark the fish photonically was much less expensive. Similar to fin clipping, the concept of photonic tagging had the advantage of instant, non-lethal recognition. This meant that no fish heads would need to be collected, and stored, no tags would need to be extracted and decoded, and no large freezer capacity would need to be maintained. Manpower and cost savings could be substantial.

A study to evaluate the photonic marking technique and paired fin clipping on chinook salmon in Lake Michigan was designed. In the spring of 1999 and again in the spring of 2000 three separate lots of CWT chinook salmon fingerlings were marked and released from Strawberry Creek along with the standard production fish. In 1999 one lot was marked with the conventional adipose fin clip and CWT

(A-CWT), a second lot was marked with an adipose, right ventral fin clip, and CWT (ARV-CWT), and the third lot was marked with an adipose fin clip, CWT, and a photonic mark (A-CWT photonic). In 1999 there were three different photonic colors utilized (orange, pink, and green), in approximately equal proportion, but they all received the same CWT code (Figure 1). The study plan for the 2000 stocking was to repeat the same three study groups except that the one lot would be marked with an adipose, left ventral fin clip (ALV-CWT), and the photonic lot would be subdivided into three separate color lots each with their own unique CWT code. Days before photonic marking was to begin, in the spring of 2000, the company cooperating in this study was unable to follow through on their plans, and the lot of CWT chinook fingerlings destined for photonic tagging was marked and stocked out as a CWT only (no adipose fin clip) as a last minute modification to the study.

Figure 1.-Photonic marked chinook salmon fingerlings stocked at Strawberry Creek in the spring of 1999. These fingerlings were part of a marking technique study and in addition to the photonic mark they were also marked with an adipose fin clip and CWT. Three colors, (orange, pink, and green) of photonic tags were utilized in approximately equal proportions but all three colors carried the same CWT code.

In the spring of 1999 all three study lots of CWT chinook fingerlings were stocked into the SCW pond on May 3rd, and reared with the standard production fingerlings. At the time of stocking into the SCW pond, the various groups of CWT study fingerlings were similar in size and ranged from 82.6mm to 86.6mm and 4.3g to 5.0g. The chinook fingerlings were released from the SCW pond on May 17th. Before release, underwater video of the CWT fingerlings mixed in with the standard production

fingerlings was filmed in the SCW pond. In this video, the photonic tagged fingerlings can easily be seen mixed in with the non-marked fingerlings. At the time of release from SCW pond the photonic mark was very visible to the unaided eye without the use of an UV light source. It is estimated that the following numbers of chinook marking technique study fingerlings were successfully released from SCW: 24,900 A-CWT; 25,000 ARV-CWT; and 24,800 A-CWT/photonic split into approximate thirds and marked with one of three different photonic colors, (8,300 pink, 8,300 green, and 8,200 orange).

In the spring of 2000 all three study lots of CWT chinook fingerlings were stocked into the SCW pond on May 10th, and reared with the standard production fingerlings. At the time of stocking into the SCW pond, the various groups of CWT study fingerlings were similar in size and ranged from 85.4mm to 86.7mm and 5.1g to 5.7g. The chinook fingerlings were released from the SCW pond on June 5th. It is estimated that the following numbers of chinook marking technique study fingerlings were successfully released from SCW: 26,000 A-CWT; 26,000 ALV-CWT; and 27,000 CWT without an adipose clip.

In the fall of 2000 the 1999 year class was recovered at SCW at the age of 1+ (Table 1, Figure 2). The A-CWT photonic tagged chinook were recovered at a rate of 1.20 percent, the ARV-CWT treatment group was recovered at a rate of 1.04 percent, and the standard production A-CWT treatment group was recovered at a rate of 0.92 percent.

Table 1.-Marking technique study return rate of CWT chinook salmon at age and by year class to the Strawberry Creek Weir, Door County, for year classes 1999 through 2000.

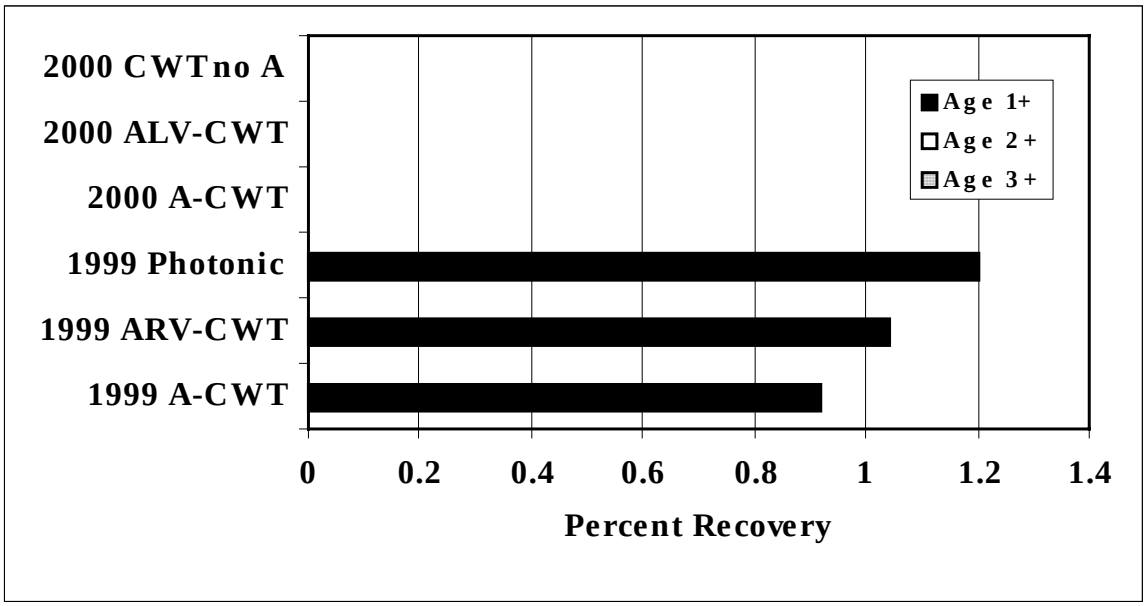
YEAR CLASS	TREATMENT GROUP	AGE AT RETURN					CUMULATIVE RETURN BY YEAR CLASS
		AGE 1+	AGE 2+	AGE 3+	AGE 4+	AGE 5+	
1999	A-CWT (std production)	0.92					0.92
	ARV-CWT	1.04					1.04
	A-CWT + Photonic	1.20					1.20
2000	A-CWT (std production)						
	ALV-CWT						
	CWT without A clip						

In the fall of 2000, all chinook likely to be age 1+ (by preliminary size evaluation) and adipose clipped were visually inspected for the presence of a photonic mark. In normal daylight conditions, no photonic marks were detected. All of these same fish were then taken to a darkened room and viewed under 365 wavelength UV light. Still no photonic marks were detected by this technique. As a final step, the anal fins of all of these chinook salmon were severed near the base of the fin and the fin was viewed in cross section under the UV light in a darkened room. Viewed under these conditions, many of the chinook had detectable sometimes even bright colored photonic marks. In all, a total of 636 chinook were checked with these techniques. During subsequent extraction and decoding of the CWTs in the chinook sampled, it was determined that 68 of the fish did not have a CWT or the CWT was lost during extraction. Another 35 of these fish were from other studies. These other fish were age 1+ strays from other locations, or were small, slow growing age 2+ or older chinook, that were not part of this study group. Seven of these fish were ARV-CWTs that were inadvertently tested, improperly clipped

(missing the RV), or had RV fin regeneration. A total of 526 of the fish tested by these techniques were actually part of this study. Of these 296 (56 percent) were from the group marked with photonic tags and 230 (44 percent) were from the group stocked at SCW as a control for the ARV-CWT and A-CWT photonic groups.

Figure 2.-Percent recovery of chinook salmon at age, at Strawberry Creek Weir, from the marking technique study CWT treatment lots, from the 1999 and 2000 year classes.

Interpretation of the presence or absence of a photonic mark was not an absolute technique. About a



third of all of the 636 chinook salmon anal fins observed under UV light in a darkened room exhibited some light yellow/green color fluorescence, typically around the edges of the fin cross section. This false/positive reading was common among all of the study groups whether they had been marked with photonic tag or not. Another confounding factor was an apparent color shift in the photonic tag that had been used. When applied, the photonic colors used were pink, orange, and green. At the time of tagging, there seemed to be good color separation between color groups. Yet many of the viewers of the chinook anal fins under UV light described the observed colors as red, orange, yellow, or green. This was especially confusing when different viewers would describe the colors they saw as red, orange, and green and the next days observer described the colors as orange, yellow, and green. Some viewers on other days used all four colors in their interpretation (red, orange, yellow, and green). In retrospect, when compared to preserved specimens collected at stocking, it would appear that the pink photonic tag exhibited a color shift to something intermediate to red/orange and the orange photonic tag exhibited a shift to a color intermediate to orange/yellow. The green color was still interpreted as green. For the purpose of this analysis of the photonic mark, the pink and orange groups were combined and represented approximately two thirds of the photonic marked fingerlings stocked.

Of the 296 chinook, identified by CWT lot number as the study group that had been marked with one of the three photonic colored tags, 213 (72 percent) were interpreted to have a recognizable photonic mark when cross sections of the anal fin were viewed under UV light in a darkened room. The

red/orange/yellow marks accounted for 173 (81 percent) of visible marks and green accounted for 40 (19 percent) of the visible marks. Additionally, 77 percent of the red/orange/yellow marks were interpreted to be good or strong and 23 percent were called weak. Whereas, only 45 percent of the green marks were interpreted as good or strong and 55 percent were described as weak. Also, 30 of the 68 (44 percent) no tag/lost tag group were interpreted to have a photonic mark. Four (2 percent) of the 230 A-CWT control group were interpreted to have a weak orange photonic mark. Whether this was a misinterpretation of the false/positive light yellow/green color fluorescence, inadvertent mixing of the CWT lots after tagging but before photonic marking, or cross contamination from the shears used to cut the anal fins is unknown.

In the fall of 2001, all chinook likely to be age 2+ (by preliminary size evaluation) and adipose clipped were visually inspected for the presence of a photonic mark. In normal daylight conditions, no photonic marks were detected. The anal fins of all of these chinook salmon were severed near the base of the fin and the fin was viewed in cross section under the UV light in a darkened room. Viewed under these conditions, many of the chinook had detectable sometimes even bright colored photonic marks. As of March 1st 2002, the CWT extraction process has been completed for the fall 2001 chinook, but the decoding process has not been completed.

With the techniques used, looking for the photonic marks, has been quite labor intensive. Only a single cut of the anal fin (near the base) was made. It is not known if multiple cuts of the anal fin at various distances from the base would have improved detection rates of photonic marks. After two years of chinook recovery at SCW the chinook salmon marking technique study is not ready for final interpretation. However, it is obvious from the recovery of age 1+ and 2+ fish, that the initial hope that photonic tagging could be used as an instant recognition, non-lethal technique of marking and recognizing study fish is probably not going to happen. It does appear that the photonic marking technique may have some valid fisheries application for marking fish, and study fish will continue to be checked in subsequent years for mark retention. At this time it would appear that neither the photonic marking of chinook fingerlings, or the use of a combination ARV clip was overly detrimental to the subsequent recovery of age 1+ or 2+ chinook at SCW.

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NEARSHORE RAINBOW TROUT STOCKING EXPERIMENT

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.

Angler harvest of trout and salmon from nearshore areas of Lake Michigan (pier and shore fisheries) has declined from 11.1% of Wisconsin's total salmonid harvest in 1986 to a low of 3.2% of the total harvest in 1998 (Figure 1). Since 1990, nearshore harvest has been steady and averaged 5.8% of the total salmonid harvest.

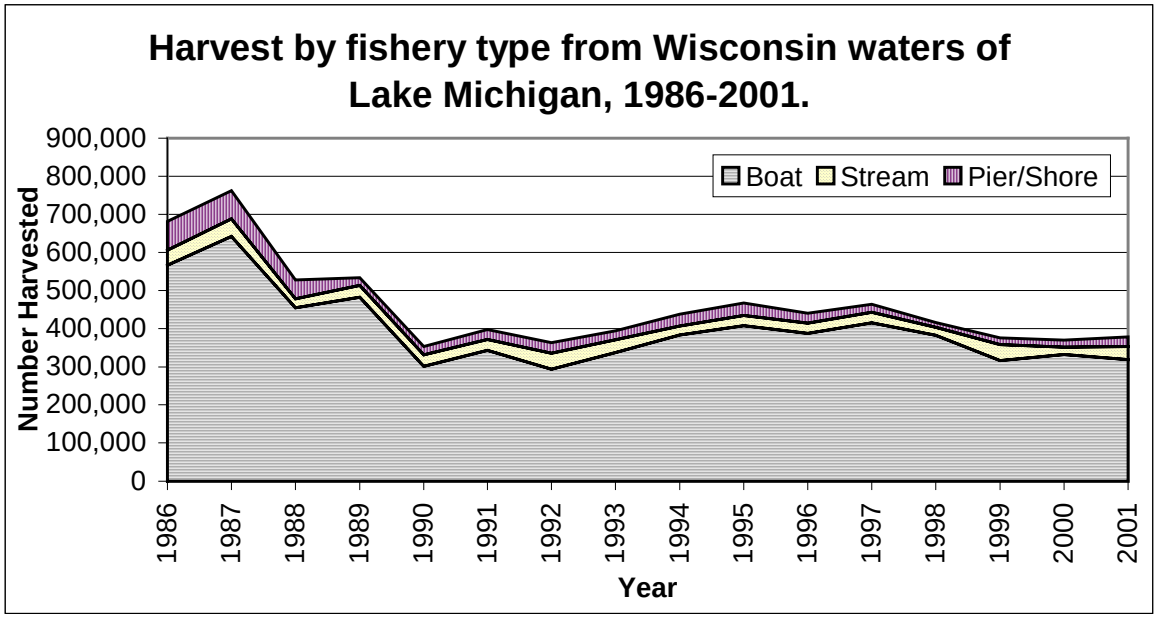

Figure 1. Harvest of Lake Michigan salmonids by fishery type from the Wisconsin waters of Lake Michigan, 1986 through 2001. Boat harvest includes salmonids caught in the ramp, charter and moored boat fisheries.

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. Rainbow trout are desirable as a nearshore species for several reasons. First, many strains of rainbow are available and desired characteristics can be selected for and secondly, rainbow have the ability to utilize many types of forage and are less dependent on alewife than other Lake Michigan salmonids. After receiving public input on the project, Arlee rainbow trout were selected for the experimental study due in part to their past performance in Illinois waters of Lake

Michigan. To accommodate the stocking of these fish within lakewide caps, an equal number of brook trout were not stocked.

Kenosha, Milwaukee, Sheboygan, Manitowoc, Algoma and Sister Bay each received a stocking of 12,000 Arlee in the spring of 2001. When stocked, the Adipose-Left Pectoral (ALP) clipped fished averaged 174 mm (SD-20.1 mm) in length and 55.1 g (SD-17.7 g) in weight. By July, the Arlee were already 250 to 356 mm in length. Anglers reported that at times the trout could be seen schooling near the piers and shore in the harbors where they were released**.** Anglers harvested an estimated 1,324 Arlee during the first summer, and many others were returned to the water (Table 1). Harvested Arlee in 2001 ranged in length from 229 to 432 mm and averaged 330 mm in length.

Table 1. The estimated 2001 sport harvest of Arlee Rainbow Trout from the Wisconsin waters of Lake Michigan by fishery type.

Fishery Type	Observed Number Harvested by Anglers	Estimated Total Harvest	% of Total Arlee Harvest
Boat	1	62	4.7%
Pier/Shore	46	1,262	95.3%
Stream	0	0	0.0%
Total	47	1,324	

The first six months of creel-survey data is encouraging and indicate that the Arlee rainbow trout may be benefiting nearshore anglers. The continued experimental stocking of Arlee rainbow trout will continue through 2004. It is hoped that in 2003, a second strain of rainbow trout will be added to the study to determine what strain provides the greatest fishing opportunities for nearshore anglers. If they grow like other rainbow trout stocked in Lake Michigan, by spring 2002, the age-2 Arlee will be 430 mm in length and weigh about 1 kg. Arlee rainbow trout may live to 5 years of age in Lake Michigan and reach 635 to 750 mm in length and 5 to 10 kg in weight.

Other species including brown trout and brook trout will also be studied to improve their contribution to the nearshore fishery.

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